VOL. 5 AUGUST 1913 No. 3

Pacific Service Magazine

Vol 5
Nos 1 and 2
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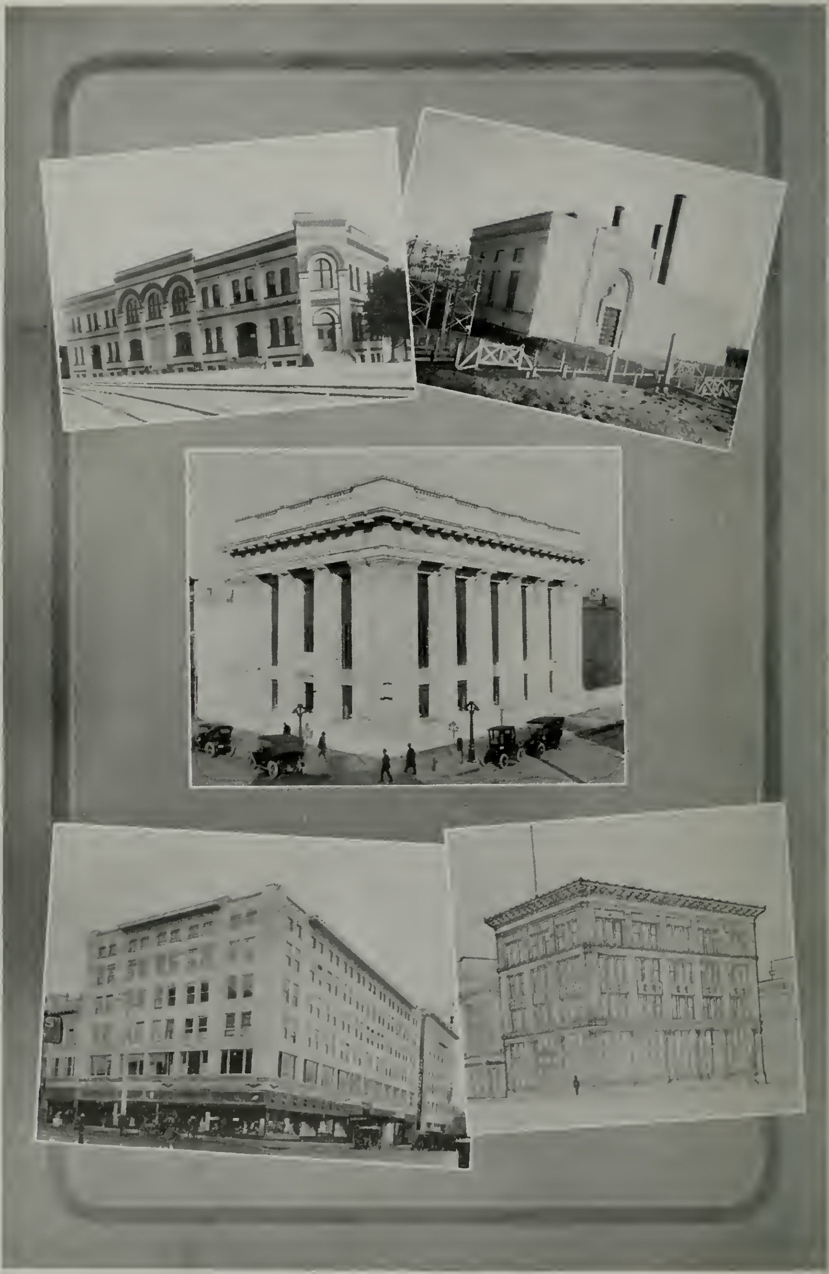
Ordered

PUBLISHED MONTHLY BY THE
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CALIFORNIA

Pacific Service Magazine

Vol. V | Contents for August | No. 3

Yearly Subscription $1.50 | Single Copies each 15 cents



The City of Sacramento is setting a strong pace in building developments. The picture in the centre is of the new home of the National Bank of D. O. Mills and Company. On the upper left, upper right and lower right, respectively, are seen the Pacific Gas and Electric Company's substation at Sixth and H Streets, power station on the river bank, and new office building at Eleventh and K streets (the last-named in course of construction). The view at the lower left corner is of the Forum Building.

Pacific Service Magazine

VOL. V — AUGUST 1913 — No. 3

A Modern System of Street Lighting

By J. O. TOBEY, Superintendent Sacramento Power Division.

J. O. Tobey

Perhaps in no other city in the United States were the "staying qualities" of the old 9.6 ampere constant current Thompson-Houston, Brush and Wood arc machines, with their auxiliary apparatus and lamps, more severely tested than in the City of Sacramento.

It was in the early 80's that the arc lamp was first adopted in Sacramento for street-lighting purposes, and at that time but few cities in America could boast of so marvelous an improvement in electric street-lighting. At this point it might be well to look back to February, 1884, at which time the Pacific Thompson-Houston Electric Light & Power Company installed about $30,000 worth of machinery in Sacramento, a large portion of which was for six T. H. arc machines with their regulators and necessary steam-engines for driving them. The arc machines alone represented about $15,000 of the total amount. In this equipment was included a number of the 9.6 open arc lamps which the Thompson-Houston people invoiced on their books at $80 each. The carbons which burned in these lamps were also included at a price of 6 cents each, and as it generally required 3 carbons per lamp per night it can readily be seen what an expensive luxury the first arcs must have been for those cities and other consumers who were progressive enough to desire the convenience. This is fully illustrated by the following Journal entry during 1884, which is only one of a number:

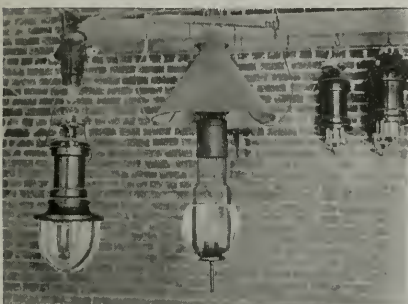
State Capitol Commission, Dr.
To P. T. H. E. L. & Pr Co.

For 2 Lamps, July 1st to Aug. 1st.........	$41.15
2 " Aug. 2nd to Sept. 30th......	63.00

At about the same time that the Pacific Thompson-Houston people began the arc-lighting industry in Sacramento, the Sacramento Electric Light Company entered the field by procuring the exclusive rights for operating the "Brush" arc machines in Sacramento, at a cost, for this privilege alone, of $20,000. They at once expended considerable money in arc machines and equipment and began obtaining consumers in opposition to the Pacific Thompson-Houston Electric Light & Power Company. This lasted for about three years when they united and formed the company which after nearly a quarter of a century was taken over by the Pacific Gas and Electric Company. Most of the old arc machines were, of course, inherited and as the demand for lights increased more machines of the old type were installed until, in 1911, thirteen of these, at the Sixth and H Street Substation, having a capacity of 1250 lamps and representing many thousand dollars, were replaced by the Mercury Arc Rectifier Sets, with their accompanying luminous lamps, one of the most efficient and satisfactory developments known in modern

Looking down K Street, Sacramento, from the corner of Eleventh Street, where the Pacific Gas and Electric Company is erecting a handsome new office building. A night picture, revealing the part played by "Pacific Service" in street-lighting and illumination.

arc lighting science. This lighting system has now been in operation nearly two years, supplying lights for the residence and suburban sections of Sacramento. In the business section where the underground restrictions make the use of these lamps impractical, electroliers



New Luminous 4-amp. lamp and old T. H. 9.6-amp lamp.

have been installed by the various business enterprises. These electroliers in the business district, together with the luminous lamps in the residence and suburban sections, all of which are supplied by "Pacific Service," make Sacramento one of the best lighted cities on the Pacific Coast.

Before passing from the subject of the old arc machines I would like to mention the fact, well known to those who have had experience with them, that all was not calm and serene in their operation during their lifetime of nearly a quarter of a century. In proof of this I quote extracts from the substation daily log as entered on December 18th and 19th, twenty-two years ago:

December 18th:

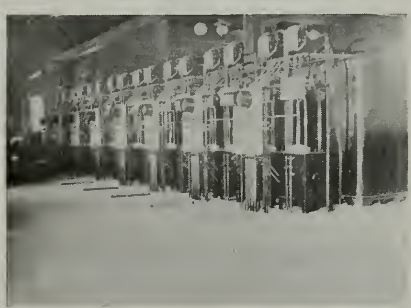
"Nun of the Controllers on Arke machines wont worke had to pull the wirs out of Big machine and couldnt run city Lites all night the Arke Lamps in Station wont burn."

December 19th:

"Nun of the Controllers on Arke machines wont worked I cant run the Arke machines in this shpe had too shut Big machine down 10 minutes too change Brushes.".

In comparing the above log book records with those of today we are pleased to note that the progress and efficiency of the station operators have more than kept pace with the equipment which is under their constant supervision.

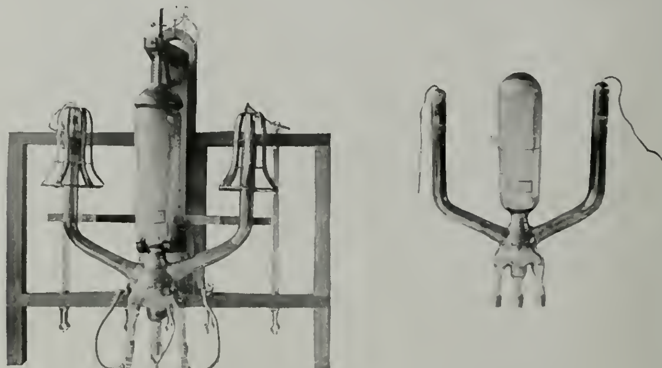
It was in February of 1911 that the engineers of the Operation and Distribution Departments of the Pacific Gas and Electric Company decided upon installing the modern system of street-lighting to replace the old, and an appropriation was authorized by the management for the change. The necessary contracts were placed and during June and July, 1911, nine 100 light 4 amp. Mercury Arc sets were received from the factory. In making the change from the old to the new, the street lamp service could not be interrupted; it was therefore necessary to install two new sets temporarily and load them up with two 120-light circuits on which the old lamps had been replaced by the new. This temporary installation permitted cutting out three of the old 100-light generators together with their countershafting, pulleys, belting, etc.



Eight complete 100-light Mercury Arc sets, Sacramento Substation. For cooling purposes the tubes are immersed in oil in small tanks at rear of panel board.

The floor space thus acquired was utilized for the permanent installation of five of the new sets to which the circuits were transferred as rapidly as the lamps could be changed. The transfer was made gradually and was completed on September 28, 1911.

For the benefit of those of my readers who may not be familiar with the principle of operation of the Mercury Arc set, I will give a brief description of its main features. The development of the Mercury Arc Rectifier set for lighting purposes was brought about by the superiority, in various ways, of the high voltage direct current over the alternating current for the operation of certain arc lamps. This, of course, means that the alternating current received from the long distance transmission lines or other sources must be converted or rectified into direct current. This is accomplished mainly by two devices, the constant current transformer and the mercury arc rectifier tube, the former being similar to the ordinary A. C. constant current, arc transformer, with mechanically balanced, movable, primary coil (2200 volt in the above sets) and stationary secondary coils. Both primary and secondary coils act on a common magnetic core. The primary voltage



Rectifier Tubes, with and without holder—Sacramento Substation.

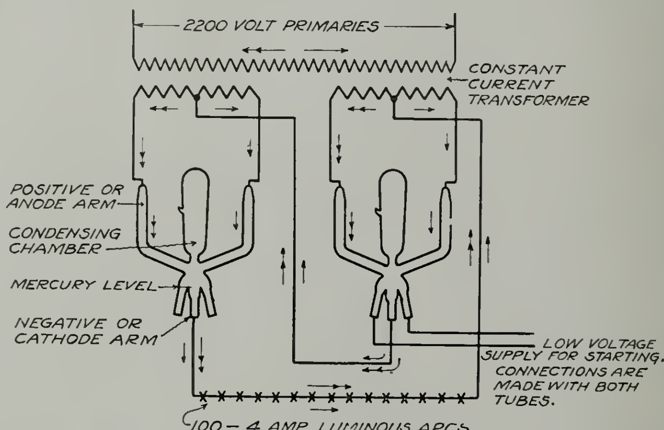


Diagram of connections of 100-light Luminous Arc Rectifier Sets—Sacramento Substation.
Single arrow indicates direction of current flow for first half-cycle, double arrow for second half-cycle of the alternating current.

is, of course, constant but the secondary voltage is variable, depending upon the relative positions of the two coils. When the coils are together the secondary voltage is at its maximum; it decreases, however, as the coils are separated, due to the leakage of the magnetic lines of force being greater as the coils become farther apart. When separated to their fullest extent the secondary voltage is only sufficient to force a small amperage through the circuit when shorted. Upon the short being removed the current at once passes around through the series of lamps in the circuit and, due to the added impedance, the amperage drops. The primary coil then automatically moves toward the secondary, which raises the voltage of the latter until normal current is produced through it and the lamp circuit, at which point a magnetic balance exists between the two coils. If additional lamps are added or taken from the circuit, the primary coil will at once adjust its position and thus change the secondary voltage to give the normal current through the lamp circuit.

In the ordinary alternating current series arc system the secondary of the constant current transformer, as above described, is connected direct to the lamps, but in the case of the Mercury Arc direct current series system the terminals of the transformer secondaries connect to the rectifier tubes as shown in the accompanying sketch. The tubes in this case consist of a sealed glass bulb, from which the air has been exhausted, partly filled with mercury. The bulb is provided with two main arms, or positive electrodes, projecting upwards, to which terminals of the constant current transformer secondaries are connected. Three electrodes project downward, the center being the negative to which one leg of the lamp circuit is connected. The two other terminals, brought out of the bottom of the tube, are for applying a low voltage for starting the arc, for vaporizing the mercury in the tube. The duty of the tubes

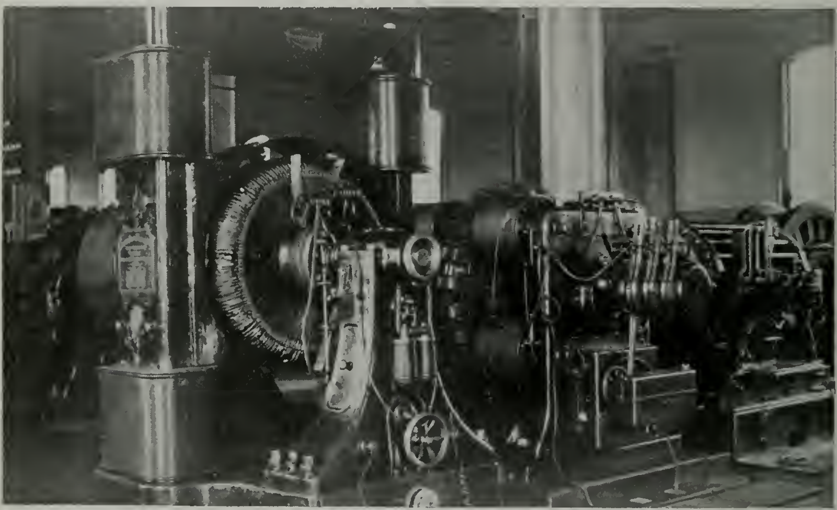
Interior of Sacramento substation. Arc machines, motors and countershafting in foreground, previous to removal.

is solely to receive the alternating current from the transformer and deliver direct current to the lamps.

This it does, due to an inherent characteristic of the mercury vapor in the tube, by allowing the current to pass through in but one direction. By again referring to the sketch the reader will be able to trace the path of the current for each half cycle or

would be 4 amps., at 8000 volts, or 32 K. W., and as the sets are giving a minimum efficiency of 80%, including transformer, tube and line losses, the normal A. C. input to each 100 lights may be said to be about 40 K. W. Various pronounced advantages of the new over the old, are as follows:

Better service, by giving less interruptions and much superior light.



Here are shown (from left to right) Wood, Brush and T. H. machines, just before their removal from Sacramento substation.

alternation. It will be noted that two tubes and two secondary coils are shown. It will also be noted that at any given instant but one-half of each secondary coil and one-half of each tube is in operation; in other words, each alternation might be said to have its own private route. As the 100-light sets supply about 8000 volts direct current, two tubes are used in series in order that the high impressed voltage will be divided between the two and thus cut down the potential stress.

The lamps consume approximately 4 amps. at 80 volts each, which on a 100-lamp circuit

Simpler and easier to operate.

No moving machinery.

Much less floor space necessary.

Much quicker to get back in service in case of main line interruption.

Some of the disadvantages are, the high line voltage necessary, the low power factor at light load and the expense of tube renewals. But, taking it all in all, the city, the general public and the company have all been greatly benefited by the amount expended in giving Sacramento one of the most modern systems of street illumination.

The Wonderful Progress in Electric Lighting Made in Recent Years

By F. C. PIATT, Electrical Distribution Department.


F. C. Piatt.

In the last few years the development of new and superior light sources and improved shades and fixtures for controlling light has been more rapid than ever before in the history of electric illumination, making possible splendid effects in both exterior and interior lighting. A complete list of the many improvements recently made would fill volumes, but a few may be mentioned in this article.

The development of the Mazda lamp to its present satisfactory state is the most important advance in the construction of light sources and has practically revolutionized interior lighting. As originally put on the market a few years ago, the Mazda lamp, while vastly superior to the old carbon, gem or tantalum lamp in efficiency, was still in some respects unsatisfactory, being very fragile and subject to blackening of the bulb. The invention of the wire-drawn filament Mazda lamp has made this type of lamp almost as rugged as the old carbon type; blackening of the bulb is now prevented in larger size Mazda lamps by the use of a newly discovered chem-

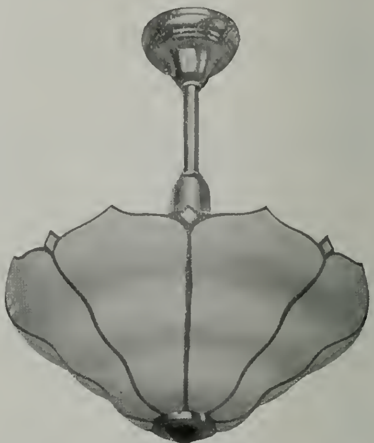
Effect of semi-indirect lighting in the Buffalo General Electric Company's building. First floor fixtures in the Pacific Gas and Electric Company's new office at Sacramento will be similar in appearance.

ical placed inside the bulb which volatilizes as the lamp burns, and the efficiency of the new lamp is much higher than the original Mazda, although giving as good life.

A comparative table showing the relative amounts of light available by the use of different type lamps for the same cost of current may be of interest:

Carbon lamps (3.5 w)	1.00
Gem lamps	1.40
Tantalum lamps	1.75
Mazda (original)	2.80
Mazda (present)	3.50

These improvements in the Mazda lamp coupled with recent reductions in price make it today without rival for interior lighting. It is interesting to note that in most cases the tendency has been to improve the lighting by the use of the more efficient units rather than to retain the old unsatisfactory illumination at a saving in cost of current. In size the Mazda lamp covers a very wide range. Recently as a demonstration of manufacturing possibilities Mazda lamps were made ranging in size from 3000 watts to 1/10 watt; the candle power varying from 2500 to .125, thus showing the practicability of almost any size of Mazda lamp at good efficiency.



Convertible fixture for semi-indirect lighting.

Mazda Electrolier.

A recent reduction in the size of the bulb of the 60-watt lamp has made possible its use in the ordinary 16 c. p. carbon or 40-watt Mazda fixtures, thus permitting a considerable increase in illumination without expensive changes in the fixtures. Another novelty in the construction of Mazda lamps is the concentrated filament lamp for projector use by which, due to the small size of the light source, better effects can be obtained in headlights or projectors than are possible with the arc lamp.

In the development of shades for the control of light from the brilliant sources developed, great increase in efficiency has been obtained as compared with the old so-called ornamental glass shades. The key note of the present use of shades is the elimination of glaring bare lamps from the range of vision, a result which the old shades too seldom accomplished.

The Holoplane glass shade, with prisms accurately calculated to direct light exactly as desired, is one of the most efficient of present day shades, though properly designed shades of the white translucent type give practically as good results. The most recent development in shades is the concealing of the light source by the shade, light being thrown against the ceiling and there reflected, thus obtaining a well-diffused light, resulting in almost total absence of shadows with the minimum amount of glare.

When the shade is opaque the lighting is said to be indirect; when the shade is translucent, so that part of the light comes through the shade directly, the remainder being reflected from the ceiling, the lighting is said to be semi-indirect. The latter is the most up-to-date of all methods of illumination, giving particularly soft, pleasant effects, the fixtures having a somewhat more cheerful appearance than the indirect units, while the eye is satisfied by seeing a glowing source of light.

The new Pacific Gas and Electric Company office building at Sacramento will be lit entirely by semi-indirect fixtures, the first floor fixtures being particularly handsome, probably superior to anything in use in any office building on the coast. The upper floor fixtures are of the convertible type, in which it is possible to reverse the shade for use as a direct unit if desired. This type of fixture is now in use in several of the company's office buildings, particularly in San Francisco and Stockton, and has given very great satisfaction.

Illumination by concealed sources has extended to exterior building effects, notably the lighting of the Panama-Pacific Exposition at

Mazda Ornamental Post.

San Francisco, where concealed lights in reflectors will brightly illumine the exterior walls of the buildings, bringing out the rich colors of tinted walls, mural paintings and flashing jewels in a most beautiful manner. While splendid results have been achieved with outline lighting of buildings, the white sparkling appearance of which is particularly effective in the distance, it is expected that the colored, glowing masses of the buildings of the Exposition will create quite as impressive an effect and will have the advantage of novelty.

For street lighting the Mazda lamp is quite efficient and now very popular, being used either in electroliers, ornamental posts or in

Street illumination with Luminous Arc lamps.

pole bracket fixtures. The steadiness of the light and the fact that smaller and more numerous units can be installed for the same price has made this type of lighting a favorite, particularly in small towns, over the arc light. In Europe, notably in Dresden, Mazda lamps of large size, 400 to 1000 c. p., have recently been used to replace arc lamps.

Where a brilliant illumination of the streets is desired the new luminous arcs have proved very successful, the clear, bright, white light being very pleasing in appearance. The ordinary suspension type lamp is usually mounted on a pole bracket, lamps being spaced 300 or 400 feet apart. Where a particularly ornamental effect is desired, the post type of luminous arc lamp is used. This ornamental type of lamp is now supplied in three classes: White Way type for brilliant city effects; Boulevard type of lower candle power for wider spacing and less brilliant effect; Park Way type fitted with reflector and on higher post suitable for still wider spacing and less brilliant illumination. Where excessively brilliant effects are desired, the new long burning flame arc lamps have a considerable field of usefulness and have proved very popular in the East, particularly in Chicago.

Other types of lamps, including Titanium Arcs, Neon tubes, improved Mercury Arc lamps, etc., are now in the experimental stage and may soon surpass in economy and brilliance even the best of the present lamps.

How Electricity Contributed to New York City's Safe and Sane Fourth of July

For the first time since New York City began celebrating a safe and sane Fourth of July no money was spent this year for fireworks. Instead of dangerous pyrotechnical displays the Mayor's Committee decided to omit them entirely in favor of electrical illuminations in the various public parks and on public buildings and monuments.

Electrical illuminations were arranged at fifteen places in Manhattan and the Bronx, eleven of the points being in Manhattan and four in the Bronx. Seventeen thousand electric bulbs of eight candle power each were used, making a total of 136,000 candle power of illumination. Three nights were scheduled for the lights to be turned on, July 4th, 5th and 6th, from 7:30 p. m. until midnight. All of the current required for the illuminations on these three nights was given to the city by The New York Edison Com-

Washington Arch, New York City, illuminated on the night of the Fourth of July by the New York Edison Company.

City Hall Park, New York City, as it appeared on the night of the Fourth of July. The picture is from a photo supplied by the New York Edison Company.

pany, the only cost to the city being the stringing of the lights, which was done by a number of private electrical contractors. The illumination on the City Hall and on the music stand at the north end of the Mall was outlined with rows of lights, while over the two fountains on the Mall huge Japanese parasols were suspended from the points of which colored lanterns cast their varying hues in the water of the fountain.

Soldiers' and Sailors' Monument, New York City.
Photo by New York Edison Company.

Bronx Boro Hall was donated by the Edison Company, including the lights and wiring, without any cost to the city whatever. The illuminations in Manhattan were at the following points:

City Hall: 3,000 lights. Outline of building.

Washington Arch: 2,000 lights. Arch outlined.

Seward Park: Hester street and East Broadway—1,000 lights.

Tompkins Park: Avenue A and East 10th street—1,000 lights strung through the trees.

Columbus Park: Bayard and Mulberry streets—1,000 lights in the trees.

Chelsea Park: Twentieth street and Ninth avenue—2,000 lights.

Central Park, The Mall: 3,000 lights. This was the most attractive illumination of all. Rows of Japanese lanterns extended along either side of the Mall from 66th street to 72nd street. The

Sailors' and Soldiers' Monument: Eighty-ninth street and Riverside Drive—1,000 lights.

Thomas Jefferson Park: First avenue and 114th street—1,000 lights.

Grant's Tomb: Riverside Drive—400 lights festooned along the walk leading to the tomb.

The illuminations in the Bronx were:

Bronx Boro Hall: 2,000 lights.

McKinley Square: One Hundred and Sixty-ninth street and Boston Road—700 lights.

St. James Park: One Hundred and Ninety-second street and Jerome avenue—500 lights strung through the trees.

St. Mary's Park: One Hundred and Forty-ninth street and St. Ann's avenue—1,000 lights hung in streamers from a large pole in the center of the park.

The accompanying illustrations are furnished by the New York Edison Company, whose management is justly proud of its success.

Measurement of Gas

A Lecture Delivered at the University of California

By E. C. JONES.

E. C. Jones

The station meter for measuring gas before it enters the storage holder, was among the earliest inventions in gas manufacture. Its importance is demonstrated by that fact, for without a means of measuring the gas it was impossible to know how much gas was yielded by the coal or to determine the relative value of different coals. The station meter also afforded a ready means of determining the amount of gas lost in distribution and known as leakage.

The first station meter was invented by Clegg, and the basic principles of the wet station meter now in use were probably evolved from a revolving gas-holder designed and used by Clegg prior to 1817, at which time it was in use at the Peter Street Gas Works, London.

In "A Practical Treatise on Gas Light" by Frederick Accum, published in London in 1818, there is a picture of a rectangular gas-holder in a cast iron tank, but no mention is made of the rotary gas-holder, or any means of measuring gas; but in the "Description of The Process of Manufacturing Coal Gas" by Accum, and published in 1820, the rotary holder is shown as a frontispiece, and a plate descriptive of the Gas Light Apparatus erected by Accum at the Royal Mint shows an excellent picture of Clegg's Station Meter.

This meter consisted of an outer cylindrical case containing a revolving drum divided by partitions into two compartments which alternately received and delivered gas, and the drum was actuated by the pressure of the gas which it measured. The axis of the drum was hollow and served as an inlet for the gas. Valuable improvements to this meter were made by John Malam, and these are described in a paper read before the Society of Arts in 1819. Malam's meter had five compartments, one in the center and four around it; and although it possessed the serious faults of Clegg's meter, of absorbing a great deal of pressure in revolving through the water, it contained a novel feature which is in use today in all wet station meters. The gas inlet was through a bent pipe or dry well, which rising above the water in the central chamber delivered gas continuously throughout the rotation of the drum.

The next step in the improvement of the meter was by Samuel Crosley, who divided the interior of the drum into compartments by partitions set at an angle which greatly reduced the resistance in passing through the water. He constructed meters embodying his own inventions, combined with those of Clegg and Malam, which were in use for many years both as station meters and consumers' meters.

In 1882 a wet meter drum having three partitions was invented in England by Wm. C. Parkinson. This had many advantages over the four partition drum, it could be rotated at a higher peripheral speed without greater loss of pressure; and the elimination of one partition resulted in easier action. These combined to increase the capacity 20%, due to the increased number of revolutions at a given loss of pressure. This meter continued to be the accepted standard until 1896, when Charles W. Hinman, formerly Inspector of Gas and Meters in Massachusetts, invented improvements in wet meters, which have proven of great value to gas companies by combining correct measurement with greatly increased capacity. The same

EARLY TYPE
OF
STATION METER
WITH FOUR COMPARTMENT DRUM

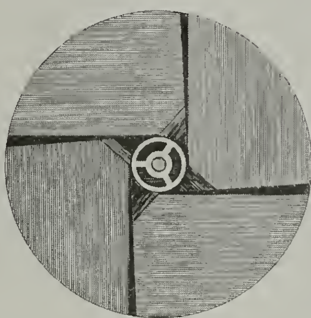


FIG. 1

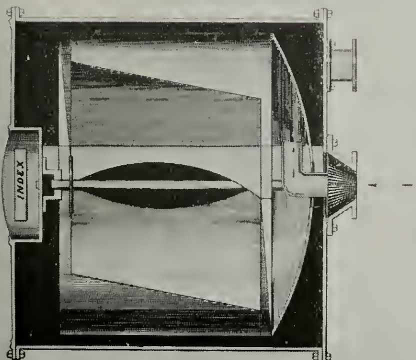


FIG. 2

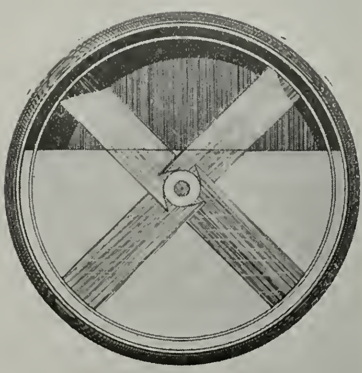


FIG. 3

style of meter case is used, but the effective length is increased by shortening the dry well.

The drum has four partitions like the Crosley drum, but utilizes more completely the space in the meter case. It passes more gas per revolution, and offers less resistance to the water when rotated, thus allowing a greater speed of rotation at constant loss of pressure.

The Hinman drum as constructed today will run at about 50 per cent greater peripheral speed than the Parkinson type at a given loss of pressure, and to this is added a greater capacity per revolution.

The station meter consists of the outer case, and the measuring drum. The case is usually made of cast iron, cylindrical in form and supported by cradles. The length and internal diameter of the case is nearly always the same. The inlet for gas is in the centre of the rear head, and the outlets are on either side of the centre line, above it. In newer forms of cases the outlet is often on the front head near the top. The dry well box projects into the case through the inlet gas way, and carries a shaft bearing on its inner end. The other shaft bearing is usually cast on the front end. The drum is the part of a meter which measures the gas, it is constructed on a turned steel shaft running in bronze boxes. To this shaft cast iron drum centres are fastened, and on these centres the drum frame is built. This frame supports the body, partition, and hollow cover of the drum which are made of heavily coated tin plates of number 16, or 18 B. W. G. The partitions divide the drum into four compartments, and these partitions are set at such an angle as to offer the least resistance in passing through the water consistent with the purpose for which they are intended. The partitions in the Clegg and Malam drums entered the water in a manner similar to the paddles of a steam boat, while those of the Crosley, Parkinson and Hinman type might be compared to the propeller of a steamer entering the water.

The meter case is more than half filled with water, and while the compartments in the drum perform the duty of measuring the gas, the height of the water-line in the case regulates the capacity of these compartments. The capacity is calculated and the water-line is tentatively determined, and before the meter is placed in commission it is carefully tested and the correct water line is established, and marked on gauge glasses on the front of the meter, and a water overflow is adjusted to maintain the proper water level. If the water level in a wet meter is too high, the meter will register "fast," and if it is too low it will register "slow."

The rotary motion of the shaft is communicated through a train of geared wheels to the registering index on the front head of the meter. The capacity of a station meter should be based on the capacity of the drum per revolution, multiplied by the number of revolutions it will make in one hour at a given loss in pressure.

The makers of meters have adopted as a basis of rating the different sizes, a given peripheral speed of the drum in inches per second; for the Crosley four partition type, seven inches per second; the Parkinson three partition type, eight inches; and for the Hinman drum, twelve inches per second.

The wet station meter is a durable piece of apparatus requiring little care, and its registration of gas is correct if the water line is maintained at the proper level. As this is a condition dependent on the care and integrity of the engineer, the modern wet station meter may be said to be an instrument of precision. Its disadvantages are its high cost and great bulk.

Probably the wet station meters of largest dimensions in this country are three meters 18 ft. 6 in. in diameter in New York. The gas made at the Potrero Station, San Francisco, is measured by five meters 16 feet diameter, fitted with Hinman drums.

The following table gives some useful data relating to the various sizes of wet station meters:

Station Meters.

Size.	Capacity per Hour in Cubic Feet with 1 inch Loss.		Capacity per 24 Hours in Cubic Feet with 1 inch Loss.		Usual Size of Connections	Weight of Meter	Weight of Water	Weight of Meter and Water
	Parkinson	Hinman	Parkinson	Hinman				
4 Ft.	5,200	8,000	124,800	192,000	8 in.	3,800	2,200	6,000
4 Ft. 6 in.	6,800	11,250	163,200	270,000	8 in.	4,950	3,100	8,050
5 Ft.	8,500	14,500	204,000	348,000	8 in.	5,950	4,200	10,150
5 Ft. 6 in.	10,400	18,000	249,600	432,000	10 in.	7,450	5,650	13,100
6 Ft.	12,400	21,750	297,600	552,000	10 in.	8,750	7,350	16,100
6 Ft. 6 in.	14,700	25,750	352,800	618,000	12 in.	10,500	9,300	19,800
7 Ft.	17,100	30,000	410,400	720,000	12 in.	12,250	11,500	23,750
7 Ft. 6 in.	19,800	35,000	475,200	840,000	12 in.	14,350	14,000	28,350
8 Ft.	22,500	40,000	540,000	960,000	12 in.	16,600	17,250	33,850
9 Ft.	28,800	51,000	691,200	1,224,000	16 in.	24,000	24,500	48,500
10 Ft.	36,000	63,000	864,000	1,512,000	16 in.	29,500	33,500	63,000
11 Ft.	44,000	77,000	1,056,000	1,848,000	16 in.	36,000	44,200	80,200
12 Ft.	53,000	92,000	1,272,000	2,208,000	16 in.	44,500	57,500	102,000
13 Ft.	63,000	109,000	1,512,000	2,616,000	20 in.	54,000	73,300	127,300
14 Ft.	74,000	128,000	1,776,000	3,072,000	24 in.	66,000	91,500	157,500
15 Ft.	86,500	150,000	2,076,000	3,600,000	24 in.	80,000	112,500	192,500
16 Ft.	100,000	173,000	2,400,000	4,152,000	24 in.	95,000	136,000	231,000

In describing wet station meters, the writer has quoted freely from the excellent paper on "Station Meters" read before the Congress of Gas Associations of America at St. Louis, in 1904, by Mr. Donald McDonald, an eminent authority on the subject.

Efforts have been made to reduce the size and cost of station meters and adapt them to the measurement of gas under high pressure.

The most recent developments along these lines was the invention of the electric gas meter by Prof. C. C. Thomas. This device is best explained in the words of the inventor.

"The meter depends for its operation upon the principle of heating the gas electrically through a fixed range of temperature as it flows through a passage, and measuring the quantity of electrical energy required to produce this rise in temperature."

"The quantity of heat required to raise the temperature of a cubic foot of a given gas, through one degree Fahrenheit, that is, the specific heat of the gas, is a fixed quantity and one which can be accurately computed. Moreover, this quantity remains the same within practical limits after this cubic foot of gas has been compressed to a smaller volume or expanded to a larger volume, also after it has been heated to a higher temperature or cooled to a lower temperature. If gas in flowing through a passage is heated through a fixed and constant temperature range by means of a heater in the passage it follows from the above that the quantity of heat thus introduced is a measure of the quantity of gas flowing."

"This heat can be conveniently introduced by means of an electric heating unit disposed across the gas passage, and the quantity of heat supplied to the heater in the form of electric energy can be measured with various forms of wattmeters."

By means of electric thermometers before and after the heater the quantity of electric energy supplied can be so regulated that the difference in temperature of the gas between inlet and outlet of the meter is automatically kept constant."

In practice this meter consists of an enlargement of a cast iron main containing a heater unit in the form of a screen of nichrome wire, across the pipe, on either side of this heater unit is placed a thermometer unit, also in the form of a screen, and made up of one continuous length of nickel wire wound on insulating supports. This with the necessary electrical apparatus for supplying, regulating and measuring the current forms an extremely simple and efficient gas meter. These meters have been proven against wet station meters and holders for low pressure gas and the Pitot tube on natural gas at pressures varying from 46 to 185 pounds pressure with satisfactory results.

The amount of electric current used for heating the gas is only about 18 watts per thousand cubic feet.

The gas engineer uses the terms "gas made" and "output" to designate the amount of gas actually produced in twenty-four hours, and the gas sent into the distributing system during the same period.

The amount of gas made is ascertained by taking the readings of the station meter twenty-four hours apart and subtracting the lesser from the greater. Gas output represents the gas made, plus or minus the difference in quantity of gas remaining on hand in the storage holders. For instance, if there is a stock of gas on hand in all the storage holders of 5,000,000 cubic feet this morning, and the gas made during the twenty-four hours is 10,000,000 cubic feet, and the stock of gas on hand tomorrow morning is 4,000,000 cubic feet, then the output would be 11,000,000 cubic feet or 1,000,000 feet more than the amount made, and a loss of 1,000,000 feet from the stock of gas on hand. A gain in amount of gas on hand would be subtracted from the gas made to find the output.

The invention of the consumers' meter was essential to the success of the gas business, and it was necessary that this "arbiter between the company and the consumer" should not be an inferential device, but a positive and reliable measuring instrument. Before the use of meters, the quantity and cost of gas used was estimated by the number of hours it was consumed through burners of stipulated size. It was the duty of inspectors to make the rounds of the consumers at certain hours of the night to see that the lights were extinguished according to contract. Failure on the part of the consumer to extinguish the lights was followed by a warning rap at the door, and if this warning was not effective the inspector shut off the gas at the service tap in the street.

Try and imagine the application of this system at the present time in San Francisco with nearly one hundred thousand gas consumers using gas for all purposes, and with thousands of pilot lights constantly burning in readiness to ignite the gas in water heaters and incandescent lamps.

The development of the consumer's meter was coincident with the station meter, and the same minds were devoted to it. The first type used was the wet meter, which required frequent care to maintain the water line, and the water was a source of trouble in freezing weather. These faults could only be overcome by the use of a dry meter, and although John Malam invented a dry meter in 1820, and he was followed by other inventors, it was not until 1844 that the dry meter invented by W. Richards received serious consideration, and this meter with but few modifications is in almost universal use today.

The dry meter is a combination of the principles of a common bellows with the slide valves of the steam engine.

The outer case of the meter is made of tinned iron, this case is divided into two chambers by a horizontal partition. The upper chamber contains the slide valves, through the ports of which the gas passes into and out of the measuring compartments below. The lower chamber is divided into two compartments by a vertical partition. Movable leather diaphragms are attached to each side of this partition by a metal ring. The diaphragms are held in shape by metal discs fastened on the front, and are maintained in the same plane by means of guide rods and connecting arms.

The collapsible diaphragms and their equivalent of volume when freely extended in the spaces in front of them, are the measures of the gas.

The gas inlet opens directly into the valve chamber. The slide valves each have three ports, the middle one of each is the exhaust or outlet, and the other two lead to the inside and outside of the diaphragms respectively.

The motion of the diaphragms is communicated to the valves, and also to the index for registering the amount of gas measured.

The sizes of meters have always been nominally expressed in "lights," and it was at first intended that a three-light meter would supply gas to three burners consuming six feet of gas per hour each; but as improvements were made in constructing meters, the capacity was increased so that the lights might be multiplied by fifteen to obtain the capacity of meters of the smaller sizes. When gas was used almost exclusively for lighting, the sizes of consumer's meters in general use were 2, 3 and 5 lights; but as the use of gas increased, the 2-light meter has become obsolete, and the 3-light is seldom used. The 5-light meter is now the smallest meter used by the larger gas companies. Much progress has been made in standardizing meters and connections, and a few simple improvements have greatly increased the capacity of meters without materially increasing the cost to manufacture them.

In 1904 Mr. B. H. Spangenburg made exhaustive tests of the meters then in use, and found the average capacities to be as follows:

	Feet per hour
3-light meter with 5/10 loss of pressure......	67
5 " " " " " " "	96
10 " " " " " " "	142
20 " " " " " " "	218
30 " " " " " " "	287

and as the result of his experiments he discovered that if larger valves are used, and the sizes of the channels are increased in the old type of meter, that the capacities would be increased to the following:

	Feet per hour
3-light meter with 5/10 loss of pressure capacity	148
5 " " " " " " " "	219
10 " " " " " " " "	378
20 " " " " " " " "	604
30 " " " " " " " "	898

These discoveries more than doubled the measuring capacities of meters, and made the 5-light meter large enough to serve consumers using modern gas appliances.

The term "loss of pressure" means the difference in pressure between the inlet and outlet of a meter when it is in operation, and is the pressure absorbed in working the meter. The usual amount specified in purchasing meters is 5/10 inch loss. Experiments show that when the loss is 7/10 inch the gas flames fluctuate, at 6/10 inch the flames are steady, and at 2/10 inch the capacity of the meter falls appreciably.

In recent years the tendency in the improvement has been towards cast iron cases and solid iron connections; these are considered safer from the effects of fire than tin meters, and lead connections. A meter of this type has been invented which is extremely simple in its construction, having a single revolving glass valve, and the diaphragms are held between the flanges of the case thus eliminating the sewing or tieing of the diaphragm leathers. This meter has large capacity and measures gas with accuracy. It is also easily and quickly repaired without the use of soldering irons, the entire meter being held together by screws. Besides being practically impervious to fire, the all-iron meter can be used with higher gas pressure, as high as two pounds without injury to the meter.

Governmental laws require that gas meters shall register within two per cent above or below absolute correctness, and experience has proven that while the gas meter may be favorably compared with good watches for keeping time, or the best scales for weighing household commodities; that whatever slight errors exist are usually in favor of the consumer. Regular periodic inspections are desirable to keep meters in perfect condition, and it has been determined that a meter may remain in service for six years under favorable conditions without need of repairs. To facilitate the changing, testing, and repairing of meters, the Pacific Gas and Electric Company has adopted a plan of using a distinguishing color for meters set each year, this applies to repaired as well as new meters. Using a scale of seven colors permits the changing of all meters every six years without confusion.

The following colors have been used since 1905 and are now being repeated:

Year	Color	Year
1905	Blue	1912
1906	Red	1913
1907	Yellow	1914
1908	Lead	1915
1909	Flesh	1916
1910	Gray	1917
1911	Green	1918

The reading of a meter statement is very simple, in fact, it is easier than telling time by a watch and is learned in much the same way; that is, no one knows just when or how the knowledge was acquired.

Meters in ordinary use have three dials in a straight line, and a small dial, registering two feet to each revolution above these dials, for testing purposes. The hands on the dials do not all move in the same direction, the two on the outside move towards the right, and the one in the middle moves towards the left. The hands are fastened to pinions of a single train of geared wheels, so that each successive wheel and hand turns in an opposite direction. The dial on the right (marked 1 thousand) indicates one hundred feet from one figure to the next. One hundred cubic feet is the smallest amount considered in reading meter statements. The middle dial (marked 10 thousand) indicates one thousand feet from one figure to the next. The dial on the left (marked 100 thousand) indicates ten thousand feet from one figure to the next. To take a statement from the meter, begin at the left and write down the *lowest* figure next to the hand on each circle. By subtracting a former statement from these figures, the difference between the two statements is the amount of gas consumed.

The foregoing concludes the series of lectures on Gas delivered by our Mr. E. C. Jones at the University of California in the spring of the present year. They were delivered under the auspices of the Pacific Coast Gas Association, whose active interest made possible the course in Gas Engineering which has been established as a regular branch of study at Berkeley. The lectures, being the work of one who is a master of his subject, attracted an unusual degree of interest. Mr. John A. Britton, who is a Regent of the State University, prefaced the course with a comprehensive address in which he traced the history of gas from its inception upwards of a century ago up to the present day.

EDITOR PACIFIC SERVICE MAGAZINE.

[See Following Page.]

Auburn Residents Praise "Pacific Service"

Manager H. M. Cooper of the Auburn District is acting for "Pacific Service" in receiving many compliments upon the booklet gotten out by the company featuring our new construction work up there and, in this way, advertising the advantages to prospective settlers that are accruing from the enlargement of the irrigating system throughout the deciduous fruit district. The following communication speaks for itself:

AUBURN CHAMBER OF COMMERCE
Placer County, California.
Auburn, California, July 15, 1913.

Pacific Gas and Electric Company,
San Francisco, California.

Gentlemen:

The Directors of the Auburn Chamber of Commerce have by resolution instructed me to convey to you their thanks and appreciation for the splendid Placer County Booklet compiled by officers of your company in connection with a committee from the Auburn Chamber of Commerce, and printed on your Perfect System Press. District Manager, H. M. Cooper, author of the major part of the booklet, submitted several copies at our last meeting, and informed us that some 7,000 copies were subject to our disposal. We consider this a very valuable acquisition to our county literature, and have no doubt but that they will assist very materially in the upholding of our county.

Yours very truly,
By JOHN A. LIVINGSTON, Sec.

How There Came to be Established a Course in Gas-Engineering at Berkeley

The facts and circumstances attending the establishment of a course in Gas-Engineering at the University of California will be found set out in the following circular issued by Sec. Bostwick of the Pacific Coast Gas Association to the members subscribing to the fund:

PACIFIC COAST GAS ASSOCIATION
Office of the Secretary
445 SUTTER STREET
San Francisco

July 12, 1913.

To the SUBSCRIBERS to the
GAS ENGINEERING DEGREE FUND of the
PACIFIC COAST GAS ASSOCIATION.

In transmitting you herewith bill covering second payment due on account of your subscription to the Gas Engineering Degree Fund, I take pleasure in informing you that this degree is now a part of the curriculum of the University of California, and all work in connection with same is being taken up actively by the University.

On January 29th, 1913, Mr. John A. Britton, Vice-President and General Manager of the Pacific Gas and Electric Company delivered the first lecture of this course before the student body, the lecture having to do with the general history of the development of artificial gas, and on April 4th, 1913, Mr. Britton delivered the second lecture having to do with the accounting methods as prescribed under the regulations of the Railroad Commission.

Mr. E. C. Jones, Chief Engineer of the Gas Department of the Pacific Gas and Electric Company, during the spring semester delivered the following lectures before the student body:

February	17,	1913,	The Manufacture of Coal Gas.
March	3,	"	Purification of Coal Gas.
"	17,	"	The Manufacture of Water Gas.
"	31,	"	The Manufacture of Oil Gas.
April	14,	"	Distribution of Gas.
"	21,	"	Measurement of Gas.

In order that there may not be any misunderstanding on the part of any of the contributors to this fund, it is only proper to state that the above lectures were given gratuitously by both Mr. Britton and Mr. Jones, without any expense whatsoever to the University, and no part of the $2700 which has been turned over to the University by the Association, account of the first year's subscription, was drawn upon in connection with the lectures, the full sum being available for use by the University authorities in maintaining the course in Gas-Engineering.

In connection with the above, it will be of interest to know that the students of Gas-Engineering visited the Potrero Gas Works of the Pacific Gas and Electric Company between lectures and had practical demonstrations and laboratory work. It will also be of interest to know that the gas companies of the Pacific Coast generously found places for such students in the Gas Engineering Degree Course who desired to work during the vacation period, and reports to hand indicate that all these young men are showing considerable enthusiasm and aptitude in their work.

In a general letter, which will shortly be sent to all members of the Association, there will be enclosed a list of the contributors to this fund, with a request for further donations from such members who have not as yet contributed, as the total amount of the subscription at this time will not provide sufficient funds to carry this work to the successful conclusion which we all hoped for.

Thanking you on behalf of the Association for your interest in this great work, I am,

Yours very truly,

HENRY BOSTWICK,
Secretary.

Crime No Trivial Matter Nowadays

Address Delivered by Judge Mahon of the Superior Court of Sutter County in Passing Sentence Upon Thomas Cannon, a Striking Lineman Formerly in the Employ of the Pacific Gas and Electric Company, Full of a Sound, Common-Sense Philosophy.

One of the most remarkable addresses ever delivered by a judge to a convicted criminal in this part of the world is to be found in the records of the court of Sutter county, at Yuba City. The case, that of Thomas Cannon, a striking employee of the Pacific Gas and Electric Company, convicted of tampering with the company's high-tension power line; the judge, His Honor Judge Mahon of Sutter County.

The case is familiar to readers of up-country newspapers, for it happened but recently. Cannon, a lineman out on strike, in company with one of his kind, one George Elling, deliberately short-circuited our 60,000-volt line near Live Oak on the night of May 14th. The case was officially investigated, and as a result a chain of circumstantial evidence was wound around the two men. They were arrested, and within two months Cannon was brought to trial before a jury in Yuba City. The result was conviction, the only point debated by the jury being whether or not to recommend the defendant to the mercy of the court because of his youth—for he was but 22 years of age! But the crime was so heinous that it was decided to omit the recommendation.

In passing sentence of two years' imprisonment in San Quentin, Judge Mahon delivered an address that is worth sending out to the world. It was no vehement arraignment of an unfortunate entirely at the court's mercy; nor, on the other hand was it any studied arrangement of platitudinous, commonplace sentiment. It was clear, concise, well-ordered, unprejudiced, unbiased philosophy. As such we consider it worth reproducing here. We quote from a verbatim report published in the Marysville *Appeal* of July 16th:

"The crime of which you were convicted is not a trivial offense; it is not a small matter. In my judgment, it is one of the most serious crimes that a man can commit. I think it is more serious than the crime of grand larceny or burglary. It is an offense that was provided against by our legislature for the protection of human life as well as property. I cannot understand, I cannot comprehend why anybody would attempt to destroy such property and do so much damage—a damage which might occasion the death of human beings; because electricity is dangerous, very dangerous and you knew the instrument that you were fooling with.

"And then, you got no benefit out of the crime yourself. I can understand why a man robs a bank; he gets money out of it and expects to get away with it. One who commits burglary is looking for property that he can steal, get away with, and use it. And with the case of most other crimes, I can understand the motives for committing them. But I cannot understand why a man would go deliberately and interfere with one of these high-tension power lines. As an electrician, you knew the damage you might occasion by committing such an act.

"I do not think it was an accident that lead you to select that particular place to do the damage. I think it was done because at that place you knew that there you could cause the most damage. It was testified to here on the stand that that wire was connected with the whole system, and that when an interference occurred there it was communicated all over the system. It was felt forcibly at Watsonville and Fresno, and all around. It caused the company damage to the extent of thousands of dollars. I do not know just how much damage it did cause, but it cost them a great deal of money, and it is fortunate that nobody was killed. I do not think that when you did it you took into consideration or that you cared much whether anybody was killed or not. Innocent men who happened to be in a position of danger at that time were liable to lose their lives, men that you never saw, men that you had no reason to kill, no purpose in killing. And yet, if they had been in a place of jeopardy, you knew that they would get it.

"Now, laws are made to be observed. This country is governed by laws; men do not govern this country except to enforce the laws as made. And one who violates the law must expect to meet punishment. The law must not be broken down. The law must be respected, if we wish to have government. People's lives must be preserved, if we can preserve them. Their property must be protected if we can protect them. That is the object of government, and of courts and of judges and clerks and sheriffs, district attorneys and court reporters; and people all over the country pay heavy taxes to support them. It is not a trivial matter when people disregard the law and try to make a breach in the law. Some places stand for it. In some places they do not seem to care much about it, whether they have good or bad conditions; they go right along in their easy way. But in this county we do care.

"We always have cared in Sutter County. We have a law-abiding people here, and it is a mighty unsafe place for anybody to commit crime in. Here they do not look upon the violation of the law of this country as a trivial matter. Jurors generally do not wear their hearts on their sleeves in Sutter County. They do not have much sympathy for people who commit crime. They know that if they enjoy protection themselves they have in turn to protect other people when their rights are violated and invaded. Generally when they have a fair show they convict in Sutter County. Jurors when they convict criminals, expect that their verdict will be executed by the court.

"I cannot consider for a moment that belonging to a union is any justification for this crime; I do not believe that your union justifies or upholds your acts; I do not believe that your union stands for it. If I thought they did I would have very little respect for it, but I do not believe it stands for these violations. I have never belonged to a union, but I have always understood that they do not stand for violence. Some of the best men within my acquaintance belong to unions, and these men would not belong to an organization that believed in the violation of the law.

"So, I cannot believe that the fact that you belonged to any union is a justification for your act. I believe you would have done it just as quickly if you had not belonged to a union; persons who do these things would do them anyhow; it shows that you are careless and reckless, and you care nothing for consequences, not even for life, and I want you to understand and I want everybody to understand that this matter is in my judgment a very serious one—a very serious matter—in fact I cannot conceive of a crime that is more serious than the crime that you have been convicted of.

"Now, you are a young man; that is the one thing I am considering! I am not considering your justification at all in this thing; but you are a young man, and it may be that this is the first time that you have committed crime of so serious a nature as this, and there may be some hopes for you when you have served this sentence that I am about to impose; that you will come out and, having learned a lesson, will be a decent citizen and will, in the future, respect the rights and properties of other people and respect the law as it is written. The law protects you, and, if you break it down, you will have no protection. If it is broken down in any respect neither you nor any one of us will have any protection whatever. It is the only thing that protects us, our rights, and our property. And you as well as everybody else must respect it and must observe it. When you fail to respect and observe it you must expect punishment; that must follow until our present laws are changed.

"There is a disposition among some people to break down the laws and do away with penitentiaries, and thus diminish hardships that have heretofore been imposed upon criminals; I have no sympathy with such people. I have no sympathy with such maudlin sentimentality—not a bit. I believe that when people do not observe the law they should be put in a place where they have to observe it, where they will learn a lesson. If you have not learned the lesson on the outside, it should be taught you now. The penitentiary is a severe school, it is a bad place; but it seems the only school in which some people will learn.

"I hope you will learn the lesson of respecting the rights of other people, which you apparently have not yet learned. If you learn to do this, you will come out and be a decent and respectable citizen afterwards. If you fail, you will have to take the consequences."

Cannon's partner in crime, George Elling, saved the State the trouble and expense of a trial, by pleading guilty. In this way he secured for himself such leniency as the District Attorney of Sutter County might see fit to recommend and the Court be willing to grant. He was sentenced to 18 months in San Quentin.

Pacific Service Magazine

PUBLISHED IN THE INTERESTS OF ALL THE EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

JOHN A. BRITTON - - - - EDITOR-IN-CHIEF
FREDERICK S. MYRTLE - - MANAGING EDITOR
A. F. HOCKENBEAMER - - BUSINESS MANAGER

Issued the middle of each month
Year's subscription $1.50
Single copy .... .15

Published by the
PACIFIC GAS AND ELECTRIC COMPANY
at 445 Sutter Street, San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. V AUGUST, 1913 No. 3

EDITORIAL

THE REGULATION OF PUBLIC UTILITIES by State Commissions has grown to be an established custom all over the land. It has been in effect in California nearly sixteen months now and has proved a success here as it has everywhere else. It has worked to the benefit of both the public service corporations and the public they serve. It has placed the utilities upon a better footing with the people and it has given the people a better understanding concerning the duties and responsibilities of the utilities.

All that being admitted, it is refreshing to note that the new order of things has not been one-sided in its effect; in other words, that it has not been of benefit merely in curbing the public service corporations in their heretofore wild and unrestrained career, but that it has actually been of educational value in the sense of revealing the corporations as not altogether political institutions of the get-rich-quick order but as being, for the most part. business organizations doing their business in business-like fashion and endeavoring to treat the public as they themselves would have the public treat them.

An instance of this educational result is furnished by the case of the Hon. John B. Olmsted, late Public Service Commissioner of New York State, who upon retiring from office recently delivered a speech which has proved a very revelation in its unusual frankness of expression. It is a confession, in fact, of a man big enough to admit that he went into office with all manner of anti-corporation prejudices only to find his point of view changed by personal contact with the very corporations he went in to check, regulate and otherwise administer.

"I came into office with decided leanings toward the anti-corporation view of public utility questions," admits Mr. Olmsted. "Some of my good friends among the corporation lawyers in Buffalo were kind enough to say I was too much of an anarchist to be of much use as a commissioner." Then he comes out frankly and admits that in this, as, we venture to think, in most instances of the kind, his prejudices were due to want of knowledge. He says:

"Want of knowledge as to the precise point involved I have found in many cases to be the principal cause of the prejudices I then entertained. Experience has taught me that there is another side to these questions, and one not lightly to be dismissed."

Mr. Olmsted at the outset of his official career appears to have entertained old-fashioned views concerning corporation managers and their attitude toward the public. He confesses he expected to find that attitude "recalcitrant and objurgatory, which is a Latinized and 'more tenderer' way of saying that it was made up of kicks and damns." But to his amazement he found it almost uniformly conciliating, when expressed in the presence of the Commission, at any rate, and willing to abide by the results of a fair hearing. "The difficulty with me has not been so much in getting the corporations to do what I thought was right as to determine in my own mind what under all the circumstances of certain cases was right," he says.

There is the case in a nutshell. Mr. Olmsted, like many others, we hope, has discovered that corporations have rights as well as duties, and that questions of right and duty are not of necessity to be solved to the discomfort and inconvenience of the particular corporation involved. Mr. Olmsted goes on to say:

"I am fully aware that this is not the popular view of public service corporations, nor do I wish to be understood as having discovered wings on the shoulders of the managers thereof. I say that a better knowledge of the conditions under which their business is carried on brings one to a more just appreciation of some of the difficulties under which they labor. I know well that there are many—very many—particulars in which the service which they are rendering may be improved, as I know well that there are very many particulars in which the business of every man in this room might be improved if an inquiry into it were started by a commission armed with power. Such a commission would be at once met with the objection that its suggestions required too much of an outlay to carry them out, and would be asked how it proposed to provide the funds for the improvements recommended.

"I believe that in the past ten years a great change has come over the minds of men who are in the management of public utilities. There are still some left who cling to the old 'public-be-damned' idea, but they are fast being supplanted, and the up-to-date railway or electric light official stands ready to listen to any reasonable complaint that may be brought to his attention and, what is more to the point, to turn a deaf ear to proposals which call for abhorrent and forbidden methods in their accomplishment.

"I have intimated that one great difficulty with certain corporations is the lack of means to carry out the improvements to service which their operating men admit would be advisable and desirable. On this point some figures from our last annual report may be illuminating. Out of 78 steam railroads reporting to the commission in this State, only 27 paid any dividends for the current year. Out of 364 electric railroads, light, heat and power, and gas corporations, 237 paid no dividends. In 1909 it was 237 out of 310, so that conditions are improving some; but the figures are significant. They are contradictory to the general impression that dividends are the foundation upon which all public service corporations are erected, and they have a sobering effect upon an official who starts in with the idea of building Rome—or even Schenectady—in a day.

"The consideration of them has not swayed the mind of the Commission where conditions have become intolerable or even irritating; but they have at times prevented the attainment of ends which otherwise might have been ordered.

"The Public Service Commission is organized to hand out justice as near as it can determine it, both to shippers and to carriers, to consumers and to producers, and if it has attained some success in its work of the last five years it has done so by a strict adherence to that view, and not by spectacular brandishings of the 'big stick.' It has accomplished more good by getting both parties before it, pointing out the strength or weakness of opposing views, and then appealing to that sense of fair play which is inherent in every man, than it ever has by a display of the tremendous powers which the law undoubtedly confers upon it."

Mr. Olmsted's statement is significant in that it points to a healthier and a saner condition of things than has ever before been known in the public utility field. And if the commission form of government which has been recently established is responsible for this altered condition so much the better.

Mr. A. F. Hockenbeamer, our Second Vice-President, Treasurer and Comptroller, is back from a six weeks' sojourn in the East where, he says, he enjoyed the doubtful privilege of encountering the hottest weather known in twenty-two years. He is recuperating rapidly, however, under the influence of some wholesome San Francisco sea-fog.

Mr. Hockenbeamer was so busy while he was in the East that he had but little time to pay attention to the weather. He was there for the purpose of conducting negotiations with the New York bankers whereby a sufficient sum of money should be placed at the disposal of our company to enable it to carry on the great construction work in progress in the Sierras. That he succeeded in his mission is of record, for the press, both local and Eastern, has advised the financial world that a sale of $4,500,000 one-year 6 per cent notes, part of an authorized issue of $7,000,000, has been effected wth a New York Syndicate headed by J. P. Morgan & Company.

It was no little task to conduct negotiations of this kind to a successful issue at a time when the bankers all over the country were tightening their purse strings and refusing loans on even gilt-edge securities. It speaks more than a word for the regard in which "Pacific Service" is held by those whose business it is to appraise public utilities' and other securities from the point of view of sound investment. In speaking of the matter on his return, Mr. Hockenbeamer said:

"Our needs for the next twelve months have been satisfied and I venture to predict there will be little or no trouble from now on in financing our great undertakings. From what I observed in the East I think the atmosphere is clearing. There was something of a scare a little while ago which threatened to develop into something worse; but the clouds are rolling away rapidly and the sky may be clear within a very few months."

Fifty years in harness; in the seventy-ninth year of his age; still vigorous and never missing a day's work.

This, in brief, is the record today of John Yablonsky, who on August 7th rounded out an even half-century of service with what is now the San Francisco district of the Pacific Gas and Electric Company. He is celebrating his jubilee in his native land, England, whither he sailed July 16th. This is to be a flying trip, for the middle of October will see "Johnnie" back again and ready for another spell of the work he declares keeps him young.

This old-young man has had quite a record. He was born in England, in 1834 and came to San Francisco by the Cape route in 1850. He started to work in the printing business, but in due course he left this and on August 7th, 1863, he entered the service of the San Francisco Gas Company. Since that time he has passed through several grades of employment: first, janitor, next, meterman, then statement-reader and, later, collector. He proved such a popular as well as persuasive collector that the company kept him at it over forty years, until a year or so ago he was taken into the records department where he now is.

It is a pleasure to meet an optimist of his years. "I am going abroad for a spell," he said before leaving. "I thought it would be nice to celebrate my fiftieth anniversary with relatives in the old home. I have got a brother to see and also three cousins if I can find them. I want to revisit some of the scenes of my boyhood, Kew Gardens, Hampton Court and such places. It will be an interesting trip for me and, then, unlike many travelers, I am looking forward to the sea voyage both ways. I have picked out some pretty good ships to enjoy it in,

John Yablonsky

for I am going over on the Mauretania and coming back on the Imperator. It is not the first time I have been back there, you know, but the last time was 1861 and that is some little while ago."

When he reached New York he proceeded to have a good time and was assisted in this by Mr. Jack Judge, a former employee of the San Francisco district, who is with W. P. Bonbright & Company. "Johnnie" wrote to his old superior officer and friend, "Charlie" Barrett, telling him of his doings in the gay metropolis.

"Pacific Service" wishes John Yablonsky a pleasant trip and a safe return.

Another employee of "Pacific Service" who is summering abroad is Mr. J. E. Poingdestre, Manager of the Marysville District. Mr. Poingdestre is a native of the Channel Islands, a delightful part of the world where life is something of a dream. But in addition to visiting his old home, Mr. Poingdestre is traveling extensively in England and France, and his friends have been able to keep track of him through the illustrated postcards with which he has good-naturedly bombarded them. He is due back shortly.

Mr. Charles J. Wilson, Assistant Engineer of Electrical Distribution, has gone to Panama for a vacation. Accompanied by Mrs. Wilson he left July 21st in the W. R. Grace Company's newest vessel the Colusa. He expects to be gone about six weeks, during that time he will absorb considerable information about the canal zone and its doings and prospects. Before leaving he promises to get together some interesting material for the readers of the magazine and with a view to the fulfillment of this promise, he took with him an awe-inspiring stack of photographic material.

Mr. Edward G. Wilcoxon, foreman at Deer Creek power-house, became a benedict last month. He was assisted in this by Miss Laura F. Reno of Chico and the ceremony took place July 19th in Nevada City. The bridegroom is a young man who has made his own way in the world and promises to go higher. He hails from French Corral. His bride, a most prepossessing young lady, was born in New Mexico, but before her marriage resided many years at Chico where she was a successful school teacher.

W. S. Keith, late foreman of construction at Drum, is now with the Henry Cowell Lime & Cement Company at its Portland, Oregon, branch.

From the President's office comes the announcement that the distribution system of the town of Colfax and vicinity has been made a part of the Placer County District, and placed in charge of District Manager H. M. Cooper.

Noting Progress of the World's Fair

During the month of July the republics of Peru, Guatemala and Honduras were added to the roll of participants in the Panama-Pacific Exposition. Sites for their respective exhibits were dedicated with appropriate ceremonies and deeds to the ground handed over to their respective representatives. Frederico Alphonso Pezet, envoy extraordinary and minister plenipotentiary from Peru to the United States, planted the flag of his country in the Fair Grounds; Joaquin Mendez, Minister from Guatemala and Acting Minister from Honduras, performed a similar office for the countries named.

Applications for space in the California building are being filed daily and already reservations have been made for a great deal more than the 100,000 square feet originally planned as the capacity of the building.

The illumination of the Exposition promises to be a feature more striking than anything of the kind ever before attempted. A distinguishing characteristic of the illumination will be the absence of dark shadows. Perfect reflection of whole buildings, with all the details of their facades, will be seen in the lagoons upon the grounds. Many millions of candlepower will be utilized, and the chief zone of illumination will extend to a height of 125 feet, with a variation of but 5 per cent in the intensity of the light. The result will be to bathe the Exposition in a full flood of light with the effect almost of daylight. There will be four principal sources of light on the Exposition grounds: Illuminated arc standards, reflecting light against the walls of the palaces and buildings; illuminated fountains in the great interior courts; concealed lights within the columns of the encircling colonnades and the arcades of the towers; and the lighting of the Exposition palaces.

Upon the roofs of these palaces will be batteries of searchlights, while others will be set out upon pontoons set some distance from the harbor's edge. The effect promises to be superb. Needless to say "Pacific Service" will furnish power for this entire scheme of illumination.

An important point worthy of being called to the attention of intending exhibitors is the system of protection against fire which will include a high pressure water supply system and a regularly organized fire department divided into three engine and two fire companies and an auxiliary squad equipped with motor apparatus, hose-wagons, pump-engines, ladder-trucks, etc. The fire department will number one hundred men, and four fire stations will be built on the Fair Grounds at advantageous points. In addition, the San Francisco Fire Department has stations close to the grounds, and in all probability a city fireboat will be moored at one of the Exposition wharves. High pressure hydrants will be spaced about every 300 feet along the streets; there will be a service water supply system in addition to the high pressure system for fire protection only; there will be numerous chemical engines and street pipes with hose attached for first aid purposes. An elaborate fire alarm system reinforced by a watchtower will insure prompt discovery of any mishap that may occur.

In his report to President Moore, Director of Works Connick states that twenty-two important contracts have been already completed and that work on the remainder is well on the way. As a matter of fact, it is well known that the entire Exposition is ahead of schedule. By next July all the palaces will be ready to receive their contents. This will beat any achievement in the records of past Expositions.

Alameda County Manufacturers' Exhibit and How "Pacific Service" Contributed to its Success

By J. CHRYSOSTOMO, JR., Commercial Department, Oakland District.

J. Chrysostomo

Markedly successful was the big exhibit of home products planned and exhibited by the manufacturers' committee of the Oakland Chamber of Commerce which closed April 30th after a record-breaking attendance of 100,000. And in that success, we are proud to record, "Pacific Service" participated.

The exhibit lasted ten days and represented, approximately, three million dollars capital. It was planned and launched primarily for the purpose of educating the public regarding the vast scope and variety of industrial development on the eastern side of the bay. But little interest was manifested in the undertaking, at first, and those who entered an exhibit did so with apparent reluctance, even to regarding the entire affair as a donation party. But this feeling vanished when the undertaking began to expand and before long gave way to one of unqualified enthusiasm.

The stone-walled, floored and ceiled basement of the new Kahn Bros. department store building was offered to the committee without charge, and available exhibit space of 30,000 square feet was subdivided into 10x12 units with large aisles. Before the opening over a hundred manufacturers had installed displays.

The exposition, located as it was in the heart of the business district, had the advan-

THE MANUFACTURERS COMMITTEE

OF THE

Oakland Chamber of Commerce

This Certifies

That

has been awarded this

BLUE RIBBON OF MERIT

For Exhibit of

In Testimony Whereof the Chairman and Secretary have hereto set their hands and affixed the organization seal at Oakland, California,

this day of 1913

Chairman

Secretary

Chairman

Secretary

tage of accessibility. Then again, admission was free to the public. The result was an average of 10,000 visitors per day.

The economic benefits of home patronage were brought home to approximately 100,000 civic-spirited individuals, and a tremendous impetus given to the demand for local products. Since the exposition closed many manufacturers have been given unsolicited confirmation of this gratifying result.

The most important result, however, has been the solidifying of the individual efforts of the local manufacturers into one harmonious, united, self-sacrificing and self-effective whole.

Laying aside his own personal affairs, each one unstintingly gave his time and himself to the multifarious details of the exposition work. Each member of the sub-committee had his particular task allotted to him. To myself, as a representative of the Pacific Gas and Electric Company and a member of the manufacturers' committee, fell the task of planning the illumination of the immense basement, sixteen feet in height. In addition, all the engineering details of the exposition, including the illumination, were given to me to look after. It was necessary that the illumination be evenly distributed and as intense as possible, also that no exhibitor be given preference over another. The job was a man's size, but I think I may be pardoned for my seeming egotism in saying that it was put through without a hitch.

The current for light, heat and power was supplied to the exposition gratuitously by "Pacific Service," whose efforts in behalf of the exposition contributed largely to the fine display of the working exhibits.

The Pacific Gas and Electric Company's booth was located near the entrance and was constantly the center of an interested throng. Electric machinery, pumps, and domestic appliances were painstakingly demonstrated day and night by experts from the Commercial Department, and visitors were systematically educated in the advantages of these modern labor-saving devices.

In addition, the manufacture of gas was shown, and the interior mechanism of a gas meter under pressure, which was very interesting to the public.

In view of the fine display and excellent service rendered by our company, the judges of the exposition awarded the Pacific Gas and Electric Company a blue ribbon diploma of merit. With pardonable pride, we call special attention to this.

Men Who Help to Make "Pacific Service"

Mr. Frank H. Varney, Engineer O. & M. Dept. Steam and Gas Engineering Section, received recently a communication from Mr. R. E. Fisher of the Commercial Department regarding operating conditions at the Sacramento River Station, which he considers worthy of publication. The letter follows:

San Francisco, California, June 19th, 1913.

Mr. Frank H. Varney,
Engr. O. & M. Steam & Gas Eng. Sect.

Dear Sir:—At the commencement of the present labor trouble, it was my good fortune to be assigned work under your Mr. Wm. Thompson, Chief Engineer, Station "B," Sacramento.

I take this means of expressing my appreciation and to congratulate you in having the services of a man who, in my opinion, is a gentleman and a credit to the engineering profession in every possible way.

Men like Thompson help make "Pacific Service" possible in the rigid test the organization is now undergoing.

Sincerely yours,

R. E. Fisher.

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District	Headquarters	Manager
ALAMEDA CO., BERKELEY, OAKLAND	Oakland	F. A. LEACH, JR.
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CONTRA COSTA	Martinez	DON C. RAY
FRESNO	Fresno	M. L. NEELY
GRASS VALLEY	Grass Valley	JOHN WERRY
MARYSVILLE	Marysville	J. E. POINGDESTRE
MARIN	San Rafael	W. H. FOSTER
NAPA	Napa	O. E. CLARK
NEVADA CITY	Nevada City	JOHN WERRY
PETALUMA	Petaluma	H. WEBER
PLACER	East Auburn	H. M. COOPER
REDWOOD	Redwood City	E. W. FLORENCE
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SAN FRANCISCO	San Francisco	G. C. HOLBERTON
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SANTA ROSA	Santa Rosa	M. G. HALL
SOLANO	Dixon	C. E. SEDGWICK
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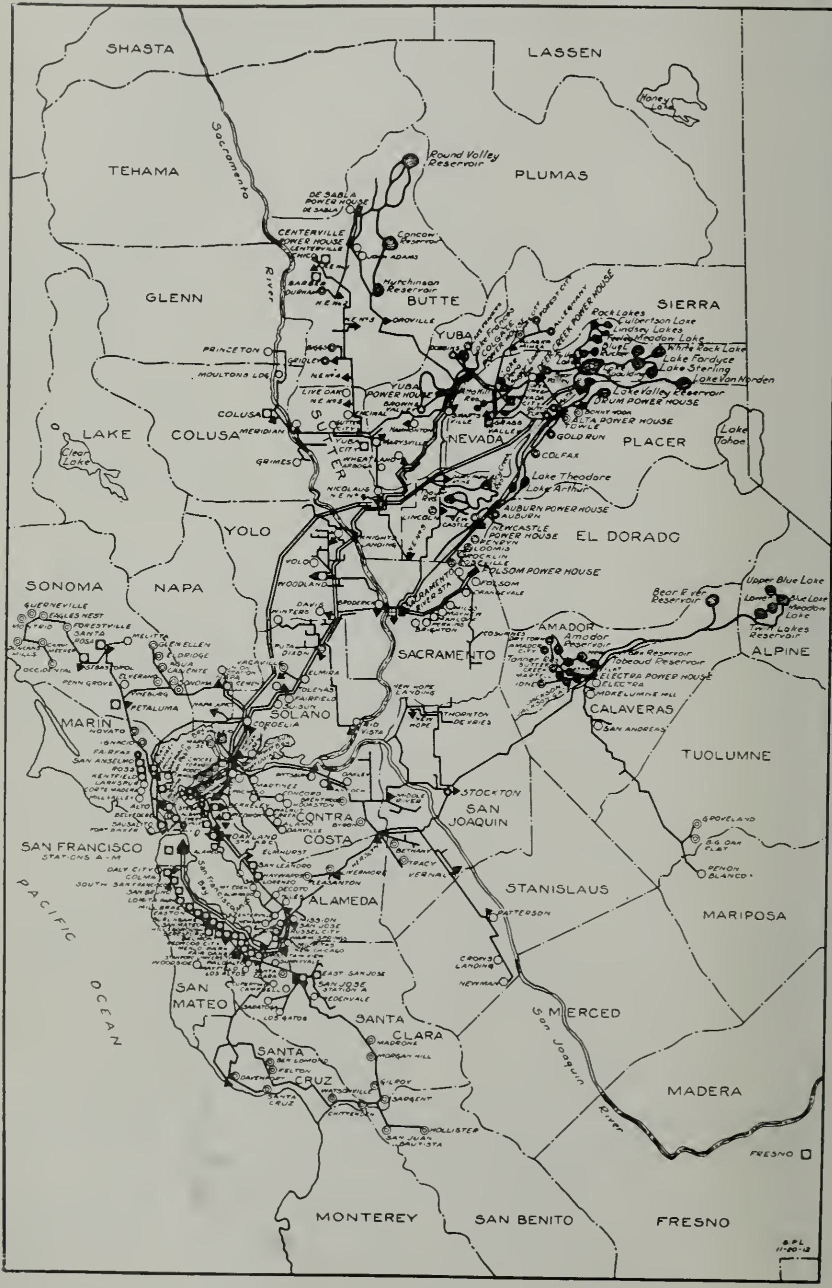

SHASTA
LASSEN
TEHAMA
PLUMAS
Sacramento River
Round Valley Reservoir
DE SABLA POWER HOUSE
CENTERVILLE POWER HOUSE
Concow Reservoir
Hutchinson Reservoir
GLENN
BUTTE
OROVILLE
SIERRA
YUBA
Rock Lakes
Culbertson Lake
Lindsey Lakes
Meadow Lake
White Rock Lake
Lake Fordyce
Lake Sterling
Lake Von Norden
Lake Valley Reservoir
DRUM POWER HOUSE
ALTA POWER HOUSE
PRINCETON
COLUSA
YUBA POWER HOUSE
LAKE
Clear Lake
COLUSA
SUTTER
NEVADA
GOLD RUN
PLACER
Lake Tahoe
COLFAX
Lake Theodore
Lake Arthur
AUBURN POWER HOUSE
NEWCASTLE POWER HOUSE
YOLO
EL DORADO
FOLSOM POWER HOUSE
SONOMA
NAPA
SACRAMENTO RIVER STA
Bear River Reservoir
Upper Blue Lake
Twin Lakes Reservoir
AMADOR
Amador Reservoir
Tabeaud Reservoir
ELECTRA POWER HOUSE
ALPINE
SACRAMENTO
SOLANO
MARIN
CALAVERAS
TUOLUMNE
STOCKTON
SAN JOAQUIN
CONTRA COSTA
SAN FRANCISCO
STATIONS A-M
OAKLAND
ALAMEDA
PACIFIC OCEAN
STANISLAUS
MARIPOSA
SAN JOSE
SAN MATEO
SANTA CLARA
MERCED
San Joaquin River
SANTA CRUZ
MADERA
HOLLISTER
FRESNO
MONTEREY
SAN BENITO
FRESNO

PACIFIC GAS AND ELECTRIC COMPANY

CITIES AND TOWNS SUPPLIED WITH GAS, ELECTRICITY, WATER AND RAILWAY

Service Furnished	Number of Towns	Total Population
Electricity	209	1,093,992
Gas	51	989,167
Water	25	52,865
Railway	1	71,000

Place	Population
Alta	20
[1] Alameda	25,000
Alamo	50
[2] Albany	800
[5] Amador City	200
Adams John	25
Alleghany	200
Alto	25
Angel Island	280
[5] Auburn	2,375
Agua Caliente	100
Alvarado	900
Antioch	3,000
Arboga	100
[2] Barber	500
[2] Belmont	350
Ben Lomond	800
Belvedere	1,000
Benicia	3,360
[2] Beresford	25
[2] Berkeley	40,000
Biggs	750
Big Oak Flat	20
Brentwood	200
Brighton	100
Broderick	200
[5] Brown's Valley	50
Byron	200
[2] Burlingame	4,000
California City	25
Camp Meeker	200
Campbell	600
Centerville	1,000
Centerville	20
[2] Chico	13,000
[2] Colma	3,500
[2] Colusa	1,500
Concord	1,500
Cement	1,500
[5] Colfax	500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Cupertino	50
Daly City	250
Danville	250
Davis	750
Decoto	350
de Sabla	25
[5] Dixon	1,000
[5] Dobbins	50
Davenport	1,000
[5] Drytown	20
Durham	500
[5] Dutch Flat	500
Duncan's Mills	150
[2] Easton	300
[2] East San Jose	1,660
Eagle's Nest	50
Edenvale	500
Eldridge	500
Elmira	150
El Verano	400
Electra	50
[2] Emeryville	5,000
Encinal	100
Fairfax	500
Fairfield	834
Forestville	100
Felton	300
[1] Fresno	30,000
[2] Fair Oaks	250
Folsom	1,800
Gilroy	2,000
Glen Ellen	500
[5] Gold Run	100
[3] Grass Valley	4,500
Gridley	1,800
Grimes	250
Groveland	125
Guerneville	500
Hammonton	500
[2] Hayward	4,000
[2] Hillsborough	1,000
Hollister	3,000
Hookston	75
Ignacio	100
[5] Ione	900
Irvington	1,000
[5] Jackson Gate	100
[5] Jackson	2,035
[5] Kennedy Flat	20
[2] Kentfield	250
Knight's Landing	350
[5] Lake Francis	5
Lathrop	300
Live Oak	200
Livermore	2,250
Los Gatos	3,000
[2] Larkspur	600
[5] Lincoln	1,400
[2] Lomita Park	100
Los Altos	500
[5] Loomis	400
Maletta	30
Manlove	50
Martinez	5,000
[5] Martell	150
[2] Marysville	7,000
Mayfield	1,500
Mayhew	50
[2] Menlo Park	1,500
Meridian	300
[2] Millbrae	300
Mills	50
Milpitas	300
Mill Valley	2,500
Mission San Jose	500
Mokelumne Hill	150
Monte Rio	50
Moulton's Landing	30
Mountain View	2,500
Mt. Eden	200
Mare Island	500
[2] Napa	7,000
[3] Nevada City	2,700
[5] New Chicago	10
Newark	700
[5] Newcastle	750
Newman	1,000
Niles	800
Nicolaus	75
Novato	250
[2] Oakland	230,000
Oakley	80
Orange Vale	100
[2] Palo Alto	6,300
Pacheco	200
Penryn	250
Patterson	300
Penn Grove	300
Perkins	50
[2] Petaluma	5,500
[2] Piedmont	1,720
Pike City	200
Pinole	1,500
Pittsburg	2,372
Pleasanton	2,000
Point San Pedro	20
Port Costa	600
[2] Redwood City	3,200
[2] Richmond	10,000
Rio Vista	884
[5] Rocklin	1,000
[5] Roseville	2,600
Rodeo	500
[2] Ross	500
Russel City	250
[4] Sacramento	71,000
San Andreas	200
[2] San Anselmo	1,500
[2] San Bruno	1,500
[2] San Carlos	100
[2] San Francisco	416,912
[2] San Jose	30,000
[2] San Leandro	4,000
San Lorenzo	100
[2] San Mateo	6,500
[2] San Quentin	2,500
[2] San Rafael	6,000
San Pablo	1,000
Santa Clara	6,000
Santa Cruz	16,000
Saratoga	50
[2] Santa Rosa	12,000
[2] Sebastopol	1,200
Sausalito	2,500
Smartsville	500
[2] South San Francisco	2,500
[2] Stanford University	2,600
Sonoma	1,200
Stege	1,000
[5] Stockton	30,000
Suisun	1,200
Sutter City	150
Sutter Creek	1,500
Sunnyvale	1,500
Tiburon	400
Tormey	20
Towle	100
Tracy	1,200
Union Station	40
Vacaville	1,200
[2] Vallejo	15,000
Vineburg	200
Walnut Creek	350
Warm Springs	200
Watsonville	4,500
Wheatland	1,400
Winters	1,200
[2] Woodland	3,200
Woodside	200
Yolo	400
[2] Yuba City	1,200
Total	1,148,992

Unmarked—Electricity only
1—Gas only.
2—Gas and Electricity.
3—Gas, Electricity and Water.
4—Gas, Electricity and Street Railways.
5—Electricity and Water.

EMPLOYS 4,800 people.
OPERATES 11 hydro-electric plants in the mountains.
5 steam-driven electric plants in big cities.
16 gas works.

SERVES ⅔ of California's population.
30 of California's 58 counties.
An area of 37,775 square miles.
⅗ the size of New York State.
½ the size of all the New England States combined.

OL. 5 SEPTEMBER 1913 NO. 4

Pacific Service Magazine

PUBLISHED MONTHLY BY THE
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CALIFORNIA

Pacific Service Magazine

Vol. V | Contents for September | No. 4

Yearly Subscription $1.50 | Single Copies each 15 cents

Interior of Palace of Machinery, showing progress of construction. In this will be housed all the industrial exhibits, including that of "Pacific Service."

(Official Photo, copyright, P. P. I. E.)

Pacific Service Magazine

VOL. V SEPTEMBER 1913 No. 4

Lighting the Panama-Pacific Exposition

Written Expressly for Pacific Service Magazine

By GUY L. BAYLEY, Chief Mechanical and Electrical Engineer, P. P. I. E

We have much pleasure in presenting to the readers of PACIFIC SERVICE MAGAZINE *a very able and comprehensive article in which Mr. Bayley has outlined the scheme of illumination to be carried out at the Universal Exposition held in San Francisco in 1915 in honor of the completion of the world's greatest engineering feat, the Panama Canal.*

It is truly a stupendous task that the engineering department of the Exposition is undertaking in producing night effects which will enable visitors to the Exposition after sundown to believe that they stand in a veritable fairyland. The every-day person, perhaps, has little or no realization of what it involves in the way of invention as well as hard work to carry out a project of such magnitude as stands revealed by Mr. Bayley's article. What follows here, then, will commend itself to technical and non-technical minds alike. It will satisfy the one, amaze the other and interest both.

It may not be amiss here to remind our readers that the magic fluid known as electricity used to carry out this great scheme of illumination will be furnished by "Pacific Service." Our Company holds the contracts to supply the Exposition with all electricity, gas and steam to be used by the Exposition for whatever purpose during the construction period, the life of the Exposition and the following period of dismantlement.

The Pacific Gas and Electric Company has already completed a temporary installation on property belonging to it adjacent to the Fair grounds, and stands ready to meet demands for increased service as they are made. This work of installation, of course, is only in the initial stage. There will be a very great deal more of it in the not far-distant future.

EDITOR PACIFIC SERVICE MAGAZINE.

MUCH has been written of the varied and beautiful lighting effects which are promised by the Exposition, but little has been said as to how these results are to be obtained. The object of this article is to describe briefly some of the methods and apparatus which will be used.

The illumination has been designed to enhance the beauty of the buildings, courts, statuary, gardens and mural paintings at night and to produce effects which are impossible of realization by daylight.

As the architectural and decorative treatments are varied throughout the Exposition, so will the lighting effects be changed to harmonize at all times with the idea or motif as expressed by the designers in their work. Barring the one spectacular piece of lighting referred to below as the Scintillator, all artificial light will be made subservient to the varying needs of the object illuminated, and except for an occasional minor effect, all light sources will be concealed from view. This plan is a radical departure, both in conception

and execution, from anything done before in the way of outdoor lighting, particularly at expositions.

The practice in the past has been to exploit the lighting per se, as exemplified in the so-called outline lighting where myriads of incandescent lamps were spaced along the principal architectural outlines of the buildings and structures, and no attempt was made to illuminate the details of the architectural and decorative features.

There have been some beautiful effects produced by outline lighting, notably at the Pan-American Exposition held in Buffalo in 1907, but this type of decorative lighting has been relegated to the commonplace by its adoption for "Great White Way" and Amusement Park lighting.

Since the last international exposition, (St. Louis, 1904) the art and science of illumination has really been created, which, coupled with the advantages due to both new and improved lighting units, makes it possible to adopt a plan which would have been impossible of realization even a few years ago, with certainty as to the results.

Without question, the most impressive view of the Exposition will be that obtained as the visitor enters the great South Garden through the main entrance gates at the foot of Scott Street. The focal point of the Exposition is the colossal tower culminating in a great ball 430 ft. from the ground. This lofty structure is balanced by two minor towers, 200 ft. high, marking the entrance to the Court of Palms on the East, and by two similar towers at the approach to the Court of Flowers on the West. These five towers will be flooded with light (on four sides) by searchlight projectors. No less than sixty-four projectors will be required to produce the desired amount of light upon the towers. These will be placed over the entrance gates and upon the tops of the buildings. Each projector will be fitted with doors in which are mounted dispersion lenses which will spread the beam of light vertically and horizontally so as to cover a large area with light.

The sharp heavy shadows which would be cast by columns and pavilions, will be relieved by concealed tungsten lamps. These lamps are being dipped to produce a slightly purplish light, a color essential to preserve the sense of depth.

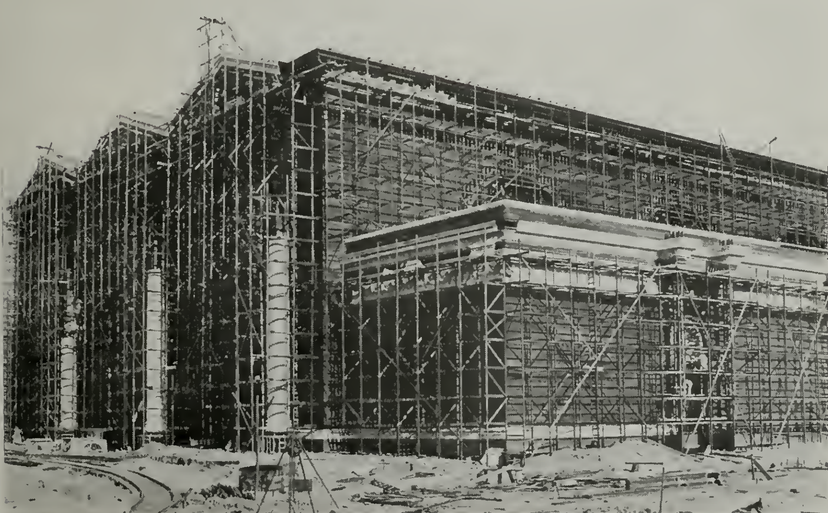
The towers will have their important architectural lines and decorative features studded with imitation jewels which will reflect and break up into prismatic colors the light projected into them by the searchlights. There are being made in Austria 125,000 of these jewels, of a hard grade of flint glass ground by hand. They will be in the following colors: canary, white, emerald, ruby and aquamarine, the canary color predominating, and will vary from 27 to 47 millimeters in diameter. These jewels will be suspended so that the slightest breeze will cause them to vibrate, thus increasing their effect in much the same way that a diamond is made more effective by a slight movement.

These jewels will not be used lavishly lest their effect be cheapened, but even so it will require 50,000 for the main tower alone. While the consideration of cost was not the determining factor in the adoption of jewels as a substitute for incandescent lamps for decorative needs, it so happens that their first cost is far less, and their cost of operation nil.

The South Garden will be lighted by metallic arc lamps mounted on tall standards, with the lamps concealed from the South by ornamental reflectors constructed of staff. Leading up to the main tower will be a broad avenue lined with ten standards each carrying ten lamps. The light from these and other similar arc lamps in the South Garden will not only illuminate the ground area but, in addition, will furnish the light for the lower portions of the towers and facades of the buildings. The stray light from these arcs and that reflected from the structures will be sufficient to obliterate the searchlight beams in much the same way that the spotlight beam in a theatre is made to disappear when the footlights are turned on.

The three pools, one large and two small, which are a part of the formal treatment in the South Garden, will each have a fountain with a single jet capable of throwing a solid stream one hundred feet high. Searchlights fitted with color screens and concealed in the shrubbery will play upon these geyser-like jets.

The Court of Honor, which approaches in form an ellipse with a major axis of 900 ft., and a minor axis of 500 ft., will be illumi-



Exterior of Palace of Machinery, showing progress of construction.

(Official Photo, copyright, P. P. I. E.)

nated in a novel manner. The architects have made provision for two large fountains, similar in design, which are on the main axis of of which the water will flow, and above which will rise a splendid shaft terminating in a large ball. The shaft has an average diam-

The Tower of Jewels
(Official Photo, copyright, P. P. I. E.)

the court and about equidistant from each other and the ends of the court. Each fountain has a large pool from which rises a structure carrying a series of basins, over the lips eter of four feet and a total height of sixty-four feet. While the shaft is enriched with sculpture, there is a section of twenty feet which has been left free from ornament, and this section will be built of heavy opalescent glass which in the daylight would pass for marble. This glassed-in section of each of the shafts will contain thirty-two fifty ampere projector lamps so spaced as to illuminate equally the entire inside area of the glassed surface. The glass to be used has the quality of diffusing the light and modulating its intensity. The glass section of each shaft will act as a secondary source of light so that the direct rays from the arc will not be observable. Careful calculations show that the light from these two sources will illuminate the entire court with a variation in intensity not to exceed 2%, an amount the eye cannot detect. The large pools from which the fountains rise will be illuminated from lights located in the fountain structure, and set below the water line.

The avenue leading from the Court of Honor to the North Gardens will be divided by a long rectangular pool and terminate, architecturally, in a Roman column 183 ft. high. The pond will have sixty small jet fountains along its border. The jets are designed to break the water into a spray and this spray will be given a touch of color from lamps placed below the jet and under the surface of the water.

The Court of Honor is surrounded by a colonnade of 180 sixty-foot Corinthian columns, the columns being doubled transversely. Behind this colonnade and concealed in the columns, will be 150 watt tubular tungsten lamps to illuminate the space between the colonnade and the building walls. These lamps will be arranged for a falling away in intensity toward the ceiling, and the effect of height will be further increased by giving the top lights a tinge of purple.

Surmounting each pair of Corinthian columns will be a statue, 14 ft. high, representing the stars. The statue as modeled is the draped figure of a young woman standing on a sphere suggestive of the earth, with her head encompassed by the rays of a great star. This star will be set with 60 imitation jewels which at night will be lighted from incandescent projectors. The projector to light the star of one figure will be placed in the base of corresponding figure on the opposite side of the court and perfectly concealed from view.

The outlines of the sunken garden in the Court of Honor will be marked by a ballustrade, the posts of which carry 18″ balls. Since these balls are merely part of a decorative scheme the lamps installed in them will be of low candle power.

The Palace of Fine Arts, with its favored location on the banks of the main lagoon, offers a wonderful opportunity for a moonlight effect and the reflection in the lagoon of the classic lines of the building and its great rotunda. To secure this effect twelve 18″ searchlights will be placed on the roofs of the buildings across the lagoon. Each lamp will be fitted with a wide-angle dispersion lense in order to bathe with light the 900 feet of facade. No light sources will be placed upon the building proper, but certain groups of statuary will be accentuated by throwing a small amount of warm, yellow light upon them from concealed sources.

The architectural treatment of the Court of Four Seasons admits of the use of eight ornamental standards for the general lighting of the court. On each standard three metallic arc lamps will be mounted and concealed by figures modelled in staff. In each of the four niches of the court will be a pool with a statuary group symbolic of the season it represents. These groups will be lighted from the adjacent building cornices, and the pools lighted from beneath the surface of the water. Relief lighting will be employed here as elsewhere, to modulate the shadows in the groups. The color and intensity of the light for each niche will be that which is mentally associated with the season portrayed—Winter with subdued light fading into a cold blue, as contrasted with bright yellow, and warmth, for Summer.

The Palace of Fine Arts
(Official Photo, copyright, P. P. I. E.)

The treatment of the Court of Abundance has for its inspiration joy and festivity, and here lighting of the theatrical order will be used, with shifting colors and a wide range of light and shade. Searchlights and incandescent projectors will be used to secure these effects, whereas incandescents within lanterns of staff will mark the arcade which extends around the court. This court will contain a cascade of unusual design, in which the water runs down two oppositely curved inclines. Instead of flowing unobstructed down the incline the water is obliged to follow tortuous paths between shrubs and flowers. At night the streams will be given life by the light from vacuum tubes laid beneath the water surface. The appearance of the water can be varied further from time to time by using different gases in the vacuum tubes.

One of the most prominent objects in the view of the Exposition from the city will be the huge glass dome of the Palace of Horticulture located in the South Garden. This dome is 150 feet in diameter and 186 feet high—one of the largest in the world. At night this great dome will be flooded with light from the inside, and the property of the glass selected for use in its construction is such that the light will be intercepted and broken up into innumerable beams which give life to

The Court of Honor
(Official Photo, copyright, P. P. I. E.)

the glass and conceal the source of the light. The lighting of this dome will be from tungsten lamps and reflectors mounted on top of a column placed directly beneath the center of the dome. The color of the light may be changed with screens and the dome made to resemble a giant pearl or fiery opal.

The lighting of the interior of the Festival Hall with its dome 150 ft., in diameter and 165 ft. high, has been solved by projecting the light from the basement through an opening in the floor, to the ceiling, from which it will be reflected and diffused throughout the auditorium. Twelve 18" searchlight projectors will be used for this purpose, each fitted with a large number of small dispersion lenses. The effect of total indirect illumination will be relieved by wall fixtures made of staff. The corridors and reception rooms will be lighted by massive chandeliers of original design.

In all previous expositions the buildings which were closed at night looked dead; this defect will be overcome at this exposition by illuminating all the windows and giving the impression of life and occupancy, even though the buildings are closed and the interiors lighted but dimly for janitor and patrol service. The glass used for the windows will intercept and diffuse the light from a series of tungsten lamps suspended behind the windows.

The festal appearance of the Exposition will be largely due to the liberal use of flags, banners and streamers, some 200 being mounted on the building parapets and 120 on 75 and 100 ft. poles placed in front of entrances and along the building facades. These decorations will be made brilliant at night by throwing on to them the intense beams from searchlights mounted on the building roofs. Demonstrations have shown that with good, strong colors in the flag, it can be seen distinctly a mile away. For flag lighting purposes one hundred and twelve 13" and eight 18" searchlights, and 200 tungsten projectors will be installed.

The area covered by the Exposition palaces and the adjacent gardens will be lighted by electricity, except for such gas lighting as will be installed for emergency and exit light-

Seraphic Figure—One of the Stars

ing. Outside of this area all lighting done by the Exposition will be with gas arcs; this applies particularly to the street lighting in the States and Foreign Sites, and the Concessions zone. Where gas lighting is used for emergency purposes only, the lights will be turned on automatically should the electric service be interrupted in the vicinity of the lights.

The spectacular lighting of the Exposition will be confined to the operation of a battery of forty-eight 36" searchlight projectors. These projectors will be installed on the peninsula which juts out from the Yacht Harbor, from which position they will have free play upon the Exposition and the Bay. These lights will be fitted with color screens and innumerable combinations of colors will be possible. An accompanying picture shows the lights set to give a fan-like effect, but the lamps are so mounted that it will be possible to go through numerous evolutions, and the effect in the sky will be seen for many miles. This battery will be particularly effective during those periods of the year when high fogs are prevalent, for the fogs will prove a desirable medium on which to play the searchlights. So powerful is this array of searchlights that it will be possible to project a color upon the fog and have that color reflected upon the whole of the Exposition and a part of the City. With this means at hand it will be easy to change the general color tone of the Exposition and add variety to its beauty.

As a substitute for fireworks there will be installed near the battery of searchlights a system of perforated steam pipes from which steam will be blown and upon which the searchlights will play. The arrangement of the steam pipes can be changed from time to time, and "set pieces" made in much the same manner as for fireworks. A jet of steam in a powerful colored light is a truly beautiful sight, as with one color alone every shade known to that color is obtainable, for the reason that where the steam jet is thick the color will be pure and deep, and where the steam is thin the lighter shades will prevail.

The Exposition will have an installation of searchlights such as has never been assembled before, there having been ordered forty-eight 36-inch, one hundred 30-inch, two hundred 18-inch, and one hundred 13-inch searchlight projectors. The total effective spherical candle power of these lights is over six hundred thousand, and the total beam candle power is three and one-half billions. Even with such a large amount of light available the general intensity of the light on the buildings will not exceed 2 foot candles. For supplying the direct current required for searchlights two 1000 K. W. and two 250 K. W. motor-generators will be installed. The 250 K. W. sets will be three machine units and will be used as balancers in addition to generating power. The motor-generators will be installed in small sub-stations in various buildings in order to keep the quantity of copper required down to a minimum.

The lighting for the Exposition has been planned by Mr. D'A. Ryan, and most of the effects have been tried out at the Illuminating Laboratory of the General Electric Co., that company having donated a large sum for experimental work in connection with the illumination of the Exposition.

The illustrations accompanying the foregoing article are from photographs taken by Mr. W. W. Swadley, official photographer of the Panama-Pacific Exposition. It is needless, perhaps, to inform our readers that these views are copyrighted and are reproduced here by express permission of the Exposition authorities.

There is a large quantity of views always on hand at the Service Building out at the Fair Grounds, where are to be seen, also, models of the most important structures and a relief map of the Canal Zone by which spectators can trace the course of vessels.

How "Pacific Service" is Serving the Exposition

By F. F. BARBOUR, San Francisco District

"PACIFIC SERVICE" will be used exclusively at the Panama-Pacific International Exposition at San Francisco. This "Service" includes furnishing all electric energy for the "pre-exposition" or construction period, for the "exposition" period proper and for the "post-exposition" period, when buildings are being razed and the grounds restored to the original condition. It also includes furnishing gas for the entire area, also steam for such buildings as require heating, to the amount of 1000 boiler H. P.

One feature of this service deserving of special mention is the furnishing of all electrical apparatus required by the Exposition Company for Exposition service. This includes pole lines for the pre-exposition period, transformers, meters, motors for contractors' construction work, for pumping water and for ferry slips; underground cables for Exposition period, and such other apparatus and material commonly used by power companies as may be required by the Exposition.

Such service could only be rendered by a Central Station Company of such magnitude and rapid growth that material and appliances so furnished could be rapidly absorbed and placed in permanent use by it after the close of the Exposition.

"PACIFIC SERVICE" is now supplying electric energy for construction work on the Exhibit Palaces in course of erection.

A temporary substation was first installed about the middle of February, 1913, at Fillmore and North Point Streets, containing 4-100 K. W. Transformers for supplying power to the Contractors for the Machinery Building—W. W. Anderson & Company. These transformers supply energy to 3-100 horse power induction motors which drive air compressors.

The rules of the Department of Works forbid the use of coal, oil or other fuel during construction of buildings, on account of the smoke nuisance and fire risk. For this reason *electricity* is used for compressing air, which in turn is used in ordinary steam hoisting rigs on the erecting derricks. Compressed air is also used for drills and other tools.

Motors are also used for driving circular and band saws used in the mills for framing timber.

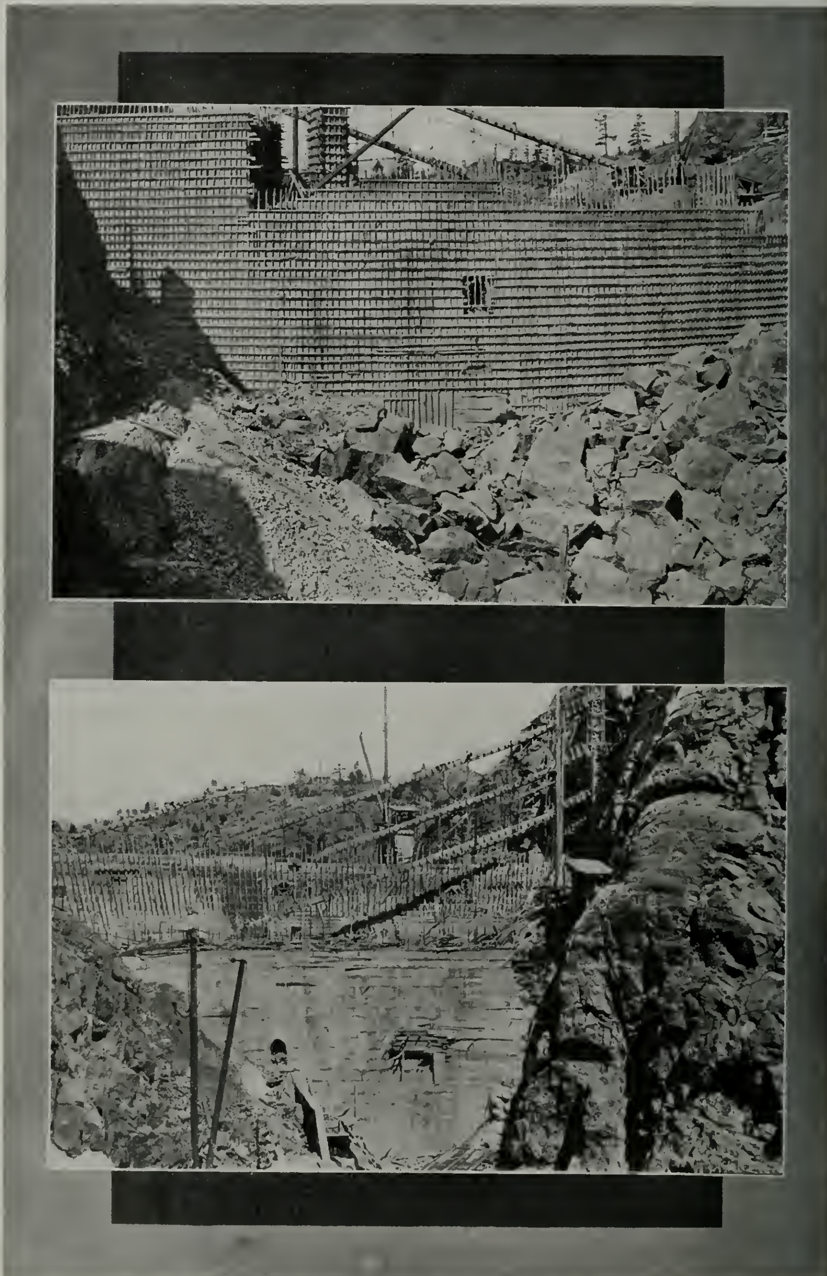
On March 10, 1913, the Exposition Company notified the Pacific Gas and Electric Company that it should be prepared to furnish 4000 K. W. for Exposition Service. To do this a substation was at once established in the former Gas Department Office building at Buchanan and North Point Streets, and 3-750 K. W. water cooled transformers installed. Current is received at 11,000 V. and transformed to 2300/4150 V. for distribution about the grounds. Additional transformers will be added as required.

Overhead pole lines at present distribute this energy throughout the grounds to the various saw mills, pumps and air compressors. About 500 horse-power is now in use on these circuits and is being added to rapidly.

Arc lights for patrol service in the grounds are supplied from a 75-light constant current arc transformer also located in the substation previously mentioned.

Permanent underground conduits are being installed in the Exposition Streets and cables will soon be installed therein. As fast as this is done the present load will be transferred from the overhead lines, which will then be removed.

In the Exposition grounds there is a notable absence of power apparatus—other than electric—the single exception being pile driver engines. "PACIFIC SERVICE" here again shows its resourcefulness.



Views of Spaulding Dam in course of construction. That at the top is the upstream face of the dam, showing the unstripped concrete forms. The lower picture shows the downstream face of the dam, with three lines of concrete-distributing chutes. The opening on the left is the inspection tunnel to the drains, weepers, etc. The dam as shown here is 150 feet above bedrock.

Breaking a World's Record in Our Lake Spaulding Dam Construction

By F. G. MUDGETT, Statistician Engineering Dept.

F. G. Mudgett

Breaking a World's record for pouring concrete in a concrete dam during an entire month of 31 days, is what has been accomplished in the marvelous progress of construction at Lake Spaulding.

This record shows 40,485 cubic yards of concrete placed in the dam during the month of August, 1913. The best day's run was 2,150 cubic yards, on August 18th. That performance establishes a new world's record. Four Smith mixers, each of one cubic yard capacity, constitute the plant, together with a perfect gravity system from which an average daily output of 1,306 cubic yards of concrete was poured. It is the perfect gravity system that makes it possible to distribute this tremendous mass of concrete over the large area of the dam in this short time, or at the rate of over 200 cu. yards per hour. The transportation problem alone limits possibilities in this direction, as will be seen from the best day's run referred to.

This record made at Spaulding beats that held previously by the construction workers on the concrete dam of the Medina Valley Irrigation Works* near San Antonio, Texas. Their best month's record was 40,303 cubic yards with five mixers in operation. What we have accomplished up in the Sierras is believed to be without parallel in speed of construction or quantity of concrete poured on similar work, even where much larger equipment was available. And it is only fair to state that our remarkable progress is largely attributable to regular delivery of gravel and cement, the average being more than three train loads of twenty cars each day. It must be remembered, also, that we have men like Mr. F. G. Baum, as Chief Engineer, and Mr. D. H. Duncanson, as Superintendent, behind the organization.

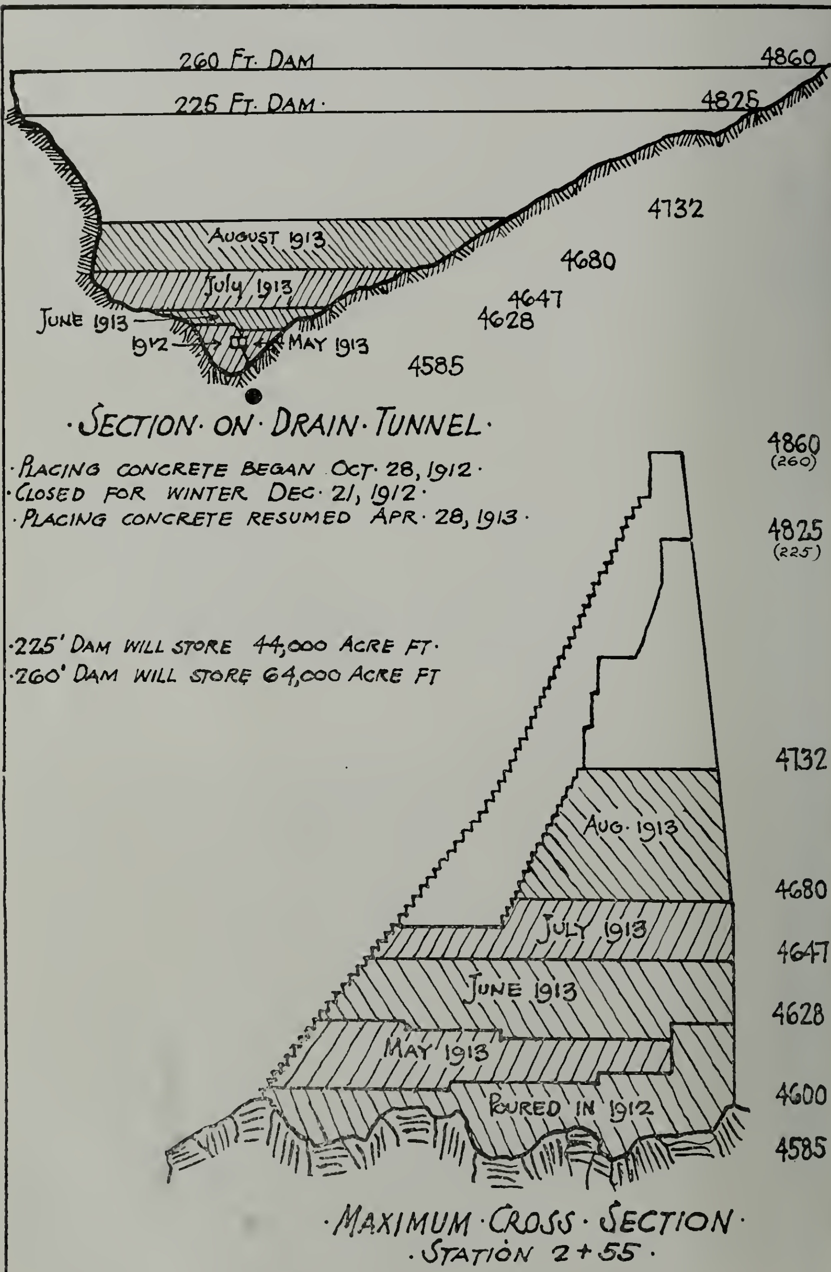
The early construction work was opened a little over a year ago by Mr. Duncanson, known to "Pacific Service" as the man who put in the Smart broad-guage spur track "laid while you wait". The dam that was started then has grown in height in one month from an elevation of 4680 to one of 4732 feet. Fifty-two feet added to ninety-five feet completed previously, gives this massive structure an average height to the end of August of 147 feet above bedrock. It is estimated that the dam will be finished to the 225 foot section before the end of October.

The ultimate height to which the dam will be raised will be 305 feet, the highest dam above bedrock in the world. The catchment area is 120 square miles, the water shed of which area contains 22 small lakes, the spill wasted waters of which are all controlled by one large reservoir, Lake Spaulding. The capacity of Lake Spaulding in back of the 225 foot dam to be completed this year will be 44,000 acre feet, increasing to 97,000 acre feet or 30,000,000,000 gallons with the 305 foot dam, from which a continuous discharge of more than 350 second feet will be obtained.

Water will be drawn from the reservoir through two pressure intake tunnels, the concrete-lined finished size being 8 feet 8 inches in diameter.

The upper intake is at an elevation of 4770 feet and the lower intake is 100 feet below. Each tunnel is controlled by a separate gate valve, so that the source of supply may be taken from either level. The water regulation will be made by two needle control valves located 1000 feet below the dam. The

*See Engineering and Contracting, Vol. 38, No. 15.

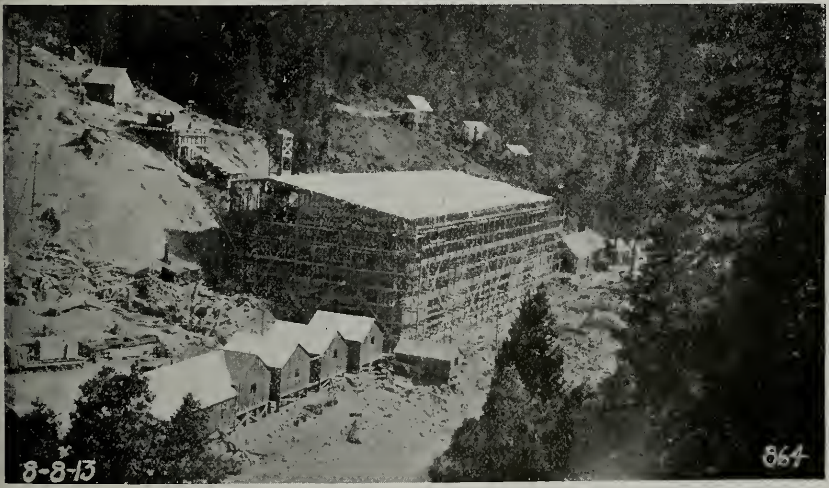


Profile and cross-section of Spaulding Dam, showing progress and elevation to date.

Masonry lining of a portion of Drum Canal. This section passes through huge boulders of granite.

pressure intake will be controlled eventually through a 5,000 kilowatt turbine to be installed at the adit tunnel about 1,100 feet from the intake. From the adit plant Spaulding tunnel is unlined. This flow tunnel length is 3358 feet, by 9.5 feet in diameter, emerging into a canal by which it is carried a distance of 8.5 miles to Drum forebay, a large regulating reservoir gouged out of the top of a hill and having a capacity of 400 acre feet.

Mr. James Martin, as Superintendent of Division No. 2, opened construction work on the canal and forebay in July 1912. The



Drum Power-House as it stood August 8th, this year.

Men stringing wire on new double-circuit steel-tower line.

building of construction camps, a 3.5 mile standard railroad and a good percentage of work was completed before winter snows closed camp. Early in June, while Mr. Martin was at work on power developments Nos. 4 and 5, near Auburn, Mr. O. W. Peterson was made Assistant Superintendent to Mr. Duncanson and placed in charge of the canal and forebay work. Mr. Peterson, who came to "Pacific Service" from the Los Angeles Aqueduct, where he had charge of one of the difficult divisions, opened the throttle of progress, and we find the Drum Canal rapidly nearing completion with four steam shovels at work night and day, and Drum forebay, a huge bowl scooped from a hill top, practically finished.

The location of the Drum forebay is an ideal one in the lower Sierra Nevada Mountains, being 1375 feet above the power house and connected to the plant by a large steel penstock (two pipes eventually) or pressure pipe line. This steel pipe is 72″ in diameter by 3/8″ thick at the forebay and tapering according to pressure to 52″ in diameter by 1 1/4″ thick at the power house.

Mr. G. M. Wehrle, an old time pipe superintendent, also from the Los Angeles Aqueduct, is laying pipe line from the forebay to the power-house. An accompanying picture gives a picturesque view of the pipe being laid in place.

Drum Power House is located on the South bank of the Bear River 6,200 feet from the intake of the pipe lines at the forebay. To find a site for the power house it

Steel tower line passing through the lower Sierras.

was necessary to sluice by means of a hydraulic monitor 40,000 cubic yards of hill slope, excavating finally by blasting into bedrock for a site 100 ft. by 500 feet long.

The erection of the structural steel was begun in December 1912, and completed early in January 1913. Here work was closed for three months owing to the winter conditions being unfavorable to outside work. The building is reinforced concrete and steel, being 77′ 6″ wide by 208′ 8″ long and 65′ high. It was designed by Mr. H. C. Vensano, Civil Engineer, for four 12,500 kilowatt units, two of which will be installed this year. The building is now practically completed in the rough. The walls are in, the roof is on, the floors are being finished and the plastering will be done this month. The completion of the building and the erection of the machinery being under the direction of Mr. P. B. Dawson who had charge of setting the two de Sabla and the two Electra 5,000 kilowatt generators.

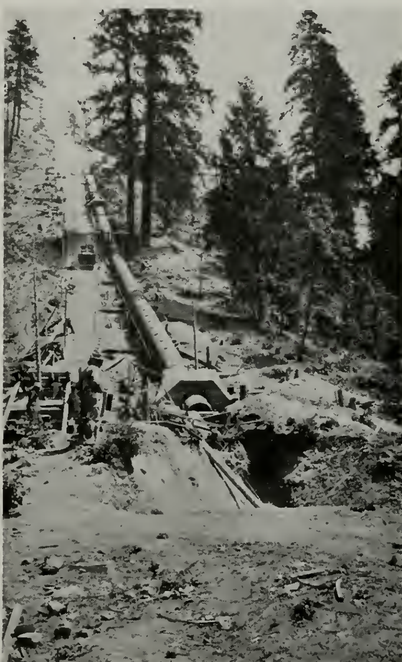
The foundations for the two 12,500 kilowatt Westinghouse generator units were completed in July to receive the generators and water wheels in August. Both generators are on the ground.

Two double overhung Pelton-Doble impulse water wheels, each of 17,000 H. P. capacity, are to be operated under a maximum head of 1375 feet of water. Both have arrived and are waiting installation. The wheels are designed to drive the generators at 360 R. P. M. The generators are of the revolving field type—horizontally divided.

The main units are provided with Lombard type governors of the type styled 20,000 foot lbs. per second.

From the generators the current will be led through low-tension switches to six 4,250 K. V. A. transformers and stepped up from 6600 volts to 115,000 volts. The design of the electrical installation was made under the direction of Mr. J. P. Jollyman, Electrical Engineer.

Leading from Drum Power Station the electric power will be conveyed along a double circuit steel tower line, via Nicolaus to Cordelia, the load center of the "Pacific Service". The line will for the present have but one circuit that will deliver 100,000 volts at Cordelia Sub-Station 114 miles westward, one of the highest potential—long distance transmission lines in the world. Distribution from Cordelia is made at 60,000 volts to



Looking along Drum Penstock No. 1, from an anchor above the power-house. Showing the 54 in. pipe on a slope of 40 degrees.

Oakland, San Rafael, San Jose and elsewhere in different directions.

Of the total number of 731 steel towers, 400 have already been erected, while the remainder are assembled at their foundations awaiting erection. The wires have been strung over a portion of the distance already and the record is moving up daily. Mr. E.

H. Steele is superintendent of line construction in charge of this work as a whole.

Work on the new sub-station at Cordelia is progressing rapidly and Mr. J. A. Barker, superintendent of construction there, informs us that the building will be ready in October.

To sum up, we have something like 1,500 men actively employed on this work at the present time, and there will be no let up of any kind until word comes from the engineer in charge that everything is ready for the first transmission of electricity along the high tension wires. All men are making an effort to be the first to say "I am ready", and no one wants to be last.

Drum plant is expected to be in operation by Thanksgiving and it is a safe prediction that before the first of the year consumers of "Pacific Service" will be enjoying the benefit of some 33,000 horsepower of electric energy that will have been added to our already extensive system.

Concerning Members of "Pacific Service"

Mr. George C. Holberton, manager of the San Francisco District, left August 28th for a three-weeks' business trip in the East.

Mr. Holberton's immediate purpose in taking this trip was to attend the annual convention of the Association of Edison Illuminating Companies, scheduled to assemble at Coopertown, N. Y., on the 8th of the present month. Mr. Holberton was elected Secretary of this Association at the convention in 1912, and so his presence was imperative. He arranged, however to take advantage of the opportunity afforded by his proximity to the great centers of industry in this country to turn a trick or two for "Pacific Service", for he took with him a large number of lantern slides showing our more recent developments and announced his intention of lecturing not only before the Cooperstown convention, but, also, should circumstances permit, in the cities of New York and Chicago, not forgetting Schenectady. where is located headquarters of the General Electric Company in whose factory Mr. Holberton gained his first practical experience as an engineer.

Mr. Holberton, no doubt, will gain much valuable information during his trip as he will meet most of the big men of the light and power industry in this country.

From the President's office comes the announcement that the name of John Toland has been added to those on the Company's pension roll.

Mr. Toland has been in the employ of the Company continuously for 44 years. He started in May 1869 tending an engine and pumping water for the old tanks formerly at Fifth and Tehama Streets, San Francisco. Later he went to the works at First and Howard Streets as fireman and gasmaker and lobored at this employment for 35 years.

Mr. C. J. Wilson, Assistant Engineer of Electrical Distribution, returned September 4th from a short vacation passed in the Panama Canal Zone. All he has to say at present of the work progressing in that region is "It is beyond the comprehension of any man who has not the good fortune to go there and see things for himself."

In the near future, however, readers of Pacific Service Magazine will hear more from Mr. Wilson on this subject. He has come back with a vast amount of detailed information, all of which, with original photographs, he intends to lay before us in a forthcoming issue.

Rights of Way in National Forests

Description of a lawsuit commenced by the Pacific Gas and Electric Company against the Secretary of Agriculture, involving the legality of regulations established by the Department of Agriculture for the purpose of governing the acquisition and use of rights of way for reservoirs and canals for power purposes on reserved public lands of the United States.

A question of supreme importance to the power companies not only of California but the entire United States and upon the settlement of which depends, to a very large extent, the progress of development of the natural resources of the country, is involved in a law suit recently brought by the Pacific Gas and Electric Company against the Secretary of Agriculture and several forestry officials by which "Pacific Service" seeks to enjoin what it believes to be a threatened unwarranted interference with its rights in the matter of the Lake Spaulding-Drum power development.

As all who are interested in our activities are aware, our gigantic work of construction in the Sierra country is being carried on under special authorization from the State Railroad Commission, which gave its official approval of plans and estimates submitted to it shortly before the first spadeful of earth was turned in July of last year. Also it is a matter of common knowledge that the right to appropriate the waters of the lakes and streams tributary to our Lake Spaulding reservoir site has been in undisputed possession of our company and its predecessors in interest for upwards of forty years; furthermore, that all rights of way for the Drum aqueduct by which water will be conveyed from Lake Spaulding to the new power-house in the Bear river gorge, with one exception which will appear presently, have been legally secured. Last, but by no means least, the right of the Pacific Gas and Electric Company to appropriate and use non-navigable waters of the State for the purposes of electric power development, irrigation, etc., is one that has been recognized by the laws of California since the early mining days and confirmed by several acts of Congress beginning with one as far back as 1866.

But now, just as we are in the middle of our construction work, a threatened obstacle to our course has arisen. It appears that a part of our Lake Spaulding reservoir site and, also, a small piece of land along the line of the Drum aqueduct lie within the limits of what is known as the Tahoe National Forest, over which the Department of Agriculture claims a special jurisdiction. And in February of this year the Secretary of Agriculture issued certain rules and regulations in connection with forestry service under which, should these be found constitutional and otherwise valid, any power company or other enterprise of similar character desiring to make use of any part of a forest reserve must, before proceeding with its work of construction, apply to the Secretary of Agriculture for a revocable permit for the same. These regulations were issued in February of this year by the Hon. James Wilson, the then Secretary of Agriculture, under authority of an Act of Congress passed in 1901 which by its terms delegates to that official the necessary power to issue such regulations.

Our company's activities threaten to be affected by the enforcement of these regulations, for the reason that it would appear that however much of a mere formality the application for and the consequent granting of such permit might prove, the very fact that we were holding even an acre of our property upon sufferance, so to speak, might have the effect of clouding our title to rights which, as before stated, have been held by us and our predecessors in undisputed possession for a great number of years. And so, in order to test this question a suit has been entered in the District Court of the United States for the Northern District of California by which our company seeks and injunction against the Hon. David F. Houston, Secretary of Agriculture, Henry S. Graves, Head of the Forestry Service, Coert Du Bois, District Forester, and R. P. L. Bigelow, Forest Supervisor in charge of the Tahoe National Forest, to prevent the enforcement of the regulations referred to as against our activities in the Sierras and to declare those regulations as well as the act of Congress by which such authority was delegated to the Department of Agriculture unconstitutional and void.

It promises to be a very interesting legal debate. The complaint sets forth the objects and purposes for which the Pacific Gas and Electric Company is organized; its ownership of all the lands included in the Lake Spaulding reservoir site, except the small tract referred to, into and through which the South fork of the Yuba river flows; its ownership of lands adjacent to the reservoir site and riparian lands above and below it, also the lands crossed by the Drum aqueduct, except the small parcel already mentioned, in its course from Lake Spaulding to the Bear river; its acknowledged right to appropriate for its purposes of public benefit an amount of water and, in addition thereto, storm and flood waters to be stored in Lake Spaulding, from the South Yuba to the extent of 11,000 miner's inches; its forty years' possession above referred to; the fact that on July 3, 1912, the State Railroad Commission gave permission for the erection of works looking to the enlargement of Lake Spaulding into a storage reservoir of 92,586 acre feet and the construction of a power-house below of 40,000 K. W. capacity; the fact that a sum in excess of $2,285,000 has already been expended in construction; that no navigable streams are included in any of our water rights, nor in our work of development are we interfering nor do we propose to interfere with the other proper uses of water but that, on the contrary, our mission is one of benefit to the various communities we serve; that there is no timber, stream or lake or anything else of commercial value standing or growing upon either of the forest reserve sections through which we pass; that the impounding and storing of water in Lake Spaulding will not only do no damage but will be of material benefit by diminishing the volume of winter and spring floods in the lower stretches of the South Yuba river.

It is pointed out in the complaint that should our company be compelled to go outside of the government section through which the Drum Aqueduct flows it will involve a cost to us of something like $70,000 for the construction of a syphon, a cost of about $55,000 extra to the present plan of construction. It is urged that the Tahoe National Forest is subject to the jurisdiction of the State, having been neither purchased nor deeded to the Government by the State Legislature nor dedicated by the President of the United States or Congress for any public or governmental purpose. It is averred that our company has so located its Lake Spaulding reservoir site and Drum aqueduct as not to interfere with the proper occupancy by the United States Government of the

Tahoe National Forest, and that such is the fact has not been questioned by the defendants to the suit. But, as stated before, the entire action depends partly upon the constitutionality of the Act of Congress of 1901 and partly upon the construction of certain earlier acts.

With regard to the permits provided for in the regulations under question,—these not only are limited to a life of fifty years, subject to renewal by consent of the Federal authorities, but also may be revoked at any time by the Secretary of Agriculture in his uncontrolled discretion. Rental charges for these permits are provided on the basis of sums up to $1.00 per horsepower per year and $5.00 per mile for transmission lines. It is provided also that the Secretary of Agriculture may impose new rental rates after a term of ten years.

Mr. William B. Bosley appears as attorney of record in the case, with the Hon. Frank H. Short of Fresno, a well-known authority on water questions, of counsel. Both are of the opinion that the Law and the Constitution are with us. Mr. Bosley discussed this very point some three years ago in an article entitled "Conservation and the Constitution" published in the Yale Law Journal, November 1910. In this the writer after stating the doctrine that the government of the United States is one of enumerated powers and can exercise within the States only such powers as are actually granted to it by the Constitution either expressly or by necessary implication, says:

"There is no express provision in the Constitution conferring upon Congress the power to regulate either the mining industry or the power industry, or to prohibit monopoly therein. The Supreme Court has repeatedly held that the general power to preserve the public peace and the public morals, to protect the lives, health and property of the citizens, and to regulate their social, industrial and commercial relations in respect to all matters, save those over which jurisdiction has been conferred upon the United States or prohibited to the States, is vested in the several States". Then, later on:

"The ownership by the United States of public lands situate within any State does not involve or carry with it any general or exclusive jurisdiction or power of legislation over such lands or their occupants. On the contrary, subject only to the right of the United States to provide for the sale or other disposition of the public lands and to make such rules and regulations concerning the same as may be required for the exercise, enjoyment and protection of its proprietary rights therein, each State possesses the same power of legislation and jurisdiction over the public lands of the United States situate within its boundaries as over lands held in private ownership by its own citizens." And further on:

"Each State possesses absolute title to all water in the streams, rivers, lakes and other bodies of water, whether navigable or non-navigable, situate within its boundaries, and also possesses the legislative power of regulating the use of all such water, subject, first, to such private proprietary rights therein as have been acquired by natural persons and private and public corporations; second, to such private proprietary rights therein as have been acquired by the United States in its proprietary capacity either by virtue of its ownership of riparian lands or by appropriation; and, third, to the right of the United States to regulate the use of navigable streams and waters as means of commerce with foreign nations and among the several States and with the Indian tribes. Each State also possesses the legislative power of determining, subject only to the duty of protecting vested rights, what rights of a proprietary nature may be acquired in its waters by natural persons and corporations."

"The use of water appropriated for sale and distribution to the public is, by the laws of the State of California and of some of the other States, a public use subject to legislative regulation, in general, and, in particular, to the power of the State and its political subdivisions by or under the authority of law to prescribe the rates to be charged by the appropriators to the public for its use."

"If Congress should enact a statute regulating the use of the waters belonging to the several States or their inhabitants for private purposes, or for any public use except navigation; or a statute regulating or prohibiting monopoly in the business of generating, distributing and selling electric power for either private or public uses; or imposing a tax or other charge on a franchise granted by a State for furnishing electric power to the public; or a statute declaring when or how the several States should exercise their power to prescribe rates for the sale of electric power, or their power to regulate or forbid monopoly in its production or sale, such a statute would clearly be unconstitutional."

Mr. Short in his collected points and authorities for submission to the Court takes a similar view of the situation. He says, for instance, "Jurisdiction over and the regulation of, the appropriation, diversion, distribution and use of non-navigable waters is in the various States, and the United States, except as to the protection of navigation, has no jurisdiction or control and does not claim any, over such use and appropriation or use of such waters. This situation is so well established in the authorities, both federal and state, that it is quite unnecessary to elaborate the point or make any extended citations, and for the sake of brevity and convenience, we will here add that so far as governmental jurisdiction over non-navigable waters, the appropriation or use thereof, are concerned, the United States has no more power or jurisdiction in a state wherein it holds public lands than in another state wherein it holds no such lands."

"The United States has, with respect to the beneficial use of water, uniformly recognized the right of appropriation and beneficial use, and has, with equal uniformity, recognized as an essential incident to such appropriation and use, the right to rights of way for all necessary works, dams, canals, aqueducts and other structures requisite to such appropriation and beneficial use. In fact, it may be asserted upon many authorities that it would have been constitutionally incompetent, and the United States would have had no authority, to close the public lands as against such essential rights of way any more than it would have had the right to prevent the state from constructing or using roads, railroads, telephone and telegraph lines or other essential means of communication over public lands."

Many important decisions bearing upon the point have been found. The most recent is that in the case of the United States vs. The Utah Light and Power Company, wherein Judge Marshall, in an opinion rendered March 31st last, held that rights of way for reservoirs and canals granted by the earlier acts of Congress may be availed of for power purposes without the necessity of obtaining a permit from the Secretary of Agriculture under the Act of 1901.

IN MEMORIAM

ALFONSO A. TREGIDGO — FRANCIS V. T. LEE

During the month of August there passed from this life two men who were identified with the early stages of hydro-electric power development in California. One of them, Alfonso A. Tregidgo, may be said to have been, in a sense, the father of the great organization known as the Pacific Gas and Electric Company, for it was his initiative that laid the foundation of the old Nevada County Power Company, out of which grew "Pacific Service". The other, Francis V. T. Lee, in association with Mr. John Martin, was an individual factor in the installation of many of our hydro-electric plants, notably that at Colgate, from whence first the electric "juice" was sent humming along the high-tension wires to the shores of San Francisco bay.

"Pacific Service" mourns the loss of these two men, who were loved for themselves as well as for what they did. The sub-joined sketches of their lives were prepared from notes supplied by men who were associated with them in their early struggles and who followed their subsequent careers with affectionate interest.

EDITOR PACIFIC SERVICE MAGAZINE.

ALFONSO ADOLPHUS TREGIDGO

ALFONSO A. TREGIDGO, as the first three letters of his family name indicate, was of Cornish descent. He was born in the South of England in 1858. His family leanings appear to have been in the direction of what is known over there as "the service," for his father was a Post-Captain in the English navy and one brother rose to the rank of Rear-Admiral. He, himself, was marked for a similar career, but on account of defective eyesight he was compelled to forego this and enter, instead, the mercantile marine service. It was on a sailing ship that he arrived in California about 1878. He left the ship at Vallejo; with that his maritime career ended. In Vallejo he fell in with Sir Henry Lowe, who laid out the town, and under that competent engineer he learned surveying and some little mining engineering. The result was that he secured employment at the St. John's Quicksilver mine, which was then going full blast.

Tregidgo married Miss Marion Russell, a niece of John Leate, the then owner of the mining property, and he stayed with that concern until a fall in the price of quicksilver necessitated a shut-down. Later he went to Tombstone, Arizona, where he became superintendent of two or three mining enterprises, afterward taking charge of the Planet Copper Mines on Bill Williams Fork, a tributary of the Colorado river. He had an interest in this property, the other owner being Eugene de Sabla, Sr., father of the man who afterward became identified with the experiments in the long-distance transmission of electric power which resulted in the organization of what is now the Pacific Gas and Electric Company.

The younger Mr. De Sabla speaks af-

Two men identified with the early stages of hydro-electric power development in California, and whose loss "Pacific Service" mourns, for they were with us and of us.

fectionately of Tregidgo as "the first man I ever worked for." "He hired me to shovel coke at a dollar a day," says E. J. Jr. "It was about on the border line between Yuma and Mojave counties and the temperature was 115 degrees at midnight. I worked at the smelters by day and pulled slag-pots at night time."

Tregidgo left Arizona when a fall in the price of copper from 16 to 8 cents brought about the suspension of the Planet Mines. He returned to California and was next heard of as superintendent of the Washington and Blue Bell Gold Mines on the South Fork of the Yuba River. He remained there a few years and then fell in again with Eugene J. de Sabla, Jr., who had also located in the Golden State. de Sabla had leased the Peabody Mine in Grass Valley and together they worked this property, with varying fortunes, for some two or three years, Tregidgo acting as superintendent. There were rich pockets in this mine, but there was also a veritable river flowing underground, and they found it impossible to handle so large a volume of water with steam pumps, although they had the largest in California. Cheap electric power had not then been developed, but it may be said that this failure of the Peabody Mine had a good deal to do with future developments, because it caused both Tregidgo and de Sabla to wonder whether some other power than steam could not be devised for pumping water out of the mines. At any rate it was this difficulty, lack of proper power facilities, that caused a suspension of operations at the Peabody Mine.

This was in the early nineties, and just about then Tregidgo read of the successful transmission of electric power from Tivoli to Rome, in Italy, a distance of twenty miles. This set him thinking, and it occurred to him that it might be feasible to develop cheap electric power in this same fashion and thereby effect the rescue of the Grass Valley and Nevada City mines, a number of which were in a similar predicament to the Peabody. Tregidgo developed his idea and endeavored to get men of capital interested, but without success for a long time. One and all denounced the scheme as preposterous. But along about 1893 he got hold of a group of capitalists who agreed to put in sufficient funds for the construction of a diverting dam on certain water rights he had secured on the south Yuba river. This was the beginning of Tregidgo's most notable achievement, the construction of the Yuba dam. But again misfortune found him, for the early winter storms washed the dam out before it was completed, and put a quietus upon Tregido's ambitious schemes for another two years. He did organize a company and sold some stock here and there, but the people had very little faith in the feasibility of his schemes, so, for the time being, he resumed his occupation of mining superintendent and handled various properties.

In the year 1894 Eugene de Sabla, Jr., returned to California from a trip to Central and South America, where he had been closing up his business as a coffee merchant. He became interested in water-power again and taking over the Tregidgo water rights on the South Yuba river formed the nucleus of an organization subsequently known as the Nevada County Power Company. Tregidgo went in as superintendent and the practical demonstration of the long-distance transmission of electric energy was started. It was a more or less exciting time up in that mining region, and bets were made about how long it would take to erect the first pole. But that pole went up and so did many others. Bonds were issued and money raised on them, and in 1895 the construction work was started upon what was subsequently known as the Rome power plant on the South Yuba river, about six miles from Nevada City. The installation was about 1000 horse-power. Tregidgo had full charge and constructed not only the dam but the six-mile flume leading therefrom to the power house.

Mr. John Martin comes into the story at this point, for he was at that time in the electrical supply business and contracts for the installation of the power-house, including the pipe-line and pole-line, were let to him. After the completion of this plant in March, 1896, Tregidgo became superintendent of the Grass Valley division of the Nevada County Power Company, while de Sabla took charge in Nevada City. The power, of course, was used solely for the mining region roundabout.

Tregidgo, however, only remained in the business about a year. The Klondike fever broke out about that time and he caught it. He sold out his interests in the Power Company and went up to Alaska with A. J. Bowie, a well-known mining expert of those days, to handle some interests of the late James R. Keene. From then to the day of his death, Tregidgo had nothing more to do with the electric power development. He worked in the Klondike country with varying fortunes, and in due course returned home, where he took up his old work at the St. Johns Quicksilver Mine in Solano County, which had been reopened. He was superintendent of the mine when he died. He was also President of the El Dorado and Placer Counties Light and Power Company, a dredging enterprise on the middle fork of the American river. This has been passed upon as good property, and had Tregidgo lived he might have become possessed of more than an ordinary miner's share of the world's goods.

He was a man much beloved among men. Mr. de Sabla who knew him so well says of him, "he was very able, a good mathematician and engineer and besides being a gentleman in every way was possessed of an enormous amount of energy. It may be said of him that his genius was ahead of his financial ability, for other men made more of his ideas than he did. If he had a fault it was that he was too 'hail-fellow well-met' with people, so that he was more than once imposed upon by designing people whom he thought were his friends. He was a man of splendid attainments and high character."

Tregidgo probably was the most popular president the California Miners' Association ever had. He was connected with the Association from its foundation and was its leader in 1906. Previous to that he was president of the Nevada County Miners' Association. He was a Knight Templar and an Elk. He left many friends to mourn his loss. His two sons, Don A. and Eugene de Sabla Tregidgo, are both identified with "Pacific Service" as employees of the gas distribution department. His only daughter, Mabel, is Mrs. C. M. Harmon.

Francis Valentine Toldervy Lee

[Written by A. H. BABCOCK, Electrical Engineer, Southern Pacific Company]

Born—Winchester, Hampshire, England, August 28, 1870.

Died—Victoria, B. C., August 17, 1913. Son of Francis V. T. Lee, of Shropshire, England, an Officer of the Queens Own Light Infantry.

His school and college training was as follows: Manchester Grammar School, Manchester, England. College Communal, Boulogne, s. m., France. Leland Stanford, Jr., University, California, was graduated 1897, B. A. in Electrical Engineering.

Assistant to Dr. F. A. C. Perrine, Prof. of Elec. Eng. 1893-1897. Came to Sherbrooke, Canada, in 1887, and for the greater part of three years was in the service of the Canadian Pacific Railroad as private secretary to the Division Superintendent. He resigned from railroad service to supplement that part of his school training that was taken abroad with a more adequate technical training in this country. Shortly after his resignation he went to Victoria, B. C., and thence home to England on a trip, after which he returned to New York, where he entered the Manhattan Electric Company in order to gain experience that would enable him to test his liking for the specialty of electrical engineering. Here he came in contact with the late Dr. F. A. C. Perrine, and there resulted one of the great friendships of his life. Often a preceptor exercises a very great influence on the life and personality of a student, particularly is this true when they come as intimately in contact as did Dr. Perrine and Mr. Lee. who then was working his way through college, and assisted Dr. Perrine as secretary and general laboratory assistant. So strong was Dr. Perrine's influence that many of Mr. Lee's old friends have often remarked on the little personal mannerisms, if they may be so called, that each acquired, unconsciously, doubtless, from the other.

Shortly after being graduated from the University he was appointed Assistant Engineer to John Martin, Agent for the Pacific Coast Department of the Stanley Electric Mfg. Co. He rose rapidly in this service, being appointed Engineer, January 1898; Manager of the office in June 1899, and a year later was made Vice-President and General Manager of John Martin & Co., Electrical Engineers and Contractors, also District Pacific Coast Manager for the Stanley Electric Mfg. Co., and many other Eastern manufacturers. During the above period there came under his direct supervision the erection of many of the earlier lighting and power plants that later were absorbed by the Bay Counties Power Company and the Pacific Electric Railway Co., for example.

Early in 1906 he severed his connection with John Martin & Co., but followed Mr. Martin's interests into the Pacific Gas and Electric Co., where he was made Assistant to the President. As such he was generally responsible for the construction and operation of the hydro-electric developments of that Company.

About three years ago he resigned from the service of the Pacific Gas and Electric Company to rest and to enjoy his well-earned competence. His last three years were play years, enjoyed fully in the close companionship of his wife and two daughters, with whom he spent these years abroad, in his old home in England, and traveling on the Continent. They returned a few months ago to Victoria where he had intended to make his future residence.

On September 27, 1899 he was married to Edith K. Bonnallie, of Sherbrooke, Quebec, Canada, who, with his two daughters, Ruth and Margaret, survives him.

Mr. Lee died before much of his work, particularly that of the last seven years, had time to demonstrate its real worth. In all his business life his relations with the really big men with whom he worked, brought a mutual confidence and personal regard that in many cases amounted to a real affection. For the others, those of less caliber, he had a good-humored tolerance.

His absolute faith in the kindliness of human nature was wonderful, for he had many rebuffs but they never embittered him, and by habit he refused to believe any harm or evil of anyone until he had absolute proof of it. Many times he was heard to say "They say,' is a liar," and this he lived up to. Those who came intimately in contact with him knew the absolute integrity, the uprightness and the sweet disposition of him, and are thankful for the memory of him they cherish, and for the last three years he enjoyed so much.

His personal tastes were simple. The Fine Arts, of which he had a cultured enjoyment, appealed to him strongly. His reading covered a wide range, and having leisure he enjoyed his fine reference library to the full. A list of the works therein is an index of his versatility, and is a revelation even to his intimates.

At the time of his death he was a member of the American Society of Mechanical Engineers, the Institution of Electrical Engineers, the American Institute of Electrical Engineers, the American Gas Institute, the American Society of Civil Engineers, and the American Electrochemical Society. Also he was a member of Occidental Lodge, F. & A. M., of California Chapter, R. A. M., and a Knight Templar, member of Golden Gate Commandery, K. T., all of San Francisco.

Pacific Service Magazine

PUBLISHED IN THE INTERESTS OF ALL THE EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

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Issued the middle of each month
Year's subscription $1.50
Single copy .... .15

Published by the
PACIFIC GAS AND ELECTRIC COMPANY
at 445 Sutter Street, San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. V SEPTEMBER, 1913 No. 4

EDITORIAL

THE PUBLIC SERVICE COMMISSION of Ohio has overruled an ordinance passed by the City Council of Toledo reducing gas rates in that city. The Commission, after an investigation, held that the new rates established by the city were unjust to the gas company and ordered the old rates restored.

This was a case of arbitrary rate-fixing on the part of the municipal council. The Commission found that the new rates would not yield the utility a fair interest on its investment. In its decision the Commission laid stress upon the necessity, as a basis for rate-fixing, of taking into account the value of all the utility's property actually used and useful for the convenience of the public, also the obligation imposed upon the utility to make reservations from income for surplus, depreciation and contingencies, and such other matters as might be deemed proper according to the facts in the particular case under consideration.

Another interesting decision is of record in Wisconsin, where the Railroad Commission, having jurisdiction over the public utilities of that State, decided in favor of the Water, Light and Power Company of Superior in an investigation of rates instigated by the Commercial Club of that city. In this case the complaint was that the existing rates were too high, and in support of its charge the complainant resorted to comparative statistics, quoting the rates charged for service in other cities where municipal ownership was in force. In deciding against this method of arriving at a basis for rate-fixing the Commission said:

"It is claimed by many city officials where there are municipally operated plants that their departments are making money at the low rates charged, and their reports are pointed to to substantiate their statements. In many of these reports, however, one can look in vain for a charge of interest on the investment not included in the bonded debt; also for a charge of taxes which would be paid if the property were owned by individuals. Depreciation on the cost of the works is also missing from the production cost. All of these are a part of the cost of production, and unless they are included it is impossible to tell what the cost of furnishing the commodity is or whether there is a loss or a profit in conducting the business. There are hundreds of plants in other States that have not at present on their books any charge for depreciation and that have not considered who is going to make good the plant when it is worn out and who is going to pay the necessary rates in later years out of which has to come the fund for rebuilding that plant.

"Where all the expenses of operation and fixed charges are not borne by the revenues of the plant but are helped out by taxation, as is frequently the case with municipally owned plants, it is not equitable to the property owners that one should be required to help maintain the plant so that another enjoys the use of the commodities. Private plants often have to charge higher rates to make a legitimate rate of interest on their investment, due to the fact that they have not a source of taxation to care for a large percentage of their expenses."

We have been put to a certain amount of annoyance of late by rumors of a shut-down upon our construction work in the Sierras. These rumors, we think, are attributable partly to the financial stringency which has been prevalent in the East and partly to our decision to carry our Lake Spaulding-Drum development to the point where we can make practical use of it before completing our developments lower down the valley.

At any rate, whatever the cause, these rumors got abroad, and in consequence Mr. Britton found it advisable to address an open letter to the press setting forth the true condition of affairs.

As a matter of fact, our work up there is not only progressing but, as will be seen from an article in this issue of PACIFIC SERVICE MAGAZINE, at record speed. Just as sure as the sun's rays beat down upon Lake Spaulding in the noonday we will be supplying our customers for electricity from the Drum power plant before the close of the present year, should no unforeseen mishap upset our calculations.

We think that a great enterprise like ours whose activities are of an entirely beneficial character should receive the best of encouragement at the hands of the people, and that those who have the interests of our glorious State at heart should get together and boost for her progress and development in every direction and not give ear to idle rumors which appear to possess too much flavor of what has done more than anything else in the past to hold California back—"the knock."

For the benefit of those of our readers whose attention has not already been called to it, we reproduce here the following editorial published in the San Francisco Chronicle of date August 29th:

MORE DYNAMITE.

It Is Once More Demonstrated That the Public Has a Duty to Perform.

Another dynamite outrage has been committed in Contra Costa county and this time the immediate principal pecuniary loss falls upon a corporation not involved in any trade dispute. The perpetrators would probably be quite ready to apologize and confess that it was a mistake.

But the miscreants who took this method of expressing their hate of a particular corporation were utterly indifferent to the damage inflicted on residents of large sections of Contra Costa county which were plunged into darkness, and who must repair their broken windows as best they may.

Presumably the intent of the dynamiters is to so injure the public that it will demand that the corporation shall yield to the demands of the strikers, regardless of cost or merit.

If outrage and terrorism are to be employed to compel employers to forego rights which the law gives them, and do acts which the law declares that they need not do, then the question is right up to society to determine whether we shall live under the reign of law or the reign of terror.

And if society is so cowardly and degraded as to submit to the rule of ruffians, then it is not worth preserving and may as well perish now as later.

The time has come when high explosives should be sold only upon certificate from competent authority to persons having a legitimate use for it, and who shall be bound to vigilantly protect it. The unauthorized possession of any high explosive should be made a criminal offense, and in case of outrage be made prima facie evidence of guilt. And the commission of any crime with the use of dynamite should be made a felony, with heavy penalty, and if human life is endangered the penalty should be that which the law prescribes for train robbery or murder.

Such use of dynamite as that in these Contra Costa county explosions is conclusive proof that the perpetrators are utterly depraved, enemies of society and unfit to be at large.

ITEMS OF GENERAL INTEREST

All members of "Pacific Service," no doubt are aware that we are about to increase our already enormous electric-generating plant at Station "A" in San Francisco by another 15,000 K. W. steam turbine, or, to speak more correctly, turbo-generator. Well, what we have to announce now is that the foundation for this has been poured and all is ready for the installation of the turbine, some parts of which have already been shipped from the works of the General Electric Company.

In another part of this number of Pacific Service Magazine attention is called to the breaking of a world's record in pouring concrete on Lake Spaulding dam. Another record may or may or may not have been broken at the Potrero, though it is a very much smaller undertaking, for the foundation-pouring started on the morning of Tuesday, August 26th, and was completed in a little less than twelve hours. A total of 90 yards of concrete was poured.

Mr. Frank H. Varney, Chief Engineer of our Steam Electric Department, is in charge of this new installation, of course, and there is pride in his voice as he speaks of the unusual speed with which the preliminary work was completed. It appears from the record that the foundation for the first turbo-generator installed at Station "A", one of 12,000 K. W. capacity, was made by blasting with dynamite. It is also of record that it took some 23 hours to pour the concrete. The foundation for the second turbine, of similar capacity to the one soon to be installed, was made by a channeling machine. The pieces of rock scooped out by this process averaged about 40 tons in weight each. The concrete was poured in installments stretching over a period of 8 days.

This time, however, although two old reciprocating engines had to be taken out to make room for the new turbine, the work was done more speedily and just as efficiently and at a smaller cost by a process known as the Eastwood methcd, named after our very able superintendent at Station "A". Some gads, weighing 500 pounds apiece, were hammered into the rock with battering rams of 3 tons weight slung from an overhead crane. Through this process the rock was broken up into comparatively small pieces, loaded on railroad cars and taken away. The action of the gads resembled that of a wedge in splitting wood. This is the first time that Superintendent Eastwood's method had been put into practical operation, and if it is a record for "Pacific Service" we are glad of it.

The new turbine is of the Curtis type, vertical, and of 18,700 K. V. A. capacity. As already stated, it is being completed at the General Electric Company's works at Schenectady, New York, and some shipments have already been made. Mr. Varney expects to have it installed, duly tested and in working order by November 1st.

A contract has just been signed with the San Francisco Bridge Company, providing for the furnishing of power for the purpose of operating the large suction dredger owned by the Bridge Company, at various points on San Francisco Bay and bodies of water adjacent thereto. The Bridge Company has decided to use electric power after having had several years' experience with a steam-operated dredger, and is now arranging to install on the steam-driven dredger a large motor which will be used in place of the steam turbines. The steam turbines will, however, remain installed on the boat in order that they may be operated at pointh where it is not possible to obtain electric power.

The Marconi WirelessTelegraph Company of America is now installing a large transmission station at Bolinas Bay, in Marin County. For the purpose of furnishing energy for sending messages from the station to the Hawaiian Islands, Japan and China. A 500 K. W. motor generator set will be installed. The current for operating this motor generator set will be furnished by our Company by an extension of our 11,000-volt line from the Alto substation.

There has recently been installed at Easton, near Burlingame, in San Mateo County, a street car which in operated from storage batteries. These storage batteries are charged at a main charging station, in which is installed a 100 K. W. motor generator set for converting the current from alternating current to direct current, as it is necessary to charge the batteries with direct current. The car has been in successful operation for several months and promises to be the forerunner of many such street car lines in the vicinity of San Francisco Bay. The current for operating the motor generator set is supplied by our Company.

The Pacific Gas and Electric Company has closed a contract with Jacobsen and Bade, contractors for the Stockton Street Tunnel, and all motive power used will be operated electrically. A 200 horse-power induction motor driving an air compressor is located at the corner of Pine and Stockton Streets, and will furnish all the air for the air-drills and other purposes where air is required. About 20 horse-power will be used for saw mill and other small machinery; a 30 horse-power locomotive is delivering the materials from the tunnel to the auto trucks.

The North Tower Power Division has just finished the installation of three Automatic Voltage Regulators at Sausalito which hold a constant voltage on the Marin District feeder circuits in that territory regardless of the fluctuations in load that occur.

A 1000 horse-power Motor Generator set was recently put in operation at Alto Power House by the Northwestern Pacific R. R. Co. to supply 600 Volts Direct Current to their third rail system. Power to drive this set is delivered from the North Tower Power Division substation at Alto.

The Pacific Gas and Electric Company has renewed its contract with the State for supplying of electric energy for the operation of 1000 horse-power in motors and lights at San Quentin prison.

The Company has decided to proceed with the construction of a new gas holder at Marysville, which will have a capacity of 150,000 cu. ft. One of the present holders having a capacity of 30,000 cu. ft. has been in service since the early 60's.

San Jose District reports having contracts for supplying 5,239 horse-power in motors since the first of the year.

The new office building of the Company in Sacramento is rapidly nearing completion. It is expected that it will be ready for occupancy by September 15th.

Reconstruction of the Colusa gas works has been completed, and Manager Hartsock is, as a result, greatly pleased, as he will be well prepared for the winter load. The improvements made will result in a greatly improved service.

The residents of San Andreas, in Calaveras County, have voted in favor of forming a Highway Lighting District. About thirty Mazda lamps will be installed. This action on the part of the people of the little mountain town is evidence of the fact that they believe in progressing.

What "Pacific Service" Has Done For the Baker

By C. A. ROSS, Industrial Dept.

C. A. Ross

Among the many successful installations which the Industrial department of "Pacific Service" has handled recently is the converting to gas of the baker's brick oven.

For years it was the universal custom to fire bake ovens with four-foot pine wood—a method entailing considerable expense, long hours of splitting of wood, back-breaking work, and accumulation of unnecessary dirt. Latterly crude oil has been used somewhat, but when the owner of the average small bake-shop figures he has to spend from three to five hundred dollars to set up his plant, he begins to figure costs and results. During the last year and a half the Industrial Department has converted seventy-one bakeries to using gas as fuel, and from the interest displayed by others we hope to more than double that number in the coming year.

In San Francisco there is hardly any uniformity of size in bake ovens, these varying from 9′x12′ to 15′x17′. When one considers that these ovens cover a space equivalent to the size of an ordinary room, and that the roof, floor and walls must be brought to a uniform heat, the record made by our Industrial Department is a gratifying test to the efficiency of gas.

A Gas-fired Bake Oven Installed by "Pacific Service."

The burner we employ is a Home Industry product—made in San Francisco—and consists of a swinging arm to which a 1/20 H. P. motor direct-connected to a small fan blasts the gas through a spray nozzle and heats the oven to a cherry red.

It requires about an hour to bring an oven to the necessary heat, and the cost of gas per day will average seventy-five cents.

The large ovens used by French bakers, which need a greater heat than for milk or steam bread, naturally consume a little more gas.

When it comes to camparative costs between wood and gas, a careful baker can pay for the cost of the burner in a year in the saving on his wood bill. One pleased customer who conducts a commercial pie bakery told the writer that he had increased his output fifty per cent and saved from eight to ten dollars per month in his fuel bill. Another baker who lives near Golden Gate Park used to spend his afternoons splitting wood. The day we installed gas in his oven he told his wife to get her hat and they spent their first afternoon in years in communion with nature in Golden Gate Park.

When one considers the instantaneous, ever-ready, powerful heat, the freedom from dirt and work, and the low cost of gas in San Francisco, the field for industrial gas is enormous. It has been truly said that the ultimate expectation of every business transaction is profit; well, the benefits from these installations to both baker and gas company are mutual. As gas is desirable to the baker, so the baker's business is likewise desirable to the producer; for his demand for service comes largely on the off peak load, and the necessary statement-taking, bookkeeping, collection and incidental expenses are no higher than for a residence and each installation advertises our success to a circle of the satisfied customer's friends.

The following is a partial list of bakers using gas for fuel. To those who are familiar with the requirements of these men and the superior class of goods they turn out, their adoption of gas in their bake ovens is a sufficient recommendation for gas fuel.

E. Meyer, 163 Kessling.
Chas. Devini, 314 Montgomery Ave.
E. Steiff, 416 Hayes St.
M. Bimmerle, 122 Silliman St.
J. T. Eberly, 2010 Mission St.
Rebois, 2351 Mission St.
Columbia Bakery and Cafe, 3312 Mission St.
Ocean View Bakery, 98 Broad St.
C. A. Coombs, 8th Avenue.
New Popular Cafe, 115 Third St.
Golden Cafe, 2653 Mission St.
Cuneo Bros. 523 Green Street, 2 ovens.
Phoenix Bakery, 1192 Turk St.
M. Rosenberg, Ninth Avenue.
Berlin Bakery and Cafe, 1452 Haight St.
Lurline Bakery and Cafe, 1235 Polk St.
Herman Schmitt, 315 25th Ave.
John Arenz, 1668 Haight St.
Palm Bakery, 1714 Waller St.
C. Strade, 800 Greenwich St.
W. H. Kearney, 520 Castro St.
J. Taulis, 1667 Revere St.
A. Scheflau, 4013 Folsom St.
Louis Lane, 412 Church St.
C. E. Pfefferman, 543 Montgomery St.
Ale. Hoecamp, 1614 Polk St.
La Favorite Bakery, 544 Kearny St.
Gunzley & Kunz, 147 Eddy Street.
W. H. Ferguson, 3147 22nd St.
Meads Bakery, 259 Third St.
B. Langendorf, 878 McAllister St.
Eppler's Bakery, 2 ovens, 2828 California St.
Miss Weirigh, 1557 Hyde St.
Goldberg, Bowen & Co., 977 Sutter St.
Beyer, 3227 22nd Street.
W. Smith, 4350 California St.
Al. Walter, 4696 18th Street.
John Vielhauer, 3147 19th St.
Occidental Bakery, 1541 Haight St.
Sulzer & Wiederman, 142 6th St.
Mission Bakery, 2170 Mission St.
Henry Eggeling, 1598 Fulton St.
A. Walter, 436 Balboa St.
Golden State Bakery, 35 Clement St.
Miss Carlson, Spreckels Market.
C. Winterrowd, 1149 Valencia St.
Peacock Confectionery, 1816 O'Farrell St.
Lechten Bros., 1242 Devisadero St.
Pig & Whistle, 130 Post St.
Ruffieux, 211 Powell St.
Johan Schneir, Church and Clipper Sts.
S. Biedermann, 1261 Webster St.
H. Werle, 396 Precita Ave.
H. Dragon, 416 Pine St.
F. Wagner, 671 Broadway.
The Emporium, Market Street.
Oswald Elliger, 311 Jules Ave.
G. Lavagnino, 17 Neptune St.
W. H. McNelly, 601 Third Ave.
A. Ansen, 101 Valencia St.
L. D. McLean Co., 1158 Sutter St.

PACIFIC GAS AND ELECTRIC COMPANY

DIRECTORS

F. B. Anderson
Henry E. Bothin
John A. Britton
W. H. Crocker
E. J. De Sabla, Jr.
F. G. Drum
John S. Drum
D. H. Foote
Wm. G. Henshaw
A. F. Hockenbeamer
Samuel Insull
John Martin
C. O. G. Miller
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John A. Britton .... Vice-Pres. and Gen. Mgr.
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D. H. Foote .... Secretary and Asst. Treasurer
J. C. Love .... Asst. Treasurer
Charles L. Barrett .... Asst. Secretary

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R. J. Cantrell .... Property Agent
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J. P. Coghlan .... Manager Claims Dept.
H. Bostwick .... Secretary to President
F. S. Myrtle .... Manager Publicity Dept.
L. H. Newbert .... Manager Appliance Dept.
J. J. Valentine ... Superintendent of Transportation
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H. P. Pitts .... Industrial Engineer
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J. P. Jollyman ..... Engr. of Electric Construction
P. M. Downing .... Engr. O. & M. Hyd.-Elec. Sect.
C. J. Wilson ..... Asst. Engr. Electric Distribution
F. H. Varney .. Engr. O. & M. Steam & Gas Eng. Sect.
F. G. Baum .... Chief Engineer Hydro-Electric Dept.

DISTRICT MANAGERS

District	Headquarters	Manager
Alameda Co., Berkeley, Oakland	Oakland	F. A. Leach, Jr.
Chico	Chico	H. B. Heryford
Colusa	Colusa	L. H. Hartsock
Contra Costa	Martinez	Don C. Ray
Fresno	Fresno	M. L. Neely
Grass Valley	Grass Valley	John Werry
Marysville	Marysville	J. E. Poingdestre
Marin	San Rafael	W. H. Foster
Napa	Napa	O. E. Clark
Nevada City	Nevada City	John Werry
Petaluma	Petaluma	H. Weber
Placer	East Auburn	H. M. Cooper
Redwood	Redwood City	E. W. Florence
Sacramento	Sacramento	C. W. McKillip
San Francisco	San Francisco	G. C. Holberton
San Jose	San Jose	J. D. Kuster
Santa Rosa	Santa Rosa	M. G. Hall
Solano	Dixon	C. E. Sedgwick
Stanislaus	Newman	W. A. Widenmann
Vallejo	Vallejo	A. J. Stephens
Woodland	Woodland	W. E. Osborn

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Nevada (Nevada City) .... George Scarfe
Placer (East Auburn) .... H. M. Cooper
Standard (Electra) .... W. E. Eskew
Stockton (Stockton) .... J. W. Hall

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De Sabla .... I. B. Adams
Electra .... W. E. Eskew
Marysville .... E. C. Johnson
Nevada .... George Scarfe
North Tower .... C. D. Clark
Oakland .... William Hughes
Sacramento .... J. O. Tobey
San Jose .... J. O. Hansen
South Tower .... A. H. Burnett
Stockton .... E. C. Monahan
Solano .... J. W. Coons

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C. A. Eastwood .... Supt. Station "A," San Francisco
J. W. Varney .... Supt. of Sub-Stations, San Francisco.

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Oakland and Alameda (Overhead) A. U. Brandt
Marin .... Chas. Dallerup
Redwood .... R. C. Bragg
Sacramento .... C. R. Gill
San Francisco .... A. R. Thompson
San Jose .... A. C. Ramstad
Valley District (Chico, Marysville, Woodland and Colusa) .... W. F. Blide

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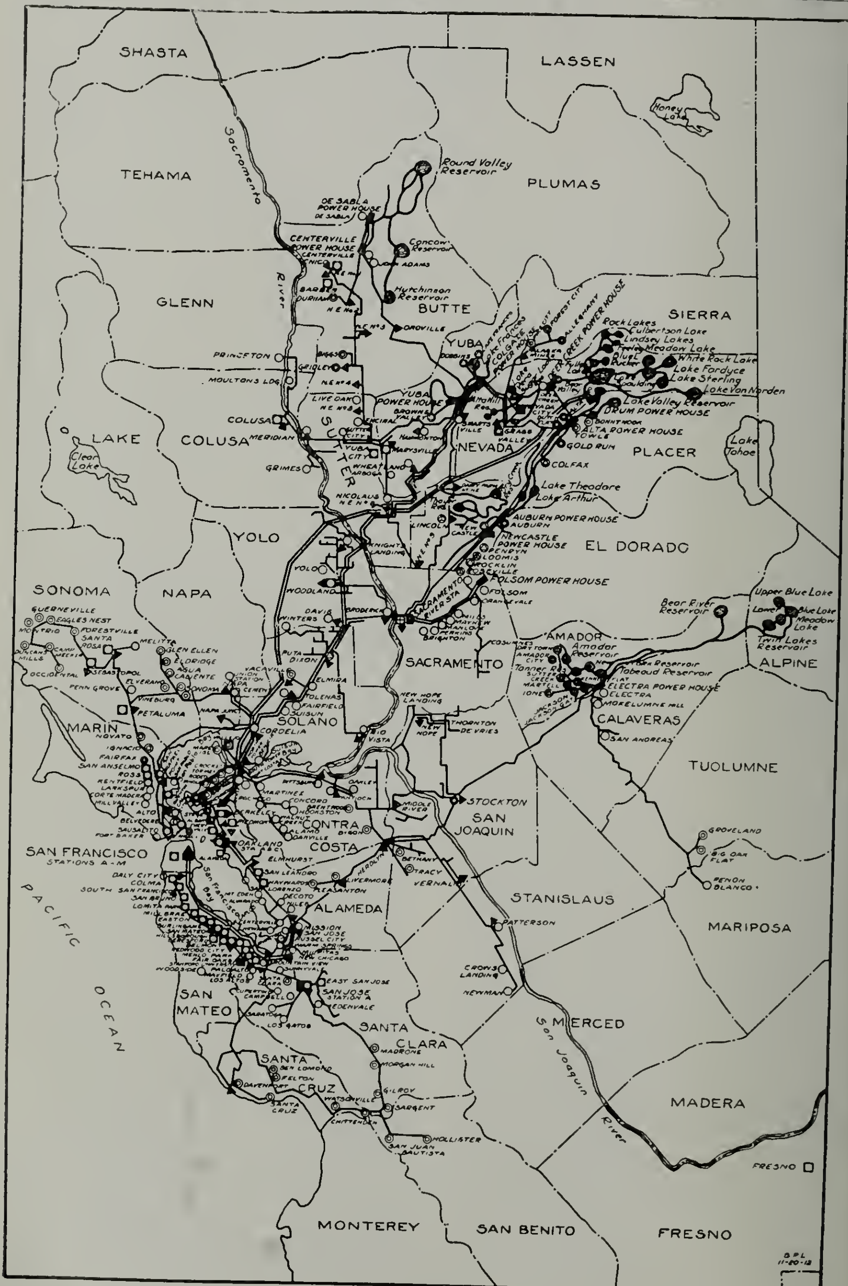
Oakland .... A. C. Beck
Sacramento .... Edward S. Jones
San Francisco .... Dennis J. Lucey
San Jose .... R. H. Hargreaves

SUPERINTENDENTS OF GAS DISTRIBUTION

Oakland .... George Kirk
San Francisco .... D. E. Keppelmann
Superintendent of Railway Department .... N. J. Hullin


SHASTA
LASSEN
Honey Lake
TEHAMA
Sacramento River
Round Valley Reservoir
PLUMAS
DE SABLA POWER HOUSE
CENTERVILLE POWER HOUSE
Concow Reservoir
GLENN
Hutchinson Reservoir
BUTTE
OROVILLE
SIERRA
YUBA
YUBA POWER HOUSE
COLGATE POWER HOUSE
PRINCETON
COLUSA
LAKE
Clear Lake
SUTTER
NEVADA
PLACER
Lake Tahoe
Lake Theodore
Lake Arthur
AUBURN POWER HOUSE
NEWCASTLE POWER HOUSE
EL DORADO
YOLO
FOLSOM POWER HOUSE
SONOMA
NAPA
Bear River Reservoir
Upper Blue Lake
Twin Lakes Reservoir
AMADOR
Amador Reservoir
ALPINE
SACRAMENTO
ELECTRA POWER HOUSE
SOLANO
MARIN
CALAVERAS
TUOLUMNE
STOCKTON
CONTRA COSTA
SAN JOAQUIN
SAN FRANCISCO
STATIONS A-M
OAKLAND
ALAMEDA
STANISLAUS
PACIFIC OCEAN
MARIPOSA
SAN MATEO
SANTA CLARA
MERCED
San Joaquin River
SANTA CRUZ
MADERA
FRESNO
MONTEREY
SAN BENITO
FRESNO

Pacific Gas and Electric Company

CITIES AND TOWNS SUPPLIED WITH GAS, ELECTRICITY, WATER AND RAILWAY

Service Furnished	Number of Towns	Total Population
Electricity	209	1,093,992
Gas	51	989,167
Water	25	52,865
Railway	1	71,000

Place	Population
Alta	20
[1] Alameda	25,000
Alamo	50
[2] Albany	800
[5] Amador City	200
Adams John	25
Alleghany	200
Alto	25
Angel Island	280
[5] Auburn	2,375
Agua Caliente	100
Alvarado	900
Antioch	3,000
Arboga	100
[2] Barber	500
[2] Belmont	350
Ben Lomond	800
Belvedere	1,000
Benicia	3,360
[2] Beresford	25
[2] Berkeley	40,000
Biggs	750
Big Oak Flat	20
Brentwood	200
Brighton	100
Broderick	200
[5] Brown's Valley	50
Byron	200
[2] Burlingame	4,000
California City	25
Camp Meeker	200
Campbell	600
Centerville	1,000
Centerville	20
[2] Chico	13,000
[2] Colma	3,500
[2] Colusa	1,500
Concord	1,500
Cement	1,500
[5] Colfax	500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Cupertino	50
Daly City	250
Danville	250
Davis	750
Decoto	350
de Sabla	25
[5] Dixon	1,000
[5] Dobbins	50
Davenport	1,000
[5] Drytown	20
Durham	500
[5] Dutch Flat	500
Duncan's Mills	150
[2] Easton	300
[2] East San Jose	1,660
Eagle's Nest	50
Edenvale	500
Eldridge	500
Elmira	150
El Verano	400
Electra	50
[2] Emeryville	5,000
Encinal	100
Fairfax	500
Fairfield	834
Forestville	100
Felton	300
[1] Fresno	30,000
[2] Fair Oaks	250
Folsom	1,800
Gilroy	2,000
Glen Ellen	500
[5] Gold Run	100
[3] Grass Valley	4,500
Gridley	1,800
Grimes	250
Groveland	125
Guerneville	500
Hammonton	500
[2] Hayward	4,000
[2] Hillsborough	1,000
Hollister	3,000
Hookston	75
Ignacio	100
[5] Ione	900
Irvington	1,000
[5] Jackson Gate	100
[5] Jackson	2,035
[5] Kennedy Flat	20
[2] Kentfield	250
Knight's Landing	350
[5] Lake Francis	5
Lathrop	300
Live Oak	200
Livermore	2,250
Los Gatos	3,000
[2] Larkspur	600
[5] Lincoln	1,400
[2] Lomita Park	100
Los Altos	500
[5] Loomis	400
Maletta	30
Manlove	50
Martinez	5,000
[5] Martell	150
[2] Marysville	7,000
Mayfield	1,500
Mayhew	50
[2] Menlo Park	1,500
Meridian	300
[2] Millbrae	300
Mills	50
Milpitas	300
Mill Valley	2,500
Mission San Jose	500
Mokelumne Hill	150
Monte Rio	50
Moulton's Landing	30
Mountain View	2,500
Mt. Eden	200
Mare Island	500
[2] Napa	7,000
[3] Nevada City	2,700
[5] New Chicago	10
Newark	700
[5] Newcastle	750
Newman	1,000
Niles	800
Nicolaus	75
Novato	250
[2] Oakland	230,000
Oakley	80
Orange Vale	100
[2] Palo Alto	6,300
Pacheco	200
Penryn	250
Patterson	300
Penn Grove	300
Perkins	50
[2] Petaluma	5,500
[2] Piedmont	1,720
Pike City	200
Pinole	1,500
Pittsburg	2,372
Pleasanton	2,000
Point San Pedro	20
Port Costa	600
[2] Redwood City	3,200
[2] Richmond	10,000
Rio Vista	884
[5] Rocklin	1,000
[5] Roseville	2,600
Rodeo	500
[2] Ross	500
Russel City	250
[4] Sacramento	71,000
San Andreas	200
[2] San Anselmo	1,500
[2] San Bruno	1,500
[2] San Carlos	100
[2] San Francisco	416,912
[2] San Jose	30,000
[2] San Leandro	4,000
San Lorenzo	100
[2] San Mateo	6,500
[2] San Quentin	2,500
[2] San Rafael	6,000
San Pablo	1,000
Santa Clara	6,000
Santa Cruz	16,000
Saratoga	50
[2] Santa Rosa	12,000
[2] Sebastopol	1,200
Sausalito	2,500
Smartsville	500
[2] South San Francisco	2,500
[2] Stanford University	2,600
Sonoma	1,200
Stege	1,000
[5] Stockton	30,000
Suisun	1,200
Sutter City	150
Sutter Creek	1,500
Sunnyvale	1,500
Tiburon	400
Tormey	20
Towle	100
Tracy	1,200
Union Station	40
Vacaville	1,200
[2] Vallejo	15,000
Vineburg	200
Walnut Creek	350
Warm Springs	200
Watsonville	4,500
Wheatland	1,400
Winters	1,200
[2] Woodland	3,200
Woodside	200
Yolo	400
[2] Yuba City	1,200
Total	1,148,992

Unmarked—Electricity only
1—Gas only.
2—Gas and Electricity.
3—Gas, Electricity and Water.
4—Gas, Electricity and Street Railways.
5—Electricity and Water.

EMPLOYS 4,800 people.
OPERATES 11 hydro-electric plants in the mountains.
5 steam-driven electric plants in big cities.
16 gas works.

SERVES ⅔ of California's population.
30 of California's 58 counties.
An area of 37,775 square miles.
⅗ the size of New York State.
½ the size of all the New England States combined.

OL. 5 OCTOBER 1913 NO. 5

Pacific Service Magazine

PUBLISHED MONTHLY BY THE
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CALIFORNIA

Pacific Service Magazine

Vol. V | Contents for October | No. 5

Yearly Subscription $1.50 | Single Copies each 15 cents

Station "S", our new steam-distributing plant in San Francisco.

PACIFIC SERVICE MAGAZINE

VOL. V OCTOBER 1913 No. 5

Station "S", San Francisco, from which "Pacific Service" Supplies the Public with Steam-heat

By C. H. DELANY, O. & M Dept.

C. H. Delany

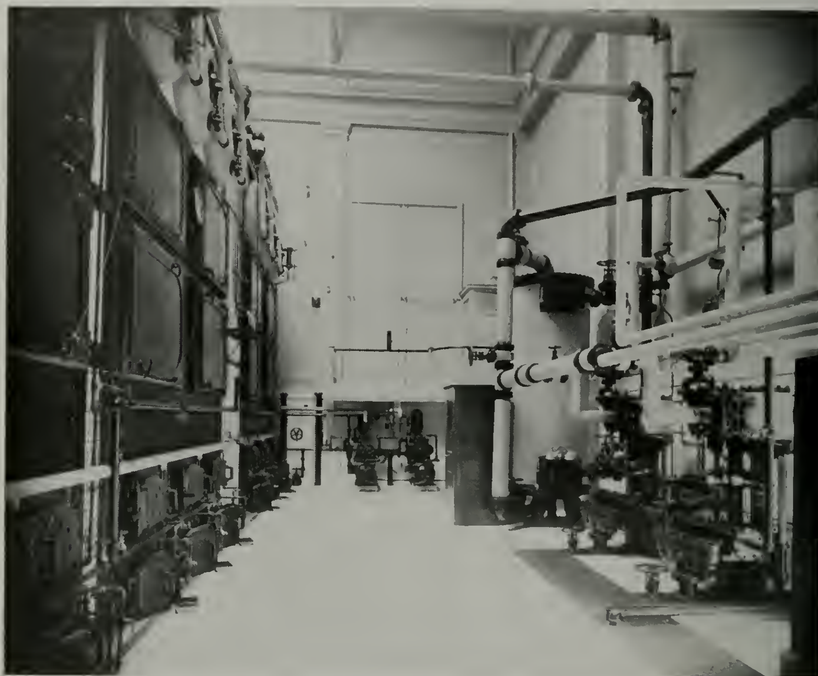
"S" stands for steam. That is why several letters of the alphabet were skipped when a name was given to the latest addition to the Company's long list of handsome buildings.

Steam is a comparatively new branch of "Pacific Service", and a good many of the readers of PACIFIC SERVICE MAGAZINE may not be aware that an extensive steam-heating system is in operation in the San Francisco District. Station "S" is used entirely for the generation of steam. From the station the steam flows through underground pipes at high pressure and is distributed through the streets to a number of apartment houses, hotels, theaters and factories, where the steam is used for heating, cooking and various other purposes.

Station "S" is located on the west side of Meacham Place, which is a small street running off Post Street, just west of Hyde. The building is of steel frame and brick construction and was designed by Mr. Frederick Meyer. The front of the building, facing on Meacham Place, is of ornamental design. An open space at the south of the building is devoted to an artistic flower garden. Upon entering the building one steps on to the visitors' gallery, from which a general view of the interior of the station is obtained. Here one sees the immense steam boilers, the large feed water-heater and all the pumps and other apparatus required to make a complete steam station. One is struck immediately with the handsome appearance of the station, with its ornamental tile floor, white tile walls, and the boiler fronts, partly of white enamel brick and partly of black iron, making a pleasing contrast.

The three boilers are of the well-known Babcock & Wilcox make and have a rated capacity of 500 H. P. each, making a total of 1500 H. P. for the station. Each boiler has 294 4-inch tubes, 18 feet long, expanded into cast iron headers and grouped in 21 sections, each containing 14 tubes. Each boiler is provided with three steam drums, 42 inches in diameter and 20 feet 4 inches long, made up of steel plates 7/16 of an inch thick. The boilers are built to carry a pressure of 160 pounds per square inch.

Each boiler is provided with a superheater of the Babcock & Wilcox standard "U" design. The superheaters raise the temperature of the steam about 75 degrees above the temperature of saturated steam, so



Interior of Station "S", showing boilers and auxiliaries.

that when operating at a pressure of 100 pounds per square inch the actual temperature of the steam leaving the station is approximately 410 degrees.

Each boiler is provided with three oil burners of the outside mixer steam-atomizing type. The burners are supplied with oil by two Blake horizontal duplex oil pumps, having six-inch steam cylinders, four-inch oil cylinders and a common stroke of six inches. After leaving the pumps the oil passes through two oil heaters, where its temperature is raised to about 150 degrees by means of the exhaust steam from the pumps. Each oil pump is mounted on its own heater, so there are two complete units, either one of which is large enough to operate the plant.

The oil pumps obtain their oil from two large tanks, located under the sidewalk, just outside the building. These tanks have a total capacity of 400 barrels, which is sufficient fuel oil to run the plant for 24 hours The suction pipe is provided with valves so that oil can be taken from either tank as desired. Consequently, while oil is being taken from one tank the other tank can be filled and accurate measurements taken of the amount of oil received. For filling the tanks, a pipe is provided, running from the corner of Meacham Place and Post Street, so that the oil wagons can unload either at the corner or right at the plant. The filling pipe is provided with valves operated in the boiler room, which deflect the oil into either tank as may be desired.

For determining the amount of oil in the tanks, oil indicators are provided in the station, which are connected to floats in the tanks. The indicators show the exact quantity of oil in either of the tanks at any time.

The water used in the boilers is obtained partly from the returns from the heating system, which come back from the various buildings to the plant through pipes in the street, and partly direct from the mains of the Spring Valley Water Company. The return water as well as the make-up water goes direct to a large hot well tank, 13 feet long, 6 feet wide and 6 feet deep. All condensation obtained in the plant from drips and drains is also led into this tank, so that no hot water is wasted. The tank has a capacity of 3,500 gallons. This amount of water would be sufficient to keep the plant in operation for 30 minutes, even if all water supply were cut off.

The feed pumps take water direct from the hot well tank. These are two Worthington vertical, duplex pumps. The steam cylinders are 12 inches in diameter, the water cylinders 8½ inches and the common stroke 10 inches.

From the feed pumps the water goes through a National vertical closed feed water-heater. The exhaust steam from all the pumps in the station except the oil pumps discharges into this heater. A thermometer is provided at inlet and outlet to indicate exactly how much the temperature of the feed water is increased on going through the heater.

Two blow-off tanks are provided to reduce the pressure and temperature of the water when the boilers are blown down. The water runs by gravity from the blow-off tanks into a sump located under the floor of the boiler room. From this sump the waste water is pumped out to the sewer by means of a Worthington horizontal 6"x4"x6" duplex pump.

As in all other stations it is necessary to carefully watch the operating efficiency of the station in order to keep down the cost. In this station, however, it is not possible to measure the output of the station by means of K. W. hours or indicated horsepower, for the steam is not used either to generate electricity or to drive an engine. To determine the output of the plant, therefore it is necessary to measure the quantity of steam itself, and this is done by means of steam-flow meters. Four of these meters have been installed in the plant. Three of them are connected direct to the boiler outlets so that the quantity of steam generated by each boiler is indicated. The fourth meter shows the total quantity of steam flowing out to the steam mains in the street. The steam meters used are of the General Electric Co.'s type and operate on the principle of the Pitot tube, measuring the quantity of steam by its velocity.

In addition to the steam-flow meters which show the quantity of useful energy obtained from the plant, a CO_2 Recorder has been installed, which shows the quantity of energy going to waste up the smokestack. This CO_2 recorder is of the Uehling type and has an attachment for indicating the instantaneous value of the carbon dioxide as well as making a permanent record of same. This instrument is also provided with a pyrometer attachment, which shows the temperature of the escaping gases at any instant and, also, makes a record of this temperature on a chart.

Other instruments for observing the operation of the plant are steam gauges and draft gauges, one of each of which is attached to each boiler, and thermometers showing the temperature of superheated steam, the temperature of feed water, the temperature of fuel oil, etc.

The plant was first placed in operation on the 8th of May this year, but it was not entirely completed until the early part of August. It is now ready for all demands that may be made on it by "Pacific Service".

Steam Distribution

(By the same Author.)

In taking up the question of distribution of steam for heating purposes, it is of interest to compare the economies obtained from steam used for heating with the economies obtained from steam used for driving an engine. The steam engine has frequently been called the most inefficient of all machines; this however, does not by any means apply to the use of steam for heating purposes. The overall efficiency of a boiler and engine does not usually run over 10%, which means that nine-tenths of the heat in the fuel cannot be used in a steam engine. The total heat in steam consists of about three quarters latent heat and only one-quarter sensible heat. In operating a steam engine all of the latent heat is either blown into the atmosphere through the exhaust pipe, or, in the case of a condensing engine, it is passed into the circulating water and carried away. In the case of steam heating, on the other hand, this is entirely different as both the sensible heat and the latent heat can be used. The only losses are chimney losses from the boiler, radiation from the apparatus and pipes where no heat is needed, and the heat contained in the condensed steam after it leaves the heating system of the building. The latter loss is eliminated if the water is returned to the boiler at the same temperature at which it leaves the heating system. The total efficiency of a boiler and heating system may be as high as 75% as against 10% in the case of a boiler and engine.

There are two general methods by which steam is used for heating purposes, called respectively, the high pressure and the low pressure systems. The ideal method from an engineering standpoint is to use the exhaust steam from engines for heating purposes, as we are then able to operate the engine and still make use of the latent heat of the steam in the heating system; this is the low pressure system, the pressure available for the heating system being governed by the amount of back pressure on the engine. This method is suitable for one building or in cases where the distance the steam is to be transmitted is short. In the case of distributing steam for any great distance, however, there are many objections to the low pressure system.

The high pressure system consists in operating boilers for the sole purpose of heating, and taking live steam directly from the boilers into the steam distributing pipes. One of the prime advantages of this system is the fact that small sized pipes and high steam velocities may be used, owing to the fact that a considerable drop in pressure is not objectionable. In power plant work it is not advisable to have a drop of more than 10 or 15 lbs. between the boilers and the engine, as the greater the drop in pressure in the steam pipe, the less economical is the engine. This is not because there is any loss of heat in the steam supplied to the engine, but because the engine is not able to absorb as much heat if steam is supplied at a reduced pressure, and consequently more heat is discharged to the exhaust. In the case of steam heating, on the other hand, the only limit to the permissible drop in the pressure is the pressure required in the radiators of the building to be heated, which runs from 5 lbs. to 10 lbs. Consequently if the boiler pressure is 100 lbs. and the pipe is, say, 3,000 feet long there may be a drop of 90 lbs in the pipe, or 30 lbs. per thousand feet. This drop in pressure does not mean a loss of energy, as the friction of the steam against the walls of the pipe generates heat which goes into the steam, tending to dry it and superheat it. With steam at 100 lbs. and a drop in pressure of 30 lbs. per thousand feet it is possible to carry a quantity of steam equivalent to 1,000 H. P. through a 6″ pipe. The velocity of this steam would be somewhat over 10,000 feet per minute. In the case of the low pressure system, any drop in pressure in the pipes results in a corresponding increase in the back pressure on the engine, and in order to prevent the back pressure becoming excessive the drop in pressure in the pipes must be reduced to a minimum. In order to carry 1,000 H. P. of steam 3,000 feet with the low pressure system without excessive drop in pressure, it would be necessary to use a pipe at least 18″ in diameter.

The amount of heat lost by radiation in the mains of a steam distributing system depends on three factors: First, the area of outside surface of the pipe. Second, the difference between the temperature of the steam inside the pipe and that of the ground surrounding the pipe. Third, the effectiveness of the nonconducting covering on the pipe. In the case of low pressure steam the difference in temperature is less than for high pressure steam, but owing to the much larger pipes necessary, the total radiation is greater. In the case just cited, the radiation from 3,000 feet of 6″ pipe carrying high pressure steam would amount to about 18¾ H. P. This figure has been obtained from actual measurements of condensation occurring in a section of steam main. Assuming the same efficiency of pipe covering, the radiation from 3,000 feet of 18″ pipe carrying low pressure steam would amount to 36 H. P., almost twice as much. This is a considerable advantage in favor of the high pressure system. In addition we have the fixed charges on the investment consisting of the interest, depreciation, taxes, etc., on the capital invested in the steam mains. The cost of an 18″ steam line would be three or four times as much as a 6″ line, and the additional fixed charges due to this extra cost are more than enough to counterbalance the saving in fuel which is effected by the use of exhaust steam in the low pressure system. This is true even when there is sufficient exhaust to supply the entire demand for steam. As a matter of fact, however, in most low pressure systems, while there may be enough exhaust steam to supply the demand during the peak of the electric load, at other times of the day it is necessary to supplement the supply by means of live steam fed through a reducing valve. The result is that during the greater part of the 24 hours a considerable quantity of fuel is burned for heating purposes alone, and at the same time the burden is carried of high fixed charges and large radiation losses due to the large size of pipe installed.

Another advantage of the high pressure system over the low pressure is that it enables steam to be supplied for other purposes besides heating, such as laundries, restaurants, kitchens, pumps, ice machines, etc. This means that it is possible to secure more business where high pressure is used than where the low pressure system is adopted.

The Pacific Gas and Electric Company has installed a high pressure system in certain parts of the cities of San Francisco and Oakland. In this system the largest size of pipe used is 6″, this size being adopted for the principal mains. From the 6″ pipe, branches are run of 3″ or 4″ pipe depending on the amount of steam required on different streets. The pipes are very carefully insulated by means of felt casing and concrete, the concrete being thoroughly water-proofed to prevent moisture seeping through to the casing. That this insulation is effective is shown by the fact that the heat transfer amounts to ½ a B. T. U. per sq. ft. per hour per degree difference in temperature, which compares favorably with the heat transfer obtained with ordinary commercial coverings used on suspended pipe. Expansion of the pipe due to heat is taken care of by the use of slip joints. The longest single pipe on the system in a straight line is 3,500 feet. The expansion in this line caused by the high temperature of the steam, amounts to over 6 feet, and this of course must be provided for. Manholes of reinforced concrete are provided wherever there is an expansion joint, and in these manholes are placed the valves, traps, etc., that are required to properly operate the system. In addition to the steam pipe, a pipe is provided for the return of water of condensation from the various buildings back to the power plant, where it can be fed to the boilers and used over again. The return pipe is galvanized iron and is provided with expansion joints, valves, etc., similar to the steam pipe.

In order to obtain high efficiency of the entire system it is essential that all of the heat in the steam be extracted and made use of before the water of condensation is discharged. In cases where the condensation is discharged to the sewer, all of the heat in this water is a dead loss. When the water is discharged to the return pipe there is a good deal of loss through radiation from the return pipe before the water gets back to the boiler plant. It is therefore important in all cases to reduce the temperature of the condensation to as low a point as possible, by absorbing its heat in such a manner as to derive benefit from it. The simplest method of doing this is to make use of the returns from the heating system for the purpose of heating the domestic water supply, by running the returns through a coil in a water heater before discharging them. In buildings where indirect radiation is used it is possible to run the return water through air heating coils before discharging it, thus making use of the heat contained in the condensed steam to heat the air.

The amount of steam used in the various buildings is measured by passing the return water through condensation meters. These consist simply of a pair of buckets arranged to fill with water and then dump. Each bucket holds a definite quantity of water. The number of dumps are counted by ordinary counting mechanism, the register being arranged to read the number of pounds of water passing through the meter.

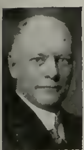
The climate of San Francisco is such that a fairly steady load is obtained throughout the year and in this respect our Steam Distribution system has a great advantage over steam systems in Eastern cities where there is a heavy heating load in wintertime and no load whatever in summertime. In addition to heating of buildings, a good deal of steam is used for heating the domestic water in buildings, and this also has a tendency to produce a steady load throughout the year. This is of considerable advantage, as it enables the installation to make returns on the investment during the whole year instead of during only a few months in the winter-time.

The election of Mr. E. C. JONES to the vice-presidency of the Pacific Coast Gas Association was hailed with delight by the entire convention. It was indeed a wise selection, for it means that Mr. JONES will be president in the all-important year 1915, when the Association will meet in the Exposition city, San Francisco. Mr. JONES can do more, probably, than any other member to further the interests of the Association, and his name will prove a veritable drawing-card two years hence.

It is also quite in accord with the fitness of things that Mr. JONES should be appointed to represent the Association at the annual convention of the American Gas Institute held this month at Richmond, Va. Mr. JONES left for the convention city October 9th. When he returns next month we expect to hear that he has accomplished great things in the direction of an International Gas Congress to be held in San Francisco in 1915.

The Story of the Twenty-first Birthday of the Pacific Coast Gas Association

By E. C. JONES.



E. C. Jones.

There could be no more appropriate place in which to celebrate the coming of age of the Pacific Coast Gas Association than in the Garden City of California, and the large attendance showed the unflagging interest in this now "grown up" Association. About one hundred and twenty-five members gathered in San Jose on the morning of September 16th to listen to a most interesting and attractive program beginning with the address of President C. S. Vance, in which he ably covered the field of progress in the gas industry during the past year. The address touched upon points of improvement in the manufacture and distribution of gas, and described the transmission of natural gas from the wells of Kern county through a pipe line 120 miles long to the City of Los Angeles, and its subsequent uses. President Vance discussed topics close to the hearts of the members, including the International Gas Congress and the progress of the Gas Engineering Course at the Univrsity of California, to both of which projects the Association has given its support and promise of success.

The papers presented were of unusual merit, beginning with the paper on "Oil Gas" by Mr. Leon B. Jones, in which he described a new method of manufacturing oil gas in which hydrogen is used as a catalyzing agent to prevent the formation of the lampblack by-product, and to assist in the synthetic production of methane. The paper teemed with new ideas and suggestions of economy in the use of oil. It is well discussed and in the minds of the members it "comprised original research and endeavor of sufficient importance to the gas fraternity to merit the award of the Association gold medal."

A paper entitled "Standards of Quality and Service for Oil Gas," by Mr. H. Papst of Portland, Oregon, was particularly well received and intelligently discussed. Mr. Papst recommended the appointment of a committee to confer with State Commissions and other rate-making and regulating bodies for the purpose of suggesting proper standards of quality and pressure of oil gas to be adopted for the mutual best interest of the gas consumers and the manufacturers. Such a committee, consisting of John A. Britton, E. C. Jones, H. Papst, W. E. Barrett and Prof. C. L. Cory, was appointed.

"Gas Company's Public Policy" was ably treated in a paper by Mr. L. A. Wright, Jr., of San Diego, and the discussion emphasized the fact that gas companies today are striving to give perfect service and make friends of their consumers.

The sale of the finished produce is the subject which is now uppermost in the minds of gas men, and papers showing new ways to dispose of gas, and means of displacing other fuels by gas are of first importance.

"Industrial Uses of Gas", by Mr. John B. Redd and "Why the Gas Company Should Handle Gas Arc Lamps", by Mr. C. B. Babcock, brought forth discussion which might have been extended to occupy a whole day of the meeting. This is as it should be, as the ultimate aim of any manufacturing concern is the marketing of its product.

A paper by Mr. D. E. Kepplemann on "Modern Gas Distribution and the Part Played by the Automobile", was received with enthusiasm by the members, because it outlined economics and improvements in service, in gas distribution and explained the latest methods employed in welding steel and wrought iron mains and the making of special fittings. The cost tables accompanying this paper are particularly interesting and valuable for reference.

The able and scholarly paper by Dr. Alex Humphreys of New York on the subject of "Rate Making" included a discussion of the paper read at last year's meeting by Prof. C. L. Cory, on the subject of "Reasonable Gas Rates and Their Determination", and an abstract of the paper presented by Dr. Humphreys at the meeting of the British Institution of Gas Engineers on the subject "Depreciation—Estimated and Actual". The paper was exceedingly interesting and was well received and discussed.

The departments of Wrinkles and Experiences, handled by Mr. H. W. Burkhart and Mr. John Clements, respectively, brought cut a fund of new and valuable information, and reflected credit on these editors for a large amount of intelligent and tireless work.

Mr. H. P. Pitts, in charge of the Novelty Department, gathered together a creditable exhibit of gas appliances. It was probably the attractiveness of this exhibit which prompted the Association to recognize the importance of making a still more extensive showing of gas consuming appliances, and it was determined to place this department in the hands of a Committee on Gas Exhibits, consisting of Messrs. C. B. Babcock, R. H. Thompson, B. S. Pederson, Paul Haugh and H. P. Pitts.

The report of the Committee on the International Gas Congress was read by Mr. John A. Britton, Chairman, and included the work done by the local committee and the splendid results accomplished by the committee of the American Gas Institute and the joint committee on International Gas Congress. The Pacific Coast Gas Association has undertaken the pleasant task of acting as host to the gas men of the world during the Gas Congress, and with true California enthusiasm will attend to the entertainment of its guests.

Prof. C. L. Cory reported on the work accomplished in the class in gas engineering at the University of California during the past year, including a list of the lectures delivered, and the equipment of the gas laboratory. This work is carried on by a fund generously donated by the members of the Association.

The following officers were elected to preside over the Association activities for the coming year: President, C. S. Vance, Los Angeles; Vice-President, E. C. Jones, San Francisco; Secretary-Treasurer, Henry Bostwick, San Francisco; Directors, John A. Britton, San Francisco; Wm. G. Kerckhoff, Los Angeles; Wm. Baurhyte, Los Angeles; F. S. Green, Long Beach; C. F. Babcock, San Francisco; Prof. C. L. Cory, Berkeley; H. R. Basford, San Francisco.

The President appointed H. W. Burkhart of Los Angeles, Editor of the Wrinkle Department, John Clements of Oakland Experience Editor, and E. C. Jones Librarian. The Committee on the International Gas Congress was enlarged and now consists of: John A. Britton, Chairman; W. B. Cline, Geo. H. Collins, L. P. Lowe, C. O. G. Miller, John Martin, F. A. Cressey, Jr., W. P. Hutchinson and E. C. Jones.

During the convention twenty-four active and three associate members were elected to membership in the Association. The meeting was declared to be the best ever held, and the members are looking forward to the 1914 meeting to be held at Long Beach, California.

The annual banquet was held in the Hotel Vendome Wednesday evening, September 17th, and was attended by nearly every member present. After an excellent dinner the evening was rounded out by music and speeches, all tending to closer cement the bond of friendship existing between all gas men on the Pacific Coast.

On Thursday, September 18th, the Association had an "outing" as the guests of the San Jose District of the Pacific Gas and Electric Company. First a trolley ride around the beautiful Santa Clara Valley, and then to Alum Rock Park where a typical California barbecue was enjoyed, followed by songs, speeches and dancing. The Association thoroughly appreciated the entertainment of the ladies by the generous-hearted citizens of San Jose, including automobile rides and a delightful luncheon served at Congress Springs, as well as a theatre party on the evening of the banquet. Our genial host at San Jose, who looked after our comfort and welfare, was Mr. John D. Kuster, Manager of the San Jose District, and to him we are indebted for a most delightful meeting.

Oil Gas

By LEON B. JONES, Asst. Engineer, Gas Dept.

This highly instructive paper by a talented son of a talented father was awarded the gold medal at the recent convention of the Pacific Coast Gas Association. It is by special permission of the Association that we reproduce the paper for the benefit of our readers.

EDITOR PACIFIC SERVICE MAGAZINE.


L. B. Jones.

It is not my intention to attempt to cover the scope suggested by the title of this paper, but merely to review a series of experiments and the resultant developments, carried on in San Francisco in the past few years.

Since 1902, when gas made exclusively from crude oil was first introduced as the supply of a large city, until today, when oil gas is used to the exclusion of all other methods of production in California, many have doubted the eventual success of this process. But the doubters were not in the ranks of the true oil gas men, the noble pioneers who conceived the idea of the manufacture of gas from crude oil years before the enormous production of crude oil in California made oil gas an economic necessity and those who nursed the infant industry and bravely bore the discouragement of failures and put on a solid running basis, an industry which in the hands of less noble men might easily have been a failure.

These men worked and are still working for the success of oil gas from a purely unselfish love of the business and upon such men and such principles depend the perfection to which oil gas will and must attain.

For years the one feature which has prevented oil gas from being an ideal process for gas manufacture has been the large percentage of the rich hydro-carbons of the oil which are dissociated, only the hydrogen portion of which appears in the gas, the carbon being a by-product. The severe treatment of the oil with extremely high heats was the cause of the excessive production of lampblack in the early oil gas and the proportionately poor quality of the gas.

It was not alone the extreme temperature but the lack of uniformity of temperature. The extremely high temperature being in a measure what we might call "false heat" or "surface heat;" that is, the actual temperature existed but its capacity for doing work in the breaking up of the oil was lacking. The extreme temperatures lasted only during the beginning of a run or gas-making period and in the latter part of a run, the temperatures were far below any now utilized for gas making. Were this not so, the efficiency of the early oil gas would have been extremely high, only the quality of the gas being low. Had uniformly high heats been employed, the early oil gas man would have encountered no scrubbing troubles other than the removal of lampblack. Tar would have been an unknown trouble. But this we know was not the case.

The oil used per thousand feet was high, the quality of the gas was low and tar as well as lampblack represented a large portion of the oil. In each run, a portion of the oil was destroyed by being subjected to temperature far in excess of the bonding point of its hydrocarbons and the remainder was stewed at temperatures below the fixing point of a commercial gas.

It was soon realized that during the run at some intermediate point between the extremes of temperature, the oil was subjected to the proper degree of heat,—a treatment that produced not only a good quality of gas but efficient results. But this point was quickly reached and more quickly passed and the results attained were lost in the aggregate. By a process of elimination, we may assume that if one temperature is right for the reforming of the oil, all the rest must be wrong. And from this theory, the striving has been toward the maintaining of a uniform temperature, the treatment of all the oil alike. The greatest mechanical development tending to unify the heat to which the oil is subjected was the improvement of the two shell machine with the gas offtake intermediate of the point of combustion of the oil used for heating the generator and the stack valve. It has been definitely proven not only by experience but by careful tests that the heat of the checker brick or heat reservoirs immediately adjacent to the stack valve and also the point where the initial combustion of the heat oil takes place is "false heat" or "surface heat" and lacks the body and is not the substantial heat which we find in the checker brick in the central portion of the generator. This is due to the fact that when oil is injected into the machine together with a forced blast of air for heating the apparatus, combustion is not immediately complete but the heat of the checker brick is utilized in a gradually lessening degree to convert the oil into a gaseous or more easily combustible state until the combustion is complete. The following three samples of combustion products will show more clearly what I have endeavored to explain:

	CO_2	O_2	N_2
Sample No. 1	14.2	0.0	85.8
Sample No. 2	15.0	0.0	85.0
Sample No. 3	15.4	0.0	84.6

These samples were taken in their order simultaneously at increasing distances from the combustion chamber, the increasing percentage of CO_2 showing the combustion to be more nearly complete some distance from the initial point of combustion.

The reason for the lack of stability of the heat in the checker brick nearest the stack is usually an economic one.

In order to minimize the loss of heat at the stack, the combustion should be regulated so that the maximum liberation of heat is in the central portion of the checker work and the checker work nearest the stack gets only the tail end of the combustion and while the brick attain a considerable temperature, they do not contain any great quantity of heat.

A result of these peculiar combustion conditions is the inverse variation of the temperatures in the two ends of a generator; if the combustion end is excessively hot, the stack end will be proportionately cool. From this fact, the two shell machine with the gas offtake intermediate of the course of combustion in heating, derives its undisputed advantage over all other forms of generators. The natural balance of heat in the two shells maintaining a uniform quality and production of gas at all times.

In the two shell sets where oil is injected with steam into the top chamber of both the long and short shell simultaneously for gas making and the gas offtake is located in the lower half of the long shell, the first temperature to which the oil is subjected is not the maximum temperature. The checker brick in the upper portion of each shell with which the oil first comes in contact do the greatest amount of work and are the regulators which limit the quantity of oil per run, but the temperature of these brick does not constitute the fixing or superheating temperature to which the gas is subjected in the central portion of the long shell near the offtake. While the temperature in the upper portion of the checker brick in each shell to which the oil and steam are first subjected vary several hundred degrees Fahrenheit during a run, the superheating or fixing temperature remains fairly constant.

The gas made during the entire run, therefore, is fixed at very nearly a uniform temperature, the gas made in the early part of a run being fixed instantly while that made in the latter portion of the run requires a longer passage through the brick before being fixed.

In the past ten years, the art of manufacturing gas from crude oil has advanced rapidly until today, the modern oil gas is without doubt, the most nearly ideal fuel, being superior in many respects to coal or water gas. The advancement has been not alone in the quality of the gas but equally in the efficiency of production, and oil gas, the infant industry, now compares favorably with the older methods as regards a comparison of production, raw material used and unchanged by-product. The coal gas man is forced to find a market for his by-product while the oil gas man is more fortunate, as he may utilize the carbon by-product for the production of water gas and thus stay exclusively in the gas business. For several years, the large oil gas works have maintained water gas units for utilizing the lampblack and thus practically all of the oil is eventually converted into gas. But this meant the duplication of a great deal of apparatus and duplicate handling of the raw material first as oil, then the separation of the by-product and the handling as water gas fuel. This extra labor is excessively expensive when compared with the ideal oil gas, the production of oil gas without the lampblack by-product.

And it is thus along these lines, the combining into one process what was accomplished in two, that the oil gas engineer has been working.

The first step was a study of the existing conditions in the production of Lampblack Water Gas. To attempt to reproduce in an oil gas set the conditions existing in the generator of a water gas set was apparently hopeless. The extreme temperature of the fuel bed which makes the dissociation of steam and the conversion of most of the carbon to carbon monoxide possible would be disastrous to the hydro-carbons of the oil and as a luminous high heat value gas is still the requirement, the attempt to imitate the generator portion of the apparatus was given up. While the apparatus used in the production of Water Gas from lampblack is substantially the same as employed when coal is used as the base, certain differences exist in operating conditions. The best results are obtained with an empty carburetor using no checker work. The temperatures employed are higher and the time of contact proportionately less than when using coal. The same quality of oil is used for enriching in the water gas as is used in the production of oil gas. The carburetor and superheater temperatures are nearly as great as are employed in oil gas and yet no lampblack is produced. Wherein lies the difference? It is a well known fact that certain chemical reactions are entirely different when taking place in an atmosphere of aii or in an atmosphere of hydrogen. Certain reactions will only take place or are greatly stimulated by the presence of a catalyzer. This catalyzer does not enter into the reaction, yet its presence is essential.

The one great difference between conditions in an oil gas set and the conditions in the carburetor of a water gas set is the atmosphere into which the oil is injected.

When the heating period is completed in an oil gas set, the interstices of the brick and the chambers are filled with carbonic acid and nitrogen, the products of combustion from the heat oil and into this inert atmosphere the oil for gas-making is injected. In the water gas carburetor, it is entirely different, the oil is injected into an *active* atmosphere of carbon monoxide and hydrogen produced in the generator and passing through the carburetor. And this gas is the catalyzer which prevents the destruction of the oil and the consequent waste of large quantities of uncombined carbon.

Here was a condition which could be reproduced in the oil gas generators. It was at first thought to attach a small water gas generator to one of the large oil gas sets. This was not practical as our endeavors were to eliminate the lampblack by-product and this would have been our only available solid fuel for the water gas generator.

We next endeavored to produce the desired result by purging one of the 16-ft. Jones Sets with steam for a minute before any oil was injected. This was done by admitting all available steam after the blast valve and stack valve were closed and the machine ready to make gas. A portion of this steam was dissociated and recombined with the fine particles of carbon remaining on the brick from the previous heating period, thus forming an active initial atmosphere.

The two following analysis sheets show the results of this test. Gas samples were taken from the primary and secondary shell just above and below the common gas offtake at the end of each consecutive minute. The temperature, quantity and quality of oil and all other conditions were as nearly identical as possible in these two runs except that all available steam was turned into the set for one minute previous to the admission of any oil in Run No. 2. A comparison of the two runs shows a marked increase in the quality of the gas in the second run, especially in the first few minutes. The marsh gas and illuminants were greatly increased especially in the primary, and the carbon monoxide of the primary gas was considerably increased. These conditions were not due to any reduction in temperature as the quantity of gas made in the second run was greater than in the first and in both runs, identically the same quantity of oil was used.

The following table shows the composition of Oil Gas made in the primary and secondary shells of Generator 3 at the same time. The samples were taken at the end of each consecutive minute for a complete run of 10 minutes at an outlet of the primary just below the offtake and at the secondary just above it:

RUN NO. 1.

Minutes	CO_2	C_nH_{2n}	O_2	CO	H_2	CH_4	N_2
1 Pri.	6.2	.6	6.0	15.4	27.9	17.9	26.0
Sec.	9.8	4.2	.4	12.8	26.7	35.2	10.9
2 Pri.	3.4	.6	.8	15.6	54.9	23.9	.8
Sec.	5.4	5.4	.4	9.6	39.6	36.8	2.8
3 Pri.	2.6	1.2	.6	14.6	48.6	27.0	5.4
Sec.	4.0	6.0	.6	8.2	33.0	43.3	4.9
4 Pri.	2.2	1.2	.6	14.6	48.9	28.1	4.4
Sec.	3.2	6.8	Tr.	7.4	39.5	41.3	1.8
5 Pri.	2.2	2.0	.2	13.8	50.9	28.6	2.3
Sec.	2.6	6.8	.2	7.4	37.8	41.5	3.7
6 Pri.	2.0	2.0	.4	13.4	49.3	28.8	4.1
Sec.	2.2	8.0	.4	6.0	38.9	41.7	2.8
7 Pri.	2.0	2.0	.6	13.6	51.4	28.8	2.8
Sec.	2.0	7.8	.2	6.6	38.9	41.7	2.8
8 Pri.	4.6	1.0	.2	16.2	62.4	13.0	2.6
Sec.	2.2	8.0	1.0	6.0	42.3	38.6	1.9
9 Pri.	7.2	.4	.2	14.6	68.1	6.4	3.1
Sec.	3.8	6.8	.6	8.2	47.6	30.2	2.8
10 Pri.	7.6	1.2	.2	12.6	74.1	4.0	.3
Sec.	5.4	5.6	.2	10.4	52.3	22.2	3.9

The following table shows the composition of Oil Gas made in the primary and secondary at the same time. The samples were taken at the end of each consecutive minute for a run of 11 minutes at the outlet of the primary below the offtake and at the secondary above the offtake. During the first minute of the run no oil was used, but all the available STEAM was turned on in both shells:

Francisco, our own oil gas scrubbed, purified and ready for distribution proved the best substitute. And it is this gas that is used today in the improved oil gas process. The idea of putting a finished saleable gas from the storage holders back into the generators may seem queer to say the least, but I will endeavor to prove that it is not queer but quite the proper thing to do.

At this stage of our experiments, the Metropolitan Company was acquired. The major portion of their generating equipment consisted of two oil gas units. These were two shell sets, both shells 15 ft. in diameter by 39 ft. high, connected at the bottom by a large rectangular throat piece. Each shell was equipped with a stack valve and gas offtake at the top and heat burners at the bottom. The oil for gas making was injected at the top of one shell, passing downward through the neck and up the second shell. Each alternate run, the direction was reversed. The small capacity of these sets in compar-

RUN NO. 2.

Minutes	CO_2	C_nH_{2n}	O_2	CO	H_2	CH_4	N_2
2 Pri.	7.0	1.4	.6	18.2	40.8	31.5	.5
Sec.	3.0	4.6	.8	7.2	39.4	40.8	4.2
3 Pri.	4.2	2.4	.4	15.8	41.2	32.2	3.8
Sec.	2.8	6.0	.4	6.2	41.7	41.3	2.4
4 Pri.	2.8	3.0	.4	13.8	45.3	33.3	1.4
Sec.	2.2	6.0	.4	6.0	44.6	39.8	1.0
5 Pri.	2.4	3.4	.2	13.0	45.9	32.4	2.7
Sec.	1.8	7.0	.4	5.6	44.0	40.4	.8
6 Pri.	2.4	3.2	.4	11.6	42.1	37.1	3.2
Sec.	1.6	7.4	.4	5.4	43.5	41.1	.6
7 Pri.	1.6	3.0	1.0	10.2	46.8	36.4	1.0
Sec.	1.0	10.0	.6	4.4	37.2	43.4	3.4
8 Pri.	2.2	3.2	.6	10.2	38.2	40.5	5.1
Sec.	1.0	8.8	.8	4.0	45.9	36.6	2.9
9 Pri.	1.6	2.6	1.0	10.4	47.8	33.8	2.8
Sec.	5.4	2.4	.8	12.2	70.4	7.9	.9
10 Pri.	3.6	2.6	.8	14.0	50.9	22.4	5.7
Sec.	8.0	2.4	.6	13.4	63.8	7.6	4.2
11 Pri.	5.2	1.2	.8	15.4	60.2	14.2	3.0
Sec.	9.0	1.4	1.0	12.2	66.2	6.4	3.8

The initial atmosphere produced by the dissociation of the steam in the first minute benefited materially the gas produced in the first few minutes of the run. To produce the desired results, it is not sufficient to commence the destructive distillation of the oil in an initial atmosphere of an active gas or gases but to continue in an atmosphere other than the gas produced by the machine from minute to minute. Natural gas under pressure would be ideal for the production of this catalytic atmosphere but as no natural gas is available at the present time in San ison to their size made a reconstruction necessary. The rebricking and re-arrangement of these sets was an ideal opportunity partially to test the ideas of the new process.

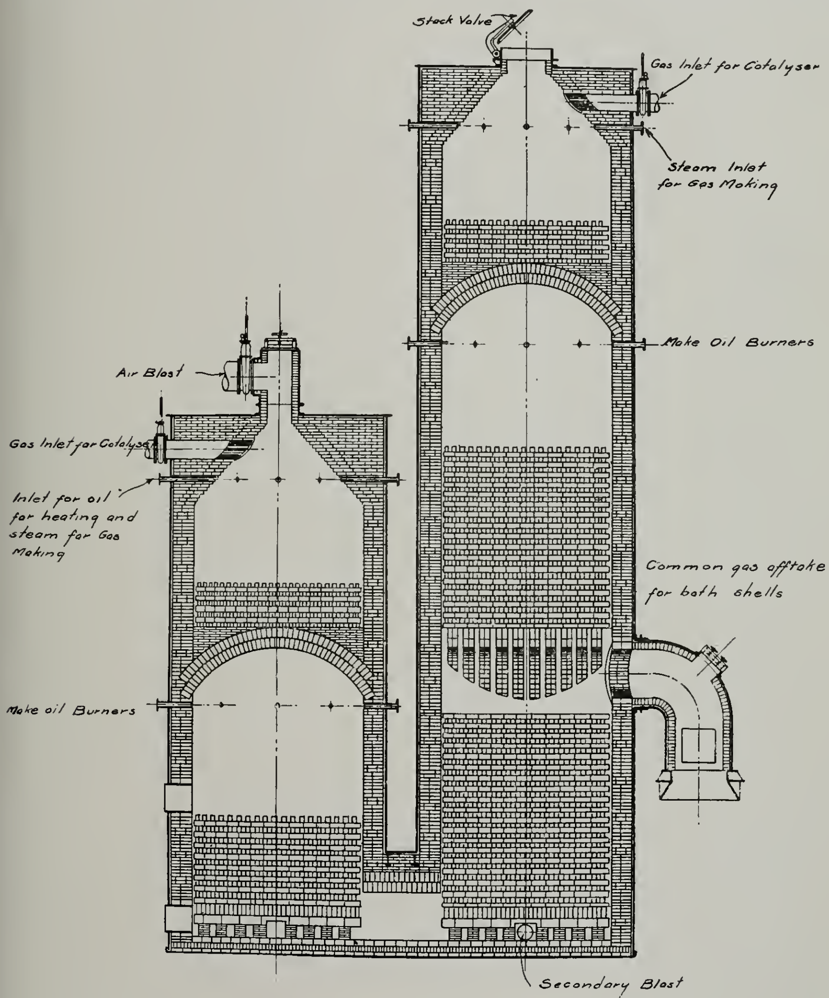
In our estimation, the apparatus for the best results from this new process would be a two shell set, a long and a short shell connected at the bottom by an ample throat piece, the top of the short shell being the blast inlet and the top of the long shell the stack valve, the common gas offtake located on the side of the long shell intermediate of its ends. The bricking and checker work to be so arranged as to form double chambers in the upper end of each shell. Short piers in the bottom of each shell support the main checker work up about two-thirds of the height of the short shell and three-fourths the height of the long shell. At this point, open arches are sprung across the shell forming the tops of the lower chambers and supporting the upper sets of checker work. About twelve courses of checker work rest on each of these arches and the top of this checker and the corbel work forms the top chamber of each shell.

Into the top chamber of the primary or short shell extend the oil burners for heating the apparatus connected to coils of pipe circling the shell. In the same manner, the injectors for admitting oil for gasmaking are connected into the lower primary chamber and the lower secondary chamber. To the top chambers of each shell are connected gas lines for the admission of gas under pressure for producing the catalytic atmosphere. This supply is regulated by valves controlled from the operating floor. Into these top chambers also are steam connections for supplying steam for gasmaking and also for purging. After the machine is properly heated and ready for the gasmaking period, the stack valve and blast valve are closed and the gas and steam under pressure are admitted into the top chambers of each shell.

The accompanying drawing more clearly shows the idea.

During the first minute, no oil is admitted and all the products of combustion from the previous heating period are purged from the machine. Thus at the end of the first minute when oil is admitted into the lower chambers of each shell, it comes in contact with an active atmosphere of gas and steam highly superheated by passing through the upper section of checker brick. The decomposition or destructive distillation of the oil therefore begins and is continued in an active atmosphere and when the excess carbon is freed from the reforming of the hydro-carbons, it is surrounded by steam in a highly superheated condition ideal for dissociation and combination with this carbon. It has long been the practice to admit the oil and steam for gasmaking together.

This practice to a large degree accounts for the variable temperatures to which the oil is subjected during the run. While the heat absorbed by the steam actually converted into gas is proportionally small, the heat absorbed by the total steam used including the steam used to purge the machine after the run, is a large factor in the total heat absorption. In a thousand cubic feet of average oil gas, the steam actually converted in its production based on the oxygen content seldom exceeds 6 lbs. while the actual steam used for injecting the oil is seldom less than 16 lbs. and the steam used to purge the machine in the last three minutes increases this amount to nearly 27 lbs. per M. cubic feet. These figures are based on actual running conditions, tests showing that during a ten minute run in which 2300 lbs. of oil was injected in the first seven minutes of the run and the production was 40,000 cu. ft., the steam meter showed a consumption of 5700 lbs. per hour or 665 lbs. of steam during the run and the steam used during the purge to be 8,000 lbs. per hour or 400 lbs. during the purge. The heat, therefore, absorbed by the steam during the first seven minutes was 14% of the total heat absorbed and during the entire run including the purge, the steam is accountable for 19% of the total heat loss or reduction in temperature. (These figures based on a specific heat of .6 for oil; .305 for steam). It is not the loss of this heat from temperature and as the duration of the run must be sufficient to keep up the capacity and efficiency of the machine, the initial temperature must be above or the final temperature



the standpoint of monetary value of the added heat oil to regain this loss of temperature which constitutes the error of this practice but it is not giving the oil a square deal. The oil is continually being subjected to a decreasing below that temperature which will produce both quality in gas and efficiency in results. The top chambers in the apparatus of the new process eliminate this fault to a great extent, the heat of the lower chambers being used exclusively for the breaking up of the oil while the steam and gas are superheated to the temperature of the apparatus by the brick in the upper portion of the machine before entering the gasmaking chambers. Thus where the reformation of the hydro-carbons leaves an excess of carbon in a free state, steam in a highly superheated condition is immediately present for combination. To entirely exclude steam except under a high degree of superheat from the gasmaking chambers, gas under high pressure is utilized for injecting the make oil. In some works where high pressure gas is not available, the cost of compression for this use alone might prove excessive. In that case, the steam on the injectors may be reduced to a minimum, the major portion being admitted in the upper chambers.

The addition of the top chambers and checker brick above the gasmaking chambers is a marked improvement in itself. Besides superheating the steam and gas, these chambers are the means of obtaining a uniform substantial heat in the lower portion of each shell as any sharp surface heat due to combustion effects the upper sections of brick which are not utilized for the distillation of the oil.

Another material benefit is the use of large chambers between the top of the checker work and the oil injectors thus permitting the oil to be partially broken up or at least vaporized by radiated heat before coming in direct contact with the brick. This is not only a benefit to the oil and brick but permits the heat of a greater number of the brick to be utilized before the temperature of the top portion of brick is reduced below a gasmaking temperature. The practice of the early oil gas man of attempting to fill all the space within his machine with checker brick accounts for considerable of the carbon accumulation which caused frequent shut downs and many hours of blasting to burn out. This was caused by injecting the oil directly onto the top courses of the checker brick. These brick soon lost the greater portion of their heat and only the lighter portion of the oil was vaporized, the heavier portion accumulating as solid masses of carbon. Another factor greatly affecting not only the condition of the machine but the efficiency of the results and quality of the gas are the injectors or means of introducing the oil into the generators. This subject was the basis of a series of recent experiments, and various types and means of admitting oil were thoroughly tested. Many styles of vaporizers or injectors have been used with varying degrees of success but in every case, the vaporizer is located just inside the coil and the vaporized oil and steam are conveyed to the machine through pieces of pipe extending through the lining. The result of these tests showed that the greatest fault was not the vaporizer proper but the means of conveying or the treatment after vaporization.

After testing many various types of vaporizers, it was found that most of them gave an almost perfect oil fog at the tip or outlet when the steam pressure was maintained about 5 lbs. more than the oil pressure.

When sections of ¾″ pipe such as are used to convey the oil through the lining were screwed onto these burners, a large portion of this oil fog was condensed. Various sizes and lengths of pipe were then tried. The length made no material difference but the only size with which efficient results were attained was found to exactly conform to the size of the end of the tip in the ejector. It also worked equally well with ¾″ pipe or even larger if the end of tip was reduced to an orifice to conform to the area of the ejector. The best results with the ejector of the Hayden and Derby type, most commonly used was with ¾″ pipe capped with a ¾″ to ¼″ reducer through which a ½″ drill had been previously run to remove the threads. Apparently therefore, the one essential requirement in injecting oil is to maintain the velocity after vaporizing until the oil reaches the machine.

While the basic principles of the destructive distillation of oil and the temperature conditions existing within the machines have been the subject of first importance and greatest thought, the lesser refinements and mechanical improvements have all aided materially in obtaining better results.

In speaking of the effect of various temperatures on certain oils and the resultant gas reference is only made to the quality of the heat. The quantity of heat or time to which the oil or gas is subjected to any temperature is a factor which has been entirely overlooked in oil gas practice. The quantity of heat or time of contact is of as great importance as the temperature or quality, for upon the one depends the effectiveness of the other. Many conditions affect the time of contact factor, the area and length of the machine, the number and arrangement of the checker brick and the rate of productionn of the generator. These factors constitute the velocity of the gas. Widely different results may be obtained when the same temperature is utilized for oil gas making and the velocity or time of contact varies. Likewise similar results may be obtained when the temperature varies within certain ranges and the velocity is increased or decreased to suit. To produce similar results, an increase in temperature requires an increase in velocity or decrease in time of contact. The temperature to a certain extent influences the velocity and to this reason may be attributed the fact that its importance was not sooner realized. If a machine is excessively hot, a larger quantity of gas is produced increasing the velocity and therefore is subjected to the heat for a shorter period of time. The expansion of gas due to temperature also tends to maintain a balance between the temperature and velocity but as there is no proportionate relation between temperature and time of contact, both factors must be considered.

The construction of oil gas generators in the past has been based largely upon the results obtained by some other apparatus in use and very little thought has been given to the reason for the vastly different results obtained in the different types of machines. Seldom are the results the same in different sizes of machines of the same type. With the introduction of indicating and recording pyrometers, steam meters and gauges and the supplanting with accurate knowledge the guesswork of the past, we are approaching the subject from a more scientific viewpoint.

In order to demonstrate the effect of velocity or time of contact on the gas, five runs were made on the No. 4 set at the Metropolitan Works. At the time this set was rebuilt, it was deemed advisable to more fully test the new method before making any radical changes. As the two shells of this set were of the same length, only the primary shell was equipped with the upper chamber and double set of checker brick with the idea of adding the upper chamber to the secondary at some future time, should the tests be successful. This set is only mechanically complete in one shell, in all other respects it is all that could be desired for testing the ideas of this new method. In the five runs referred to, it was endeavored to maintain all conditions other than the time of contact or velocity the same. This was accomplished by increasing the duration of each run. The first run was of ten minutes' duration; the second, eleven; the third, twelve; the fourth, thirteen; and the fifth, fourteen minutes. In each run, the first minute was devoted to purging with gas and the last three minutes to purging with steam. Thus only the time required to introduce the oil was increased and in each run practically the same amount of oil was used.

At the end of each minute, gas samples were taken at the wash box, temperature and oil readings were taken and the gas measured in the relief holder. The purge gas used was measured by a station meter.

The following table presents results obtained from a velocity test at the Metropolitan plant. The test embraced five runs of ten, eleven, twelve, thirteen and fourteen minutes duration, respectively. These average analyses are based on the analysis and net make of each minute of each run:

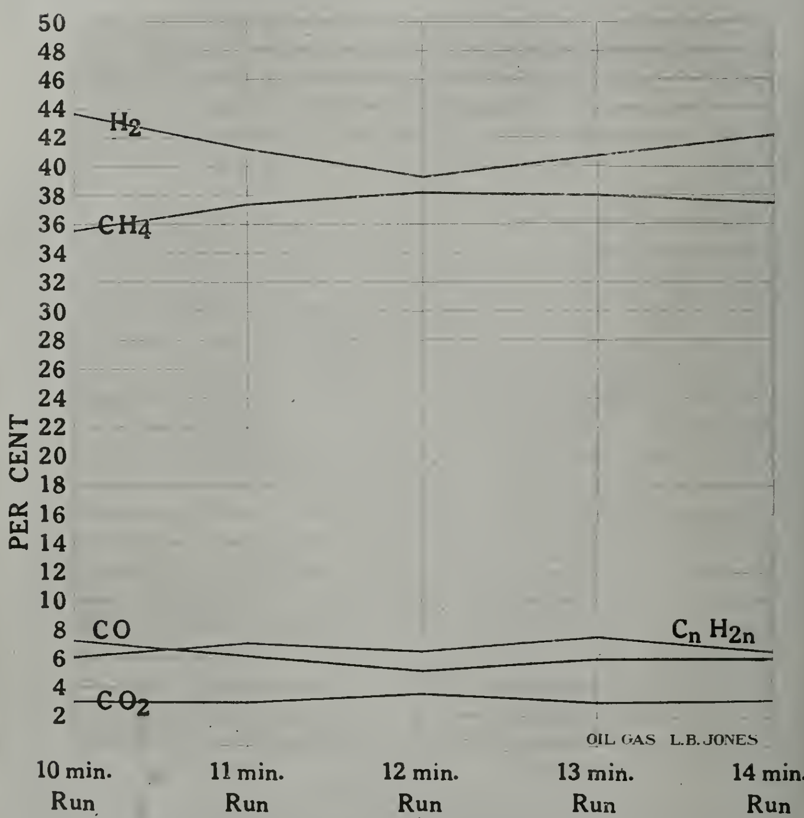
AVERAGE ANALYSES

Of 10-11-12-13 and 14 Minute Runs. No. 4 Metropolitan Set, August 2-7, 1913.

VELOCITY TEST.

Run	Net Make	Total Oil per M.	CO_2	C_nH_{2n}	O_2	CO	H_2	CH_4	N_2	B.T.U.
10 Min.	36715	8.6	3.0	6.1	0.0	7.3	43.7	35.6	4.3	679
11 "	39609	8.5	3.1	7.1	Tr.	6.2	41.2	37.4	5.0	706
12 "	39361	8.47	3.6	6.6	0.0	5.1	39.3	38.2	7.2	695
13 "	39158	8.53	3.1	7.6	Tr.	6.0	40.8	38.0	4.5	721
14 "	40204	8.6	3.2	6.6	0.0	6.1	42.2	37.5	4.4	700

CHART SHOWING EFFECT OF VELOCITY ON QUALITY OF GAS



The increase in time of contact by the increase in duration of the run from ten to eleven minutes shows a marked increase in the quality of the gas.

The illuminants were increased 1%, the methane 1.8%, the hydrogen was decreased and the heating value increased by 27 B. T. U.s. The increase from six to seven minutes (in which time the oil was injected), would constitute an increase in time of contact of 16% but as 8% more gas was made in the eleven minute run, the actual increase amounts to only 8%.

A slight increase in methane is counteracted by a decrease in illuminants in the twelfth minute, and from then, the methane decreases and the hydrogen increases with an increase in time of contact. Very little benefit is derived by the increase after eleven or possibly twelve minutes and the velocity of the gas in the eleventh minute might be considered as proper in proportion to the temperature for this machine.

The time of contact should be regulated in the construction of the generator by the length of shell or arrangement of checker work as any increase in length of run decreases the daily capacity of the machine. The practice of forcing machines to their fullest capacity is common to the oil gas man. Every machine has a capacity where efficiency and quality of gas may be combined and if the machine is forced it follows that one or the other is sacrificed.

When these tests were first undertaken with the idea of converting a greater percentage of the carbon of the oil into gas, it was the belief that this carbon would combine with the steam used and appear in the gas as Carbon Monoxide.

While the gas made by the new method embraces a larger part of the carbon of the oil, the carbon monoxide content is lower than in the gas made the usual way. The conditions for the production of carbon monoxide are equally as good and in fact superior. The temperature is sufficient, as a large quantity of carbon monoxide is produced in the last three minutes of the run after the oil is shut off. In fact, there is no good reason to believe that carbon monoxide is not formed. This leads to the belief that it is formed and combined after formation. We are thus forced to consider the production of methane or marsh gas synthetically.

Several years ago, such a suggestion would have been tabooed, but since the experiments of eminent chemists have proven the theory and have produced Methane or Marsh Gas synthetically, we must seriously consider its production on a practical scale. A great many of the experiments conducted by these chemists in the production of synthetic marsh gas have been in conjunction with a study of catalysis and in this respect, our experiments of a highly practical order have paralleled those theoretical or laboratory experiments. In Bulletin 7 of the Department of the Interior, the authors quote the experiments of Mayer, Henseling and V. Altmeyer as described in the German Journal of Gas Lighting, Vol. 52 as follows:

"By passing a mixture of Carbon Dioxide or Carbon Monoxide and Hydrogen over a catalyzer of finely divided nickel or cobalt, heated to 200° to 500° C. (392° to 932° F.), these investigators have obtained large quantities of Methane—50 to 60 per cent. Under favorable conditions, the carbon monoxide could be completely reduced to methane. By passing Hydrogen over Carbon which had previously been deposited on the nickel catalyzer, a gas containing over 90% of marsh gas was obtained at a temperature of 245° C. (473° Fah.)".

"While at temperatures between 200° and 500° C. (392°-932° Fah.), these reactions take place only under the influence of a catalyzer, it is not improbable that at higher temperatures, they may take place without a catalyzer".

In view of the fact that at the temperature employed in the velocity tests described, the formation of Carbon Dioxide from Steam and Carbon and the reaction from Carbon Dioxide to Carbon Monoxide is very sluggish, all reasoning would lead to the conclusion that an increase in the time of contact in the runs in which the velocity was decreased would produce a greater percentage of Carbon Dioxide and Carbon Monoxide.

In all probability, this is true and more Carbon Monoxide was produced but was utilized for the production of synthetic marsh gas. There are several equations which might be followed in the eventual conversion of Carbon and Steam into Marsh Gas but from the ratio of the constituents of the gas, the probable equation is as follows:

$$2H_2O + C = 2H_2 + CO_2$$
$$CO_2 + C = 2CO$$
$$2CO + 4H_2 = 2CH_4 + O_2$$
$$O_2 + C = CO_2$$

It has always been the theory that marsh gas was purely the result of the destructive distillation of the oil and this is undoubtedly true of the larger portion appearing in the gas but the exceptionally large quantity of marsh gas in the gas of the new process upholds the theory of its production synthetically.

From the foregoing reaction, an increase in marsh gas would be accompanied by an equal decrease in Carbon Monoxide and an increase of one-half as much Carbon Dioxide and a decrease of twice as much Hydrogen. Reference to the average analyses of the runs of the velocity test shows this to be true.

A comparison of the ten minute run with the twelve minute run shows:

Increase in Marsh Gas	2.6%
Decrease in Carbon Monoxide	2.2%
Decrease in Hydrogen	4.4%
Increase in Carbon Dioxide	.6%

Comparing the ten with the eleven minute run shows:

Increase in Marsh Gas	1.8%
Decrease in Carbon Monoxide	1.1%
Decrease in Hydrogen	2.5%
Increase in Carbon Dioxide	.1%

In order to prove beyond the possibility of doubt that Marsh Gas is being produced synthetically, it would be necessary to have the Hydrogen content of the Illuminants and Marsh Gas combined greater than the Hydrogen content of the oil. Such proof would be indisputable but such a gas has not to my knowledge been produced. However, it is reasonable to suppose that as the Carbon and Hydrogen are linked in the oil, the destructive distillation of the oil resulting in the liberation of carbon in a free state also results in the liberation of some Hydrogen in a free state. This is undoubtedly true as the Hydrogen from steam based on the Oxygen content seldom exceeds 35% of the free Hydrogen of the gas.

Upon this theory that the uncombined carbon or the carbon of the oil less the carbon in the gas bears some practical relation to the free Hydrogen of the gas, ten samples of gas from the old method were tested. These samples showed an average proportion of 22.5 to 1 in a comparison of weight of uncombined carbon vapor and hydrogen. In no sample did the proportion fall below 21.3 or exceed 23.3 to 1—22.5 then might be considered a fair average relation but only on this type of machine and under the same running conditions. Undoubtedly the entire Marsh Gas content of the oil gas made by the old method is solely the result of the distillation of the oil. The Hydrogen content therefore of the gas represents the maximum liberation of free Hydrogen.

As the general running conditions of the new and old method are similar, it is permissible to apply this proportion to the new process. Let us consider the ten minute run of the velocity test. After we make proper deductions from the total oil for .5 gallon of tar per thousand feet, we find 46.51 lbs. of carbon introduced. The gas contained 18.417 lbs. of carbon leaving as uncombined 28.09 lbs. of carbon. Applying our proportion theory to this quantity of uncombined carbon, we find the Hydrogen content of the gas derived from the oil to be 39.4%. From the oxygen content of the gas, we find the Hydrogen content from steam to be 13.3% or a total Hydrogen content of 52.7%. The gas by analysis showed only 43.7% Hydrogen; therefore 9% of the freed Hydrogen had been recombined and appeared in the gas as Marsh Gas.

This same theory applied to the eleven minute run shows 8.9% of Hydrogen to have been converted into Marsh Gas and 11.2% in the thirteen minute run. If we deduct the percentage of Marsh Gas formed synthetically and deduct equally for Carbon Monoxide from the analysis of the ten minute run and add to the Hydrogen and Carbon Dioxide in proportion to the equation of its formation, we have the following comparison:

Gas Analysis of 10 Minute Run		Same Analysis Stripped of Synthetic Marsh Gas.
Co_2	3.0	.8
CnH_2n	6.1	5.8
O_2	0.0	0.0
CO	7.3	11.0
H_2	43.7	50.0
CH_4	35.6	29.1
N_2	4.3	3.3

The second analysis is reduced slightly in all its constituents as the volume of the Marsh Gas formed was not equal to the original volume of its components. The second analysis stripped of its synthetic Marsh Gas is a typical analysis of the gas produced in the old process. To more clearly show the positive effect of the catalytic atmosphere on the quality of the gas and especially on the production of the Marsh Gas, a curve has been plotted of the constitutents of the gas each minute of the fourteen minute run. The gas used for the catalytic atmosphere dropped twice during this run from 700 to 600 cubic feet per minute. These drops in the third and eighth minute affected materially the gas produced in the following minutes.

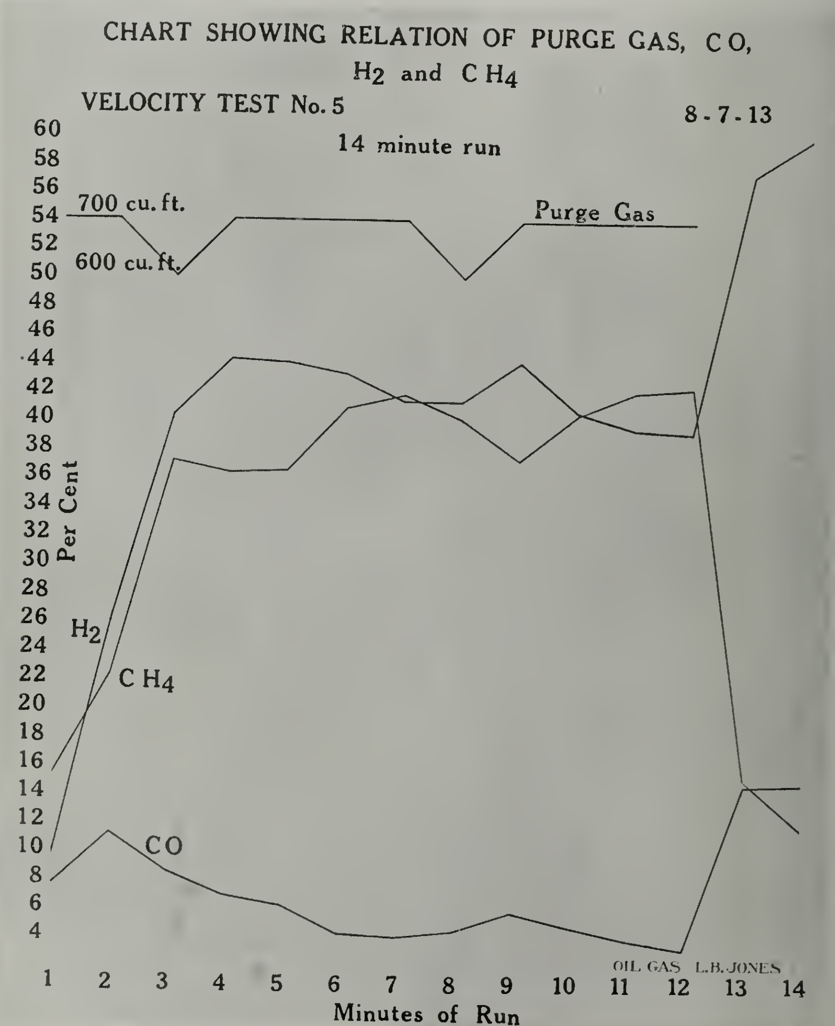
The oil used per thousand cubic feet of gas made in the new process is not at the present time greatly less than in the old method, but the gas is far superior. The production of synthetic marsh gas in an oil gas set opens great possibilities for the future oil gas. With the eventual abolition of the candle power standard, it marks the way to the production of a high heat unit gas with very little candle power at a reduced cost.

While the gas of the new process embraces fifteen per cent more carbon than the gas of the old method, this amount only constitutes five per cent more of the total carbon used. The average carbon content in a thousand cubic feet of the old oil gas is 17 lbs. and in the gas of the new process 19½ lbs. While this is a considerable increase, there is vast room for improvement. In order to produce a gas of the quality of that made in the ten minute run shown without any by-products of Lampblack or Tar and no loss of Carbon at the stack, a thousand cubic feet of gas would have to be produced from 21.6 lbs or 2.7 gallons of oil. This of course would represent 100 per cent efficiency. If the lampblack were eliminated and the loss at the stack stopped and we still produced one-half gallon of tar and the same quality of gas, a thousand cubic feet would then have to be produced from 25.7 lbs. or 3.2 gallons of oil. It appears from these figures that while great progress has been made in the efficiency of production of oil gas, we are still far from what might be considered good efficiency. As a matter of fact in the best results yet attained, the carbon of the gas represents less than 40 per cent of the carbon of the oil. These figures are based on actual carbon used as oil and carbon in the gas and may seem low to one who is accustomed to compare the carbon in the gas with the lampblack by-product. In the new process as well as the old, the actual carbon accounted for as gas, lampblack and tar seldom exceeds 60 per cent of the carbon of the oil. The greatest loss of carbon is at the stack of which no account is kept.

The troubles with carbon accumulating in the early oil gas generators is responsible for the practice which still prevails of blowing the machine before each heating period. After the run is taken off, all the available air at the greatest available pressure is turned into the machine for three minutes; at the end of which time, the air is reduced and oil turned in for heating. During the run, there is a slight accumulation of carbon on every checker brick and during the blow, the greater portion of this is wasted.

Often have we watched the sparks from our stacks at night but few have realized that in those tiny sparks, more fuel was being wasted than is introduced as oil in the following heating period.

In the operation of the old process in which 20 lbs. of lampblack of 55 per cent moisture



or 11 lbs. of dry is recovered, and approximately $7\frac{1}{2}$ gallons of oil are used, after allowing for one-third of a gallon of tar shows a loss at the stack of 20 lbs. of carbon per thousand.

This amount in a run of 50,000 feet production amounts to 1,000 lbs. or $2\frac{1}{2}$ times the amount of heat oil used. This carbon in the aggregate is of considerable amount but when divided over 30,000 checker brick amounts to slightly over one-half ounce per brick which represents a film of eight thousandths of an inch on the exposed checker brick surface.

Apparently there is no hope of preventing this loss as it must be cleared from the machine after each run or it would soon accumulate and form a stoppage. If this could be stopped, a gas of the same quality might be produced with the same quantity of by-product of lampblack and tar from 4.4 gallons of oil. This loss, therefore, represents the carbon content of 2.6 gallons of oil per thousand. It seems impossible at the present time to stop the loss and thus save a large quantity of oil but a large portion of the loss can be utilized and thus will not represent a total loss. The carbon accumulation not only amounts to over twice the amount of fuel required to heat the generator each run but is distributed evenly throughout the checker work and this presents an ideal fuel for the uniform heating of the checker brick. An equal amount of fuel is burned and an equal amount of heat liberated on the surface of each checker brick. In order to utilize this carbon for heating the set, after the run is taken off, a very small quantity of air is introduced into several points in the set. Besides the carbon on the brick, this method utilizes the greater portion of the gas remaining in the machine from the previous run. This amounts to over 3,000 cubic feet on the large sets of a gas of over 350 B. T. U.s or over a million heat units, equal to nearly 7 gallons of oil. This not only utilizes a large quantity of heat which is now lost but eliminates the smoke nuisance of gas works which at the present time is attracting considerable attention.

With a few such refinements, the oil gas works of the future may be considered a desirable neighbor rather than a nuisance.

This new method of heating has only been introduced and practically demonstrated at the Metropolitan plant within the past few weeks. No radical changes were made in introducing this method but it was endeavored rather to gradually reduce the quantity of heat oil until a point was reached where a loss in temperature or an increase in time required to heat would make further reduction false economy.

At the present time, the first five minutes of the heat are devoted to burning the gas and carbon in the machine with a very light blast and the remaining five minutes, oil is used. In this way, the heat oil has already been reduced 45 per cent or over one-half gallon per thousand cubic feet of gas. While this and a possible greater reduction until little or no heat oil is used, is of great importance, a feature of perhaps greater importance is the quality of the heat produced. Before this new method of heating was introduced and oil was used exclusively for heating, the drop in temperature of the checker brick just below the primary and secondary make chambers during a run was seldom less than 250° Fahrenheit. With the new method using the same quantity of oil during the run, the drop seldom exceeds 100° Fahrenheit. This shows that a far more substantial and uniform heat is produced.

In all of the experiments described, a distillate of about 18° B. was used and undoubtedly better results could have been obtained with crude oil.

The Metropolitan Works is not an experimental plant but is one of the large producers for the supply of San Francisco.

While this plant produces over three million feet per day, at no time has the lampblack and tar by-product been more than sufficient for boiler fuel.

RUN NO. 1. No. 4 JONES SET METROPOLITAN 11:A. M., Aug. 2, 1913.

(10 Minute)

Min.	Gross Make	Purge Gas	Net Make	Prim. Oil	Sec. Oil	Total Oil	(Degrees Fahrenheit) Prim. Temp.	Sec. Temp.	Neck Temp.
0							1610	1460	1670
1	1576	800	776				1580	1400	1670
2	4202	800	3402	15.5	14.5	30.0	1550	1310	1680
3	6531	700	5831	25.2	25.2	50.4	1520	1210	1670
4	6531	700	5831	21.5	23.3	44.8	1510	1180	1670
5	5914	800	5114	21.4	22.4	43.8	1490	1150	1670
6	5892	800	5092	20.5	23.3	43.8	1480	1120	1660
7	5366	800	4566	15.7	20.3	36.0	1480	1100	1660
8	4133	200	3933	10.9	10.0	20.9	1480	1110	1660
9	1553		1553				1480	1130	1650
10	617		617				1480	1160	1650
	42315	5600	36715	130.7	139.0	269.7			

Make Oil ....269.7 = 7.34 Gals. per M.
Heat Oil .... 46.7 = 1.26 " " "

Total Oil ....316.4 Gals.
= 8.60 " " "
Net Gas Made ....36715 Cu. Ft.

ANALYSIS SHEET No. 4 JONES SET, METROPOLITAN, 11 A. M. Aug. 2, 1913.

RUN NO. 1 (10 Minute)

Min.	Net Make	CO_2	CnH_2n	O_2	CO	H_2	CH_4	N_2	Sp. Gr.	B.T.U.
1	776	23.2	.3	0.0	9.5	5.2	18.4	43.4	.975	258
2	3402	3.3	4.9	0.0	8.4	43.1	36.1	4.2	.451	665
3	5831	1.8	5.5	0.0	6.7	44.4	38.0	3.6	.422	694
4	5831	1.5	6.1	0.0	6.0	43.2	39.6	3.6	.425	717
5	5114	1.4	7.0	0.0	5.6	42.1	40.1	3.8	.432	734
6	5092	1.3	7.8	0.0	4.9	41.6	40.9	3.5	.433	755
7	4566	1.3	8.1	0.0	4.8	40.5	41.5	3.8	.441	762
8	3933	4.1	5.8	0.0	11.3	50.4	25.6	2.8	.433	603
9	1553	11.0	2.0	0.0	17.0	61.1	8.2	0.7	.428	396
10	617	13.0	1.6	0.0	16.9	59.4	6.9	2.2	.478	369
Total	36715									
Av. Analysis		3.0	6.1	0.0	7.3	43.7	35.6	4.3	.445	679

RUN NO. 2 No. 4 JONES SET, METROPOLITAN, 11:20 A. M., Aug. 2, 1913.

(11 Minute)

Min.	Gross Make	Purge Gas	Net Make	Prim. Oil	Sec. Oil	Total Oil	Prim. Temp. (Degrees Fahrenheit)	Sec. Temp.	Neck Temp.
0							1600	1420	1680
1	1419	800	619				1580	1370	1680
2	2580	800	1780	19.6	21.5	41.1	1560	1320	1670
3	5640	700	4940	16.8	23.3	40.1	1550	1210	1670
4	6280	700	5580	20.5	24.3	44.8	1530	1150	1670
5	6028	800	5228	19.6	19.6	39.2	1500	1120	1670
6	5572	700	4872	15.8	22.4	38.2	1500	1100	1660
7	5317	700	4617	19.6	24.2	43.8	1490	1080	1660
8	5707	800	4907	18.6	24.2	42.8	1480	1060	1650
9	4561	300	4261				1480	1060	1650
10	2024		2024				1480	1080	1650
11	781		781				1480	1100	1650
	45909	6300	39609	130.5	159.5	290.0			

Make Oil ....290.0 = 7.3 Gals. per M.
Heat Oil .... 46.7 = 1.2 " " "

Total Oil ....336.7 Gals.
= 8.50 " " "
Net Gas Made ....39609 Cu. Ft.

ANALYSIS SHEET No. 4 JONES SET, METROPOLITAN, 11:20 A. M., Aug. 2, 1913.

RUN NO. 2. (11 Minute).

Min.	Net Make	CO_2	C_nH_{2n}	O_2	CO	H_2	CH_4	N_2	Sp. Gr.	B.T.U.
1	619	20.3	0.0	1.0	5.7	No explosion		73.0	1.082	20
2	1780	9.0	3.0	0.0	15.0	45.0	24.3	3.7	.514	526
3	4940	3.0	6.0	0.0	7.0	41.1	37.8	5.1	.459	691
4	5580	2.0	7.0	0.0	5.0	42.1	40.1	3.8	.434	732
5	5228	1.5	7.0	0.0	5.5	41.1	40.9	4.0	.438	739
6	4872	1.7	7.6	0.0	4.7	41.1	40.9	4.0	.439	748
7	4617	1.7	9.1	0.0	4.2	38.7	42.5	3.8	.453	785
8	4907	1.7	9.3	0.0	4.0	38.3	43.2	3.5	.453	795
9	4261	2.0	9.0	0.0	5.0	42.9	37.8	3.3	.437	750
10	2024	8.2	3.8	0.0	14.0	51.8	18.5	3.7	.472	501
11	781	12.8	1.6	0.0	15.7	57.5	9.3	3.1	.485	384
Total	39609									
Av. Analysis		3.1	7.1	Tr.	6.2	41.2	37.4	5.0	.460	706

RUN NO. 3. No. 4 JONES SET, METROPOLITAN, 11:40 A. M. Aug. 2, 1913.

(12 Minute)

Min.	Gross Make	Purge Gas	Net Make	Prim. Oil	Sec. Oil	Total Oil	(Degrees Fahrenheit) Prim. Temp.	Sec. Temp.	Neck Temp.
0							1620	1390	1680
1	1244	600	644				1590	1350	1680
2	1561	700	861	16.8	19.4	36.2	1570	1300	1680
3	4878	700	4178	14.0	18.7	32.7	1560	1190	1670
4	5463	700	4763	19.6	18.6	38.2	1550	1130	1670
5	5512	700	4812	17.7	18.6	36.3	1530	1100	1670
6	4976	700	4276	14.0	19.6	33.6	1520	1080	1660
7	4927	700	4227	14.0	19.6	33.6	1520	1050	1660
8	4951	700	4251	16.8	21.4	38.2	1510	1040	1650
9	5098	700	4398	17.7	21.4	39.1	1500	1020	1650
10	4146		4146				1510	1020	1650
11	1927		1927				1510	1040	1640
12	878		878				1500	1080	1640
	45561	6200	39361	130.6	157.3	287.9			

Make Oil ....287.9 = 7.30 Gals. per M.
Heat Oil .... 45.8 = 1.17 " " "

Total Oil ....333.7 Gals
Net Gas Made ....39361 Cu. Ft. = 8.47 " " "

ANALYSIS SHEET. No. 4 JONES SET, METROPOLITAN, Aug. 2, 1913.

RUN NO. 3. (12 Minute).

Min.	CO_2	C_nH_{2n}	O_2	CO	H_2	CH_4	N_2	Sp.Gr.	B.T.U.
1	16.0	0.0	0.0	0.0	No explosion		84.0	1.059	000
2	20.0	1.0	0.0	12.0	22.7	23.5	20.8	.780	380
3	6.4	4.0	0.0	10.6	37.3	34.9	6.8	.525	618
4	4.0	5.0	0.0	7.4	41.8	36.2	5.6	.535	657
5	1.7	6.4	0.0	4.5	42.8	40.1	4.5	.428	721
6	1.7	7.3	0.0	4.4	40.4	40.4	5.8	.447	733
7	2.0	7.8	0.0	4.2	39.6	41.6	4.8	.452	752
8	1.8	8.4	0.0	2.8	37.2	43.5	6.3	.464	772
9	1.6	8.6	0.0	2.8	37.7	43.5	5.8	.459	778
10	1.6	8.9	0.0	2.2	39.7	42.9	4.7	.443	782
11	6.0	5.7	0.0	9.7	46.7	26.2	5.7	.474	589
12	10.8	2.6	0.0	13.6	54.3	13.4	5.3	.496	451
Average	3.6	6.6	0.0	5.1	39.3	38.2	7.2	.477	695

RUN NO. 4. No. 4 JONES SET, METROPOLITAN, 11:20 A. M., Aug. 7, 1913.

(13 Minute)

Min.	Gross Make	Purge Gas	Net Make	Prim. Oil	Sec. Oil	Total Oil	Prim. Temp. (Degrees Fahrenheit)	Sec. Temp. (Degrees Fahrenheit)	Neck Temp. (Degrees Fahrenheit)
0							1670	1610	1680
1	1370	700	670				1640	1600	1680
2	2215	800	1415			11.2	1620	1590	1680
3	3906	800	3106	11.4	13.9	25.3	1610	1580	1670
4	4453	800	3653	13.5	16.4	29.9	1600	1590	1670
5	4864	800	4064	15.2	18.4	33.6	1590	1590	1670
6	5343	700	4643	17.2	21.0	38.2	1550	1600	1670
7	5846	800	5046	19.4	23.5	42.9	1520	1600	1670
8	5206	700	4506	18.0	21.9	39.9	1500	1600	1670
9	5024	800	4224	16.9	20.4	37.3	1500	1600	1670
10	4156	800	3356	13.6	16.6	30.2	1490	1600	1660
11	3151	800	2351				1500	1560	1660
12	1530		1530				1510	1530	1660
13	594		594				1510	1520	1650
	47658	8500	39158	130.5	158.0	288.5			

Make Oil ....288.5 = 7.37 Gals. per M.
Heat Oil .... 45.8 = 1.16 " " "

Total Oil ....334.3 Gals.
= 8.53 " " "
Net Gas Made ....39158 Cu. Ft.

ANALYSIS SHEET, No. 4 JONES SET, METROPOLITAN, 11:20 A. M., Aug. 7, 1913.

RUN NO. 4 (13 Minute)

Min.	Net Make	CO_2	C_nH_{2n}	O_2	CO	H_2	CH_4	N_2	Sp.Gr.	B.T.U.
1	670	22.2	0.4	0.6	8.8	9.8	17.0	41.2	.852	87
2	1415	7.5	4.1	0.0	11.4	39.3	32.1	5.6	.525	601
3	3106	4.5	4.5	0.0	9.4	43.5	33.3	4.8	.466	629
4	3653	3.4	5.0	0.0	7.6	44.8	35.7	3.5	.438	663
5	4064	2.4	6.6	0.0	6.0	45.3	36.8	2.9	.422	704
6	4643	1.8	7.8	0.0	4.6	42.0	40.0	3.8	.436	747
7	5046	1.6	8.6	0.0	3.8	41.6	41.6	2.8	.422	774
8	4506	1.7	9.4	0.0	3.7	38.3	43.3	3.6	.455	797
9	4224	1.9	9.7	0.0	4.0	35.2	45.0	4.2	.477	812
10	3356	2.0	9.2	0.0	4.6	37.9	42.1	4.2	.465	781
11	2351	3.0	7.5	0.0	7.5	39.2	36.9	5.9	.480	707
12	1530	5.2	6.0	0.0	9.4	45.0	29.1	5.3	.473	619
13	594	12.4	1.6	0.0	14.3	57.8	9.0	4.9	.481	377
Total	39158									
Aver.	Analysis	3.1	7.6	Tr.	6.0	40.8	38.0	4.5	.462	721

RUN NO. 5. No. 4 JONES SET, METROPOLITAN, 11:40 A. M. Aug. 7, 1913.

(14 Minute)

Min.	Gross Make	Purge Gas	Net Make	Prim. Oil	Sec. Oil	Total Oil	Prim. Temp. (Degrees Fahrenheit)	Sec. Temp. (Degrees Fahrenheit)	Neck Temp. (Degrees Fahrenheit)
0							1700	1620	1690
1	1233	700	533				1660	1600	1690
2	1416	700	716	2.7	3.3	6.0	1640	1590	1690
3	4658	600	4058	14.3	17.4	31.7	1620	1570	1680
4	3707	700	3007	11.0	13.3	24.3	1610	1560	1680
5	4098	700	3398	12.6	15.4	28.0	1600	1560	1680
6	5171	700	4471	16.8	20.5	37.3	1560	1570	1680
7	5098	700	4398	15.2	18.4	33.6	1550	1560	1670
8	4146	600	3536	11.3	13.8	25.1	1560	1560	1670
9	3610	700	2910	9.7	11.7	21.4	1550	1550	1670
10	3658	700	2958	11.8	14.3	26.1	1550	1550	1670
11	4414	700	3714	15.1	18.4	33.5	1520	1550	1670
12	4524	700	3824	9.9	12.1	22.0	1510	1560	1660
13	1901		1901				1520	1480	1650
14	780		780				1520	1480	1650
	48404	8200	40204	130.5	158.5	289.0			

Make Oil ....289.0 = 7.2 Gals. per M.
Heat Oil .... 45.8 = 1.13 " " "

Total Oil ....334.8 Gals.
= 8.33 " " "
Net Gas Made ....40204 Cu. Ft.

ANALYSIS SHEET. No. 4 JONES SET, METROPOLITAN, 11:40 A. M. Aug. 7. 1913.

RUN NO. 5 (14 Minute)

Min.	Net Make	CO_2	C_nH_{2n}	O_2	CO	H_2	CH_4	N_2	Sp.Gr.	B.T.U.
1	533	22.0	0.0	0.0	7.6	9.8	15.3	45.3	.940	224
2	716	18.8	1.0	0.0	11.2	26.5	22.4	20.1	.743	389
3	4058	4.0	4.8	0.0	8.6	40.4	37.2	5.0	.473	663
4	3007	3.2	5.8	0.0	7.0	44.3	36.4	3.3	.437	683
5	3398	3.0	6.2	0.0	6.4	44.1	36.6	3.7	.438	691
6	4471	1.6	6.4	0.0	4.4	43.3	40.9	3.4	.421	731
7	4398	1.6	7.6	0.0	4.2	41.4	41.9	3.3	.431	759
8	3536	2.0	8.8	0.0	4.6	41.4	40.2	3.0	.442	767
9	2910	2.6	6.7	0.0	6.1	44.2	37.4	3.0	.431	708
10	2953	2.2	7.3	0.0	5.1	40.8	40.6	4.0	.447	740
11	3714	1.8	8.0	0.0	4.2	39.6	42.3	4.1	.447	764
12	3824	1.8	8.2	0.0	3.6	39.4	42.5	4.5	.448	768
13	1901	6.9	4.3	0.0	15.0	57.4	15.4	1.0	.427	499
14	780	8.8	3.5	0.0	15.3	59.9	12.1	.4	.429	458
Total	40204									
Av. Analysis		3.2	6.6	0.0	6.1	42.2	37.5	4.4	.452	700

Drop in Purge Gas in 3rd minute affected 4th minute's gas.
" " " " " 8th " " 9th " "

Lake Spaulding Dam Now Towers 210 Feet Above Bedrock

Wasteway is Closed and Storage of Water is in Progress

Following the remarkable progress made on our Spaulding Dam and Drum power project, as outlined in previous issues, a brief summary of the work done to date will not go amiss.

A world's record was broken in August for the amount of concrete poured in the dam. The amount placed in September was 28,887 cubic yards, which raised the average height of the dam to elevation 4773 feet from that of 4732 feet in August. The increase of 41 feet made in September now shows the immense structure at a height of 210 feet above river bottom on the south side, and 135 feet on the north bank, at which point it will be necessary to transport the concrete to elevations out of reach by the gravity system. This delivery will be carried on by a system of belt-conveyors, one of which is now being operated successfully with the free delivery of concrete, with rate of progress the same as with the gravity system.

The wasteway through the dam, made for the outlet of freshet waters during the early construction period, was closed October 3rd and the storage of water is now under way.

The concrete lining in the lower gate intake and pressure tunnel is now practically completed. The four steam shovels are in their last period of work upon the canal and can be retired before the middle of this month, leaving only some trimming of steam shovel refuse and rock wall masonry to be laid to complete the canal.

The Drum Forebay has been finished with the exception of the headworks, which is being built of concrete at the present moment. Leading from the forebay, one of the two steel pipe lines to Drum power house is now being rapidly rushed to completion. These will be 6214 feet in length and will deliver water under a head of 1375 feet.

The two generating units of 12,500 kilowatts each are in place in the Drum power house and will be ready for operation by Thanksgiving. The two machines were assembled in the building. Each unit consists of a stationary armature and two 9,000 horsepower impulse water-wheels overhanging at each end of a horizontal shaft upon which a rotor is keyed. Each wheel is driven by a single deflecting jet whose size is controlled with a needle valve, which jet at maximum capacity is 6⅞ inches in diameter.

A bench switch-board has been designed by Mr. J. P. Jollyman to inter-connect the entire station and all auxiliaries either by hydraulic or electric control as may be desired.

The transformers are arranged in two banks of three each with one spare. They are fed direct from the generators at 6600 volts, and are stepped to 125,000 volts for transmission without intermediate transformation.

The steel tower line is finished except for stringing a few miles of wire, and Cordelia substation is receiving the final adjustment of equipment where the voltage delivered will be 100,000 volts for general distribution at 60,000 volts to bay points and valley towns.

The work as a whole is over 85 per cent completed. It is expected that by November 1st there will be a cessation of construction work in the mountains, and that by Thanksgiving the Drum power plant will be in operation.

Pacific Service Magazine

PUBLISHED IN THE INTERESTS OF ALL THE EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

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Issued the middle of each month
Year's subscription....................$1.50
Single copy.................................... .15
Published by the
PACIFIC GAS AND ELECTRIC COMPANY
at 445 Sutter Street, San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. V OCTOBER, 1913 No. 5

EDITORIAL

THE QUALIFIED ELECTORS of the city of San Jose have voted to surrender to the State Railroad Commission their city's powers of control over public utilities, including its power to fix rates and charges for service.

The Public Utilities Act was passed under the provisions of Section 23 of Article XII of the Constitution of this State as amended on October 10, 1911. This section provides in effect that the Legislature shall have the right to confer upon the Railroad Commission powers of regulation and control over public utilities as defined in the section and including all kinds of railroad companies, express companies, telephone and telegraph companies, heat, light, water and power companies, wharfingers and warehousemen, but that incorporated cities and towns of the State shall retain such powers of control over public utilities as may be vested in them on the effective date of such legislation as may be enacted. The section further provides that legislation shall be enacted under which the incorporated cities and towns, if they so desire, may vote into the Railroad Commission their powers over public utilities. The same Legislature which passed the Public Utilities Act accordingly also passed the Hewitt Elections Act, providing the method by which incorporated cities and towns may, if they so desire, vote into the Railroad Commission their powers over public utilities.

The election in the Garden City was held September 22nd, and the result was overwhelmingly in favor of avoiding the innumerable complications which must ensue from the inevitable clash of authority between city and state resulting from the exemption clause referred to. In other words, the good people of San Jose realize that a State Commission, the purpose of whose creation is to regulate all public utilities of the State should not be hampered in its work by local restrictions; on the other hand, perhaps, that the public utilities themselves should not be harassed by a divided authority nor compelled to obey the behests of too many masters. It may be, too, that the element of qualification for the work of rate-fixing came into the election, the people of San Jose preferring to leave this in the hands of a trained body of experts specially selected by the appointing power and responsible to that power as well as to the people for the efficiency of their work.

Whatever the reason that actuated it, the election proved a triumphant expression of confidence in the Railroad Commission. And in so deciding, San Jose followed the cities of Palo Alto, Salinas, Monterey, Antioch, Orange, Willits, Ontario, Covina, Belvedere and Eagle Rock. Four cities have by vote refused to turn over their powers to the Railroad Commission; these are, Santa Maria, Petaluma, Santa Barbara and Vallejo. But the odds in numbers are in favor of state jurisdiction, and it is more than probable that many more of these elections will be held before the next general election of the State at which the voters will be called upon to record their "yea" or "nay" upon the new amendment by which it is proposed to make the authority of the Railroad Commission state-wide without restrictions of any kind.

That the public utilities themselves are in favor of this goes without saying. All the oral expressions of opinion, all the articles written upon the subject by members of leading public utilities, to say nothing of the political economists who have carefully studied the situation, advocate the comprehensive regulation of public utilities by a commission specially appointed for the purpose. It is fairest, they think, to the people as well as to the public utility, for both will have the satisfaction of knowing that their interests are in the hands of trained officials whose entire time is given over to the solution of the public service problem in its many and varied ramifications.

The principal argument advanced in favor of the cities surrendering to the Commission their powers of control over utilities is that the Commission, being well equipped to perform the work of regulation, can better solve the intricate problems that constantly arise in the close relationship between the utility and the community it serves. The work of the Commission is divided into departments at the head of each of which is a specialist who is skilled in the line of investigation which he is called upon to carry on. His assistants, likewise, are men who have given time and study to the work which they are employed to do. Not even the larger cities call to this service, as does the Commission, men who are by education and training fitted to properly carry on the work of regulation as it should be conducted. The cost of regulation when undertaken by cities is so great that the work of accumulating and working up reliable data can not be carefully done. The Railroad Commission before which all utilities must go to secure authority to issue stock and bonds has accumulated exact information which can be used in rate investigations and which is verified from time to time from the books and records of the utilities.

Again, local bodies are less inclined to take a judicial attitude in their investigations of utilities which serve them than is a Commission which owes its allegiance to the entire State and which cannot escape the realization that unfair treatment to a utility reacts upon the community, resulting in poor service and an inability to make extensions from the development of business which means either progress or stagnation to every city, town or county in California. The larger utilities operate in territory both within and without the limits of incorporated cities and towns. The joint investment and the joint operating expenses of the utility must be segregated and apportioned as well as the revenue derived from its business. The adjustments which must of necessity be made in such cases can be fairly made only by trained men who have all of the facts at their disposal and who take a broad view of questions submitted for decision. Finally the complainant and the utility are both afforded a hearing and given an opportunity to submit the evidence and arguments. Justice can only be done to all persons concerned when all of the facts on both sides are presented and a decision honestly made by a fair Commission, having before it full and complete information on the point at issue, is apt to be final, while a decision which is not sustainable by the evidence is rarely satisfactory to either the public or the utility.

The conviction is growing that if regulation is to be successful it must be placed entirely in the hands of a central body and that the value of the work of that central body depends entirely on its efficiency, honesty and freedom from local prejudice and bias. Every utility in California needs more money than it can readily secure to develop the business of a State such as California. Intelligent and fair regulation should tend to conserve the honest investment of the bondholders and stockholders. Unintelligent and unfair regulation, whether due to unfair methods, misinformation, or ignorance, must sooner or later destroy the ability of the utility to induce capital to make investments in this State to the incalculable detriment of the development and prosperity of the State.

"Pacific Service" Plays Tennis for a Trophy

A goodly line-up of contestants.

On September 14th the third annual "Pacific Service" handicap tennis tournament was played in Oakland on a private court loaned by the genial manager of the land department, Mr. E. B. Henley, who also was one of the competitors for the trophy.

The San Francisco players met in a body at the Ferry building, took the 7:00 A. M. Key Route boat, where they were met at the Telegraph Avenue station and conducted to the court. Play was started about 9 o'clock and the tournament ran down to the finals that day. Some very close sets were run off as will be seen by a survey of the score sheet.

The entry list totaled 18 players representing the following departments: The Engineering Department, O. & M. Steam Section, Auditing Department, Land Department, Distribution Department, San Francisco District and the Commercial Department. This representation of so many departments made the play quite interesting and the rivalry very keen. The good fellowship displayed during the day showed the excellent personnel of the members of this company.

The handicapping throughout the tournament was very good as all the matches were hard fought.

The result brings the Silver Loving Cup back to the Engineering Department for its second time. If this department can win it once more it becomes their property and all the players there are going to work hard toward that end.

First round:—L. C. Steele (—30) beat H. B. Hammill (—15), 6-1, 6-3; Robert Monroe (—30) beat E. Rogers (—30) by default; H. C. Vensano (—30) beat L. F. Kendall (+15) by default; R. G. Clifford (+15) beat E. B. Henley (scr) 6-1, 5-7, 6-1; E. E. Dodge (—40) beat A. L. Trowbridge, (+15) by default; E. M. Szczezepanski (—30) beat F. G. Johnson (—15) by default; C. H. Delany (+15) beat H. Van Zandt (scr) by default; R. E. Fisher (scr) beat L. C. Williams (scr) 6-0, 6-0.

Second round:—Monroe beat Steele, 6-4, 9-7; Clifford beat Versano, 2-6, 8-6, 11-9; Dodge beat Szczepanski, 6-0, 0-6, 10-8; Fisher beat Delany, 7-5, 6-2.

Third round:—Monroe beat Clifford, 10-8, 3-6, 6-1; Dodge beat Fisher, 7-5, 6-2.

Final:—E. E. Dodge (—40) beat R. Monroe (—30), 6-0, 3-6, 6-2, 6-2.

Harry Vensano in action.

Delany about to "smash".

ITEMS OF GENERAL INTEREST

The first steel-tower line ever constructed by the Pacific Gas and Electric Company has just been completed from Alviso to San Jose.

As is generally known, Alviso is the point where our high tension lines coming in from Electra pass around San Francisco bay to serve San Francisco and the smaller cities of the peninsula. From Alviso to San Jose is a distance of about eight miles and the old pole line which has just been supplanted followed the right of way of the Southern Pacific under a lease which has still six years to run. But the right of way was narrow and the wires too close to the ground; besides, constant extensions of the Southern Pacific system necessitated continual moving. Then, the business of the San Jose district has been growing in importance at such rate that it was not thought wise to depend upon a single line service, and the steam plant in operation at San Jose was not large enough to handle the increased load. So, at a cost in the neighborhood of $50,000, the San Jose service has been re-inforced by this double-circuit steel-tower line.

It is built of standard towers 85 feet high and 16 feet square at base. The wires are 10 feet apart vertically and a little more than that horizontally. There are 48 towers in all. This double-circuit construction gives two sources of supply and now renders the San Jose district independent of its steam-electric plant. The new line was constructed under the direction of Chief Paul M. Downing of the O. and M. Department and his able assistant, Mr. E. H. Steele.

In the rush of unceasing toil which is necessary to bring Lake Spaulding dam to a point of practical completion before the winter snows come upon the scene, the boys up there still find time to relax, once in a while, as is evident from reports of a big smoker held at Spaulding camp on the night of Saturday, September 20th.

From all accounts it appears to have been a highly successful affair. It was under the leadership of Sam Wardlaw, the energetic chief steward of division 1, South Yuba construction department, and there was variety enough in the program to satisfy even the most fastidious. There was a moving picture show in which the problems of every-day life were depicted. Boxing contests were in order, the most interesting parties being: Kid Sullivan vs. Kid Gard; Jim Fell vs. Jim Fall; Yellow Jacket Conway vs. Red Coat Mack. (The reporter appears to have suppressed names here. Ed.) Mr. Al. Trowbridge came up from the city to help out the musical end of the program and his baritone voice was much appreciated. Another vocalist was Mr. Huber, a professional entertainer of San Francisco.

After the regular program the audience was entertained to a light lunch accompanied with lemonade and other equally harmless beverages. Altogether it was a most enjoyable evening.

On Friday, September 19th the camp at Spaulding received a visit from Mrs. Wise, mother of poor Jim Wise who started the great construction work at the dam and whose untimely death just a little over a year ago threw our entire company into mourning. Mrs. Wise was accompanied by Miss Curtis. They stayed at the Lake until Sunday, September 21st, when they went over to Drum and returned to the city that night. A big bunch of American beauty roses was presented to Mrs. Wise and the boys fairly overwhelmed her with attentions, some of these taking substantial form in presents of quail, trout and venison, in all of which the Sierra region abounds.

Marysville District has in the course of construction a new gas holder of 100,000 cubic feet capacity. Mr. Poingdestre reports that he expects this to be completed by November.

This news item recalls to our attention the existence at Marysville of an old gas-holder that dates from the early sixties. It appears that between 1860 and 1861 a holder of 19,000 cubic feet capacity was ordered by Mr. D. E. Knight, at that time the presiding genius of the gas industry at Marysville. This, however, met with an accident on its way around the Horn and now lies at the bottom of the Pacific ocean. But another of the same kind was immediately ordered and came out by the same route and was installed. When our company took over the gas works from Mr. Knight this holder passed into our possession and has been used as a relief holder ever since, with some slight repairs.

There has been deposited with the Board of Police Commisioners of San Francisco the sum of $450.00, covering a portion of the reward of $2000.00 offered by the Company for the arrest and conviction of anyone found tampering with its power lines or other equipment.

On the night of June 11th last two of the Company's poles were dynamited near Mountain View. An investigation resulted in the arrest of Walter Thomas, a striking lineman, after a sensational chase in which an automobile and a chauffeur by the name of Herman Ebbenritter played a part. Thomas was caught with the goods on him, so to speak, and had no choice but to plead guilty and throw himself on the mercy of the court. He is now serving a sentence of one year's imprisonment at Folsom.

Then came the question of distributing the $2000.00 reward. After a thorough investigation of the circumstances, the Company decided to pay $1250.00 to the person—whose name is withheld—who gave information which led to the capture of Thomas. The balance of $750.00 is distributed in this way: $250.00 to Detective Reihl of the local police who arrested and held Thomas until a warrant could be sworn out against him; $100.00 apiece to policemen Jas. E. Cottle and Thos. A. Cotten; $150.00 each to W. J. Bigger and J. J. Shields, Deputy Sheriffs, respectively, of Santa Clara and San Mateo counties, each of whom had a part in the pusuit and capture of Ebbenritter and, subsequently, of Thomas.

The law requires that rewards given to officials must be approved by the appointing bodies under which they serve. For this reason the reward for the policemen has been deposited with the Board of Police Commissioners, whose sanction to their receiving the various amounts set opposite their names must be obtained.

According to established custom "Pacific Service" had an exhibit at the Sebastopol apple show held during the week of August 18th to 23rd.

Our booth was larger than last year and was decorated in the Company's colors. A combination of gas and electric lighting made it the brightest spot at the show. Gas and electric appliances of all kinds were exhibited and there was something of interest for every visitor. As before, Mrs. Withers officiated as demonstrator. She held the attention of the crowds by her observations on cooking and did wonders with the gas range. An automatic water heater made a great hit and many good "prospects" were secured.

Sebastopol is the center of an agricultural district and many questions were asked by our visitors regarding irrigation by electricity. As this is a branch of the business which has doubled during the last few years, splendid opportunity was presented for affording ample information on the subject to prospective consumers.

"Pacific Service" was to the front at the Yolo County Fair, which was held at Woodland, August 20th to 23rd. The company exhibit was in a booth decorated in blue and white and lighted by Mazda lamps and cooled by electric fans. It was the brightest spot in the fair and attracted a great deal of attention.

Electric appliances of all kinds were on display as well as a model irrigation plant. The ladies were much interested in the electric washing machine which was in operation at all times. The pumping was a center of attraction to men, as irrigation has come to be the only way to insure crops in Yolo County. Many questions were asked and considerable information was given regarding pumps, motors and methods of irrigation.

Miss Eubanks of the Globe Mills baked and served hot biscuit and cake during the afternoons and evenings, all of the baking being done on an electric range.

During the week the Woodland district had the warmest weather experienced for several years. This made ice water a much wanted article. To supply the demand and to show that "Pacific Service" is equal to anything, the company kept a barrel filled with ice water at its booth at all times, and this was dispensed in sanitary paper drinking cups which were supplied to all visitors upon request. During the four days of the show twelve hundred cups were given away.

Manager "Charlie" McKillip of the Sacramento district writes:

"On August 30th we moved into our new office building at 11th and K streets. We are, however, not settled owing to the fact that the building is not completed, and due to this we will not feel quite at home before the middle of October at which time all departments will be permanently settled in their respective locations. The move was made to the new building before it was completed for the reason that our lease had expired on the old office at 201 J street and it was thought better to move into the new building and be unsettled for a few months than to make two complete moves.

"When the building is completed and we are all permanently settled we will not be ashamed to have our new home compared with any other office building in the Sacramento Valley, and we will be better prepared than ever before to dispense 'Pacific Service.'

"On September 4th Mr. E. A. Weymouth was appointed Assistant Manager of the Sacramento District. Mr. Weymouth is on the ground and is rapidly becoming acquainted with his new duties. He does not come to us as a stranger, as in his previous positions his work has often brought him to Sacramento, and as he has made himself exceedingly popular we predict that Mr. Weymouth will have the hearty co-operation of all Heads of Departments in the Sacramento District.

"In the office of the Sacramento District the little God of Love is getting very busy. On September 8th Miss N. P. Davis, a clerk in the Accounting Department, started out with her mother for San Francisco, presumably on her usual summer vacation, but not long after arriving in the city she disclosed the real purpose of her visit when she took to herself a husband, Mr. W. H. Walker.

"The next conquest of the little Love God was over Mr. W. H. Barnett, another clerk in the Accounting Department, who on September 14th married Miss Alma Shaw of Ione, Amador County, Calif.

"And on September 26th Mr. W. B. Salt, employed in the New Business Department, was married to Miss Sue Uridge of Oakland."

Our Oakland correspondent writes:

"The lighting and decorating features for the celebration of the 63rd Anniversary of the Admission of the State of California into the Union, at Oakland, September 6th to 9th inclusive, eclipsed any other display of the kind ever held in this vicinity.

"The business district was transformed into a sea of many colors by day and a maze of brightness at night. The principal decorating and illuminating features were streamers of red, white and blue lights festooned across fifty-four blocks of the business district—four and five streamers to the block. The Court of Honor was located at the junction of 14th Street, San Pablo and Broadway. On each corner was erected a pillar, 30 feet high, 7 ft. square at the base, tapering to 3 ft., on which was mounted a large vase filled with California poppies, surrounded by bear and American flags; colors cream and gold. In the center, 60 ft. above the street, a large bear outlined with lights, was suspended, from which streamers were festooned, making a canopy of 2,000 lights. At 12th and 13th Streets, the canopy effect was also carried out. There was also erected on 12th Street, an electric sign, "Welcome Native Sons and Native Daughters of the Golden West."

"On the dome of the new City Hall powerful search lights were operated, and on each side of the dome a bear 20 ft. by 12 ft. was mounted and outlined with electric lights.

"A cluster of California Bear and American flags were displayed on each street electrolier globe. Above and between each stringer of lights streamers of California Bear and American flags were strung, thus banking in the lighting effect.

How Oakland was illuminated for the Admission Day celebration.

"The entire distance of 3½ miles around Lake Merritt was festooned with lights and Chinese lanterns: This feature alone took 283 poles and 8,500 lights. The total number of lamps used in this display being over 20,000 or 800 horse-power in energy. The festooning and special feature work was handled by Hanlon and Brame of the Carnival Electric and Decorating Co.

"The electric service which played an important part in making this celebration a success was supplied by the Pacific Gas and Electric Company."

PACIFIC GAS AND ELECTRIC COMPANY

DIRECTORS

F. B. Anderson
Henry E. Bothin
John A. Britton
W. H. Crocker
E. J. De Sabla, Jr.
F. G. Drum
John S. Drum
D. H. Foote
Wm. G. Henshaw
A. F. Hockenbeamer
Samuel Insull
John Martin
C. O. G. Miller
Louis Sloss
George K. Weeks

OFFICERS

F. G. Drum ....President
John A. Britton........Vice-Pres. and Gen. Mgr.
A. F. Hockenbeamer, 2d Vice-Pres., Treas. and Comp.
D. H. Foote........Secretary and Asst. Treasurer
J. C. Love ....Asst. Treasurer
Charles L. Barrett..............Asst. Secretary

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W. H. Kline ....General Agent
R. J. Cantrell ....Property Agent
George C. Robb ....Supt. of Supplies
J. H. Hunt ....Purchasing Agent
E. B. Henley ....Manager Land Dept.
J. P. Coghlan ....Manager Claims Dept.
H. Bostwick ....Secretary to President
F. S. Myrtle ....Manager Publicity Dept.
L. H. Newbert ....Manager Appliance Dept.
J. J. Valentine...Superintendent of Transportation
G. C. Holberton..Chief Eng'r Stockton Water Dist.
W. B. Bosley ....Attorney
H. C. Vensano ....Civil Engineer
E. C. Jones ....Engr. Gas Dept.
H. P. Pitts ....Industrial Engineer
S. V. Walton ....Manager Commercial Dept.
S. J. Lisberger ....Engr. Electric Distribution
Sherwood Grover ... Asst. Engr. Gas Department
J. P. Jollyman .....Engr. of Electric Construction
P. M. Downing ....Engr. O. & M. Hyd.-Elec. Sect.
C. J. Wilson .....Asst. Engr. Electric Distribution
F. H. Varney ..Engr. O. & M. Steam & Gas Eng. Sect.
F. G. Baum ....Chief Engineer Hydro-Electric Dept.

DISTRICT MANAGERS

District	Headquarters	Manager
Alameda Co.	Oakland	F. A. Leach, Jr.
Berkeley	Oakland	F. A. Leach, Jr.
Oakland	Oakland	F. A. Leach, Jr.
Chico	Chico	H. B. Heryford
Colusa	Colusa	L. H. Hartsock
Contra Costa	Martinez	Don C. Ray
Fresno	Fresno	M. L. Neely
Grass Valley	Grass Valley	John Werry
Marysville	Marysville	J. E. Poingdestre
Marin	San Rafael	W. H. Foster
Napa	Napa	O. E. Clark
Nevada City	Nevada City	John Werry
Petaluma	Petaluma	H. Weber
Placer	East Auburn	H. M. Cooper
Redwood	Redwood City	E. W. Florence
Sacramento	Sacramento	C. W. McKillip
San Francisco	San Francisco	G. C. Holberton
San Jose	San Jose	J. D. Kuster
Santa Rosa	Santa Rosa	M. G. Hall
Solano	Dixon	C. E. Sedgwick
Stanislaus	Newman	W. A. Widenmann
Vallejo	Vallejo	A. J. Stephens
Woodland	Woodland	W. E. Osborn

MANAGERS OF WATER DISTRICTS

Colfax (Colfax).............. Jas Martin
Nevada (Nevada City).........George Scarfe
Placer (East Auburn).........H. M. Cooper
Standard (Electra)............ W. E. Eskew
Stockton (Stockton).................J. W. Hall

SUPERINTENDENTS OF POWER DIVISIONS

Colgate......................Miles Werry
De Sabla.................... I. B. Adams
Electra..................... W. E. Eskew
Marysville...................E. C. Johnson
Nevada..................... George Scarfe
North Tower.................C. D. Clark
Oakland.....................William Hughes
Sacramento..................J. O. Tobey
San Jose.....................J. O. Hansen
South Tower.................A. H. Burnett
Stockton.................... E. C. Monahan
Solano...................... J. W. Coons

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C. A. Eastwood....Supt. Station "A," San Francisco
J. W. Varney.................... Supt. of Sub-Stations, San Francisco.

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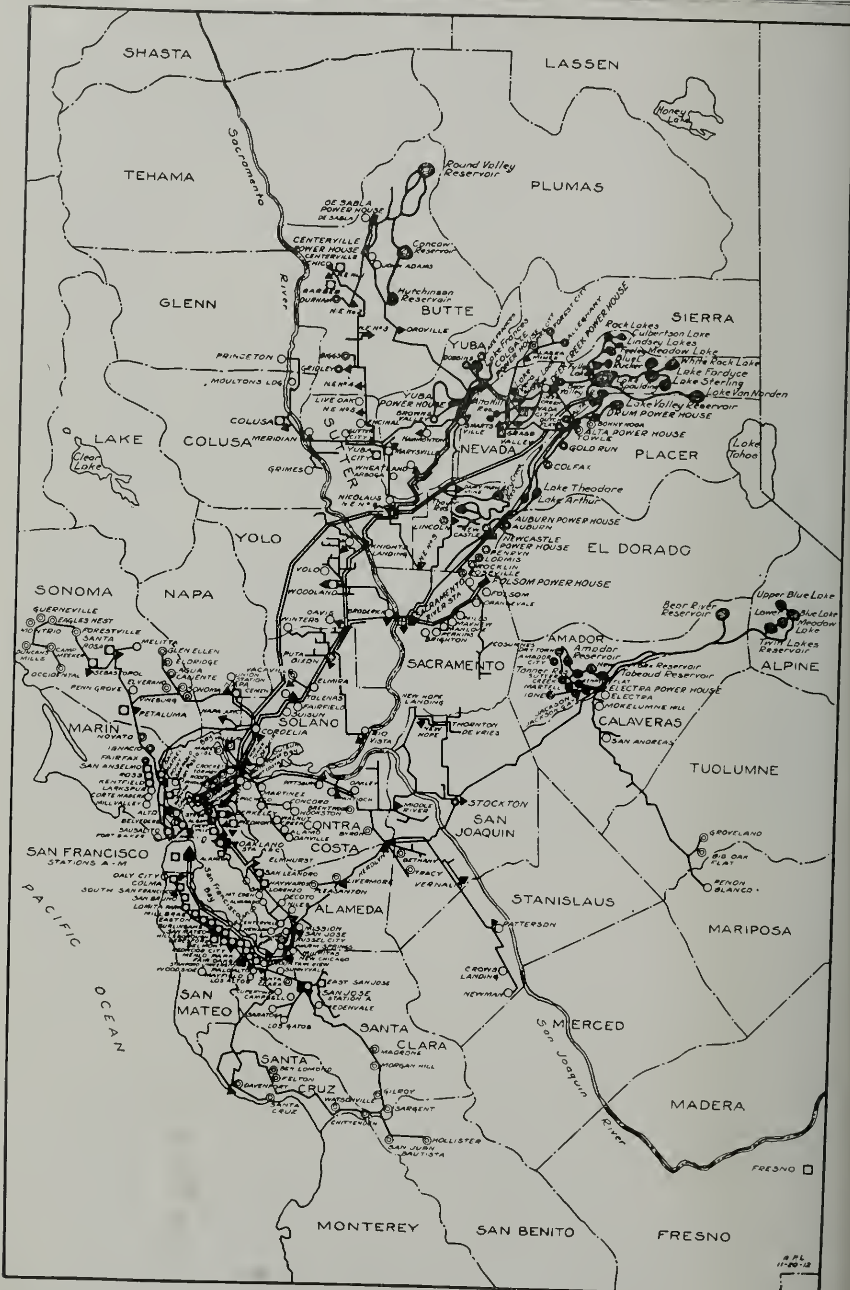
Oakland and Alameda (Overhead) A. U. Brandt
Marin........................Chas. Dallerup
Redwood.....................R. C. Bragg
Sacramento..................C. R. Gill
San Francisco............... A. R. Thompson
San Jose.....................A. C. Ramstad
Valley District (Chico, Marysville, Woodland and Colusa) ....W. F. Blide

SUPERINTENDENTS OF GAS WORKS

Martin Station.............. John Mitchell
Oakland.....................A. C. Beck
Sacramento..................Edward S. Jones
San Francisco...............Dennis J Lucey
San Jose.....................R. H. Hargreaves

SUPERINTENDENTS OF GAS DISTRIBUTION

Oakland.....................George Kirk
San Francisco...............D. E. Keppelmann
Superintendent of Railway Department....................N. J. Hullin


SHASTA
LASSEN
Honey Lake
TEHAMA
Sacramento River
Round Valley Reservoir
PLUMAS
DE SABLA POWER HOUSE
CENTERVILLE POWER HOUSE
Concow Reservoir
Hutchinson Reservoir
GLENN
BUTTE
OROVILLE
SIERRA
Rock Lakes
Culbertson Lake
Lindsey Lakes
White Rock Lake
Lake Fordyce
Lake Sterling
Lake Van Norden
Lake Valley Reservoir
DRUM POWER HOUSE
ALTA POWER HOUSE
YUBA
COLGATE POWER HOUSE
YUBA POWER HOUSE
PRINCETON
COLUSA
LAKE
Clear Lake
COLUSA
SUTTER
NEVADA
GOLD RUN
COLFAX
PLACER
Lake Tahoe
Lake Theodore
Lake Arthur
AUBURN POWER HOUSE
NEWCASTLE POWER HOUSE
EL DORADO
YOLO
FOLSOM POWER HOUSE
SONOMA
NAPA
Bear River Reservoir
Upper Blue Lake
Twin Lakes Reservoir
ALPINE
SACRAMENTO
AMADOR
Amador Reservoir
Tabeaud Reservoir
ELECTRA POWER HOUSE
CALAVERAS
SOLANO
MARIN
TUOLUMNE
STOCKTON
SAN JOAQUIN
CONTRA COSTA
SAN FRANCISCO
STATIONS A-M
PACIFIC OCEAN
ALAMEDA
STANISLAUS
MARIPOSA
SAN MATEO
SAN JOSE STATION A
SANTA CLARA
SANTA CRUZ
MERCED
San Joaquin River
MADERA
FRESNO
MONTEREY
SAN BENITO
FRESNO

Pacific Gas and Electric Company

Cities and Towns Supplied with Gas, Electricity, Water and Railway

Service Furnished	Number of Towns	Total Population
Electricity	209	1,093,992
Gas	51	989,167
Water	25	52,865
Railway	1	71,000

Place	Population
Alta	20
[1] Alameda	25,000
Alamo	50
[2] Albany	800
[5] Amador City	200
Adams John	25
Alleghany	200
Alto	25
Angel Island	280
[5] Auburn	2,375
Agua Caliente	100
Alvarado	900
Antioch	3,000
Arboga	100
[2] Barber	500
[2] Belmont	350
Ben Lomond	800
Belvedere	1,000
Benicia	3,360
[2] Beresford	25
[2] Berkeley	40,000
Biggs	750
Big Oak Flat	20
Brentwood	200
Brighton	100
Broderick	200
[5] Brown's Valley	50
Byron	200
[2] Burlingame	4,000
California City	25
Camp Meeker	200
Campbell	600
Centerville	1,000
Centerville	20
[2] Chico	13,000
[2] Colma	3,500
[2] Colusa	1,500
Concord	1,500
Cement	1,500
[5] Colfax	500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Cupertino	50
Daly City	250
Danville	250
Davis	750
Decoto	350
de Sabla	25
[5] Dixon	1,000
[5] Dobbins	50
Davenport	1,000
[5] Drytown	20
Durham	500
[5] Dutch Flat	500
Duncan's Mills	150
[2] Easton	300
[2] East San Jose	1,660
Eagle's Nest	50
Edenvale	500
Eldridge	500
Elmira	150
El Verano	400
Electra	50
[2] Emeryville	5,000
Encinal	100
Fairfax	500
Fairfield	834
Forestville	100
Felton	300
[1] Fresno	30,000
[2] Fair Oaks	250
Folsom	1,800
Gilroy	2,000
Glen Ellen	500
[5] Gold Run	100
[3] Grass Valley	4,500
Gridley	1,800
Grimes	250
Groveland	125
Guerneville	500
Hammonton	500
[2] Hayward	4,000
[2] Hillsborough	1,000
Hollister	3,000
Hookston	75
Ignacio	100
[5] Ione	900
Irvington	1,000
[5] Jackson Gate	100
[5] Jackson	2,035
[5] Kennedy Flat	20
[2] Kentfield	250
Knight's Landing	350
[5] Lake Francis	5
Lathrop	300
Live Oak	200
Livermore	2,250
Los Gatos	3,000
[2] Larkspur	600
[5] Lincoln	1,400
[2] Lomita Park	100
Los Altos	500
[5] Loomis	400
Maletta	30
Manlove	50
Martinez	5,000
[5] Martell	150
[2] Marysville	7,000
Mayfield	1,500
Mayhew	50
[2] Menlo Park	1,500
Meridian	300
[2] Millbrae	300
Mills	50
Milpitas	300
Mill Valley	2,500
Mission San Jose	500
Mokelumne Hill	150
Monte Rio	50
Moulton's Landing	30
Mountain View	2,500
Mt. Eden	200
Mare Island	500
[2] Napa	7,000
[3] Nevada City	2,700
[5] New Chicago	10
Newark	700
[5] Newcastle	750
Newman	1,000
Niles	800
Nicolaus	75
Novato	250
[2] Oakland	230,000
Oakley	80
Orange Vale	100
[2] Palo Alto	6,300
Pacheco	200
Penryn	250
Patterson	300
Penn Grove	300
Perkins	50
[2] Petaluma	5,500
[2] Piedmont	1,720
Pike City	200
Pinole	1,500
Pittsburg	2,372
Pleasanton	2,000
Point San Pedro	20
Port Costa	600
[2] Redwood City	3,200
[2] Richmond	10,000
Rio Vista	884
[5] Rocklin	1,000
[5] Roseville	2,600
Rodeo	500
[2] Ross	500
Russel City	250
[4] Sacramento	71,000
San Andreas	200
[2] San Anselmo	1,500
[2] San Bruno	1,500
[2] San Carlos	100
[2] San Francisco	416,912
[2] San Jose	30,000
[2] San Leandro	4,000
San Lorenzo	100
[2] San Mateo	6,500
[2] San Quentin	2,500
[2] San Rafael	6,000
San Pablo	1,000
Santa Clara	6,000
Santa Cruz	16,000
Saratoga	50
[2] Santa Rosa	12,000
[2] Sebastopol	1,200
Sausalito	2,500
Smartsville	500
[2] South San Francisco	2,500
[2] Stanford University	2,600
Sonoma	1,200
Stege	1,000
[5] Stockton	30,000
Suisun	1,200
Sutter City	150
Sutter Creek	1,500
Sunnyvale	1,500
Tiburon	400
Tormey	20
Towle	100
Tracy	1,200
Union Station	40
Vacaville	1,200
[2] Vallejo	15,000
Vineburg	200
Walnut Creek	350
Warm Springs	200
Watsonville	4,500
Wheatland	1,400
Winters	1,200
[2] Woodland	3,200
Woodside	200
Yolo	400
[2] Yuba City	1,200
Total	1,148,992

Unmarked—Electricity only
1—Gas only.
2—Gas and Electricity.
3—Gas, Electricity and Water.
4—Gas, Electricity and Street Railways.
5—Electricity and Water.

EMPLOYS 4,800 people.
OPERATES 11 hydro-electric plants in the mountains.
5 steam-driven electric plants in big cities.
16 gas works.

SERVES ⅔ of California's population.
30 of California's 58 counties.
An area of 37,775 square miles.
⅗ the size of New York State.
½ the size of all the New England States combined.

VOL. 5 NOVEMBER 1913 NO. 6

Pacific Service Magazine

PUBLISHED MONTHLY BY THE
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CALIFORNIA

Pacific Service Magazine

Vol. V | Contents for November | No. 6

Yearly Subscription $1.50 | Single Copies each 15 cents

SCENES IN PANAMA CITY.

1.—St. Francis Church. 2.—Pearl-fishing schooner. 3.—Church of Santa Ana, 1764. 4.—The Cathedral, completed in 1760. 5.—A native hut near Panama. 6.—The Sea-wall near Chiriqui prison.

PACIFIC SERVICE MAGAZINE

VOL. V NOVEMBER 1913 No. 6

The Panama Canal; Its Topography, Scope and Constructive Features, as Viewed by a "Pacific Service" Engineer

By C. J. WILSON, Assistant Engineer, Electrical Distribution.

This is a truly interesting description of a trip to the Panama Canal region. The trip was taken under exceptionally favorable circumstances, Mr. and Mrs. Wilson being of a party invited to accompany Mr. F. J. Grace, of W. R. Grace & Co., on the first regular voyage of the Company's new 10,000 ton steamship "Colusa", now running between San Francisco and South American ports. As will be observed from his narrative, Mr. Wilson made the most of his opportunities while in the Canal Zone. All the pictures accompanying his story are from photographs taken by himself. EDITOR, PACIFIC SERVICE MAGAZINE.


C. J. Wilson

The steamer Colusa made her way slowly through the Heads, with a heavy fog rolling in, and discharged her pilot at the light ship about 3 A. M. The blasts of the fog-whistle precluded sleep, but as we watched the last faint gleam of Alcatraz light disappear we realized with many pleasant anticipations that our 3,300-mile voyage had begun, with Panama our destination.

Our captain laid a course westerly to get outside of the coast-wise courses, and then pointed his vessel's nose southeast. Passing down the coast of California, Lower California and Mexico, our course became more easterly, until off the coast of Central America we were headed due east. The weather became quite warm after the second day out, and as we sailed along the passengers donned their ducks and linens and sought comfortable deck-chairs under the awnings. We were plowing through the indigo ocean toward Balboa, the port of the Pacific entrance to the Panama Canal. The Pacific was true to its name, and the Colusa, carrying four million feet of lumber and piling for the Isthmian Canal Commission, bowled along at 12½ knots as steady and smooth as a ferry boat on the bay.

Great schools of flying fish sailed gracefully away from our bows, and porpoises and dolphins raced us alongside. Occasionally a huge shark's fin cleaved the water and disappeared, or a turtle, whose shell would probably measure two feet across, would float lazily by or suddenly dive into the blue depths. There were few sea birds away from the shore, though we saw some black gulls and fish eagles. At night the phosphorescence gleamed like millions of reflected stars alongside the ship and vanished in the blackness of our wake.

When our course approached the coast of Mexico, we could see range after range of

blue mountains serrated with volcanic peaks, the shore line in places being very rugged or with only a narrow, gleaming beach upon which a heavy surf was beating. At Acajutla, San Salvador, our only stop on the trip south, we saw a volcanic peak spouting steam and smoke. This port is located on the open sea way, exposed directly to the ocean storms. A structural steel pier extends beyond the line of the heavy surf, from which the barges, or launches, as the natives call them, lighter freight to the steamer anchored a half-mile out. Passengers are unceremoniously hoisted in a chair from the launch or ship's boat to the pier with a donkey engine. This method of landing has some of the thrills of aviation, especially when a heavy surf is running, and requires considerable skill and judgment on the part of the boatman in getting a nervous woman or clumsy man into the chair.

The village squats on a sandy beach and consists of thatched huts and a few wooden buildings with tile roofs. Back from the beach the hills, covered with beautiful growth of green trees and vines, with an occasional grove of palms, rise gradually to the mountainous heights, blue in the distance and piercing the clouds with their sharp volcanic cones. Coffee, cane and banana plantations, or "finkas," lie in a beautiful green panorama from the sea to the mountains.

Reaching Panama Bay after ten days out, our course was changed from east to due north, as we neared Balboa. The dark blue waters of the bay were almost waveless, and the islands, covered with the tropical growths of palms, vines and cane, in all shades of green, with the thatched or tiled roofs of native houses, added greatly to the beauty of the scene. Directly ahead was the historical Isthmus of Panama, a low range of hills joining the North and South Americas. To our right, Ancon hill hid Panama City from view and the docks of Balboa lined with steamers from many ports presented a business-like appearance. The channel of the Pacific entrance to the Canal, with its fleet of dredgers, stretched away ahead of us, losing itself in a silver gleam in the foothills. The tropical vegetation in many shades of green covered the hills which rose in the distance, fresh and bright after the afternoon shower.

After the quarantine doctor had looked us over our pilot guided our ship up the channel of the Canal to the dock at Balboa just as darkness dropped upon us. There is no twilight in the tropics. The channel is marked by light buoys and, in the distance, range lights, so placed that the farther light appeared above the nearer one, were plainly visible, marking the entrance to the Big Ditch. Needless to say we were somewhat excited as we packed our luggage to go ashore, and after a farcical inspection by the customs officials boarded a train and were jerked over three miles of rough roadbed into the depot at Panama. "Coaches," each drawn by a miniature illgroomed horse and driven by a dark-skinned individual, were waiting for us, and presently we were landed at the Tivoli Hotel where we dug up ten cents "gold" per passenger. We were surprised to find a modern hotel with all conveniences, from elevator to a telephone in each room, owned by our own United States government and operated by the Isthmian Canal Commission.

The Tivoli Hotel is located in Ancon, just across the line from Panama City. It was originally built by the French for canal employees but has been remodeled since the American occupancy. The system of ventilation is unique and very effective. Through each wing runs a corridor. The rooms are arranged on either side, opening on wide verandas, the verandas as well as the doors and windows of the rooms being thoroughly screened. Extending across the upper portion of the corridor-walls of each room are large windows or transoms, usually open. The cooling night breezes pass completely through from room to room and are so effective that there is not an electric fan in use in the hotel. No blankets are used, a single sheet being sufficient covering, at times, indeed, superfluous. From the verandas of the hotel an excellent view is obtained of the Bay of Panama and the hills back of the Pacific entrance to the canal, as well as the beautiful hospital grounds on the slope of Ancon Hill. The service is good and the table excellent, considering that supplies and food are brought from the States in cold storage. Dances given at the hotel by the Tivoli Club on Saturday nights are among the social functions of the zone and are well attended by officers and employees of the canal and the representative families of Panama and Colon.

The City of Ancon was built by the French on the site of old Aspinwall. It stands upon a low coral island. The sea-wall

New docks and machine shops at Balboa, the Pacific entrance to the canal.

with a breaking surf and the lines of the cocoanut palms present a very attractive picture. Unlike Panama, the streets are laid out in squares, and buildings, principally frame, have a more or less dilapidated appearance. The new Washington Hotel, built of reinforced concrete on the ocean front by the Canal Commission, is modern in every respect and luxuriously fitted up.

The name Panama is supposed to be derived from two Indian words, meaning "many fishes." The modern city, which has a population of 8,000, is built on a peninsula projecting into Panama Bay about three miles east of the Pacific entrance to the canal. The city is fronted by a masonry wall, originally intended for protection against such raiders as Morgan, who destroyed and sacked old Panama. The streets are narrow and crooked, lined with typical Spanish buildings with tile roofs and over-hanging balconies. The few modern buildings, built of masonry, have aged to such an extent that the city appears quite ancient, although it has been practically rebuilt since the disastrous fires of 1878 and 1894. The streets have been paved, principally with brick pavement, since the American regime began, and a sewer system has been installed, with electric lighting. Recently a trolley line was added, giving the city an up-to-date air.

A modern water system installed by the Canal Commission takes its supply from a reservoir near Culebra, superseding the old method of storing rain-water in barrels and cisterns in the main portion of the city. In some of the suburban districts, water-peddlers still make a scant living by selling water from a barrel on wheels or carried in coal-oil cans.

Several Catholic churches, some of which are quite old, are to be seen in different parts of the city. The flat arch in the ruins of Santo Domingo, covered with moss and vegetation, is one of the historical objects seen by the tourist. The several plazas fronting the churches with their gardens and palms are very picturesque, particularly at night, when the cosmopolitan public of Panama promenade to the music of the National band. Sunday night is a particular event when all shades and colors of people, from the brown Panamanian to the black Ethiopian, assemble to listen to the strains of the national anthems or, it may be, one of the latest rags.

There are several hotels, patronized principally by the natives and Latin Americans. Our party enjoyed a dinner at one of these which consisted of innumerable courses, several of which are worthy of mention. Beginning with native oysters, resembling our California bivalves and served with cracked ice, then came stuffed Spanish mackerel, a most delicious dish, followed by "sancoche," a meal in itself, consisting of pork, chicken and venison, boiled with several native vegetables and served with a thin, soup-like gravy. As a side dish, baked "papaya," resembling a large banana, was served. After that a variety of native fruits; "mangoes," which are best eaten in a bath tub; "mamei," "guava" and oranges, sweet and juicy but full of seeds. Native wine, rather sweet but of good flavor, was served with the dinner, which concluded with black coffee almost as thick as syrup.

From our table we looked out on beautiful gardens in the "patio" of the hotel and could hear strains of music by the native orchestra. We learned from our host, who spoke English quite fluently, that in Panama all meat must be used the day the animal is killed, as it will not keep, even on ice. The government enforces this rule, which applies to fresh fish as well.

The national lottery, operated by the government, is located in the Bishop's Palace and attracts motley crowds of natives and canal employees to the drawings, which take place at 10 o'clock Sunday morning. The tickets are sold on the public streets, principally by old women, who make a living out of the commissions. The prizes range from $2.00 to $7,500.00 "silver."

The Chiriqui Prison, built in an angle of the sea-wall, the prison yard laid out in gardens and flowers, the women inmates sunning themselves with their sewing, had the appearance of a pleasant patio scene rather than a prison, except for the armed sentries patroling the outer walls. There was nothing in its aspect to remind us of the terrible dungeons under the sea-wall in which political prisoners and suspects in days gone by are said to have

The Gamboa Dike, Gatun Lake in the distance. The blowing up of this dike on October 10th let water into the canal.

suffered in filth and wasted away under scant rations or died of fever.

The University Club, the membership of which is made up principally of American business men in Panama, is comfortably located in a mission-type building on the sea-wall. We were fortunate in receiving guest

Typical employees' quarters at Corozal.

cards entitling us to the privileges and courtesies of the club, and we enjoyed many pleasant hours and cool drinks on the balcony over-looking Panama Bay, with the entrance of the canal and Ancon Hill in the distance.

The tourist who is an early riser will find many interesting sights at the Beach Market. Here assemble during the early hours of the morning the native fishermen and farmers bringing their fish and products to sell to the housewives of Panama or barter for store supplies. Small boats of every description, including "cayucas" or dugouts hewn from solid mahogany logs, together with an array of fish, fresh meats, fruits and vegetables and even laces, exposed for sale by all shades and colors of people, make a very picturesque sight. About a mile east of Panama is a fine bathing beach which is very popular with many of the foreigners and tourists, although the water at a temperature of 85 degs. has not the bracing effect of surf-bathing in the temperate zone. The stranger, however, does not feel at ease in the water with the thought that there are many sharks around, even though assured that there is no danger.

A nine-mile drive to Old Panama by automobile over the best-paved suburban road, passes through the Savanas, where are located the summer homes of Panama's aristocracy. This drive is considered one of the most interesting features of a visit to Panama. As we neared Old Panama the road passed through dense virgin jungles so thick with small trees, palms and interlacing vines as to be impenetrable by man or anything except crawling animals. There were few trees of any great height and these were covered with orchids and other parasitic vegetation. The trunks were entwined by huge snake-like vines, with their tendrils drooping in festoons from the limbs. There were few flowers and the few we saw were of plain colors and without fragrance.

The ruins of Old Panama are the most interesting on the zone. These grim monuments of the past, over-grown by the jungle and covered with vegetation, when seen by moonlight were beautiful to look upon and aroused in us the spirit of romance. Our thoughts went back through the centuries and pictured the destruction of the city by Morgan and his avaricious followers.

Beautiful Tobago Island is reached by boat from Balboa after a 15-mile trip on the smooth Panama Bay. Through the courtesy of one of the canal officers we made the trip on a government launch, stopping at the Leper Island and the quarantine station to leave the supplies and mail. Reaching Tobago in about two hours we were met by a fleet of skiffs rowed by natives and taken ashore at the Sanitarium, landing for the usual fee of 20c "silver." The Tobago Sanitarium is operated by the I. C. C. (Isthmian Canal Commission). It is located on a point overlooking the quaint old Spanish village and Tobago Bay. Convalescing patients from all the zone hospitals are sent to this sanitarium to recuperate, spending a week or two with beautiful surrounding in an extremely mild and healthful climate. The indolent natives of the island eke out a meagre living by fishing and raising delicious pineapples, for which Tobago Island is famous.

The climate of the Isthmus is extremely enervating, though were it not for the excessive humidity the canal zone would be a pleasant place to live in. But while the day may be excessively hot the nights are generally cool, with a pleasant breeze blowing. The average temperature is about 80 degrees throughout the year and varies only a few degrees above or below. This even temperature is due to the temperature of the sea water, which ranges from 80 to 85 degrees. There are two seasons, the rainy season from April to December induced by the trade winds, and the dry season from December to April. During the rainy season hardly a day passes without a heavy fall of rain, beginning about 3 P. M. and lasting for two or three hours. Some of these afternoon showers are little short of cloud-bursts, converting the streets and gutters into rivers and driving practically everybody to shelter. Umbrellas and raincoats afford little protection on account of the splash and spatter of the pavements.

The sun rises bright and clear and by 8 o'clock the heat is extremely dangerous to persons not acclimated. Not only visitors but residents, including the natives, seek the shade and expose themselves only when absolutely necessary. We were repeatedly warned to keep in the shade and carry umbrellas on our trips along the canal.

But the Panama zone is no longer a plague-spot. To Col. Gorgas, Chief Sanitary Officer of the Commission, fell the task of eliminating the mosquito and changing the canal district from a tropical pest-hole to a health resort. Colon and Panama, the principal cities of the zone, were unsewered and without water systems. The streets were mostly unpaved, and sewage and filth trickled along the gutters or stood in pools to add to the disease-breeding conditions. The dense rain soaked vegetation, and the water-cisterns and barrels of the villages were ideal breeding-places for mosquitoes. At the Ancon Hospital Laboratory we were shown about 125 varieties of mosquitoes, though only two species are held responsible for yellow fever and malaria, and, strange to say, the female is the guilty one in both cases. But under the sanitation department the streets of Panama and Colon were sewered and paved, a modern water system was installed, buildings thoroughly fumigated, back yards cleaned up, the grass along streams cut or burned and the banks sprayed with a tarry-looking larvacide. Barrels set up to drip the larvacide into streams and a negro tramping through swamps and low ground with a tank on his back like a knapsack, one hand working a pump-lever over his shoulder and a spray nozzle in his other hand, are common sights along the zone. Small streams and drainage ditches lined with concrete trenches are seen in most of the small villages. Houses, mess quarters and hotels used by employees are thoroughly screened with fine copper screening.

This sanitary work, which made the success of the undertaking possible, cost between six and seven million dollars, and it is still going on. The jungle and disease have only been

Dredgers in the Pacific entrance.

thwarted, not conquered. A few months lapse in sanitation would probably result in a great increase in the death rate. The war on the mosquito has been so effective, however, that during our stay of two weeks on the canal zone we did not see a single mosquito except the 125 specimens in the museum.

RUINS OF OLD PANAMA.

1.—Ruins of the Convent of Santo Domingo. 2.—The world famed flat arch of Santo Domingo Church (Panama) destroyed by fire in 1756. 3.—Ruins of San Augustine Cathedral. 4.—Stone Arch Bridge on the Old Camino Real. 5.—The old jail on the beach.

Two finely equipped hospitals at Ancon and Colon, originally built by the French, have accommodation for about two thousand patients. Emergency hospitals are located at the principal working centers, and hospital cars are attached to the regular passenger trains. As every employee is entitled to thirty days' sick leave each year, besides a vacation of seven weeks on full pay, the hospital accommodations are pretty well filled. The least injury or ailment is accepted as an excuse to go to the hospital, and thence to the beautiful Tobago Island Sanitarium for convalescence.

Seeing the canal is made very easy for tourists by the Panama R. R. which operates sightseeing cars similar to our "rubber-neck" wagons, except that a flat car is used instead of an automobile. If the tourist's time is limited the whole "works" can be seen in one or two days in a superficial way. The tourist arriving at Colon begins with a trip to Gatun dam and locks in the morning, crosses the Isthmus with a glimpse of the Culebra Cut, and, after luncheon at the Tivoli Hotel, "does" the Pedro Miguel and Miraflores locks and the Pacific entrance in the afternoon, all explained through a megaphone by a very voluble and versatile spieler. An hour's drive in a coach through Panama and the steamer leaves for San Francisco at 8 P. M. But while the tourist goes on his way with the realization that he has seen something wonderfully impressive in its engineering and physical magnitude, he will not grasp the motives and hidden forces which are responsible for the execution of the work; notably the quiet and smooth-running organization guided by Col. Goethals, the Czar of the Canal Zone, whose power is legislative, judicial and executive, all in one.

S. S. "Colusa"—W. R. Grace Co., owners.

To see the Canal in detail requires time, and to get a fairly comprehensive idea of the many features one should spend months on the Zone. As our visit was limited to two weeks, I will not attempt to go into detail but simply describe my impressions of some of the principal features.

The Isthmus of Panama, as we were taught in our school days, is a narrow strip, 35 to 100 miles in width, connecting North and South America, through which the Cordilleras, the backbone of the continent, extend, joining the Sierra Madres to the North with the Andes of South America. The impression of most people that the Isthmus runs north and south is difficult to displace with the fact that the general direction is from southwest to northeast, with the result that the Pacific Ocean is south and east of the Atlantic. (See map.) This condition seemed particularly strange to us when we beheld the sun rising bright and clear out of the Pacific Ocean. The Canal route crossing the Isthmus nearly at right angles bears from the southeast at the Pacific side to the northwest at the Atlantic side, or, generally speaking, from south to north.

To get an idea of the general route of the canal, a brief description of the topography of the Canal Zone might be of value. The range of hills known as the Cordilleras parallels the coast line about 8 or 10 miles north of the Pacific, sloping from an elevation of 500 to 600 feet southerly to the Pacific and northerly to the basin or valley of the Chagres River, about 8 miles distant. The valley of the Chagres extends from the foothills northerly toward Gatun, a distance of nearly 30 miles, and is separated from the Atlantic by a low range of hills with a gap a mile and a half wide through which the Chagres found its way to the sea. The drainage area of the Chagres basin is about 1,320 square miles, subject to an annual rainfall of 150 inches.

A great dam, built across the gap in the hills at Gatun, closed the Chagres valley and formed an artificial lake, known as Gatun Lake, with an area of 164 square miles, at a normal level of 85 feet above sea-level. A spillway to discharge the surplus flow of the Chagres was cut through a hill of solid rock conveniently located by nature at the center of Gatun Dam. At the easterly end of the dam a double flight of three concrete locks was built, connecting Gatun Lake with a 7-mile channel dredged to deep water in Limon Bay. A channel was excavated from the Gatun Locks southerly through Gatun Lake to the foothills at Gamboa, where the Culebra Cut begins. The channel varies from 1,000 feet in width and 75 feet in depth at Gatun to 500 feet wide and 45 feet deep at Gamboa.

The Culebra Cut, representing the greatest excavation ever undertaken by man, extends for nine miles through the backbone of the Isthmus to the Pedro Miguel Locks on the Pacific slope of the Cordilleras. At Pedro Miguel, a twin lock in one step will lower a vessel 30 feet to the 55-foot level of Miraflores Lake, another artificial lake, about two square miles in area. Through this lake a 500 feet channel 42 feet deep was dry-excavated to the Miraflores Locks, 1½ miles to the south. The Miraflores Locks in two steps reach the salt-water channel leading out into the deep water of Panama Bay at the Pacific entrance to the canal.

[*The remainder of this interesting narrative will appear in our December issue. Mr. Wilson has yet to describe to us the peculiarly interesting features of the canal construction from an engineering standpoint.*]

The Growing Demand for Electric Power

Manager J. W. Coons of the Solano Power Division writes:

"During the month of October we began to supply the Vallejo and Northern Railroad with direct current from our substation at Cement. The extension was built on to the old substation to house the motor generator. The Vallejo and Northern Railroad is a subsidiary of the Northern Electric Company and is using power at present for the construction of its railroad from a point below Suisun to Vacaville. The future plans of the railroad have not yet been announced but it is probable that they will operate passenger cars between Vacaville and Suisun within a few months."

Another item of news from the Solano Power Division is the installation of a pumping plant of unusual capacity for Reclamation District 108. This pumping plant is said to be the largest west of the Mississippi. There are to be 5-50" pumps, each of which will discharge 70,000 gallons per minute, an aggregate of 350,000 gallons per minute or 21,000,000 per hour.

These pumps are to be driven by 600 horsepower motors which will be direct-connected to them. The installation will require 3,000 K. W. in transformer capacity and in order to supply the load our 60 K. V. line will have to be extended from Knights Landing to Rough and Ready Landing.

Our Spaulding-Drum Development Recognized as a World Feature

Soon to be Displayed by the Most Modern of all Public Educators, the Motion Picture Houses

By FREDERICK S. MYRTLE, Manager Publicity Department


F. S. Myrtle

To the August, 1912, issue of PACIFIC SERVICE MAGAZINE I contributed an article descriptive of my first visit to the scene of our South Yuba-Bear River development in the Sierra Nevada. I have now an account to give of another visit which, apart from the fact that it was my latest to date, held special significance for me in the expectation of unusual developments therefrom.

For, I had with me two representatives of Pathé Frères, the famous motion-picture house. These gentlemen, by name, respectively, Ralph E. Earle and Jacob William Binder, went along with me because they wanted to, and for no other reason than that they had occasion to hope their trip would be productive of results. Pathé Frères do their own work, as everyone should know, and in obedience to the law of public demand they are always on the lookout for novel features; and it came to pass that Messrs. Earle and Binder in their never-ending search for material here, there and everywhere had heard of what we were doing up among the mountain-tops. So, as I said before, they came along, with some extra baggage in the way of photographic apparatus.

On the way up I sketched out in brief the story of that vast project which has its beginning in a chain of Sierra lakes and stretches down through the valleys below to where rapidly growing communities await with eagerness the result in substantial aid to their progress. I told my two companions how, in the beginning, our company had come to locate a site for a 305-foot dam just below Lake Spaulding; how there had been discovered, also, a site for a power-house in the Bear river gorge some nine miles below; how plans had been laid for a chain of additional developments downstream which reached miles below Auburn; how construction work had been commenced on the Spaulding-Drum project only a year ago last July; how, just before winter closed like a pall upon the Sierra region, the foundation of the big dam had been made secure against flood and freshet; how a tunnel leading from the dam had been bored through solid rock during that winter season; how, as soon as the spring sunshine opened the Sierra region again, the work of concrete-pouring on the dam, ditch-digging, pipe-laying, power-house construction, steel-tower erection and installation of machinery had begun in earnest.

But when I told these men what had been accomplished since resumption of surface work in April last; that in those few short months a great dam structure had been erected to a height of 210 feet above bedrock; that the tunnel was open and ready for operation, the canal had been dug, the forebay reservoir made all but ready to do its work of receiving and regulating the waters at the canal end; that the great 72-inch pipe lay upon 1375 feet of steep leading from the forebay to the power-house in the gorge below; that the power-house was a practically completed structure and already there had been installed therein two great electric generators, each

Progress of our Spaulding-Drum development. The views, taken in order from the top down, are: Downstream face of Spaulding dam; same showing concrete mixers, chutes and belt conveyors; Drum power-house in Bear River gorge; machinery installed in Drum power-house.

ready to contribute 16,000 horsepower of electric energy to the sum total of "Pacific Service"; that the 110-mile stretch of steel-tower line was already in place and the electric wires all but strung; that, in fact, this vast project almost without parallel in history was approaching a point of practical completion, so that before Thanksgiving the waters might be allowed to rise in Lake Spaulding and an initial installation of 33,000 horsepower of electric energy be sent humming across country on its mission of comfort and joy, those picture men looked at me wonderingly.

They wondered more before they got through. We left the train early in the morning at Orel and were conveyed direct to Drum camp. In a very few minutes we were on our way to the power-house. Our visitors were much impressed with the cable-way, but not so much on account of the steepness of the incline as because of its pictorial possibilities. Chief Engineer Baum went along with us and they made him stop the car at various points on the incline and then run it up and down a few times while they balanced themselves on rocks and took pictures. When they reached the power-house and saw the wonderful structure that has been erected under our Mr. Frickstad's direction in the narrow gorge, they began to realize something of the nature of our achievement. They looked up the slope, saw the gigantic 72-inch pipe lying in place and pronounced the whole a most wonderful sight. They said:

"We are rather blasé, you know, but this beats anything we have ever seen."

They took pictures around the power-house, of men at work, machinery and everything else. Then they told Mr. Baum that one thing was wanting to complete the story, so to speak, by which they proposed to educate the public at the Pathé theatres. They wanted to portray, if possible, the effects of high pressure and they asked Mr. Baum if he could throw a stream of water up in the air or conjure up some other demonstration of pressure-effect for their edification and that of

Drum canal as it looks today, with its four miles of wall construction.

Flume near Drum forebay, showing concrete inlets and outlets.

their patrons. The Chief Engineer smiled almost perceptibly at the non-technical naivety of the request.

"I might be able to do that in the course of a week or two," he replied quietly.

They said they would return if he would notify them when he was ready to gratify their desire for the spectacular.

After viewing the forebay and taking lunch at an adjacent camp we set out for Spaulding, where upon arrival the glories of the big dam burst upon the view. Out came the cameras again and pictures were taken of both heel and toe of the big structure, with all the accompanying paraphernalia in the way of concrete-mixers, belt-conveyors, cable-ways, etc. When the picture men left for San Francisco at midnight they said they were more than glad they had taken the trip; that it meant a series of first-class educational pictures for the public to enjoy at the various theatres where the Pathé pictures are on exhibition.

To me the big dam was a revelation. As editor of PACIFIC SERVICE MAGAZINE, of course, I had handled many stories upon its progress and I had paid more than one visit to the scene since work opened. But I had not been there since the early summer, and this was October; and the difference in conditions at the dam site could hardly be realized. The scene struck me with a species of awe. I remembered that when I had visited there in June I had found men paddling about in loose rock and water, and now there stood before my gaze a huge monolithic structure that made the little trickling stream below that stands for the South Yuba at the present time look puny indeed.

"Tired? Yes, a little," replied Duncanson, when I put the obvious question. "It has been hard work and there have been some anxious moments. But it is glorious to think that we have weathered the storm and are now riding in smooth water. It is something worth while to work for, isn't it Mr. Baum?"

The Chief Engineer smiled assent, and was joined in his expression of approval by Geo. Burnside, the energetic foreman who has had the handling of the squads of men all this time. The air was charged with effervescence of high animal spirits. In fact, among these men who had known no let-up from their grinding toil for now many moons the general feeling appeared to be one rather of regret that the period of construction was, temporarily at least, drawing to a close. For, in a very few weeks the Spaulding and Drum camps and their accessories will much resemble Virginia City as it looked after the collapse of the Comstock excitement.

But the men up there have been well cared for. The company has not failed to realize the value of bone and sinew and what is required to keep them at their best. The various construction camps along the line have been noted for the excellence of their accommodation, and their reputation for splendid fare has spread to the great world beyond. Everything, in fact, has been done to make all the men, from the leading engineers down to the humblest laborers, comfortable. And in pursuit of this policy the entertainment feature has not been forgotten.

While I was up there we had a dance at Spaulding camp. It was held in the long dining-room at Camp 1, and Sam Wardlaw in his capacity of master of ceremonies acquitted himself nobly. The decorations were tasteful and the neatest little dance cards imaginable were gotten up for the occasion. Pretty girls came in from all parts of the surrounding country, stretching as far as Reno on the one to Auburn on the other side of the great divide. Those who rode on horseback sent their dresses on ahead. An orchestra was hired from Truckee, and as the boys were in their Sunday best everything was carried out after the manner of a genuine old-fashioned country dance. The camp cook spread himself on cakes and sweetmeats of wondrous design, and in place of punch there was served the most delicious chocolate ever

Hill across the river from Drum power-house, showing steel-tower transmission line.

brewed. It was in the sma' wee hours that the proceedings broke up and riding skirts were donned again for the journey over hill and dale to various homes.

A vaudeville show, also, had been scheduled for this occasion, and Mr. Britton had promised to come up and deliver a lecture to the boys. Unfortunately, his engagements prevented his attendance, so the show was put off for one week. At that time Mr. Britton was on hand and the entire camp listened to his description of the great system owned and operated by "Pacific Service," accompanied by a series of interesting views. The following day, Sunday, there was a great baseball game between the rival camps of Spaulding and Drum at which Mr. Britton acted as umpire. That evening Mr. Britton repeated his lecture at Drum camp. There was a dance at Drum the following Saturday night.

Happenings in Up-Country Districts

The first week in September a forest fire broke out near Towle, in the Sierra region, and gained considerable headway. The Pacific Gas and Electric Company sent a squad of its men to the aid of Assistant State Forester Schuelle, who was on the ground in charge, and in a very little while subdued the flames.

Mr. Schuelle gives credit to "Pacific Service" for its timely assistance.

Manager M. G. Hall of the Santa Rosa District is responsible for the following account of a recent experience:

"In preparing a sub-grade for Main Street it was found after removing about 6 inches of earth that our 6 inch cast iron main which is one of the main feeds to town was above the sub-grade. In other words, the 6-inch cast iron main was in the shape of an elongated bow. It is hardly conceivable that any one laying a main could have laid the pipe in such a position, and the only explanation is that one of the freaks of the 1906 earthquake has just come to light. This has necessitated us opening our mains for the length of two blocks, when we will lower to a proper grade line.

"We also passed through a large telephone manhole, necessitating the cutting of a slot through concrete walls so the main may take the proper grade.

"There are no particular engineering feats about this, the main interest being the presumable peculiar action of the earthquake."

Superintendent I. B. Adams of the de Sable Power Division writes:

"We have just completed retimbering 1800 feet of tunnel at de Sabla. The tunnel is known as pipe line tunnel No. 2. One of the main pipe lines from reservoir to power house runs through this tunnel.

"We are rebuilding a four-compartment settling tank at de Sabla Power House. The tank is used in connection with the transformer water supply, freeing the water of silt and debris. The tank is 30′ x 30′ x 8′, made of heart redwood throughout.

"We are replacing the old wooden weir in the main canal at head of de Sabla reservoir with a concrete structure. The weir is 60′ in length, by 20′ wide, by 5′ in depth. The side walls are equipped with wells to accommodate Chronograph, Gauge Staff Readings, High and Low Alarm Bells, etc."

The Architectural Treatment of Drum Power-House

By IVAN C. FRICKSTAD, Architect Civil Engineer's Department.

I. C. Frickstad

An architectural description of Drum Power-House entails a discussion of, first, the purpose of the building; second, its location; third, the method and material used in its construction. The purpose of the building, i. e., the generating of electric energy and the method of accomplishing this, determines the motif for the design, which is further influenced by the location and the method and material used in construction.

Mr. J. P. Jollyman's preliminary layout of the plant called for a room 208 ft. long by 44 ft. wide, in which the generating units were to be installed, and also for a space 34 ft. wide by the same length, but 11 ft. higher, as the generating room. Since it was necessary to provide a means of handling the heavy pieces, the height of the generating room was established at 51 ft. from floor-level to the under side of the roof-slab, at the lowest point which gave ample overhead space for the two 50-ton cranes installed. The additional space was to have three floors and a height of 62 ft. at the apex of the roof.

Before anything could be done in design, however, it was necessary for the writer to learn from Mr. H. C. Vensano what method of construction he meant to employ, as this has much to do with both the form and detail of a design. A steel frame was decided upon, with a reinforced concrete enclosing-wall, hence the proper treatment seemed to be one that would give plain, simple lines, all of which would be in keeping with the location and the purpose of the building.

Given these determining data and the location, the writer proceeded as follows:

The generating room on the river, or low, side, where the first stages of the transforming of water-pressure into electric energy takes place, is a single room and story. Accordingly, that elevation is so treated by the design. The window openings are individually made to express height in conformance with the purpose of the room and the surrounding hillsides. These openings are grouped in series, giving by their continuity an appearance of greater length to the building which is further increased by the horizontal line of the cornice covering the whole. This cornice is broken out and projects over each group of windows, emphasizing and giving prominence to a center group as a central feature with one group on each side to balance the whole. This arrangement gives ample light and ventilation for this large generating room.

The location of the Drum power-house amid the simple grandeur of the mountains seemed to demand a building of plain and simple lines. It is situated between steep mountain slopes, which are covered partly by a dense growth of timber and partly with exposed rock formation, and in a region of fairly heavy snowfall in winter. The mountains, however, are not steep and rugged enough nor the snowfall sufficiently heavy to demand a steep roof from an architectural or engineering standpoint, so a rather flat, sloped roof was decided upon, constructed strong enough to carry the snow and outlined in the design in such a way as to help express the course of the generated electric energy on its way from the generating room to the outlet windows. Such a roof too, is in keeping with the desired simplicity of the whole structure.

Since the appearance of the building as a whole is long, narrow and rather low, the treatment is along horizontal lines, the appearance of height being obtained, as before mentioned, by the height of the window openings and further emphasized by the break in the cornice which gives the opening an appearance of continuity from water-table to

cornice. No stronger outlining of the openings on a vertical plane was used as it would have conflicted with the plain surface treatment. An effect of greater height is obtained at the end of the building by centering the outlet windows with the apex of the roof and placing them above the cornice, backing up the feature with a parapet wall with the coping sloping with the slope of the roof. This feature definitely distinguishes that portion of the building that has three stories from the part which is only one story in height.

The entrance feature, standing as it does by itself, focuses the eye, receiving sufficient attention as an entrance and fulfilling its mission in carrying out the motif selected. As a secondary feature it is directly connected with the generating floor where the first stages of the transformation of energy takes place. From this point the eye is drawn up to a group of windows placed directly over the entrance up under the cornice and centering with the feature below. The eye, then, naturally travels along the horizontal cornice, especially as there is no break over these windows, to the outlet window feature which is the point of departure for the generated electric energy and the raison d'etre of the whole building. It also is the center of the highest portion of the building. The eye naturally runs up, then down this feature and the impression of height is given.

These outlet windows are in groups of threes. Each window is seven feet in height and breadth, and glazed with two pieces of plate glass spaced 10 inches apart, with a twelve-inch diameter hole cut in the center through which a single wire passes. A concrete hood is placed over them to prevent the snow from piling up on the cornice, and on becoming dirty forming a ground for the electric current. Outlets for additional lines are also provided on the up-hill side of the building, and give to this elevation an individuality of its own, which, however, is in keeping with the rest of the design and is led up to from the river elevation by the treatment of the end elevations.

This up-hill side of the building, now that the present approach to the plant is by the tramway, is, aside from the roof, the first view one gets of the Drum Power-House. The roof, however, is the first glimpse one has through the pine trees from quite a height above, so crushed red brick and terra cotta tile were used as a finish in place of the usual gravel. As there are none of the usual unsightly projections on the roof, it presents in appearance an even unbroken, deep red mat through the various shades and tones of the green pine trees.

The finish of the building is of white cement, with a little yellow ochre added to give a slight indication of yellow or light buff, which absorbs the stronger rays of hot sunlight and relieves the glare that would be reflected from a white surface. The texture of the plain surface is roughened by a stippling process which also helps to tone down the reflected light. The cornice and raised members are finished smooth, causing them to look lighter than the roughened surface, thus furnishing an interesting contrast which helps materially in setting off the lines of the design and making up for the necessary lack of ornament. The base of the building below the water table is faced with native rock, creating an impression of harmony with the surroundings.

When the bank at the back of the building is terraced off and planted with Jerusalem oaks—shrubs native to these hills, which grow low on the ground forming a green carpet, and when the bank at the north end of the building is removed and terraced down to the base line of the building, and the space between the building and river parked with trees and shrubbery native to the location, the whole will make a very imposing appearance.

A James Hugh Wise Library

"Pacific Service" plans a lasting tribute to the memory of the eminent young engineer under whose direction the construction work on our South Yuba-Bear River development was started

IT is now little more than a year since the sad accident to James H. Wise took from our midst one who, though young in years, had already made his mark in the great world and who, if he had been spared, would have known no halt in his onward march. During the year that has passed his friends and admirers in "Pacific Service," headed by Mr. Britton, have discussed plans for a fitting monument to his memory. Various ideas have been suggested, and now it has been decided that the monument shall take the form of a company library, to be known as the James Hugh Wise Library, with the books and pamphlets which the eminent young engineer left behind him as the nucleus thereof.

The movement took definite shape at a meeting called by Mr. Frank G. Baum on October 7th. A committee was appointed, with Mr. John A. Britton as Chairman, Mr. S. V. Walton Treasurer and Mr. J. P. Baloun Secretary. A valuation committee appointed by Mr. Baum estimated the value of "Jim" Wise's books and pamphlets at $300.00. A check for this sum was at once handed to Mrs. Wise, and a subscription list opened among the men of the company to make good the amount.

The following sketch of the proposed memorial is from the pen of Mr. J. P. Baloun:

As a memorial to our late Mr. James H. Wise, popularly known to us all as "Jim," it seems most fitting that the books he so dearly loved and was so constantly associated with should be made the foundation on which to construct a pleasing remembrance of him who was so dear to all of us.

What a contrast to the Assyrian and Babylonian collections of inscribed bricks and tiles is the modern library! The libraries of today have taken such an important position in the educational policy of nations that the immense files in several individual cases exceed 1,000,000 volumes. The Egyptian King, Osymandyas, who is accredited with having the first library, properly so called, of which we have any record, well inscribed his library temple when he had a phrase chiseled on its portals, which, translated, read "the storehouse of medicine for the mind." The downfall of the ancient empires involved the destruction and scattering of these libraries; but the progress of education amongst the masses was inevitable, even in the darkest of the dark ages, and the protecting walls of churches and monasteries secured from loss many valuable private libraries.

That the importance of the library as an educational factor is now recognized everywhere is shown by the attitude of all our state governments, schools and many of the largest corporations, in having special or reference libraries, which in due time become enlarged in their scope for broader work. The affiliation of several smaller libraries with one another is another exemplification of the old adage, "in union there is strength." The value of such associated libraries lies in giving each of them the use of the whole aggregate selection of books, etc. It is the intention of the writer to secure from the U. S. Government Printing Office and its various channels, the scientific, mining and agricultural departments, copies of pamphlets covering subjects which will be of appealing interest to the employees of this Company; also, to secure through other libraries in the United States and Europe contributions and exchanges for the benefit of all concerned. Due to the broad basis on which the library is to be conducted and the interest aroused by a "home" library, which will have both a circulating and a reference department, it is expected that not only will the number of volumes in the files, both contributed and purchased, increase rapidly but, also, the range of subjects. Important pamphlets, manuscripts and magazines will be filed and classified according to their subject matter.

The late James H. Wise.

It is intended that at the beginning every employee of the Pacific Gas and Electric Company shall have access, in person or through the mails, to this library, by means of proper identification cards, etc. It is to be expressly understood that this library is not to be a place merely for the collection, storing, and care of books, but to be a center of education for reading and study, where the books will be selected with consideration for the needs of all interests concerned. It is hoped that at a not very distant date the library will be accessible to every consumer of "Pacific Service," whether for heat, light, water or power, whereby our employees and patrons may be brought closer together for the one common purpose of good fellowship and the united interest that is created and stimulated by having good books within reach.

At present all plans for the launching of this library are tentative. Full details will be given after being properly formulated. The work will be entered upon without delay.

The new office of "Pacific Service" in Fresno. It is in the heart of the business district, on the corner of J and Tuolumne Streets, and is capacious, comfortable and up-to-date.

Fresno District of "Pacific Service" Installed in New Quarters, Imposing, Capacious and Comfortable

By M. L. NEELY, Manager Fresno District

M. L. Neely

We of the Fresno District are justly proud of our new quarters on the corner of J and Tuolumne Streets.

The new home of "Pacific Service" in Fresno is a great improvement upon the old. It is finished throughout in light oak, with the furniture and counters to match, and the large plate glass windows in the front and along one side make it the best lighted as well as the best equipped office in Fresno. It is large and roomy, giving us adequate floor space for our present needs and for the increase in business that is bound to come in the next few years in as rapidly growing a city as Fresno. We have plenty of counter space to handle the rush between the first and tenth of the month without the confusion that was so common in the old office, and if necessary, can work seven men at the counter.

Ventilation is provided for by screened windows in the prism glass above the plate glass windows, and the installation of two large ceiling fans has done a great deal to temper the excessive heat that is sometimes experienced in Fresno during the summer months.

We have a fireproof vault, six feet square inside, containing a burglar proof coin safe, metal letter files and shelves for our registers and other books. This vault extends down into the basement where we have another vault for the storing of old records. We have ample space in our upstairs vault for complete records for two years, after which they are placed in transfer cases and moved down into the lower vault.

The basement extends the whole length of the office and our Arc Department is located there. We have a completely equipped repair shop and our arc business is now handled in a very satisfactory and efficient manner.

The Appliance Department is located in the rear of the office on the Tuolumne Street side, and there is always a fine display of stoves, water-heaters and other gas appliances to be seen there. In the appliance room is also located the receiving station for our telephone system, and one man now handles all trouble calls and counter orders there. We have moved our addressograph and meter books from the warehouse and they are now located in the appliance room, thus concentrating our office in one building and enabling us to handle our service in a much more efficient manner.

For publicity purposes our new location is without doubt unexcelled, as on J and Tuolumne Streets we have installed fifteen General Gas Light Company's ornamental posts, each carrying two three-mantle Humphrey inverted arcs. This lighting system is very efficient and has caused these two blocks to be nicknamed "Fresno's Great White Way".

Manager M. L. Neely reports the appointment of Mr. P. C. Funk to the position of superintendent of our gas works in the raisin city, taking the place of Mr. Charles Rice, who has returned to Chico.

"Mr. Funk will have charge of both gas manufacture and distribution, with an assistant under him in each department," writes Manager Neely.

Some of the Changes Being Wrought by Electricity

At the shrill command of his electric alarm clock John Smith, commuter, sprang out of bed in the grey dawn and switched on the electric light. He hastily washed with electrically manufactured soap. A seasoned veteran of the 7:42 express, he wasted few minutes in dressing, but before he was half clad the water was steaming hot in his electric shaving mug. Dashing down stairs he attacked a rapid-fire breakfast of eggs, electrically boiled, toast, electrically grilled, coffee, electrically percolated, and cream, electrically separated from milk electrically milked from electrically curried cows. He dashed out of his front door just in time to catch an electrically heated and propelled trolley to the railroad station built of electrically manufactured cement. While waiting for the 7:42 express he lighted an electrically made cigarette with an electrically manufactured match. When the express came buzzing up, Smith settled down in the smoking car to read his electrically printed morning newspaper.

Arriving in town he descended into an electrically lighted subway through which he was whisked on electric cars safeguarded by electric signals. He ascended to his twenty-story office in an electric elevator and touching an electric button summoned a stenographer with electrically curled hair who operated an electrically manufactured typewriter with electric—

Enough?

But it's not a joke!

One could take John Smith through every minute and hour of his business day, following him back home again until he turned in for the night—and every minute and hour of that day and night would be made in some way more convenient and comfortable by the marvels of electricity. There are hundreds of thousands, millions of John Smiths in every great civilized country today.

The change has come so gradually that we do not realize what a revolution electricity has wrought in modern life. There are few uses to which electricity is not put in modern industry and up-to-date households. For an infinite variety of work ranging from milking cows to making ice cream, from running sewing machines to washing dishes, from the manufacture of locomotives to the making of wall paper, effective and economical use is now made of electrical apparatus. Recently the Crocker-Wheeler company made a tabulation of the purposes for which one type only of their motors was used, and the following list includes only a small part of the products electrically manufactured: automobiles, barrels, baskets, boats, bolts and nuts, boots and shoes, bottles, boxes, bricks, brooms, candles, cans, carriages, cartridges, cement, chains, chairs, cigarettes, cordage, corks, elevators, envelopes, gun powder, hooks and eyes, hoops, ice, jewelry, locomotives, lead pipes, leather, lumber, matches, nails, oat meal, paint bags and boxes, pins, pottery, presses, rivets, rubber, silk, soap, spools, tacks, typewriters, wagons, wall paper and wire.

Some time in the early part of August Mr. J. D. Butler, Auditor of the San Francisco District, placed in the hands of our attorney a bill of $3.20 against a former customer who had moved to Edmonton, Alberta in the northwest Canadian territory. On August 22nd the customer aforesaid replied by wire:

"Yours received today. Been away. Sent order yesterday."

The wire came prepaid and the charges thereon were $1.75. Mr. Butler offers this as an illustration of scrupulous honesty in a customer.

Noting Progress of the World's Fair

President Charles C. Moore announces that not only will the Panama-Pacific Exposition open on time, February 20, 1915, but that it will be ready and completed, at that time, in every detail.

There is apparently no reason to doubt the accuracy of Mr. Moore's prediction. Reports show that progress on every phase of the Exposition has been unprecedented, particularly in the rapid construction of the exhibit palaces. Seven out of the eleven main palaces are on the way to completion. Mr. Moore, then, appears to have made no idle boast when he declared that by next July the nations of the world may commence delivering their exhibits on the Fair Grounds and installing them in their allotted buildings.

One of the most interesting pieces of construction work now going on is in Machinery Hall. The huge structure is crossed each way by a series of lofty naves 126 feet high, while the height of the building from floor to roof is 135 feet. The ornamentation placed on the exterior consists of a cement composition called imitation Travertine stone. It is a faint ivory yellow in color, several shades removed from white, and at a distance presents the appearance of white, to which it is considered superior as it is not so glaring in the brilliant sunlight. Some idea of the immensity of the Palace of Machinery may be gathered from the fact that while it is a wooden building, the largest in the world, it will require 1,500 tons of hardware in its construction, such as nails, bolts, joint plates, and the like. On October 1st the building was eighty per cent completed.

Many steamers are unloading lumber at the Exposition docks. More than 40,000,000 feet have been delivered out of the required amount of 70,000,000. As many as nine steamers are discharging cargoes at one time.

Exhibitors may have their exhibits delivered right on the ground from car or ship. The Exposition has its own freight ferry slip, which may be entered by car floats, bearing the cars with exhibits. The cars may then be taken to the desired building over the rails of the Exposition's standard-gauge railway system. The Exposition has also its own harbor and docks, where vessels from all parts of the world may moor and discharge cargoes. No trans-shipment will be necessary from time of first loading on car or ship.

The yacht harbor on the Exposition waterfront is about five acres in area and has such ample and convenient docking facilities that coastwise steamers and other craft, sometimes six or seven at a time, use it daily, discharging building material.

More than 6,000 applications have been received for amusement and other concessions. One hundred accepted to date involve a total expenditure of about $7,000,000. More than 7,000 people will be employed in the concessions district, and the total amount to be invested in amusements will probably aggregate $12,000,000.

Up to and inclusive of August 31, 1913, the cash receipts amounted to more than $6,000,000. The expenses to that date amounted to less than $5,000,000, and investment expenditures to $467,581.16, leaving a cash balance on hand of $1,279,264.64. The actual present available assets of the Exposition Company aggregate $11,978,811.50. It will require about $12,000,000 more to complete the work, and the actual net assets amount to this, without considering the sums to be derived from concessionaires, interest on money in bank and receipts from divers pre-exposition operations.

Twenty-eight of the world's nations, thus far, have officially signified their intention to participate in the Exposition with government displays. The plans of individual exhibitors throughout the world assure the representation of every land upon the globe.

Pacific Service Magazine

PUBLISHED IN THE INTERESTS OF ALL THE EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

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Issued the middle of each month

Year's subscription.................................$1.50
Single copy .... .15

Published by the
PACIFIC GAS AND ELECTRIC COMPANY
at 445 Sutter Street, San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. V NOVEMBER, 1913 No. 6

EDITORIAL

THE BIG JOB is nearing practical completion. The Spaulding dam has risen from its stream-bed to a height sufficient to admit of its being turned to immediate use. The Drum power-house stands proudly erect in the Bear river gorge below, its machinery all set and ready for the first charge of water to come sweeping down the penstocks. Between Spaulding and Drum the nine-mile span of tunnel and ditch is open for business. Below Drum a 110-mile stretch of steel-tower line awaits the hum of 33,000 horse-power of electric energy along its quivering wires. And all this has been accomplished in so incredibly short a space of time as to set the entire engineering world a-gape with the astonishment that spells admiration.

"Good work!" says the world; meaning, generally, that a fine piece of construction work has been put through in record time by skill, energy and resourcefulness, to say nothing of the expenditure of money. But to us of "Pacific Service" who have watched the Big Job grow, step by step, in the face of difficulties that if presented to weak and irresolute minds might have appeared all but insurmountable, and certainly would have entailed injurious delay, there is suggested another contributor to the successful result as having had more to do with bringing it about than any of the four that have been mentioned. And that greatest contributor is—Character !

To the largely accepted ideas concerning corporations and their methods it may appear incongruous, to say the least, to connect idealism with business, business with idealism. Yet to us who have been permitted to peep behind the scenes ever since the first spadeful of earth was turned on the Big Job, idealism appears to stand out in glorious relief, the idealism that consists in forming ideals and living under their influence. And in the practice of that idealism Character stands out as the strongest factor.

The value of Character in an institution such as ours is inestimable. It makes the spirit, rules the conduct of that organization, and in times of stress it makes or mars results. Some ideas of this principle as applied to the Big Job may be gathered from the story of the first pouring of concrete upon Spaulding dam. The story was well told by our Civil Engineer, Mr. Vensano, in the February number of PACIFIC SERVICE MAGAZINE. Mr. Vensano there recounted the difficulties and dangers that faced the engineers and their men when it was a question of laying above bed-rock a sufficient foundation to stand against winter storm and spring freshet. It was late in the year and the early snows were at hand. There was no time to lose. Well, just at the critical moment down came an early storm upon the scene, carrying away the flume leading from the diverting dam so that the waters again flowed over the site. Then it was that the Character of that working organization up there near the Sierra summit revealed itself. Never men worked at pumps to save ship from sinking with greater zeal than those men labored at their pumps to conquer the water that for a while seemed to rise despite their greatest efforts. And so it was done. Two paragraphs of Mr. Vensano's description tell the story:

"The concrete when poured was kept from freezing by the use of steam pipes over the completed mass and by the use of warm water for mixing. Can you see the men working in the wet river-bottom with the temperature at 25 degrees and small icicles forming wherever water leaked or splashed?

"The result of it all is that today the dam stands 38 feet high, with the river flowing over the spillway on one side of it to a point well beyond, and no matter what floods may occur in the early spring Spaulding dam will continue to rise without interruption."

That early start, with the fierce determination and resistless energy that enabled its accomplishment, shows its result today in the huge monolithic structure that stands 225 feet above bed-rock. That same determination and energy were manifested on each and every occasion when unforeseen difficulty stood between the Big Job and its completion. In May last, when things were going their merriest, an accidental overcharge of powder sent tons of rock tumbling into the gap and the waters again flowed over the dam site. But the consternation which this accident aroused lasted but a moment. In almost as little time as it takes to tell the story those men were at work again. Engineer and laborer worked side by side. Derricks went up as if by magic, and what had looked to be a catastrophe was turned to good account. For, those huge boulders that lay piled up in the river-bed were hauled out of there and made to take the place of just so much concrete in the dam. The Big Job went on as before. And now the tense period of watching and waiting is almost over, and "Pacific Service" is about to reap the reward of its confidence and courage.

What was it stimulated those men and made them rise superior to obstacles of any kind? What but Character, the dominant factor in the achievement of success? Who shall doubt the value of Character in an organization such as ours? It takes in every one, from the lowest to the highest in station, and places one in touch with another, if not on terms of perfect equality, certainly in the bond of common interest for the common weal. The general manager picks the men who are to carry the Big Job through and is with them in spirit, if not in person, day and night; the chief engineer is as an elder brother to his superintendents, and they, in turn, stand in the same relation to their foremen. Perhaps in the foremen most of all is this sense of Character necessary. A good foreman knows every man in his employ; knows his capacity to an inch, his temperament, his idiosyncracies, his foibles, his strength and his weakness. It is the little nod of recognition; the suggestion of an intimacy existing outside the relation of employer and employee; the kindly word at the right moment, and, just as necessary, the iron hand when there is absolute need for it. It is that something that makes the great general, and enables him, martinet though he may be, to lead his men to the death without a fear of desertion in his ranks. It makes the executive in every walk of life, and there is call for the display of executive ability on the part of each individual forming a link in the chain that binds a big organization together.

So there is something more than the employment of brains, skill and human force in the accomplishment of a feat such as that we are celebrating just now. And that something makes just the difference between greatness and mediocrity, between complete success and the partial success which is part failure.

We expect to present to the readers of Pacific Service Magazine next month an exceptionally interesting Christmas number which will be attractive in dress and unusually interesting in the seasonable character of its reading matter.

Beginning Sept. 26 and ending Oct. 5th there was held in San Francisco the first Mechanics' Fair since the fire. Its success was pronounced and augurs well for the future.

The Fair was held in the Pavilion and Dreamland Rink, combined, and the Pacific Gas and Electric Company had a booth situated in one of the most advantageous parts of the pavilion. It was four hundred square feet in area, and was made up into a rest room. No appliances of any kind were shown. The room was fitted up with weathered oak furniture, Mission style, while Turkish rugs on the floor gave it a home-like appearance. The general effect was aided by four beautiful lamps casting a subdued light over the whole. Monthly magazines and papers were to be found upon the centre table for those who wished to read. At a desk was to be had writing paper and ink. Suspended over the whole was a large electric sign, "Pacific Gas and Electric Company," which could be read from any part of the pavilion.

For those who wished to learn what "Pacific Service" is and stands for stereopticon views of our different power plants were displayed upon a screen. The Lake Spaulding properties were the most admired. One visitor was heard to observe: "I now know why 'Pacific Service' is 'Perfect Service.' "

Our booth was one of the most popular in the fair. Moreover, we were awarded the gold medal and diploma for the best display of illumination.

A feature of the California Land Show held in San Francisco last month was the exhibit of the Schaw-Batcher Company, the iron and steel pipe manufacturers, the center of attraction being a section of riveted pipe over which appeared the following inscription in large letters:

"This section of pipe, 52 in by 1¼ in., is one of 1400 made for the high-pressure hydro-electric plant of the Pacific Gas and Electric Company in Placer County."

This gave visitors to the Land Show some idea of our construction work at Drum, while the size of the pipe impressed those who had been used to connect all piping for the conveyance of water with the sort of thing which has its beginning in house service-pipes and its ending in a street main. The piping was manufactured at the Schaw-Batcher factory on the peninsula and the company's booth was made a part of the San Mateo County exhibit.

All the interior counties had special features illustrative of their progress. Placer County had a fine show of fruit and on October 21, being Placer day, three carloads of peaches were given away at the County's exhibit. It is worthy of mention here that our Mr. H. M. Cooper, manager of the Placer District, is now president of the Auburn Chamber of Commerce.

Excerpts from the diary of a fair member of "Pacific Service:"

"September —.

"Another secret kept from us! Miss Sadie Pierce of Mr. Henley's office announces that she has been engaged to Mr. William Wales, formerly of this company, for several months!

"September —.

"The reunion was held last night, and an enjoyable time we had. A miscellaneous shower of gifts was inflicted upon the bride-to-be, the most useful, perhaps, a fumed oak writing-desk. Those present were:

"Sadie Pierce, Land Dept.; Hazel Moulthrop, Land Dept.; Gertrude Glazier, O. & M. Dept.; Mary Murphy, O. & M. Dept.; Emily Loewenguth, General Manager's Office; Blanche Sonneborn, Civil Engineering Dept.; Tess Ryan, Electrical Construction Dept.; Mrs. Marguerite Holton, Claims Dept.; Maude Smith, Electric Distribution Dept.; Emma Ehlinger, Engineer Dept.; Mary Curtis, O. & M. Dept.; Rosa Lamont, Drafting Dept.; Letitia Curtis, Engineering Dept.; and Mrs. Paul McCarthy, Mrs. Geo. Taylor, Mrs. Lawrence B. Morton and Violet Lamont, formerly of the company.

"October —.

"The nuptials took place at the home of Miss Pierce in Oakland on October 1st, and the happy pair are now on an automobile trip. Where? We do not know. We all wish Mr. and Mrs. Wales every happiness!"


Miss Elizabeth Gleeson

In another place will be found an account of the Portola Girls' contest in San Francisco, which was won hands down by the Pacific Gas and Electric Company's representative, Miss Elizabeth Gleeson. Here is Miss Gleeson's own account of the trip she enjoyed as the result of her victory:

"Left San Francisco Saturday, October 6th, on steamship 'Governor' and arrived in Seattle Monday, 11:30 p. m., five hours late owing to very heavy storms encountered on trip. During the two days spent in Seattle we were splendidly entertained by Chamber of Commerce and Press Club on auto trips, banquets and balls. Left Wednesday morning for Victoria, the very quaint, picturesque but decidedly aristocratic English city of the north. Thursday we took the boat for Vancouver. This was indeed a beautiful trip. The boat steadily winds its way in and out between the many small but beautiful islands that so thickly stud Puget Sound.

"Friday we spent in Tacoma where we were entertained by Board of Trade and Commercial Club at a splendid banquet and ball.

"Saturday we left for Portland and upon our arrival were welcomed by the Mayor and a committee of thirty Royal Rosarians. This greeting was one never to be forgotten and conveyed to the girls a fine idea of the sincerity of the 'Portland Spirit.' Our stay in Portland was a repetition of the visit in Seattle, one of continued pleasure such as girls get from balls, parties and automobile rides.

"When we turned our thoughts homeward and bade farewell to our official escorts and the friends we made while in Portland, the hospitality of the Portland people was further extended in the form of an earnest invitation to come again in the near future.

"All the girls were unanimous in acknowledging this trip of ten days to be one of continual good times and expressed freely their thanks to their employers and friends through whose kindness they were able to make this glorious trip."

Miss Alma I. West, stenographer in the office of Mr. R. J. Cantrell, Property Agent, desires to thank all those who cast their ballot in her favor in the recent Popularity Contest. As she will be unable to thank each one individually, she takes this means of expressing her appreciation.

"Electricity on the Farm, and the Power Problem presented by its ever increasing use," was the subject of an address delivered by Mr. Stanley V. Walton, Manager of the Commercial Department, at the University of California, October 21st.

Mr. Walton is a Berkeley boy himself, of the class of '04, and a large audience, consisting mostly of members of the U. C. Agricultural Club, gathered in the Agricultural building to hear him. His lecture was illustrated with lantern slides.

The North American Dredging Company is engaged on a two-year contract, dredging Mare Island channel for the government. This dredger is being supplied by power from our North Tower substation, the load being about 1200 horsepower. The dredger operates continuously 24 hours a day and every day in the year barring accidents. The power is carried to the dredger at 11,000 volts by means of a pole line extended into the channel a short distance and then by submarine cable. The transformers are located on a barge alongside the dredger. The mud and silt is being pumped to the west side of Mare Island back of a breakwater which has been recently constructed, in some cases a distance of half a mile from the dredger.

As previously mentioned, the San Francisco Bridge Company is doing some dredging on the western side of Mare Island in San Pablo bay. The dredger itself is operated by a steam turbine installed on the boat. A booster pump of 350 horsepower capacity installed about midway between the dredger and the end of the pipe line is operated by "Pacific Service" power. To supply this power it was necessary to extend our 11,000-volt line across Mare Island and into San Pablo bay, a distance of 2¼ miles, to the transformers which are located with the pumping station on the pile structure.

The American Dredging Company has just received a contract from the United States government for dredging in the Oakland estuary east of Webster street bridge. Power for supplying this dredger will be taken from our 11,000 volt line along First street in Oakland. The dredger will require about 800 horsepower. It is estimated that the job of dredging will last from 1½ to 2 years, the dredger working 24 hours per day.

The H. W. Johns-Manville Company is actively engaged in selling throughout our territory a small ice-making and refrigerating machine known as the Audiffren Refrigerating Machine. This machine is made in small sizes suitable for use in a restaurant, butcher-shop, country grocery-store, saloon, dairy or private residence, sizes varying from a capacity of 10 pounds of ice per hour, which is equivalent to 16 pounds of refrigeration, to 100 pounds per hour, which is equivalent to 160 pounds of refrigeration, the smallest machine taking a one-half horsepower motor. This machine operates most satisfactorily when working continually 24 hours per day and is proving very valuable to consumers taking power at our regular power-rate. The local representative of the H. W. Johns-Manville Company advises that he has a large number of inquiries for the machine throughout our territory although the machine has only been on the market a little over a year. The refrigerating process instead of being dependent on ammonia, which is more or less dangerous, is dependent on SO_2 gas which is confined in a hermetically-sealed condenser. This machine is proving very satisfactory wherever installed.

The Spring Valley Water Company is now engaged in building a large hydraulic-filled dam on Calaveras Creek in Alameda County. The machinery for handling this will require power to the extent of 1500 to 2000 horsepower, which is being supplied by our company over an extension of the 60,000-volt line from a point near Sunol. This work is being carried on night and day and will require several months for completion.

A contract has been entered into with the Trustees of Reclamation District No. 108 in Colusa and Yolo counties for supplying power for a 3000 horsepower Reclamation pumping plant which is being erected on the Sacramento river at Rough and Ready Landing. The plant is being installed by C. C. Moore & Co. The area drained by this pumping plant is approximately 55,000 acres, being the largest Reclamation project in California.

How Our Company's Girl-Candidate Won Portola Festival Honors

By CHARLES L. BARRETT, Campaign Manager for Miss Elizabeth Gleeson

C. L. Barrett

September 5th, after a spirited voting contest among the employees of the San Francisco district under direction of Mr. Geo. C. Holberton, and during which 863 votes were cast, Miss Elizabeth Gleeson, one of our bill payment receivers, was chosen the company's most popular girl candidate for the triumphal trip to be given by the Portola Festival Committee to Oregon and Washington. This was but one of twenty-three selections that were being made in similar manner in hotels and commercial houses throughout the city.

The real work of campaigning commenced September 14th, at which moment the eligible list closed. The twenty and odd girls involved in the contest selected managers to look after their interests and assist in inventing schemes to effect the sale of votes in their favor. These votes had a sale price, prearranged by the Portola Committee, of one cent each. Midway in the contest the committee, wishing to ascertain the standing of the contestants, requested a counting of votes, and, to give additional zest to the struggle, offered two articles of jewelry dear to feminine minds and hearts, a solitaire diamond ring and a watch-bracelet, as first and second prizes. The company's candidate, Miss Gleeson, won the ring with a showing of 272,100 votes, the bracelet going to Miss Lulu Bettanier, the candidate of the St. Francis Hotel, with 168,295 votes. Miss Gleeson's friends outside the company were exceedingly active in her behalf, while the company's patrons and supporters responded most generously to the calls sent out.

An incident which occurred during the heat of the campaign is of interest as showing the growing attitude of confidence on the part of the public toward this company. One of our consumers, a large apartment house lessee, entered my office one day and said, modestly and without ostentation, "Mr. Barrett, I am the lessee of the ——— Apartments. I understand the company is backing one of the young lady Portola contestants. To show my appreciation for the decent treatment I have always received at the company's hands I want to make a contribution toward her candidacy. Here is twenty-five dollars; and Mr. ———, owner of the Hotel ———, a friend whom I happened to meet on my way to the office and to whom I spoke of my errand, has asked me to donate the same amount for him." Whereupon he placed $50.00 in gold upon my desk. I considered this incident, wholly voluntary in nature, worth every effort of the arduous campaign.

As the last days of the contest approached every conceivable effort was made to increase the totals. Our candidate was hostess at three dances, one, in particular, being not only brilliant in character but successful financially. On the evening of October 6th, in the presence of several hundred persons, the final count of votes was had in the tapestry parlor of the St. Francis Hotel. Miss Gleeson again showed a handsome plurality over all other contestants, thereby acquiring, in addition to the trip proper, a number of privileges and prizes donated by the Portola Committee and various local dealers, including $100 in pin money, a $100 hat, the best stateroom on the "Governor," a Pullman drawing-room on the train returning, a personal maid for the entire journey, the selection of any pair of shoes in our best dealer's shop, and a number of other very nice gifts.

This highly exciting and interesting controversy polled 2,113,312 votes and netted over $21,000 to the Portola Festival Committee.

PACIFIC GAS AND ELECTRIC COMPANY

DIRECTORS

F. B. Anderson
Henry E. Bothin
John A. Britton
W. H. Crocker
E. J. De Sabla, Jr.
F. G. Drum
John S. Drum
D. H. Foote
Wm. G. Henshaw
A. F. Hockenbeamer
Samuel Insull
John Martin
C. O. G. Miller
Louis Sloss
George K. Weeks

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F. G. Drum .... President
John A. Britton .... Vice-Pres. and Gen. Mgr.
A. F. Hockenbeamer, 2d Vice-Pres., Treas. and Comp.
D. H. Foote .... Secretary and Asst. Treasurer
J. C. Love .... Asst. Treasurer
Charles L. Barrett .... Asst. Secretary

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W. H. Kline .... General Agent
R. J. Cantrell .... Property Agent
George C. Robb .... Supt. of Supplies
J. H. Hunt .... Purchasing Agent
E. B. Henley .... Manager Land Dept.
J. P. Coghlan .... Manager Claims Dept.
H. Bostwick .... Secretary to President
F. S. Myrtle .... Manager Publicity Dept.
L. H. Newbert .... Manager Appliance Dept.
G. C. Holberton.. Chief Eng'r Stockton Water Dist.
W. B. Bosley .... Attorney
H. C. Vensano .... Civil Engineer
E. C. Jones .... Engr. Gas Dept.
H. P. Pitts .... Industrial Engineer
S. V. Walton .... Manager Commercial Dept.
S. J. Lisberger .... Engr. Electric Distribution
Sherwood Grover ... Asst. Engr. Gas Department
J. P. Jollyman ..... Engr. of Electric Construction
P. M. Downing .... Engr. O. & M. Hyd.-Elec. Sect.
C. J. Wilson ..... Asst. Engr. Electric Distribution
F. H. Varney .. Engr. O. & M. Steam & Gas Eng. Sect.
F. G. Baum .... Chief Engineer Hydro-Electric Dept.

DISTRICT MANAGERS

District	Headquarters	Manager
Alameda Co., Berkeley, Oakland	Oakland	F. A. Leach, Jr.
Chico	Chico	H. B. Heryford
Colusa	Colusa	L. H. Hartsock
Contra Costa	Martinez	Don C. Ray
Fresno	Fresno	M. L. Neely
Grass Valley	Grass Valley	John Werry
Marysville	Marysville	J. E. Poingdestre
Marin	San Rafael	W. H. Foster
Napa	Napa	O. E. Clark
Nevada City	Nevada City	John Werry
Petaluma	Petaluma	H. Weber
Placer	East Auburn	H. M. Cooper
Redwood	Redwood City	E. W. Florence
Sacramento	Sacramento	C. W. McKillip
San Francisco	San Francisco	G. C. Holberton
San Jose	San Jose	J. D. Kuster
Santa Rosa	Santa Rosa	M. G. Hall
Solano	Dixon	C. E. Sedgwick
Stanislaus	Newman	W. A. Widenmann
Vallejo	Vallejo	A. J. Stephens
Woodland	Woodland	W. E. Osborn

MANAGERS OF WATER DISTRICTS

Colfax (Colfax) .... Jas Martin
Nevada (Nevada City) .... George Scarfe
Placer (East Auburn) .... H. M. Cooper
Standard (Electra) .... W. E. Eskew
Stockton (Stockton) .... J. W. Hall

SUPERINTENDENTS OF POWER DIVISIONS

Colgate .... Miles Werry
De Sabla .... I. B. Adams
Electra .... W. E. Eskew
Marysville .... E. C. Johnson
Nevada .... George Scarfe
North Tower .... C. D. Clark
Oakland .... William Hughes
Sacramento .... J. O. Tobey
San Jose .... J. O. Hansen
South Tower .... A. H. Burnett
Stockton .... E. C. Monahan
Solano .... J. W. Coons

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H. N. Mosher..... Chief Engr. Station "C," Oakland
C. A. Eastwood.... Supt. Station "A," San Francisco
J. W. Varney .... Supt. of Sub-Stations, San Francisco.

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Berkeley .... J. H. Pape
Oakland (Underground) .... R. C. Powell
Oakland and Alameda (Overhead) A. U. Brandt
Marin .... Chas. Dallerup
Redwood .... R. C. Bragg
Sacramento .... C. R. Gill
San Francisco .... A. R. Thompson
San Jose .... A. C. Ramstad
Valley District (Chico, Marysville, Woodland and Colusa) .... W. F. Blide

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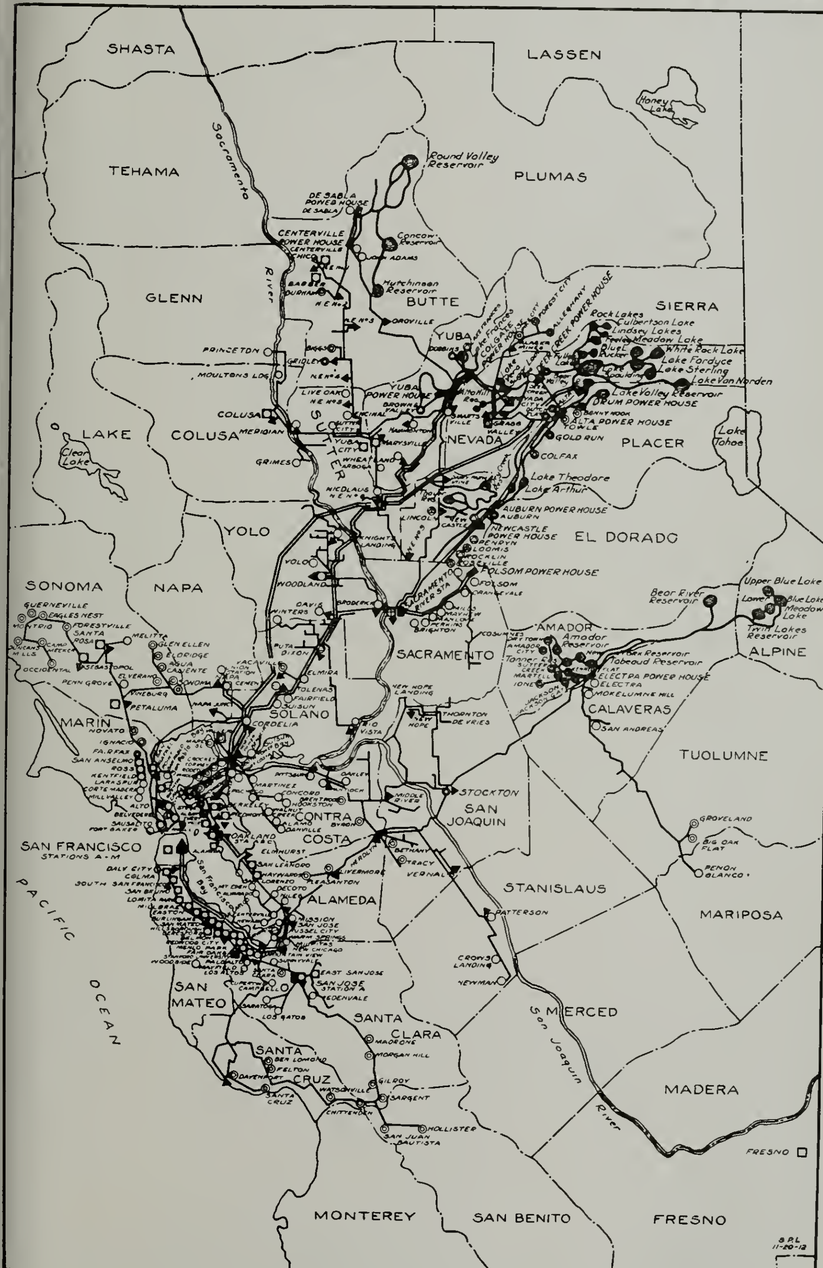
Martin Station .... John Mitchell
Oakland .... A. C. Beck
Sacramento .... Edward S. Jones
San Francisco .... Dennis J. Lucey
San Jose .... R. H. Hargreaves

SUPERINTENDENTS OF GAS DISTRIBUTION

Oakland .... George Kirk
San Francisco .... D. E. Keppelmann
Superintendent of Railway Department .... N. J. Hullin


SHASTA
LASSEN
Honey Lake
TEHAMA
Round Valley Reservoir
PLUMAS
Sacramento River
DE SABLA POWER HOUSE
CENTERVILLE POWER HOUSE
Concow Reservoir
Hutchinson Reservoir
GLENN
BUTTE
OROVILLE
YUBA
SIERRA
Rock Lakes
Culbertson Lake
Lindsey Lakes
White Rock Lake
Lake Fordyce
Lake Sterling
Lake Van Norden
Lake Valley Reservoir
DRUM POWER HOUSE
ALTA POWER HOUSE
PRINCETON
MOULTONS LDG.
COLUSA
MERIDIAN
LAKE
Clear Lake
COLUSA
SUTTER
NEVADA
GOLD RUN
PLACER
Lake Tahoe
COLFAX
GRIMES
Lake Theodore
Lake Arthur
AUBURN POWER HOUSE
AUBURN
NEWCASTLE POWER HOUSE
YOLO
EL DORADO
FOLSOM POWER HOUSE
FOLSOM
SONOMA
NAPA
WOODLAND
Upper Blue Lake
Bear River Reservoir
Blue Lake
Meadow Lake
Twin Lakes Reservoir
AMADOR
Amador Reservoir
ALPINE
SACRAMENTO
Tabeaud Reservoir
ELECTRA POWER HOUSE
ELECTRA
CALAVERAS
SAN ANDREAS
PETALUMA
MARIN
SOLANO
TUOLUMNE
STOCKTON
SAN JOAQUIN
CONTRA COSTA
SAN FRANCISCO
STATIONS A-M
GROVELAND
BIG OAK FLAT
PENON BLANCO
PACIFIC OCEAN
STANISLAUS
ALAMEDA
MARIPOSA
PATTERSON
San Francisco Bay
SAN JOSE
EAST SAN JOSE
SAN MATEO
SANTA CLARA
LOS GATOS
MERCED
San Joaquin River
SANTA CRUZ
GILROY
WATSONVILLE
MADERA
HOLLISTER
SAN JUAN BAUTISTA
FRESNO
MONTEREY
SAN BENITO
FRESNO

Pacific Gas and Electric Company

CITIES AND TOWNS SUPPLIED WITH GAS, ELECTRICITY, WATER AND RAILWAY

Service Furnished	Number of Towns	Total Population
Electricity	209	1,093,992
Gas	51	989,167
Water	25	52,865
Railway	1	71,000

Place	Population
Alta	20
[1] Alameda	25,000
Alamo	50
[2] Albany	800
[5] Amador City	200
Adams John	25
Alleghany	200
Alto	25
Angel Island	280
[5] Auburn	2,375
Agua Caliente	100
Alvarado	900
Antioch	3,000
Arboga	100
[2] Barber	500
[2] Belmont	350
Ben Lomond	800
Belvedere	1,000
Benicia	3,360
[2] Beresford	25
[2] Berkeley	40,000
Biggs	750
Big Oak Flat	20
Brentwood	200
Brighton	100
Broderick	200
[5] Brown's Valley	50
Byron	200
[2] Burlingame	4,000
California City	25
Camp Meeker	200
Campbell	600
Centerville	1,000
Centerville	20
[2] Chico	13,000
[2] Colma	3,500
[2] Colusa	1,500
Concord	1,500
Cement	1,500
[5] Colfax	500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Cupertino	50
Daly City	250
Danville	250
Davis	750
Decoto	350
de Sabla	25
[5] Dixon	1,000
[5] Dobbins	50
Davenport	1,000
[5] Drytown	20
Durham	500
[5] Dutch Flat	500
Duncan's Mills	150
[2] Easton	300
[2] East San Jose	1,660
Eagle's Nest	50
Edenvale	500
Eldridge	500
Elmira	150
El Verano	400
Electra	50
[2] Emeryville	5,000
Encinal	100
Fairfax	500
Fairfield	834
Forestville	100
Felton	300
[1] Fresno	30,000
[2] Fair Oaks	250
Folsom	1,800
Gilroy	2,000
Glen Ellen	500
[5] Gold Run	100
[3] Grass Valley	4,500
Gridley	1,800
Grimes	250
Groveland	125
Guerneville	500
Hammonton	500
[2] Hayward	4,000
[2] Hillsborough	1,000
Hollister	3,000
Hookston	75
Ignacio	100
[5] Ione	900
Irvington	1,000
[5] Jackson Gate	100
[5] Jackson	2,035
[5] Kennedy Flat	20
[2] Kentfield	250
Knight's Landing	350
[5] Lake Francis	5
Lathrop	300
Live Oak	200
Livermore	2,250
Los Gatos	3,000
[2] Larkspur	600
[5] Lincoln	1,400
[2] Lomita Park	100
Los Altos	500
[5] Loomis	400
Maletta	30
Manlove	50
Martinez	5,000
[5] Martell	150
[2] Marysville	7,000
Mayfield	1,500
Mayhew	50
[2] Menlo Park	1,500
Meridian	300
[3] Millbrae	300
Mills	50
Milpitas	300
Mill Valley	2,500
Mission San Jose	500
Mokelumne Hill	150
Monte Rio	50
Moulton's Landing	30
Mountain View	2,500
Mt. Eden	200
Mare Island	500
[2] Napa	7,000
[3] Nevada City	2,700
[5] New Chicago	10
Newark	700
[5] Newcastle	750
Newman	1,000
Niles	800
Nicolaus	75
Novato	250
[3] Oakland	230,000
Oakley	80
Orange Vale	100
[2] Palo Alto	6,300
Pacheco	200
Penryn	250
Patterson	300
Penn Grove	300
Perkins	50
[2] Petaluma	5,500
[2] Piedmont	1,720
Pike City	200
Pinole	1,500
Pittsburg	2,372
Pleasanton	2,000
Point San Pedro	20
Port Coata	600
[2] Redwood City	3,200
[2] Richmond	10,000
Rio Vista	884
[5] Rocklin	1,000
[5] Roseville	2,600
Rodeo	500
[3] Ross	500
Russel City	250
[4] Sacramento	71,000
San Andreas	200
[2] San Anselmo	1,500
[2] San Bruno	1,500
[2] San Carlos	100
[2] San Francisco	416,912
[2] San Jose	30,000
[3] San Leandro	4,000
San Lorenzo	100
[2] San Mateo	6,500
[2] San Quentin	2,500
[2] San Rafael	6,000
San Pablo	1,000
Santa Clara	6,000
Santa Cruz	16,000
Saratoga	50
[2] Santa Rosa	12,000
[3] Sebastopol	1,200
Sausalito	2,500
Smartsville	500
[2] South San Francisco	2,500
[2] Stanford University	2,600
Sonoma	1,200
Stege	1,000
[5] Stockton	30,000
Suisun	1,200
Sutter City	150
Sutter Creek	1,500
Sunnyvale	1,500
Tiburon	400
Tormey	20
Towle	100
Tracy	1,200
Union Station	40
Vacaville	1,200
[2] Vallejo	15,000
Vineburg	200
Walnut Creek	350
Warm Springs	200
Watsonville	4,500
Wheatland	1,400
Winters	1,200
[2] Woodland	3,200
Woodside	200
Yolo	400
[3] Yuba City	1.200
Total	1,148,992

Unmarked—Electricity only
1—Gas only.
2—Gas and Electricity.
3—Gas, Electricity and Water.
4—Gas, Electricity and Street Railways.
5—Electricity and Water.

EMPLOYS 4,800 people.
OPERATES 11 hydro-electric plants in the mountains.
5 steam-driven electric plants in big cities.
16 gas works.

SERVES ⅔ of California's population.
30 of California's 58 counties.
An area of 37,775 square milea.
⅗ the size of New York State.
½ the size of all the New England States combined.

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Pacific Service Magazine

VOL. V — No. 7

Yearly Subscription $1.50 :: :: Single Copies, Each, 15 Cents

Contents for December

"When God outspread His spotless snow a carpet for the coming year."

PACIFIC SERVICE MAGAZINE

VOL. V DECEMBER, 1913 No. 7

California's Christmas

×

BY JOHN A. BRITTON

×

OUR STATE

Its eastern rim bold hills of granite gray,
Snow-capped, serrated to the skies of blue;
Its western edge by tropic waves embraced
And 'tween them valleys vast, and rivers, too.

PROLOGUE

Where is God's temple? does its vaulted dome
Uprise on piers of steel and stone,
With cornice line on line to fret the sky,
Or is it in our hearts alone?

Its place may lie where Nature's mood is found,
Where granite crags and towering trees
Point upward and in silence all profound
The temper of the gods appease;

Fantastic spiders weave their silvery webs
From pine to fir, from fir to pine,
And drops of crystal dew like strings of pearl
Hang all along the spiders' line;

Where strings of berries red, like coral, hang,
And Christmas trees are crown'd with snow;
While dangling sprays of frozen spiders' webs
From bush and tree and rock do flow.

THE PLAY

Kriss Kringle rings his Merry Christmas bells
On snow-clad hill and icy plain,
In furry coat with prancing reindeer team
That stir impatient under rein.

On sun-kissed hills and in the pleasant vales,
'Mid poppies red as sunset's glow,
He winds his way with songs of plumaged birds
To where the purple lupines grow.

The snow-clad peaks, with Christmas trees agleam,
Look down on purling streams of white
That chase o'er rocks and fens and shady glades
To valleys green and gardens bright.

Wild roars the peal of thunder 'tween the hills;
The lightning plays amid the trees;
The brilliant sun bejewels fertile plains
While ocean ripples to the breeze.

Oh! land of arctic robes and tropic sun,
Of snow and ice and carpets green;
Of grizzly, giant trees that touch the dome
Of that great space as yet unseen!

✠

For these our California Christmas days,
From frozen east to tropic west
We send this gladsome message to you all
To you who love our State the best.

May blessings sweet your every path attend
Through all the days that are to come,
And joy and peace and every comfort cling
To thee, California, our home!

SAN FRANCISCO, DECEMBER 1, 1913.

Starting the Drum Plant

By F. G. BAUM, Chief Engineer Hydro-Electric Department

On Wednesday, November 26th, on the eve of Thanksgiving, the following dispatch from General Manager John A. Britton at Drum was received at "Pacific Service" headquarters in San Francisco: "Drum synchronized with 'Pacific Service' at 10:56 today. Everything from Spaulding to Cordelia in perfect harmony."

This dispatch, laconic in its brevity, meant much to the Pacific Gas and Electric Company. It meant not only that the work upon which so many hopes had been set was an accomplished fact, but that it had stood the test and had not been found wanting; that the big Lake Spaulding dam was already in service; that the water impounded by it was rushing through tunnel and ditch down Bear Valley and with the gigantic force of a drop of 1375 feet was turning the wheels in the Drum power-house in the gorge below; that the electric energy generated there was already on its 110-mile journey across country to Cordelia, contributing its share to the sum total placed at the disposal of the Company's consumers.

How well the Big Job has stood the test was revealed subsequently in the report presented by Mr. F. G. Baum, the engineer under whose direction the South Yuba-Bear River development was brought to completion. The report contained this sentence: "It is interesting to note that not a single mechanical or electric weakness developed in the entire system from Spaulding to Cordelia." That sentence spoke volumes; it told the story of a great work well done.

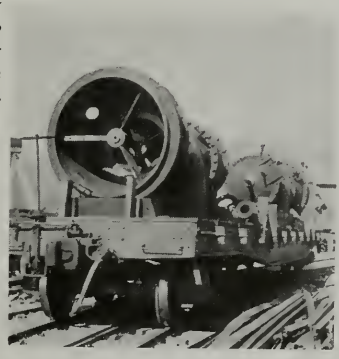
And now Mr. Baum himself, in his own modest way, tells the story of the final touches put to the great work and how on the day mentioned above the simple closing of a switch put the entire plant in operation. Like many men who do things, Mr. Baum is a man of few words. The story which he presents to our readers speaks for itself and does more, perhaps, than anything we could offer in the way of editorial comment to reveal the character of the man from whose shoulders the burden of a tremendous responsibility has just been lifted.

Editor Pacific Service Magazine.

F. G. Baum

THE last work on the various sections of the Drum development for the initial testing was done on November 22d. On that day the last concrete was placed in in the dam and tunnel, and the Forest Reserve siphon was completed. On the following day, November 23d, about 10:30 a. m., the first water was turned through the tunnel and on through the 9-mile canal to the forebay. The water reached the forebay about 8 o'clock on the evening of that day and was immediately turned in to fill the pressure pipe, which had previously been about one-half filled. At 5 a. m., November 24th, I notified Mr. J. P. Jollyman that the pressure pipe was full and ordered him to start "rolling over" the generators to dry them out.

On November 26th, about 10:50 a. m., No. 1 unit in Drum power-house was formally started by Mr. John A. Britton, Vice-President and General Manager, and synchronized with the system at 10:56 a. m. A few minutes later one nozzle was opened to give delivery of 6000 K. W. at Cordelia. On December 3d the governors were adjusted and now the units are in regular operation subject to orders from the Load Dispatcher, although the Drum plant will not be formally turned over to the Operating Department until December 20th.



Discharge controlling valves for use at Spaulding dam.

The plant passed through all tests with a clean score, not a single defect, electrical or mechanical, developing. This is indeed gratifying to those in charge of the design and construction; all parts of the plant were ready practically at the same time.

It may be said of the Drum plant that it satisfies everyone who has had anything to do with the work and everyone who has seen it. I doubt if there is a better plant in existence today, and as it is the first of a series to be built by the Company, after a number of years of hydro-

Drum forebay and the canal that empties into it at the end of a nine-mile journey from Spaulding.

electric inactivity, it is gratifying to have the results in every way fully up to expectations—with some to spare. High class apparatus was furnished by all manufacturers and high class construction maintains throughout the system.

I realize probably more than anyone what a "drive" it has meant to all concerned to complete the plant on time, but at no time, nor for one moment, did I lose confidence that the results would be obtained in some way, and in time for the need. It has been hard work for everyone and everyone is tired, but happy. Character has had the greatest opportunity to show, resulting in a number of pleasant surprises and, as usual, in a few disappointments.


Water discharge from Drum power-house checked by tail-race baffles.

It has been an interesting year's work with a satisfying result; and I am very thankful for the helpful and loyal assistance given by the men. I believe the efficiency of the organization has never been surpassed on any work, and to mention all the names of those contributing to the efficiency would require several pages of the Magazine. The Company treated the men fairly and received fair treatment by them, and it has been demonstrated that fair treatment pays well.

In a paper read at St. Louis before the International Electrical Congress in 1904, I told of the success of 60,000 volt transmission and predicted that in a few years the 60,000 volt lines would really become primary distributing lines and that the real transmission of power would be at a much higher voltage. The Drum plant and the transmission line to Cordelia fulfill that prediction, and with a similar line delivering power at Mission San Jose the ideal condition of the system for the economical delivery of the largest amount of hydroelectric power will be obtained, and this condition should also give ideal conditions for continuity of service and safety.

The Company now has plans for power development carrying it up to 1920 in a series of installations for which the foundation is laid and the most difficult work, financially and physically, already done. The future of the Company is therefore very encouraging and the Company no doubt will be a very large factor—if not the largest factor—in the uniform and stable development of Central California. For hydroelectric power is ideal power, and electricity is the ideal method of distribution; and it requires no prophet to predict that the future civilization of California will be largely influenced by electric power; in fact, the degree of civilization will be measured largely in kilowatt hours' consumption per capita of electric power. For electric power can lift many a burden now carried by the people and make life brighter and happier, as well as make available much that is now waste.

Hydroelectric power uses only what

is already going to waste, and in using this waste energy to lift the burdens of humanity we make a net gain for civilization, and do not merely transfer a burden from one set of shoulders to another. That is, electric power tends to make masters of men and to eliminate slavery.

Every civilization consuming its resources is certain to decay and all the wisdom and philosophy of the ages will not prevent it. Examples of this are found in Rome and China, which decayed in spite of the philosophy of men like Marcus Aurelius and Confucius. The electric transmission of intelligence and power would have prevented the decay of Rome, and the electric motor would awaken China. A country like California having large water power needs never fear decay, for with electric power we can refertilize our lands and prevent the consumption of other resources necessary for our future welface, while adding enormously to our economic gain by having available this ideal power to do our hard labor for us.

We are all, therefore, in a business making for the character and stability of the present and future civilizations, and it is a wonderful privilege to be a part of the organization that has done and is to do so much to advance hydroelectric work as has the Pacific Gas and Electric Company and its predecessors. The starting of the Drum plant means more, therefore, than the mere addition of 25,000 K. W. to the system, but in order to tell just what this addition means we would have to follow the flow of this power to its ultimate consumers and tell how it prevents the effects of a drought at one place and a flood at another; how it lightens the burdens and adds to the luxuries of thousands, and makes the future certain for all of us and those to follow after us.

A last view of Lake Spaulding as it looked when the waters were beginning to rise.

The Common Sense Engineering Principles of the Spaulding Development

By R. G. CLIFFORD, Construction Engineer


R. G. Clifford

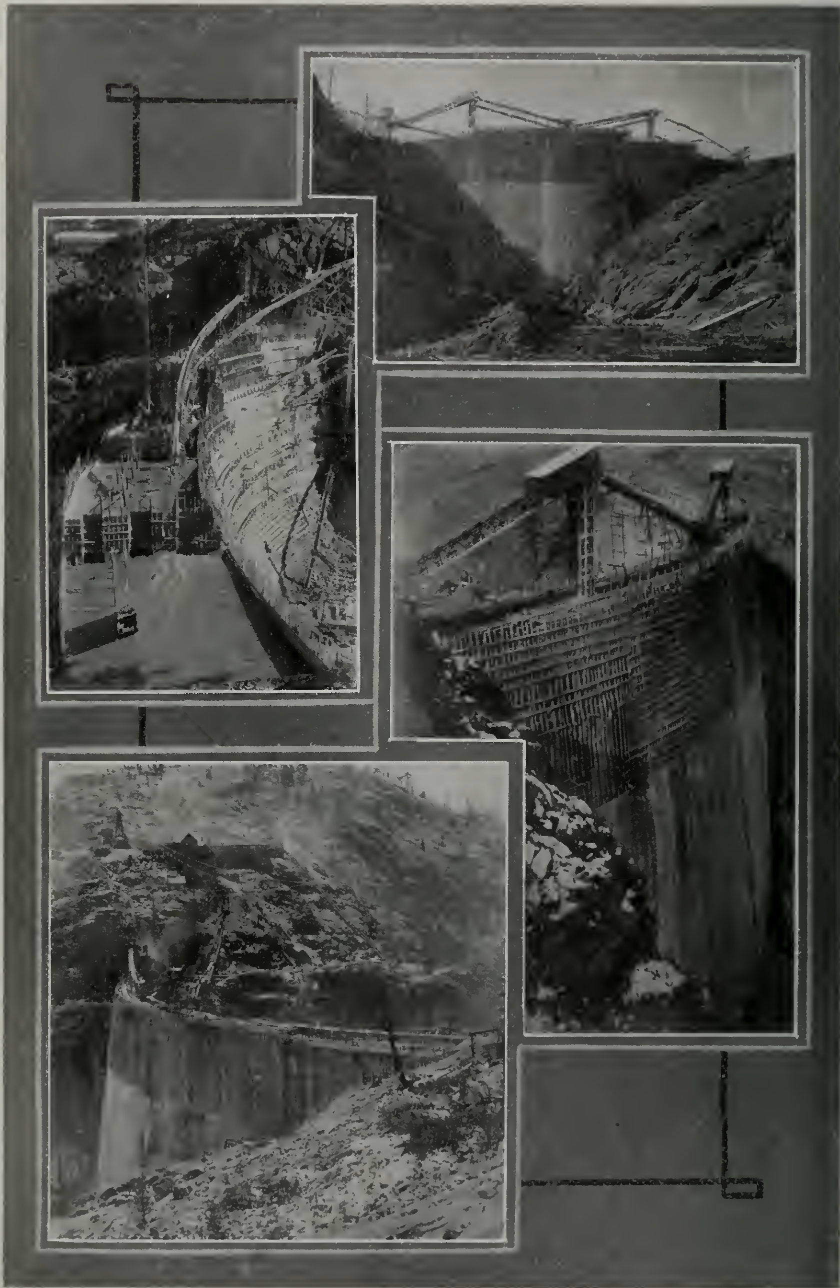
IT is the purpose of this article to recount briefly some of the more important engineering principles involved in the dam-building and water-control as embodied in the Company's Spaulding development. Lest it be inferred that the readers are about to be afflicted with any intricate theories or complicated formulas, let it be known at the start that such is not the intention, but rather is it desired to enumerate a few of the practical conditions to be met with in the harnessing of the most useful of nature's elements—water—and to show why a dam is more than a giant mass of concrete plugging up the narrowest part of a gorge, with a hole at the bottom out of which the stored water runs.

As in other forms of activity, so in dam building and water control, it is found that experience and common sense are the very best foundations upon which to build; and it is evident that although a certain type and design of dam may be the best in one case, it may prove more expensive and be even less safe in another case where conditions are different. The two basic principles behind any dam are the two factors just mentioned, Cost and Safety, while subsidiary to Cost comes Permanence.

A review of the successful dams of the world shows a great variety of types, all supposedly built on the same basic principles. The variation, however, is chiefly among the lower dams under 150 feet, for above that height there are so far but two types, that depending upon its arch action and that based on its sheer weight or gravity action, both types being constructed of concrete. Now, you can put a load of some 140 tons on a square foot of good concrete before it is crushed, but it will resist only one-tenth of this strain applied as tension under the best conditions, and as hair-cracks frequently develop during drying out it is against good practice to put any dependence whatsoever on the concrete's tensile strength, unless the expense is nearly doubled by the addition of steel.

It can be seen, then, that the gravity type is an expensive proposition, for the triangular-shaped block of concrete constituting a section of the dam must have a base varying from 75 to 100 per cent of its height, depending on whether or not the foundations are porous. If water can get under the structure it acts as a wedge tending to tip it over, and in several dams constructed the element of safety required a base thickness equal to the height.

In order to be justified in the choice of an arch dam there are two conditions of the site essential, namely, excellent foundations and narrowness of canyon. The many readers who have noticed the photographs of the Spaulding dam, or who have been fortunate enough to have visited the site, cannot but have been impressed by the beneficent way in which Providence has provided for such a dam. Glaciers have augmented the centuries of work done by the South Yuba River, and the marks can still be seen where all loose, overlying material was scraped clean until an absolutely solid base, free from seams or fissures of any kind, was left. The exact site chosen would have been picked immediately by any of our readers, for here the side walls converge on each side in such a manner that the pressure of the water in the reservoir tends to wedge an arch dam more tightly into the sides and the whole arch load



Views of Lake Spaulding dam, whose completion to the 225-foot level has added enormously to the water-storage facilities of "Pacific Service" in the Sierra Nevada.

bears at right angles to the granite walls. It will be noticed, however, from the general view of the dam shown, that even at the present height of about 225 feet the canyon widens out and for the 305-foot height the top length is such that the arch must be fairly flat, the shortest radius practicable being about 400 feet. Since the cost depends on the thickness and the thickness depends on the radius of curvature, a variable radius modification of the arch type, developed within recent years by the F. G. Baum Co., was chosen as the logical solution of the element of cost, while the safety of the structure was also increased to a considerable extent.

In the view looking down on the Spaulding dam two prominent features are apparent, one being the fact that the dam is being built in vertical sections and the other that two rows of pipe are seemingly being left in the dam. The joints between the consecutive sections are termed "contraction joints," being spaced 80 feet apart, and the 6-inch pipes are really only forms left in until the concrete is partially set, when they are yanked out, leaving a very complete drainage system to carry off water finding its way into the dam.

The shrinkage of concrete as it cools off and dries out is very considerable, amounting to one-half an inch or more in each 100 feet. While the water is against the dam this is largely prevented by the pressure of the arch, but when empty there is not enough tensile strength in the concrete to prevent it cracking. If these vertical cracks in the dam should diverge away from the reservoir a very distinct weakness would develop in the dam, it being conceivable that such a section might be dislodged when the water pressure was applied. The contraction joints are artificial radial lines of weakness spaced 80 feet apart to anticipate the effects of contraction, the resulting blocks resembling the stones in an arch except that interlocking is provided in our case. The photograph shows plainly these 8-foot jogs in the section. To prevent undue leakage a column of medium soft asphaltum ex-

The old Spaulding dam fast disappearing under the flood of waters.

tends from top to bottom of the joint 2 feet from the water face.

The ease with which water finds its way into concrete is evidenced by the wet concrete cellars in San Francisco adjacent to the bay, and when under the tremendous pressure which will exist in the Spaulding dam there is no way of preventing percolation for a considerable distance into the face. This leakage water is under the same pressure as that on the outside unless it can be carried away freely, and this force would act as a hydraulic jack destroying much of the stability due to weight. The very complete drainage system referred to above intercepts this leakage, the 6-inch holes 8 feet apart in each row carrying the water vertically downward into a 7x9-feet drainage gallery, the forms for which can be seen in the photograph protruding from the concrete in the extreme foreground. This drainage gallery parallels the hillside some 10 feet above it until dropping to a level 35 feet above the base of the dam, when it runs nearly horizontal, finally discharging into the permanent sluiceway, 6x8 feet in size, running radially out of the dam on a 1½ per cent grade.

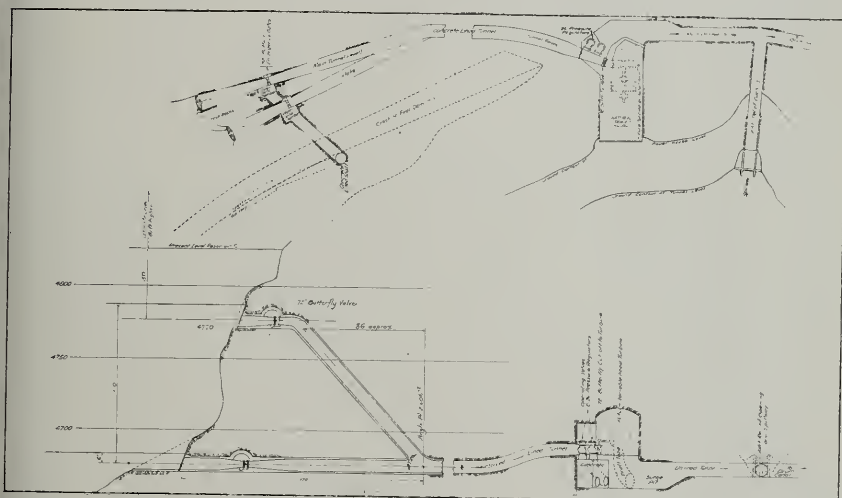
This drainage gallery is also used as an inspection tunnel to observe cracks and leakage and to reach the 30-inch valve on the sluice pipe. The water is carried in drains on either side while steps molded right in the concrete make it easy of access. On the south or cliff side, this inspection gallery enters the vertical wall and joins a shaft sunk in the granite just below the south end of the dam. At other levels above and below, connection is made between the shaft and the emergency gate chambers, which are small rooms near the face of the cliff hollowed out of the solid rock and lined with concrete.

Strange as it may appear at first glance, it is just as difficut a task to draw large quantities of water out of a deep reservoir as it is to impound the water in the first place, and this is largely due to the little successful experience we have to refer to. The water drawn from Spaulding at an ultimate depth of 230 feet would shoot out of a hole at the rate of nearly 120 feet per second, or a mile and a half per minute, at which time a 24-inch round opening would be needed to carry the water for Drum canal. As the reservoir lowers, this opening would have to increase until with a head of say 20 feet a round opening 44 inches in diameter is needed. The tremendous amount of energy stored in this water must be overcome in some manner, and it has been decided to make use of it by installing a variable head turbine in the outlet tunnel. A special turbine is designed to fit this case of variable head, and a maximum of 5000 K. W. can be conserved in this manner instead of dissipating it in troublesome valve control.

The varying head of a storage reservoir has never before been utilized, and yet, when the trouble that valves give is considered, the turbine is the logical solution of the problem. The sluice gate valves used in high heads, such as the well-known Pathfinder, Shoshone and Roosevelt dams, are a source of warning to all. They are designed with the utmost care and best materials and no expense has been spared, but it is almost beyond the limits of human ingenuity to intercept a huge jet of water with a gate at right angles to the flow. This form of gate vibrates, when partially closed, until the jarring can be felt all through the dam. Two or three types based on more logical principles are now being tried out; one being a very large needle valve similar to those used so successfully in power-house nozzle regulation, and another, which we have adopted, being a large mushroom-shaped valve used as a pressure regulator in connection with Allis-Chalmers turbines. The butterfly type of valve, of which we also have several installed, resembles a discus in shape and is balanced on a horizontal shaft passing through its center. These are not intended for operating conditions but are an ideal emergency valve to be used during repairs to the tunnel, turbine or regulating valves.

The layout at Spaulding, then, is briefly as follows: Two concrete-lined openings, 10 feet in diameter in the vertical cliff close up to the dam, tap the reservoir at levels 130 feet and 230 feet respectively below high water. These tunnels taper rapidly to 6 feet, where the protecting emergency valves operate and then flare out again to the constant size of the lined tunnel 8 feet 8 inches in diameter. The upper tunnel drops down on a 45 degree chamber the water drops back into the main tunnel through draft tubes from either the turbine or the pair of regulating valves. A natural granite basin 10 feet below the tunnel floor will allow the water to kick out the last of its pent-up energy without damage, the draft tubes reducing the high discharge velocities first.

This, then, ends the cycle of storage and water control, and the water in our new Lake Spaulding is already pressing the massive arch dam more firmly into its granite abutments and the two pres-



General plan and section of outlet works.

slope until joining the lower horizontal tunnel and a single bore conducts the 350 c. f. s. needed for 1000 feet to the point where the turbine is later to be installed and where the regulating gates are now installed.

The original tunnel comes within 150 feet of the surface at this point and has been blocked up solid, a new branch being driven curving upward and outward until entering a spacious vaulted cavern where the turbine and operating valves are located. The operating floor of this natural rock power-house is 22 feet above the main tunnel and its roof 27 feet higher. From this operating sure regulators, shown on the car in the illustration, have started on their years of work. An operator opening or closing a small water valve lifts or lowers the conical face of the gate up or down into the stream regulating the flow to the Drum power-house where the real work of the water begins. Through the coming spring 33,000 H. P. maximum will be generated by this water, but when the whole chain of developments is completed 150,000 H. P. in electricity, besides the irrigation of over 60,000 acres of land, will be dependent on the stability of the Spaulding dam and the successful control of the outlet works.

Business Men View Dam and Power Plant

Week-end excursion to the Sierra region proves delightful experience to party of Company's guests.

ON Saturday, December 6th, Vice-President and General Manager Britton took a party of guests upon a week-end excursion to our Spaulding-Drum development. There were twenty-eight in the party, among whom were President F. G. Drum and Messrs. F. B. Anderson, John Martin, C. O. G. Miller, John S. Drum, A. F. Hockenbeamer and D. H. Foote, of the board of directors; John D. McKee, Mercantile Trust Company; W. P. Hammon, the well-known capitalist who is connected with the Yuba Consolidated Goldfields and other development enterprises up country; Charles Sutro, of Sutro & Company; M. H. de Young, of the San Francisco Chronicle; H. H. Noble, of the Northern California Power Company; W. W. Briggs, Great Western Power Company; Victor Etienne Jr., of Etienne Bros., Cyclops Iron Works; F. Birdsall, Union Iron Works; C. A. Heise, Westinghouse Company; George T. Cameron, Standard Portland Cement Company; W. A. Doble, Pelton Water Wheel Company; and William Schaw and J. A. Batcher of the Schaw-Batcher Company. Officials of the Company completed the party.

Two Pullman coaches were engaged and were attached to No. 4 Overland, leaving San Francisco at 7 p. m. Saturday. At Colfax the coaches were detached and taken by special engine up to Smart, the Company's station in the snow-sheds near Emigrant Gap and close to Lake Spaulding. Breakfast was had at the lake-side, and the greater part of the morning spent in exploring the 225-foot dam which now spans the South Yuba canon below the lake. After that Mr. Britton conducted the greater part of his guests down the Drum canal, a nine-mile stretch of ditch carrying the water from Spaulding down Bear Valley to the new power-house on the Bear River. This journey was made in flat-bottomed boats, engineers of the Company acting as gondoliers. It was a unique experience and heartily enjoyed. Lunch was had at a way-side camp and the entire party collected later in the afternoon at Drum, where they inspected the power-house and enjoyed the exhilarating experience of a ride in the tramway down the 1375-foot steep. Supper was served at Drum camp and some speech-making was indulged in. Mr. H. H. Noble and Judge Melvin congratulated the Company on the complete success of its new undertaking. Mr. Britton replied happily. Mr. Schaw spoke for the firm that had supplied the gigantic pipe that conveys the water to the Drum power-house; Will Doble said a few words for the company that put in the water wheels; Carl Heise accepted congratulations on the success of the big electric generators his company had installed; Mr. Geo. T. Cameron told of the cement his company had furnished to make the concrete of which the dam is built. Frank B. Anderson represented the men of finance who had found the sinews of war when needed; Frank G. Baum talked for the engineering department whose skill and energy had accomplished such great results; Frank G. Drum, as president of the Company, while modestly disclaiming any personal glory, congratulated the Company generally on its splendid organization.

After supper the party was conveyed over the Company's spur track to Orel, a station just this side of Blue Canon, where the special train was found waiting. San Francisco was reached at 8:30 Monday morning, the entire party feeling benefited by the trip as well as gratified with the unusual experience.

As Told by the Snowflakes

A Christmas Episode of the Lake Spaulding Region

By JOSEPH P. BALOUN, Chief Draughtsman


Joseph P. Baloun

IT all happened on the afternoon of the 20th of November at a quarter past four o'clock on the side of Zion Hill.

A beautiful and intelligent snowflake fell amidst a crowd of his fellow-flakes who were chattering aimlessly. This latest arrival from the sky had information to impart as well as answers to give to questions. So, after asking all the flakes around him to behave and listen, he spoke as follows:

"Fellow-flakes, I note that the weather is cold and that there is no sign of an immediate thaw to mar your sweet faces or pretty dresses; so far, so good. God has put us in this world, for a purpose, that we may do our share of the work on this earth that man needs have done for him. You know that each of us represents a very insignificant quantity of water-power, stored as we are up in these mountains; but the old adage "In unity there is strength" was never truer than in our case. The incentive for man's labor up in these mountains is the water-power that can be obtained from the melting snow-flake, a power that will turn wheels and set the world's machinery in motion. We must feel our importance, therefore, realizing that as we lie within the boundaries of this immense water-shed, that as we melt, that as we change our form from snow to water, we do but prepare to carry out man's designs for the world's advancement. Therein lies our usefulness, our purpose on this earth. Hand-in-hand we unite and provide that element which man may use over and over again.

"Now, while you are awaiting your turn to melt into streams to trickle down to your companions below, I wonder if any of you have noticed how beautiful you are. In size you have considerable range. Oftentimes in the coldest weather you are of the smallest, yea, minutest size, while when the temperature is around freezing point you seem to grow larger. As individuals you are composed of crystals of very small forms and of very intricate, delicate and beautiful designs. Many thousands of patterns, it is said, have been copied from the snow-flake. You do at times exhibit different colors when viewed in different ways; but, as a whole, your color is ever white, for the same reason that beaten foam or pounded particles of colored glass will as a mass appear white. This is because you are the result of a combination of all the different primary colors, or the prismatic rays issuing from the tiny snow-crystals.

"You wear a beautiful mantle that enhances the charm of whatever it covers. Your immaculate purity is the very essence of health. The artist admires you and attempts to reproduce your beauty what time you await in silence the signal from Mother Nature to perform your sworn duty to mankind.

"Fellow-flakes, I thank you for your silence during my short talk and accept it as expressive of your sincerity. Please make a little room down there, so that I may get a little nearer to you all and reach that little stream which is being formed by the warmth of your happy natures."

The Panama Canal; Its Topography, Scope and Constructive Features, as Viewed by a "Pacific Service" Engineer

By C. J. WILSON, Assistant Engineer Electrical Distribution.

(Continued from our November issue.)

C. J. Wilson

THE project of a canal across the Isthmus was born with its exploration and settlement by the Spanish nearly 400 years ago. A brief historical diversion might be appropriate at this time.

Columbus, on his fourth voyage in 1502, sought eagerly for a strait along the Caribbean coast of Panama that would permit him to proceed westerly, but without success. Baffled and discouraged he returned to Spain. On September 25, 1513, Balboa fought his way through the jungle and from a mountain top on the Isthmus gazed upon the Pacific, or Southern Ocean as it was known at that time. Spain quickly took advantage of these discoveries, sending out exploring expeditions, reaching the Pearl Islands and Peru, commemorating the names of Pizarro and Cortez. For 400 years Panama has been the stage of conquest, massacre and bloody brigandage, first fought between man and man, and, later, between man and nature.

From Old Panama the Camino Real, a rock-paved mule-trail, led through the jungle to Nombre de Dios, a port on the Caribbean, where the gold of Peru and pearls from the islands were loaded into the treasure galleons bound for Spain. French and English privateers and pirates, attracted by the stories of great treasure, became very active in the sixteenth and seventeenth centuries, attacking and plundering ships and fortified settlements of the Spanish. The adventures of Drake, William Parker, Francis L'Olonnais and Henry Morgan, all of them "free traders," make interesting reading in these days of law and order.

In 1671, after capturing Fort San Lorenzo at the mouth of the Chagres, Henry Morgan with 1400 followers marched across the Isthmus and attacked Old Panama, taking the city after several hours of stubborn resistance by the Spanish. Guns and cannons were in use in those days, and each side suffered the loss of several hundred men. Morgan pillaged the city, burned most of the buildings, and after a month of debauchery and riotous conduct departed for Fort San Lorenzo with 175 mules laden with silver, gold and other treasures, together with 600 prisoners. As a reward for this expedition, he was knighted by the English sovereign and appointed governor of Jamaica. Then he turned round and during his later days waged war against piracy and bucanneering. Old Panama was not rebuilt, but a new city was dedicated in 1673 on the site of the present city, about nine miles to the westward.

With the exploration of the Pacific and increasing knowledge of the geography of our globe, the value to the merchant marine of a short cut across the Isthmus was quickly realized. In 1520 a survey was ordered by the King of Spain, followed by surveys and investigations under the English, French and Dutch governments as well as our own. History records the consideration of nineteen canal routes and seven ship railway routes across the Isthmus between Tehuantepec, Mexico, and Atrato, Colombia.

In '48 Oregon became a territory of the United States and California was ceded by Mexico. The discovery of gold was followed by a rush of prospectors and immigrants from eastern states in '49. These events emphasized the necessity of a short cut across the Isthmus. The Panama railroad was begun in 1849 and completed in 1855 at a terrific cost of life and money, although "a life for every tie laid" undoubtedly is a greatly exaggerated report. Many of our pioneers sailed from Atlantic seaports to Aspinwall (Colon) and crossed the Isthmus on the Panama railroad, continuing the trip by steamer to San Francisco. The railroad quickly repaid the investment and has returned handsome dividends ever since. It is stated that more tonnage is carried across the continent over this 50-mile line than over any other transcontinental railroad. Taken over by our government in 1904, the railroad has been of great value in the canal work and its operation has developed some startling facts in the question of government ownership of railroads.


Pedro Miguel Locks—Lock-chamber and miter-gates.

Various canal routes were surveyed and engineering details worked out for both sea-level and lock-type canals, as well as ship-railways, resulting ultimately in the French organization under de Lesseps gaining a concession from the Colombian government in 1877 to construct a sea-level canal. From Limon Bay the proposed route followed the Chagres River to Bas Obispo, thence cutting through the hills to the Pacific slope and down the Rio Grande river to Panama bay. The estimated cost was $169,000,000, but after working eight years and expending not less than $260,000,000, with appaling loss of life due to fever and tropical conditions, the original French company failed in 1889 and was succeeded by a reorganized company in 1894, with a 10-year extension of its franchise. But this fared no better than the other. After a while the United States took a hand in the game.

The Spooner Act, passed by Congress in 1902, provided for the purchase of the French holdings at a price of $40,000,000, though the company had asked $101,141,500. Colombia opposed this purchase, anticipating that at the expiration of the French franchise, in a few years, the $40,000,000 in good U. S. gold would fall into her treasury. This opposition was irritating to our government, to President Roosevelt particularly. Panama, a state of the Republic of Colombia, also had her eyes on the $10,000,000 which the United States was to pay to the Republic of Colombia for the canal rights as well as the $250,000 annual rental. In 57 years there had been some 53 revolutions in Colombia, so there was little surprise when Panama started a revolution in November, 1903, seceding from Colombia. This revolution was bloodless except for the death of a non-partisan Chinaman. The most significant events resulting from this were recognition by the United States, of Panama as an independent government, two days after the revolution started, and the conclusion of a treaty with the new republic within twelve days; and Panama got the $10,000,000. The principal features of the treaty were:

1. The United States guarantees the independence of the Republic of Panama.

2. Panama grants to the United States absolute jurisdiction over the Canal zone, a strip five miles either side of the Canal route, excepting the cities of Panama and Colon; together with the rights of policing and fortifying the zone.

3. The United States is granted sanitary jurisdiction over Panama and Colon, and also police powers in these two cities should the Panamanian government fail to preserve order.

Pedro Miguel Locks, showing concrete conveyor.

4. The United States pays the Republic of Panama $10,000,000 cash and an annual rental of $250,000, beginning in 1913.

The original plan was to construct a sea-level canal as recommended by the majority report of the International Board of Consulting Engineers, this decision perhaps being affected by the earthquake scare of 1906. Congress later adopted the lock plan as recommended by the minority report, which pointed out the disadvantages of the sea-level canal, particularly the difficulties of controlling the Chagres floods, the difference of tide-levels (the oscillation on the Atlantic side being 2½ feet, while on the Pacific side there is a rise and fall of 21 feet), and, perhaps of greatest importance, a sea-level canal of equivalent capacity of the lock type would require over twice as long to construct and would be relatively more expensive.

Between 1904 and 1907 plans were prepared and an organization perfected; quarters for officers and employees were built; the Panama railway reconstructed. Most important of all, the zone was made sanitary for the carrying forward of the work. Too much credit cannot be given Col. Gorgas for his excellent service in making this pestilential jungle as healthy as an American city. In April, 1907, Mr. John Stevens, the Chief Engineer, resigned, and President Roosevelt turned the work over to the army organization and created a new commission with Col. George W. Goethals as Chairman and Chief Engineer.

The Isthmian Canal Commission is divided into the following departments:

Construction and Engineering, Col. Goethals, Chairman and Chief Engineer; Col. H. F. Hodges, Asst. Chief Engineer;

Miraflores Locks. Concrete-mixing plant in the distance. The specks at the bottom of the lock in right-hand view are men.

H. H. Rousseau, Assistant to the Chief Engineer; Lieut. Col. D. D. Gaillard,* Division Engineer, Central Division; Lieut. Col. Wm. L. Sibert, Division Engineer, Atlantic Division.

Subsistence Department, Lieut. Col. Eugene T. Wilson, U. S. A.

Quartermaster's Department, Capt. R. E. Wood, U. S. A.

Sanitation, Col. W. C. Gorgas.

Civil Administration, Richard L. Metcalf, Head of Department.

Canal Zone Judiciary, H. A. Gudger, Chief Justice.

Law, Frank Feuille, Counsel and Chief Attorney.

Disbursements, John H. McLean, Disbursing Officer.

Examination of Accounts, H. A. A. Smith, Examiner of Accounts.

Purchasing Department, Major F. C. Boogs, U. S. A.

Panama Railroad Co., John D. Patterson, General Superintendent.

The Construction and Engineering Department operated under three general divisions, namely:

Atlantic Division, headquarters Gatun, Lieut. Col. Wm. L. Sibert, Division Engineer.

Central Division, headquarters Empire, Col. D. D. Gaillard,* Division Engineer.

Pacific Division,† headquarters Corozal, S. B. Williamson, Division Engineer.

Mechanical Division, headquarters Gorgona, A. J. Robinson, Superintendent.

The Subsistence Department supplies the employees of the Canal Commission and the Panama railway with food, clothing and household necessities; and also supplies food for the hotels, messes and hospitals operated by the I. C. C., providing for nearly 75,000 people daily and doing a business of about $7,500,000 yearly.

With headquarters at Colon, meats, vegetables, produce and fruits received by the shipload from the states are stored in the cold storage plant, to be distributed to the various stores along the zone. An ice plant makes two hundred tons of ice per day; the bakery turns out 20,000 loaves of bread baked in a revolving oven built like a Ferris wheel; ice cream, the standard dessert of the zone, is made in enormous quantities and delivered to any residence on the zone for less than $1.00 per gallon.

A train of twenty-one cars leaves Colon each morning at 4 a. m., distributing supplies to the various stores across the Isthmus, the Quartermaster's Department delivering each order of the previous day to the housewife before 8 a. m. Nearly any requirement in the grocery, meat, vegetable or fruit line can be supplied at prices less than we pay at home: for example, the best cuts of porterhouse steak cost 20 cents per pound.

The recruiting and housing of labor, handled by the Quartermaster's Department, has been a very important factor in the success of the work. During our visit to the zone the employees of the I. C. C. and Panama R. R. numbered approximately 25,000 Jamaican and West

*Since deceased. †Recently abolished.

VIEWS IN CULEBRA CUT

1—The cut looking north, near town of Culebra.
2—Under Gold Hill.
3—Slide opposite Culebra. In the distance Gold Hill at left, Contractors' Hill at right of cut.
4—A turn in the Big Ditch.
5—Removing the "spoil"; contour of Gold Hill looking south.
6—Near Gatun Lake.


Miraflores Locks. Left—Emergency dam. Right—Protective gate; in foreground, main and intermediate gates; control tower in distance.

Indian negroes, 5,000 Spaniards and Italians, together with a few Chinese, Hindoos, and other Orientals, all on the "silver" payroll. Officials, the clerical force, and skilled mechanics, numbering about 5,000 "gold" employees, are practically all Americans. The "silver" employees receive from 10 to 20 cents per hour for an 8-hour day, and are charged from 27 to 40 cents per day for food and quarters. For nearly nine years now an army of men, numbering as high as 42,000, have been toiling steadily and earnestly and under adverse conditions to accomplish the greatest engineering feat ever undertaken.

The visitor to the canal is impressed with the enormity of the undertaking. Superlative adjectives are worn threadbare. To hear enthusiastic employees describe the "big ditch" and the mechanical equipment, puts one under a spell that does not die away for months. Everybody connected in any way with the work takes a personal pride in its progress and discusses, with a surprising knowledge of details, all occurrences and gossip of the zone. We heard continually such expressions as, "the largest dredge in the world," "biggest rock crusher in the world," "the most extensive evcavation ever undertaken by man," "the greatest gravity dam in the world," etc., until we became imbued with the same spirit of pride in our government, and enthusiastic over the canal project.

But though the magnitude of the various operations impressed us primarily, the engineering principles involved are not new developments or untried methods. Excavation by means of steamshovels and dredges, concrete work and hydro-electric plants are not of unusual interest in these days, until considered in the quantities representing the material involved and under the tropical conditions prevalent on the Isthmus.

In the Panama Canal construction approximately 232,000,000 cubic yards of excavation, wet and dry, have been removed an average distance of some 12 miles to be used again in the construction of dams, breakwaters, fills on the relocated Panama railroad and in filling in low ground. Nearly half of this excavation has been taken from the famous Culebra cut, about 22,000,000 yards representing the removal of slides. The French excavated nearly 80,000,000 yards from the Culebra cut, of which 30,000,000 yards proved useful in the American plan. About 5,000,000 yards of concrete have been used, principally in building the locks, there being 2,000,000 yards in the Gatun locks and spillway. Incidental to the canal work the Panama railroad was rebuilt over a new route to the east, skirting the Gatun Lake. The original route lay along the lake bottom and partially through the Culebra cut.

Culebra means "snake." Whether the name originated from the sinuous route of the cut or the presence of reptiles in early days is not definitely known. Entering the Culebra cut on an incline from the main line tracks of the Panama Railroad near Pedro Miguel, we obtained our first idea of the depth of the excavation between Gold Hill and Contractors' Hill. The floor of the cut is 300 feet in width, with a net-work of tracks and switches over which rumble an almost continuous procession of dirt trains, hauling the spoil from the cut to be dumped upon the Balboa breakwater and returning empty for more dirt and rock.

The cut itself appeared indistinct, due to the smoke and steam rising from puffing locomotives and steam shovels. We counted on the side walls as many as nine "benches," and in the distance the trains of twenty cars appeared like small black worms crawling out from under the slides, and the workmen like ants. The early morning fog hid the summit of Gold Hill, 534 feet in height, but this was quickly dispersed by the hot rays of the rising sun. As we proceeded up the cut, passing batteries of tripod and well-drills working on the different benches. we were obliged to switch back and forward, giving right-of-way to the work trains. Though the excavation was nearly complete there were still quite a number of steam shovels, or "iron hogs" as some one has very appropriately termed them, at work rooting and grunting as they loaded the dirt trains. These 5-yard shovels, operated by American engineers, seem almost human in the way they pick up a 10-ton boulder, too large for the bucket, raise it gently to the level of the car alongside and giving it a little toss, roll it to place on a flat car.

Further along in the cut we were delayed by the Cucaracha slide, which had covered all but one track, and we were not able to get through until the work trains had moved out of our way. This slide, which has been active ever since the French began work in the cut, is located on the south face of Gold Hill, covers about fifty acres and is still moving into the canal prism at the rate of several feet per day.

The cut at Gold Hill represents the deepest excavation of nearly 500 feet, the bottom width being 300 feet and the width at the top tapering back to nearly 1800 feet, due to slides. Proceeding northerly through the cut the side walls of rocky formation, showing the drill holes, gradually decreased in height until we reached Gamboa Dyke, where our train, by means of another inclined track, reached the main line again. Crossing the Gamboa Dyke we passed through a number of zone settlements, finally reach- Matachin and Gorgona. These villages were being deserted, the houses and shops torn down to be removed to other towns on higher ground, as the waters of Gatun Lake would soon cover their sites.

They tell a story of an employee complaining that he was obliged to set his alarm clock for 3 o'clock next morning in order to move to Corozal. When questioned as to why he had to rise so early to get the 7 o'clock train, he replied that his house was to go on the same train. Notice was given on August 1st to vacate these lake villages, and the moving of houses, shops and employees had been nearly completed within a few weeks.

As we passed over the Gamboa Dyke on our return to Panama there were a great many drills of the well type at work, drilling holes for dynamite charges. The dyke was blown up on October 10th, which date marks the nominal completion of a waterway from the Atlantic to the Pacific across the Isthmus. The event was appropriately celebrated on the Pacific Coast.

The Lidgerwood unloaders have effected a great saving of time and expense in unloading the dirt trains. This mechanism consists of a huge plow which is dragged forward by a cable, forcing the dirt off the side of the moving cars. A train of twenty flat cars is thus unloaded in from seven to fifteen minutes.

At Pedro Miguel and Miraflores locks we saw in operation the huge concrete plants used for mixing and placing concrete in the sheet-iron forms of the locks. The mixer consisted of a double cantilever traveling structure with traveling buckets which conveyed broken rock and sand from the dumps to the central tower, where cement, taken from a car beneath, was mixed with the sand, rock and water. The mixture was then conveyed on an arm of the structure and dropped to place in the lock wall, or transferred to another conveyor traveling on rails in the bottom of the lock-chamber, to be placed at a more distant point. The record of this plant is 3500 cubic yards in an 8-hour day.

A different method in handling concrete was used at the Gatun locks. This method involved the use of structural steel towers traveling on rails at opposite sides of the lock structures, between which cables were suspended. The mixed concrete was carried in buckets along the cable and dumped at the proper point in the lock walls. Records for this plant are as follows: Maximum day (8 hours), 4443 cubic yards; maximum month, 89,391 cubic yards; fiscal year 1912-13, 911,137 cubic yards. Both types of concrete plants used electric power.

The concrete rock for the Pacific locks was quarried at the Ancon Hill quarry overlooking Balboa. A rock crusher of 3000 yards per day capacity located there is reputed to be the largest single crusher in the world. Sand was obtained on the coast at a point several miles from Balboa, brought in barges and thence transferred to the locks by rail. For the Gatun lock and spillway, rock and sand were obtained near Porto Bello and brought to the Gatun mixers by barge, a distance of about thirty miles. The cement was all imported from the States to Colon and thence delivered by rail to the various mixing plants. In spite of the distances that this material has been brought the mixed concrete has been put in place for the remarkably low cost of $4.50 per cubic yard.

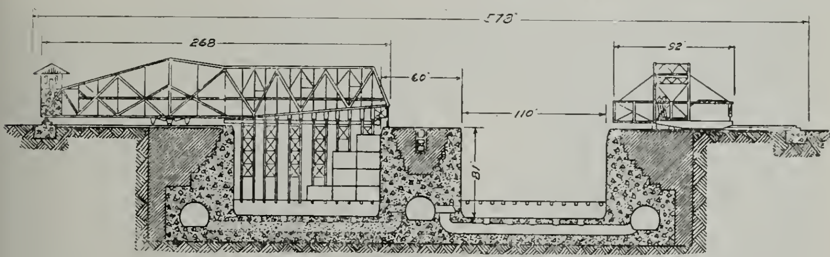
The Gatun dam, containing 21,000,000 cubic yards, is an earth dam, with a hydraulic core. Its length from hill to hill across the valley of the Chagres is approximately 1½ miles, with a base of nearly one-half mile, and about 115 feet in height at its crest. The material of which this dam was built was taken principally from the Culebra cut, being hauled over the Panama railroad and distributed by a net-work of spur tracks. The core of sand, clay and water was pumped into the center by means of suction dredges. In appearance, this dam looks almost like a continuation of the hills at either end, as the vegetation has already grown up and covered a great portion of the exposed surface.

Through a natural hill at the center of the dam a spillway has been cut and a regulating dam placed. The channel, cut through a rocky formation, is 1200 feet long and 285 feet wide. A concrete regulating dam is built on the arc of a circle 800 feet long and is equipped with fourteen regulating gates of the "Stoney" type. These gates are built of structural steel moving on rollers and are operated by electric motors. With all of the gates open, a discharge of water greater than the maximum recorded flow of the Chagres floods will be permitted. The downstream surface of the spillway dam is built on an "Ogee-curve," of such shape that the velocity of the water is kept at a minimum, and at the foot are placed concrete baffle-blocks to further retard the water as it enters the spillway channel. 225,000 cubic yards of concrete were used in this dam.

Just below the spillway dam is located the hydro-electric power-house which will supply current for operating the lock and gate machinery, machine shops, dry docks, etc., also for lighting the locks and zone towns. The building will be constructed of concrete and steel and will provide space for six 2000 K. W. units. The present installation, however, will be only three units, or a total of 6000 K. W. The units are vertical type

GATUN LOCKS AND SPILLWAY

1—Headgates to power-house.
2—Spillway and regulating gates.
3—Penstocks to power-house.
4—Power-house under way.
5—Gatun Locks looking south from control tower.
6—Gatun Locks looking north from control tower.



Cross-section of locks, showing emergency dams.

Francis turbines, each unit having an indvidual head gate, penstock and governor. The head gates and forebay are located adjacent to the east wall of the spillway and are an integral part of the spillway wall. The normal operating head will be 75 feet. The power generated will be transmitted to the Gatun locks at 2200 volts, 3-phase, 25 cycles, through underground cables. A 40,000 volt transmission line will carry the current across the Isthmus to the Miraflores locks, where a substation is to be located, stepping the voltage down to 2300 volts for use at Miraflores and Pedro Miguel locks. At Miraflores a steam generating plant will be maintained as an auxiliary.

The towers for the transmission line are built along the Panama railroad and are so designed that they may be used for trolley suspension at some future date. 2/0 copper conductors on triple-unit suspension insulators will be used. Cables are laid in conduits built in the various locks for distribution of current for gate and valve operating motors.

Transformer substations are located in vaults at intervals along the locks in each outer and the center wall. Each vault contains a duplicate set of 200 K. W. 3-phase power transformers, 2200 to 240 volts (9 to 1 ratio) and a 25 K. W. lighting transformer. On the primary side are 10 T. P. S. T. oil switches, providing for very flexible operating, and on the secondary, 12 power circuit switches of lever type, TP. D. T. mounted on slate panels.

Separate feeders from the power-house enter at each end of the locks, looping into each transformer substation and providing duplicate service. The secondary cables are principally 4/0-3 conductor and are tied through between vaults. Pipe supports and other steel or iron work is galvanized or sherardized and varnished to prevent rusting.

A novel feature in connection with the 2200-volt oil switches is the provision for disconnection from the switch leads by simply dropping the complete switch and lever-control mechanism as a unit away from stationary contacts in which the leads terminate. The switch unit slides vertically upon guides. This arrangement does away with the usual six disconnecting switches, greatly economizing space, and is a development well worth investigating by central station engineers.

All motors in each set of locks are controlled by an intricate remote-control interlocking system from a central control tower, from which the operator has an unobstructed view of the locks. A switchboard of the bench-board type is equipped with a complete model of the distribution system, control switches and return indicators. These indicators (an application of alternator and synchronous motor) are a new development and are so designed that the position of any valve hidden in the depths of a structure is indicated on the model. The position of the massive gates, or heavy fender chains which guard the entrance to the locks, is also indicated on the model.

COLON AND CRISTOBAL

1—Employees' quarters in Roosevelt Avenue, Cristobal.
2—Hotel Washington, Colon.
3—Bronze Statue of Columbus, Cristobal.
4—Colon water front.

All electric apparatus, with exception of towing locomotives, will be controlled from the central control tower, greatly reducing the operating force. The towing locomotives will be operated independently by an attendant upon each locomotive.

There are six double locks in the canal, three pairs being located at Gatun, with a total lift of 85 feet from sea level to the level of Gatun lock; one pair at Pedro Miguel, at the southerly end of Culebra cut, with a lift of 30½ feet, and two pairs at Miraflores, with a total lift of 54½ feet from mean sea level at the Pacific entrance to Miraflores lake. Each lock chamber has a length of 1000 feet, a width of 110 feet and a maximum depth of 82 feet. The locks being built in pairs, a vessel may be raised in one lock while another vessel is being lowered in the adjacent lock.

As all locks are practically of the same construction, a description of one lock will apply to all. Referring to the illustration, which represents a typical cross-section of a pair of lock chambers, it will be seen that the locks are solid concrete structures having vertical walls for the chambers, with a 60-foot center wall between chambers. Through the center and side walls run culverts 18 feet in diameter from which the water is distributed through lateral conduits having well openings in the floor, to the chambers. Suitable gate valves are installed in the main conduits, and cylinder valves control the flow of water to the lateral conduits. Each wall is provided with a drainage gallery, a gallery for electric cables and a passageway for operators. The center wall in each set of locks is extended by a 1200-foot mooring-pier. Tracks for towing locomotives are laid on each side of the lock chambers. A rack-gear is laid in the center of the towing tracks, but not in the return tracks.

The miter gates, built in pairs, are placed at each end of all locks, with the miter pointed toward the higher level. An intermediate set of gates divides the chamber into a 600-foot and 400-foot compartment. As 95 per cent of the vessels afloat are less than 600 feet in length, a great saving of water and time will be effected by using only a portion of the lock chamber, according to the length of the vessel. Each leaf of the miter gate is built of horizontal structural steel trusses, sheathed with riveted steel plates, hinged at the lock wall on a surprisingly small pintel, or hinge, and closing against a wood sill in the floor of the lock. The miter surfaces and wall edges are lined with metal plates made practically water-tight by hydrostatic pressure. The leaves are 65 feet long, 7 feet thick and from 47 to 82 feet in height, and weigh from 390 to 730 tons. Designed to float in the water, it requires a motor of only 35 horse-power to operate each leaf through a suitably geared "bull-wheel" and strut-rod. The gates are never operated except with the water level equalized on each side. Recesses in the concrete walls allow the gates to set flush with the chamber when open.

Three important protective features have been provided. First, guard gates are placed at the entrance of each set of locks; second, massive chains built of 3½" iron are stretched across the entrances to the locks to prevent a vessel accidentally ramming the gates. These chains are raised and lowered by means of hydraulic cylinders which also provide a cushion-effect in case of contact with a vessel. Third, emergency dams, built of structural steel to swing on a pivot, will be used to close the upper locks in case of failure of the gates allowing the water of the lake to rush through the locks. These cantilever structures are provided with hinged girders which are dropped into the lock and upon which steel plates are slid down, gradually closing off the flow of water. In connection with the emergency dam, a pontoon will be floated into place at the entrance of the lock and submerged, completely closing the lock, after the manner of a dry-dock.

As a further precaution in operation, all vessels will be towed through the locks by four electric locomotives running on geared tracks, two on each side of the chamber. These locomotives will be equipped with 3-phase induction motors of the "slip-ring" type, 220 volts, 25 cycles. A trolley slot will carry two insulated conductors, the third being grounded to the rails. The two forward locomotives will pull the vessel ahead by cables, the two locomotives at the stern holding the vessel in the center and stopping it at the end of the lock. Before entering a lock-set, the vessel must tie up to the entrance mooring pier, and the towing locomotives be made fast; the fender chain is then lowered to the bottom of the lock and the gates opened, permitting the vessel to be towed ahead into the first lock.

A ship proceeding up the 7½-mile channel from the Atlantic will enter the lower Gatun lock at sea-level as above described, and the miter gates will be closed behind it. The operator in the control tower will push a button which will open the valves, allowing water from the conduits in the walls to flow into the lock chamber, gradually rising until level with the water in the chamber above. The miter gates will then be opened at the up-stream end of the lock, and the ship towed ahead into the next lock. This procedure is repeated, placing the ship in the third lock, which will then be filled to the level of Gatun lake, the gates opened and the ship towed out into the lake, 85 feet above sea-level. The ship will thence proceed under its own power across Gatun lake and through Culebra cut, a distance of 32⅓ miles to Pedro Miguel lock, where it will be towed through the lock and lowered in one step to Miraflores lake. Proceeding across this lake at a 55-foot level, a distance of 1½ miles to Miraflores locks, the vessel will be lowered in two steps to salt water in the Pacific entrance. Another 8½ miles steaming through a 500-foot channel, 45 feet in depth, and deep water is reached in Panama bay.

The total length of the canal is 50½ miles, and will require about ten hours for a vessel to pass through from ocean to ocean.

For operation at night, the locks will be well lighted by means of concrete electroliers set up at intervals of about 60 feet on the walls; two rows of single-bracket standards, staggered, on the center wall and a row of double bracket standards on each side wall. The shafts, arms and reflectors are all of molded concrete and of massive ornamental design. The reflectors have been especially designed for this service and consist of double lobes or shading skirts which give good distribution and cut off the direct rays of the lamp at a distance of 40 feet. 400-watt tungsten lamps will be used, giving an illumination of 0.7 to 0.1 foot candles on the lock coping and 0.25 to 0.1 foot candles on the water surface.

Outlet boxes are provided in the bases of the standards for portable lamps and telephones.

Range lights of 2500 to 15,000 C. P., located in lighthouses on land, will mark the tangent courses at night through the ocean entrances and across Gatun lake. Beacons will be used in Culebra cut at the turns. These lighthouses set up on prominent points in the jungle create considerable curiosity, until their purpose is explained. Acetylene gas buoys, moored in pairs at opposite sides of the channel, are also used at turns and other points where the range lights cannot be conveniently located. These gas beacons will be 850 C. P. and will burn continuously for six to twelve months without attention. All lights will be white with distinguishing flash periods.

At Balboa, the Pacific entrance to the canal, are being constructed docks 1000 feet in length and 300 feet apart. Upon these docks, which are capacious enough to accommodate the largest vessel, are being built immense steel warehouses.

In addition to the docks the steel frames for the machine shops are well under way. A large dry-dock, 1000 feet by 110 feet, also is being constructed at Balboa for repairing the largest vessels.

Fortifications are well under way at Point Toro on the Atlantic entrance and Naos Island at the Pacific entrance of the canal, though we were not permitted to visit them.

The American city Cristobal, adjoins Colon at the Atlantic entrance. Here are located the headquarters of the Atlantic division and the cold storage and manufacturing plants of the Subsistence Department. Immense concrete docks, warehouses and a coaling plant are under construction to accommodate the largest vessels afloat.

Through the courtesy of Capt. Wood we took a trip up the old French canal in one of the government launches, passing immense quantities of abandoned French machinery, which lay rusting and disintegrating along the banks. The channel is dredged to a depth of 15 feet and is 85 feet wide. It starts at Cristobal and crosses the 300-foot channel of the American canal about a mile northeast of the Gatun locks. We returned to Cristobal by way of the American channel, passing several large dredges and getting a good view of the 10,000-foot breakwater extending seaward from Toro Point.

The physical completion of the canal is now a matter of only a few months. The principal purpose of destroying the Gamboa dike, letting the water of Gatun lake in Culebra cut, was to admit dredges into the cut to facilitate the removal of slides. One of the dredges, the "Corozal," which was built on the Clyde and steamed around the Horn under its own power, has a capacity of 1200 cubic yards per hour. The average steam shovel will load on the cars about 1500 cubic yards per day of 8 hours. As the dredges operate 24 hours per day, it is readily apparent that the removal of the loose material of the slides will progress much more rapidly with dredges than with steam shovels and trains.

The mechanical and electrical equipment of the locks, the machine shops, docks, warehouses, coaling and oil facilities, together with the permanent quarters, are all well under way, and there is no doubt that the operation will be fully tested and final adjustment completed long before the official opening to the commerce of the world in 1915. Recent estimates place the total cost of the canal at $375,000,000.

The commercial, political and economic advantages resulting from this great undertaking are beyond estimation. The distance from New York to San Francisco by Magellan is 13,135 miles; by Panama, 5,262 miles; there is a saving of 7,873 miles or about a month's sailing. The Pacific coasts of North, Central and South America, with their latent and undeveloped resources, will reap untold benefits. California, particularly, will profit in the readjustment of the world's commerce, rivaling, if not surpassing the great commonwealths of our eastern shores. Truly, "Westward, the course of empire takes its way."

During our visit to the canal zone we met with great courtesy and personal favors on the part of many officials and employees of the commission, who seemed to feel that our comfort and entertainment were their particular duty. We boarded the Colusa for our return home with a feeling of patriotic pride for our country and its citizens whose loyalty and best efforts have been responsible for the success of this great work. To them I repeat the toast proposed by the people of the Pacific Coast on October 10th:

"Here's to the Panama Canal,
To those who conceived it,
To those who achieved it,
And to the event that celebrates it,
At San Francisco in 1915."

Pacific Service Magazine

PUBLISHED IN THE INTERESTS OF ALL EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

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Issued the middle of each month.

Year's subscription $1.50
Single copy .... .15

Published by the
PACIFIC GAS AND ELECTRIC COMPANY
at 445 Sutter Street, San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. V DECEMBER, 1913 No. 7

EDITORIAL

CHRISTMAS IS AT HAND, and once again according to old established custom the legend "On earth peace, good will toward men" not only rests upon our lips but is written in our hearts.

For this one brief spell of holiday-making we rise superior to the cares of every-day life, put our troubles from us and become children again. It is a short, sweet holiday and it does good. It takes the iron out of the soul and paves the way for a clean start in the New Year a week later. It is not all joy, perhaps. In some of us this glad season of Yule-tide starts memories going. As one gets older the years seem to roll by with greater speed, and as we cut another notch in the stick that reckons up our score, we are apt to think regretfully of those good old days in the nigh-forgotten past and to wish, perhaps, that we had not made more of them before they slipped away, never to return.

But if some of us do indulge in such thoughts we are surely subject to the charge of selfishness. Christmas is not for us alone; that is to say, is not for any one individual or class of individuals. It is for the great mass of humanity; a point on the chart, a mile-stone on the road of life, so to speak, by which we are reminded of our duty to our fellow man as well as to those who are nearest and dearest to us. It is a season when we should have little ones playing at our knee; when, as said before, we should become children again and act the part of children with children just as when we ourselves were in the infantile stage we had our elders do for us.

Blessed be Christmas! It is a joyous as well as a hallowed institution. It is a wholesome and religious celebration and he upon whom its advent does not lay a healing balm, exercise some softening influence, at least, must be case-hardened indeed. It were better for him that he should go from among his fellows than that he should stay to mar the serenity of this one period of the year above all others when hand clasps hand with affectionate good-will, when accounts are closed, so to speak, and the slate wiped clean.

In wishing "Pacific Service" the hearty compliments of this hearty season we feel that the moment is felicitous to a degree. We are closing a year that has been exceptionally strenuous in its demands upon our energies and our resourcefulness. It has not been all "cakes and ale" by any means. But as this glad Yule-tide season comes upon us the sky is clearing and the promise for the future is bright. It was no small feather in our cap that, thanks to most accurate calculations, backed by many other attributes to success possessed by those upon whom the burden of responsibility was cast, our great South Yuba-Bear River construction work was completed and put into operation within the time promised for its fulfillment, and within the estimated cost. Up there in the Sierra snows the water surges merrily into Spaulding tunnel and, upon emerging therefrom, speeds swiftly down valley. The whirr of the big generators in Drum power-house is heard day and night without ceasing and is as music in the ears of the young stalwarts whose pride in the achievement is undisguised.

The laconic message from the mountains that told those waiting in the city of Drum being synchronized with "Pacific Service" at a specified time conveyed eloquent meaning to all; and perhaps even more significant was the modest report of the chief engineer which stated: "It is interesting to note that not a single mechanical or electrical weakness developed in the entire system from Spaulding to Cordelia." Those words spoke volumes; they told the story of a great work well done.

So it is with light hearts that we hail the coming of Santa Claus and turn our faces resolutely to the New Year that follows upon his heels. In a previous editorial we said a good deal about character and of the great part played by it in an organization such as ours. There will be ample opportunity in the near future for further display of our quality. Our task is not yet done, by any means. We have won a good fight, to be sure, but there are other fights ahead of us, other problems to solve.

In the meantime, let us hail old Santa Claus with out-stretched arms; let us accept gratefully the gifts he bears us, and let us not forget to do our full share of giving. Members of "Pacific Service," customers of "Pacific Service," readers of "Pacific Service Magazine," we wish you, one and all, right heartily

A MERRY CHRISTMAS!
A HAPPY NEW YEAR!

New Pumping Plant Installed Near Woodland

We present herewith a picture of a new pumping plant installed near Woodland. It affords a splendid illustration of the possibilities of "Pacific Service." The plant is operated by a 20-horsepower motor direct-connected to an 8-inch centrifugal pump which delivers 1800 gallons per minute.

The topmost view shows the cabins placed at the disposal of visitors to Lower Blue Lake. In the center is seen Upper Blue Lake. Below is Lower Blue Lake.

A Vacation Spent Pleasantly in the Blue Lakes Region of Alpine County

By A. H. CAINE, Stationery Department.

IT is probable that among the employees of "Pacific Service" there are quite a number who have not yet gained personal acquaintance with the system of storage reservoirs our Company maintains in the far-away mountain tops. A table of our physical properties reveals the fact that we possess one chain of lakes near the Sierra summit, another in the snows of Alpine County; but how many have enjoyed the privilege of visiting those localities, of gazing down upon those sheets of water so snugly nestling amid lofty peaks, of admiring their beauty and the grandeur of the country surrounding them?

Modestly I recommend one and all, who are so situated, to avail themselves of the very first opportunity afforded them of making up for lost time. For me there is no land like the mountain land. To one who loves, as I do, the granite country at the top of a ridge, the thought of a vacation spent at anything like the average summer resort is a thought of something lean and unprofitable. There is so much life, so much of the real joy of living, in the free, sparkling air of the mountains. Besides, if it is no joy to you to have a two-pound trout on a light tackle, to carry a rifle from daylight till dark through timber and over the ridges in the hope of a deer or bear, to pack a heavy automatic and ten pounds of shells for hours after grouse and quail—well, it's a matter of taste, that's all.

A complete change is of vital importance to one who works in-doors, and, speaking for myself, I know of nothing more beneficial than to get back into the mountains as far from civilization as time will allow. You'll find good country, good sport and good people back there. I spent the latter part of August around the Blue Lakes in Alpine County and had such a good time, found such a good country and met such good people that a brief description of the trip, for the benefit of those who do not know, might not be amiss.

With three good friends I left San Francisco at 6.30 p. m., arriving at Reno at 8.30 a. m. Change to the V. & T. R. R. for Minden, Nevada, the end of the line,

Markleeville, the county seat of Alpine County. The building in the foreground is the court-house; behind it stands the hotel.

arriving at 2 p. m., a few hours late, but they consider that on time on that road. You are in the sage brush country there; a trifle hot, but that is part of the game. By previous arrangement we had a man with a good team meet us at Minden to take care of us for the trip. We had lunch at Gardnerville, a mile beyond; thence twenty-two miles through the sage brush and we arrived at Woodford's at 7 p. m.

Woodfords is in California, a few miles from the Nevada state line. It is at the foot of the mountains, at an elevation of 5100 feet. It boasts a small summer hotel and store run by Mrs. Merrill, her son and daughter. They are charming people, have an excellent hotel and did everything possible for us. We left at 8.00 the next morning for the lakes twenty miles away. The road through the West Carson Canyon is narrow, a few hundred feet in places, with mountains and cliffs a thousand feet high on either side. This was one of the old emigrant trails to California, and it seems impossible to realize that our pioneers drove their heavy teams over such a grade and such boulders before the present road was made. As it was, we walked some six or eight miles over the worst grades. From the canyon the road runs through Charity Valley—then Hope Valley—then Faith Valley—and then through a pass around a mountain called "The Nipple," to the summit, Lower Blue Lake, at an elevation of 8040 feet.

Walter Thornberg saying good-bye.

We arrived at 4 p. m. and were greeted by Walter and Ben Thornberg, the boys in charge of the lakes. They are as good boys as you will ever meet and each bears as close resemblance to a mountain goat as anything that walks on two feet. If you doubt this try forty miles over such a country at such an altitude; they do it for exercise.

The old buildings, built during construction of the dam, are in good repair. The boys live just below the dam, and when we arrived they turned over to us a large log cabin with four spring cots and a big stove, for sleeping quarters, and a small cabin with stove, for a cook-house. As we had a thunder-storm that night and heavy frosts every other night, that cabin looked good to us. The climate during the four months of summer is delightful, although the nights are cold. This reminds me of a conversation with the boys regarding the date of a forest fire that had burned off the timber in one locality. Many trees

Downstream face of the Twin Lakes Dam.

Mokelumne River at the mouth of Deer Creek.

eighteen inches in diameter were badly burned, some of them dead but still standing, while timber a foot in diameter had not been touched. We cut down a fir tree about six feet high and an inch through. By its rings it was twenty-seven years old. Eight months of winter makes growth and decay very slow.

The following table shows the lakes in this vicinity, the property of our company:

Lake	Elevation Feet	Flooded Area Acres	Depth Feet	Capacity Cubic Feet
Twin	8172	118.3	20	62,063,850
Upper Blue	8131	341.5	27.5	293,859,766
Lower Blue	8040	145	35	162,000,000
Meadow	7773	141.2	65.5	244,500,000

There is good fishing to be had in our lakes—the trout are mostly "cut-throat," but average twelve to fourteen inches. They havn't the fight of a stream fish, but are good sport and plentiful. Upper Blue Lake is about a mile north of the lower lake and drains into it, the water from both going some seven miles through Deer Valley to the Mokelumne River, thence some ninety miles to the Electra Power House. The boys told us that the fish in Upper Blue Lake were very large, but had never been known to bite. We tried fly, spoon and bait, then we knew that we had been told the truth.

The Nipple, one of the higher peaks, is on the east shore of Upper Blue Lake, 9400 feet high. The climb is not bad if you take it slowly, and keep off the loose rock as much as possible; I made it in a couple of hours. You will have to go yourself to appreciate that view of fifty miles in any direction. In August it's good to get into a snow bank on the north side of a bluff. Twin Lakes, all one lake except when the water is low, lie over a low ridge to the west, and some three miles beyond lies

View of Minden, Nevada.

Meadow Lake. Do any of you care for bare white granite mountains around a clear blue lake? Twin Lakes drain into Meadow Lake, thence to Mokelumne River eight miles below Deer Creek. Back in the ravines around Meadow Lake is where the grouse are found. It is hard work, but in the open season you can always find them; and is there anything to eat that equals grouse?


Ben Thornberg and canine companion.

Deer are not as plentiful as in the Mendocino country, and are much more timid. There are good cinnamon bear; we had two traps out, but the traps were a little too small and the one bruin that came our way only got into one trap and pulled his foot out. We had no dog trained to track bear, and as they hide in the willow clumps in day time there was no way to locate them. But I know where there will be the right kind of dog next year.

The latter part of September and the first of October is the time to visit the Blue Lakes region. Then the mountain quail come over from Nevada to get below the snow line in California; and a quail stew helps. Did you ever see a mother quail with a band of young just old enough to run? See her stand with ruffled feathers within six feet of you, willing to fight, until her young have time to hide? It will give you an idea of what mother love means, and is worth the trip. Of course, for that you must be early in the season, about July.

Having a desire to fish the Carson River, on our return trip we drove to Markleeville, some twenty-five miles, staying there two days and nights. A heavy thunderstorm the first night muddied the stream, so there was small hope for sport. Mr. and Mrs. Koenig have a very small hotel, but it's clean and comfortable, meals good and quantity unlimited. People courteous, glad to help you in any way; what more can you ask? Markleeville is the county seat of Alpine County and, I believe, the largest town. As the accompanying illustration shows the entire town, you can get some idea of the density of population in the suburbs.


Meadow Lake, Alpine County.

Some four miles from Markleeville are the hot springs. Some one dug a hole twenty feet square and four feet deep and put a rough board fence around it. This constitutes the bath-house. The water is as hot as you will care to get into, but after a two weeks' camp, with nothing but ice water, you'll need it.

Markleeville is at the edge of the mountains, only a few miles from the sage brush and sand of Nevada. It is twenty-five miles back to Minden, mostly sage brush, relieved by an occasional jackrabbit; but that's good for you—makes you appreciate the beauties of California. And take it from me—about seven days after you get home you will find yourself planning on just what ammunition to take or how that sleeping-bag should be fixed when you go back next year.

Noting Progress of the World's Fair

Progress on the concession section at the Panama-Pacific Exposition is so far advanced that some definite information may be given about it. It promises to be a truly marvelous feature, attractive in exterior as well as interior and magnificently illuminated.

So far the Exposition management has received more than 7000 applications for concession privileges. The hundred largest concessions already granted will cost more than $7,500,000. Preliminary work has already begun on a number of these. One of the most important features of the concession section will be a reproduction of the Grand Canyon of Arizona, a spectacle to be presented by the Santa Fe Railroad. Noted scenic artists are engaged upon canvases which will depict the canyon in natural colors; guides will deliver lectures on points of interest, and in harmony with the setting of the panorama will be an Indian village in which various tribes will dance in native costumes and display their manufactures. This concession will occupy 300 by 700 feet of ground space.

Another interesting spectacle will be "Toyland Grown Up," a great city in which the buildings will be largely reproductions of children's toys. Other concessions include the Panama Canal, a large working model of the work that is in the world's eye at the present time; The Creation, taken from the description in the first chapter of Genesis; "The evolution of the American Dreadnought," a panoramic illustration of the birth, growth and development of the American navy in which will be reproduced important historical incidents, such as Perry's victory at Lake Erie, Dewey's victory at Manila Bay and the defeat of the Spanish fleet off Santiago; a reproduction of the historic market place of the old town of Nuremberg, the only city of the German empire which has still preserved its mediaeval appearance. In addition to these there will be a forty-nine mining camp; an ice palace; a wild animal exhibition; a prehistoric garden; Mahomet's mountain; the aeroscope, an inverted pendulum, which will carry sightseers to an elevation of 268 feet; and a reproduction of the Dayton flood on an elaborate scale showing many of the thrilling incidents of that disaster. There are many other concessions under way but space does not permit of mentioning them all here.

What to call the main street of the concession district is yet an unsolved problem. Director Frank Burt has offered a prize for the best title and in consequence is being flooded with suggestions. Among those most in evidence are "The Main Drag," "The Locks," "The Canal," "The Zone," "The Isthmus," "The Ditch."

The Tower of Jewels, by which title will be known the magnificent structure at the entrance to the Exposition grounds, will undoubtedly be one of the striking structural features of the great 1915 celebration. It will be 430 feet in height and will rise in terraces, each with its sculptural decorations. At the top will be a group of huge figures supporting the the world; the base of the tower alone will cover an acre of land. It will be given its name from the fact that it is to be studded with great jewels, diamonds, rubies, emeralds, sapphires and other precious stones which at night will blaze under the mass of batteries of lights. Fronting this tower will be the beautiful South Garden which "Wizard" John McLaren promises will be one of the most beautiful landscape approaches to be seen anywhere.

Thomas A. Edison, Wizard of Electricity

OCTOBER 21, 1913, being the 34th anniversary of the birth of the incandescent lamp, was made the occasion of a general celebration of "Edison Day" throughout the country. Electric light and power men got together and paid tribute to one who has long been known by the title of "Wizard" in the world of invention. Pictures of the sage of Menlo Park and sketches of his useful life were sent out broadcast. And so it comes that we of "Pacific Service" take this opportunity to add our mite to the great sum of well-deserved homage. The following outline of Thomas Edison's career is taken from a copyrighted article published by Harper & Bros., of New York City and it is by their permission that we make use of it here:


Photo by Harper Bros.
Thomas Alva Edison

Thomas Alva Edison was born in Milan, Ohio, February 11, 1847. When he was seven years old his family moved to Port Huron, Michigan, where his boyhood days were spent in a large colonial house standing in the middle of the old government fort reservation overlooking the wide expanse of the St. Clair river.

The great inventor, whose iron endurance and stern will have enabled him to wear down all his associates by work sustained through arduous days and sleepless nights, was not at all strong as a child, and was of fragile appearance. He had an abnormally large, but well-shaped head, and it is said that the local doctors feared he might have brain trouble. In fact, on account of his presumed delicacy he was not allowed to go to school for some years, and even when he did attend for a short time the results were not encouraging. But the youth was fortunate in having a mother at once loving, well-informed and ambitious, capable in herself, from her experience as a teacher, of giving him an education better than could be secured in the local schools of the day. Certain it is that under this simple regime studious habits were formed and a taste for literature developed that have lasted to this day. If ever there was a man who tore the heart out of books, it is Edison, and what has once been read by him is never forgotten, if useful or worthy of submission to the test of experiment.

Our first knowledge of Edison in commercial life is that of a newsboy on the Grand Trunk Railroad between Port Huron and Detroit.

He took up this work at the age of thirteen, and began his experiment in chemistry and physics in one of the baggage cars on the train, where he maintained a laboratory, carrying all sorts of bottles, batteries, test tubes, etc. The train running one day at thirty miles an hour over a piece of poorly-laid track was thrown suddenly out of the perpendicular with a violent lurch, and, before Edison could catch it, a stick of phosphorus was jarred from its shelf, fell to the floor and burst into flame. The car took fire, and the boy in dismay was still trying to quench the blaze when the conductor, a quick-tempered Scotchman, who acted as baggage-master, hastened to the scene with water and saved his car. On the arrival at Mount Clemens station, its next stop, Edison and his entire outfit, laboratory, printing plant and all, were promptly ejected by the enraged conductor, and the train moved off, leaving him on the platform, tearful and indignant in the midst of his beloved but ruined possessions. It was through this incident that Edison acquired his deafness that has persisted all through his life, a severe box on the ears from the scorched and angry conductor being the direct cause of the infirmity. Although this deafness would be regarded as a great affliction by most people, Edison has always regarded it philosophically and claimed that it was a help to him in his work with telegraphy, as he heard only the key he was working.

Photo by Harper Bros.

Edison's First Lamp Factory, Menlo Park, N. J., 1879.

Mr. Edison took up telegraphy in 1862, taking a position as telegraph operator with the Grand Trunk Railroad at a salary of twenty-five dollars per month. Working as an operator for a few years, he soon reached a position which paid one hundred and twenty-five dollars a month, which was considered at that time to be a very high salary.

The first patent taken out by Thomas Edison was that of the electrographic volt-recorder, October 13, 1868. After securing many patents on the telegraph, telephone, stock-ticker, and numerous other devices, we find Edison beginning his experiments on the incandescent lamp in 1877.

There had been numerous, but impracticable, and commercially unsuccessful efforts by other inventors to produce electric light by incandescence, and at the time he began his experiment almost the whole scientific world had pronounced such an idea as impossible of fulfillment. The leading scientists, physicists and experts of the period had been studying the subject for more than a quarter of a century, and had proven to their own entire satisfaction that the subdivision of electric current was beyond attainment. These opinions were but a stimulus to Edison, for he had given the subject much thought and had become impressed with strong convictions of its possibilities, and was convinced that this subdivision was not only possible but entirely practicable.

The principal features necessary to subdivide the electric current successfully were the burning of an indefinite number of lights on the same circuit; each light to give a useful and economical degree of illumination; each light to be independent of all others in regard to its operation and extinguishment. Edison made numerous experiments on the incandescent lamp, and finally, *October 21, 1879*, after many patient trials, carbonized a piece of cotton sewing thread, bent into a loop or horse-shoe form, and had it sealed into a glass globe, from which he had exhausted the air. This lamp, when put on the circuit, lighted up brightly to incandescence, maintained its integrity for over forty hours, and lo! the practical incandescent lamp was born. Up to this time, Edison had spent over forty thousand dollars in his electric light experiments, but the result far more than justified the expenditure.

Edison carried on his experiments in a little building in Menlo Park, New Jersey. The building was little better than a shed, but from it Edison gave the world the incandescent lamp.

The next immediate step was the further investigation of the possibilities of improving the quality of the carbon filament. Edison made vast experiments of carbonized paper; these proved even more successful than carbonized thread. Between October 21, 1879, and December 21, 1879, some hundreds of these paper carbon lamps had been made and put into actual use in the streets and several residences at Menlo Park, N. J., causing great excitement and bringing many visitors from far and near. Edison was not satisfied with paper carbon; he, therefore, began to carbonize everything in nature that he could lay his hands on. During this experimental stage he tried no less than six thousand species of vegetable growth.

Photo by Harper Bros.

The old Edison home, Milan, Ohio

One day in the early part of 1880, he noticed upon the table in the laboratory an ordinary palm-leaf fan. He picked it up and in looking it over he noticed that it had a branching rib made of bamboo. He made filaments from the bamboo and found them better than anything he had tried. The bamboo filament was used until 1893, when Edison had succeeded in making an artificial carbon from refined cotton. This replaced the bamboo, and has been in use in all carbon lamps since then. While the Gem lamp of today is made of the same material as the carbon, it goes through a special treatment which gives it the characteristics of the metal filament, and is preferred to the carbon on account of its efficiency, which is greater. It is generally believed today that the Gem and the carbon lamp will soon be replaced in every case by the Mazda. The price of the Mazda lamp has been materially reduced, and has been strengthened by improvements to such an extent that there is no occasion to be afraid of its fragility.

Edison has made many experiments on the storage battery and from all accounts has succeeded in perfecting the highest class storage battery in the world today. Space does not permit of a detailed account of his experiments in this line.

It is impossible here to give an account of Mr. Edison's various patents. He placed the wax cylinder phonograph on the market in 1889, and since then has made many improve- in his invention. During the last two years he has been giving a great deal of his attention to the perfection of his Diamond Disc phonograph, and has succeeded in obtaining the most perfect reproduction of music ever known. About the time of the phonograph's appearance, we find the motion picture being worked upon, and in 1895 moving pictures were shown upon a screen the same as we see today in our modern picture houses. Up to 1910 the principal manufacturers of motion pictures were paying a royalty to Mr. Edison under his basic patent on the moving picture machine.

Mr. Edison is working at the present time on a large number of other inventions and is busy from eighteen to twenty hours a day.

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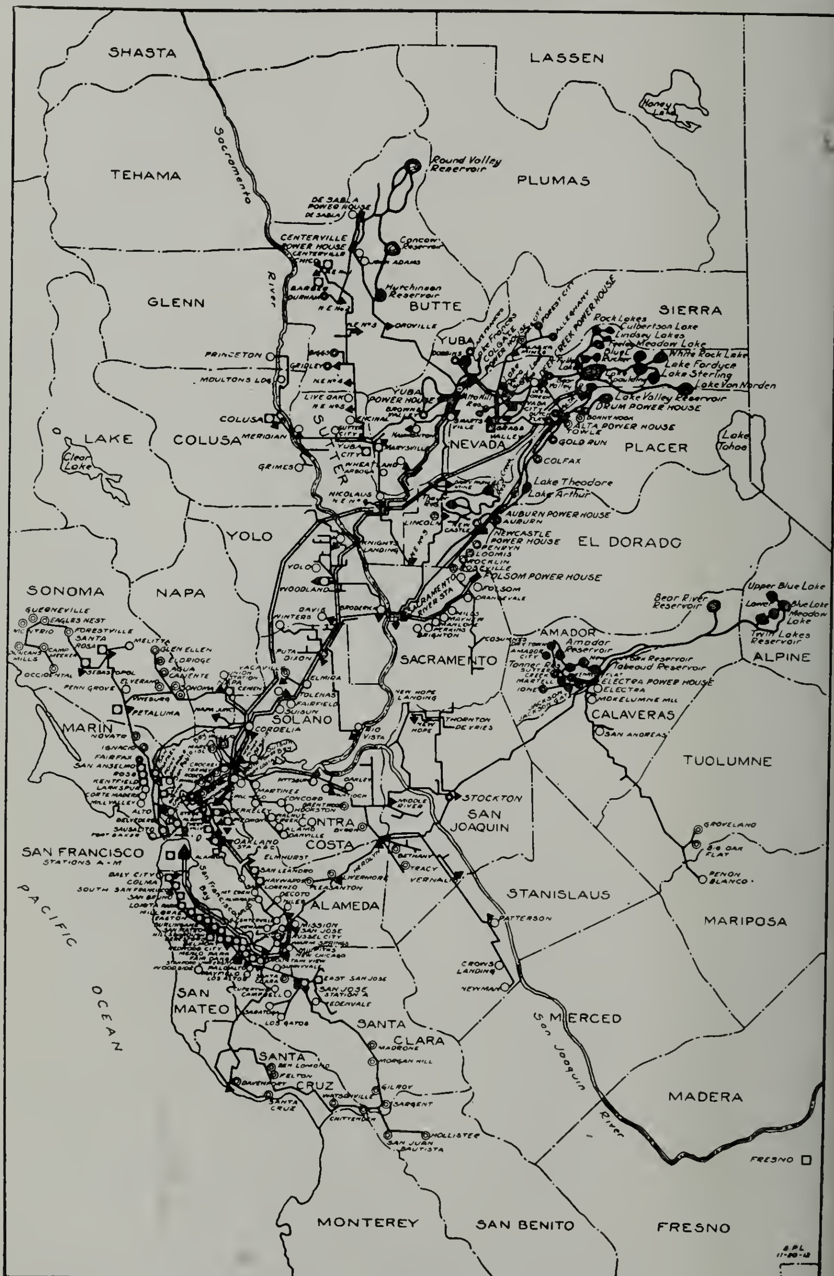
SHASTA
LASSEN
TEHAMA
PLUMAS
Round Valley Reservoir
Honey Lake
GLENN
BUTTE
SIERRA
YUBA
LAKE
COLUSA
NEVADA
PLACER
Lake Tahoe
YOLO
EL DORADO
SONOMA
NAPA
SACRAMENTO
AMADOR
ALPINE
MARIN
SOLANO
CALAVERAS
TUOLUMNE
SAN FRANCISCO
CONTRA COSTA
SAN JOAQUIN
ALAMEDA
STANISLAUS
MARIPOSA
SAN MATEO
SANTA CLARA
MERCED
SANTA CRUZ
MADERA
MONTEREY
SAN BENITO
FRESNO
PACIFIC OCEAN
Sacramento River
San Joaquin River

Pacific Gas and Electric Company

Cities and Towns Supplied with Gas, Electricity, Water and Railway

Service Furnished	Number of Towns	Total Population
Electricity	209	1,093,992
Gas	51	989,167
Water	25	52,865
Railway	1	71,000

Place	Population	Place	Population	Place	Population
Alta	20	Forestville	100	Pacheco	200
[1]Alameda	25,000	Felton	300	Penryn	250
Alamo	50	[1]Fresno	30,000	Patterson	300
[2]Albany	800	[2]Fair Oaks	250	Penn Grove	300
[5]Amador City	200	Folsom	1,800	Perkins	50
Adams John	25	Gilroy	2,000	[2]Petaluma	5,500
Alleghany	200	Glen Ellen	500	[2]Piedmont	1,720
Alto	25	[5]Gold Run	100	Pike City	200
Angel Island	280	[3]Grass Valley	4,500	Pinole	1,500
[5]Auburn	2,375	Gridley	1,800	Pittsburg	2,372
Agua Caliente	100	Grimes	250	Pleasanton	2,000
Alvarado	900	Groveland	125	Point San Pedro	20
Antioch	3,000	Guerneville	500	Port Costa	600
Arboga	100	Hammonton	500	[2]Redwood City	3,200
[2]Barber	500	[2]Hayward	4,000	[2]Richmond	10,000
[2]Belmont	350	[2]Hillsborough	1,000	Rio Vista	884
Ben Lomond	800	Hollister	3,000	[5]Rocklin	1,000
Belvedere	1,000	Hookston	75	[5]Roseville	2,600
Benicia	3,360	Ignacio	100	Rodeo	500
[2]Beresford	25	[5]Ione	900	[2]Ross	500
[2]Berkeley	40,000	Irvington	1,000	Russel City	250
Biggs	750	[5]Jackson Gate	100	[4]Sacramento	71,000
Big Oak Flat	20	[5]Jackson	2,035	San Andreas	200
Brentwood	200	[5]Kennedy Flat	20	[2]San Anselmo	1,500
Brighton	100	[2]Kentfield	250	[2]San Bruno	1,500
Broderick	200	Knight's Landing	350	[2]San Carlos	100
[5]Brown's Valley	50	[5]Lake Francis	5	[2]San Francisco	416,912
Byron	200	Lathrop	300	[2]San Jose	30,000
[2]Burlingame	4,000	Live Oak	200	[2]San Leandro	4,000
California City	25	Livermore	2,250	San Lorenzo	100
Camp Meeker	200	Los Gatos	3,000	[2]San Mateo	6,500
Campbell	600	[2]Larkspur	600	[2]San Quentin	2,500
Centerville	1,000	[5]Lincoln	1,400	[2]San Rafael	6,000
Centerville	20	[2]Lomita Park	100	San Pablo	1,000
[2]Chico	13,000	Los Altos	500	Santa Clara	6,000
[2]Colma	3,500	[5]Loomis	400	Santa Cruz	16,000
[2]Colusa	1,500	Maletta	30	Saratoga	50
Concord	1,500	Manlove	50	[2]Santa Rosa	12,000
Cement	1,500	Martinez	5,000	[2]Sebastopol	1,200
[5]Colfax	500	[5]Martell	150	Sausalito	2,500
Cordelia	150	[2]Marysville	7,000	Smartsville	500
Corte Madera	350	Mayfield	1,500	[2]South San Francisco	2,500
Crockett	2,500	Mayhew	50	[2]Stanford University	2,600
Crow's Landing	375	[2]Menlo Park	1,500	Sonoma	1,200
Cupertino	50	Meridian	300	Stege	1,000
Daly City	250	[2]Millbrae	300	[5]Stockton	30,000
Danville	250	Mills	50	Suisun	1,200
Davis	750	Milpitas	300	Sutter City	150
Decoto	350	Mill Valley	2,500	Sutter Creek	1,500
de Sabla	25	Mission San Jose	500	Sunnyvale	1,500
[5]Dixon	1,000	Mokelumne Hill	150	Tiburon	400
[5]Dobbins	50	Monte Rio	50	Tormey	20
Davenport	1,000	Moulton's Landing	30	Towle	100
[5]Drytown	20	Mountain View	2,500	Tracy	1,200
Durham	500	Mt. Eden	200	Union Station	40
[5]Dutch Flat	500	Mare Island	500	Vacaville	1,200
Duncan's Mills	150	[2]Napa	7,000	[1]Vallejo	15,000
[2]Easton	300	[3]Nevada City	2,700	Vineburg	200
[2]East San Jose	1,660	[5]New Chicago	10	Walnut Creek	350
Eagle's Nest	50	Newark	700	Warm Springs	200
Edenvale	500	[5]Newcastle	750	Watsonville	4,500
Eldridge	500	Newman	1,000	Wheatland	1,400
Elmira	150	Niles	800	Winters	1,200
El Verano	400	Nicolaus	75	[2]Woodland	3,200
Electra	50	Novato	250	Woodside	200
[2]Emeryville	5,000	[2]Oakland	230,000	Yolo	400
Encinal	100	Oakley	80	[2]Yuba City	1,200
Fairfax	500	Orange Vale	100		
Fairfield	834	[2]Palo Alto	6,300	Total	1,148,992

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1—Gas only.
2—Gas and Electricity.
3—Gas, Electricity and Water.
4—Gas, Electricity and Street Railways.
5—Electricity and Water.

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SERVES 2/3 of California's population.
30 of California's 58 counties.
An area of 37,775 square miles.
3/5 the size of New York State.
1/2 the size of all the New England States combined.

VOL. 5 JANUARY 1914 NO. 8

Pacific Service Magazine

PUBLISHED MONTHLY BY THE
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CALIFORNIA

Pacific Service Magazine

VOL. V No. 8

Yearly Subscription $1.50 :: :: Single Copies, Each, 15 Cents

Contents for January

Where the Drum-Cordelia steel-tower line crosses the Feather River. The tower seen is a special tower, 200 feet in height, and stands on the Sutter Basin side of the river.

PACIFIC SERVICE MAGAZINE

VOL. V JANUARY, 1914 No. 8

Building Drum-Cordelia Tower-Line

By E. H. STEELE, Superintendent of Line Construction


E. H. Steele

THE great Spaulding dam, the Drum power-house, the pipeline, forebay, canal and tunnels connecting this great system of which so much has been said would be of little commercial value had there not been provision made for a means of transmitting all of the stored energy of Lake Spaulding to the load centers after Drum power-house had converted it into electricity. Therefore, in order to complete the history of this great development I present here a short résumé of the work on the link known as the Drum-Cordelia tower-line.

In order to make this great development of the greatest value to the company as well as to the users of "Pacific Service" it was necessary to find means to deliver this power at a point where it would be available over all portions of the company's present system and, at the same time, require the least number of changes on the existing lines. After a careful survey of conditions Cordelia was decided upon as the geographic center of distribution.

The distance from Drum power-house to Cordelia over the route laid out for the tower-line is 110 miles, being but a slightly greater distance than a straight line between these points. The design of the towers and the material used to make a complete transmission line were of the same high standard as distinguished the construction work performed at Spaulding and Drum and Cordelia. To meet the demands of the present construction at Drum a two-circuit single tower-line was decided upon, each circuit to have three 3/0 stranded copper conductors or their equivalent. However, in order to take care of future development that will result in the ultimate completion of this South Yuba-Bear River undertaking, rights-of-way were purchased for two independent tower-lines.

The preliminary surveys were started February 1, 1912. The first construction work was commenced September 15, 1912, in clearing rights-of-way and building trails and temporary roads in the mountain sections. It must be understood that twenty-five miles of this line was built through the heart of the Sierras, through a section of country subject to heavy snows during the winter months. The season was well advanced when work was started, and it was essential that all work preparatory to the erection of the towers should be completed in the higher mountains before the winter storms set in if the construction was to be handled to the best advantage during the season of 1913. There was a great deal to do in the few short months left, but all went to work with high spirit and a full determination to beat the weather man; and in this we were not disappointed.

The work of putting in the foundations for the towers followed closely the clearing of timber from the right-of-way and the building of roads. The foundations were of concrete throughout the entire length of the line, and placed in such a shape as to exert the greatest amount of resistance against an overturning effect of the tower due to heavy winds or broken conductors, varying in depth from 6 feet to 7½ feet below the surface of the ground, the dimensions at the base varying from 4 to 5½ feet

Arrival of steel in San Francisco and process of segregation for checking.

square and all brought to a uniform size of 15 inches square at the top. These foundations were in three sizes, designed to carry three weights of towers and two distinct types. The three sizes of foundations were known as A, B and C, and signified the particular weight of tower which they were to support.

The A-size foundation took 32 cubic feet of concrete per leg, while the B foundation took 42 cubic feet and the C foundation 72 cubic feet. C class foundations were used with snow towers. All excavations for the foundations were of a size corresponding to the dimensions of the slab or pancake of concrete laid in the bottom of the excavation, and in order to bring the foundations to the required dimensions above the pancake forms had to be used. These forms were made of metal, No. 14 sheet iron reinforced with ⅞-inch angle. The forms were made in four pieces representing the four walls of the form. Catches were provided on these forms which permitted locking the four walls rigidly together so as to withstand the hydraulic pressure of the concrete; at the same time these catches were easily loosened to allow the removal of the form after the concrete was sufficiently set. The forms were light and durable and proved very satisfactory. Their durability is shown by the fact that at the completion of the work they were in shape to do another job of equal size.

In each foundation a piece of angle iron was placed which constituted the tower footing. On the tower end of this angle were bolted two small angle-plates known as the shoe. The angle, or footing, was placed in the concrete to a depth which brought the shoe approximately 2½ feet from the bottom of the foundation.

Great care had to be exercised in placing the tower-footings in the foundations, and in order to do this accurately a special template was provided of the company's own design. It was made in

Mixing concrete for steel-tower foundations.

the form of a cross of 1½-inch black iron pipe, with an angle rigidly placed at the proper batter at each of the outer points of the cross corresponding to the position of the four tower legs. The template was light for transportation purposes and gave excellent service.

The first foundations were placed November 16, 1912, and the work was completed October 7, 1913. The work was prosecuted diligently during the entire period. Accompanying photographs show the method of holding the tower-footings in place while the concrete was being poured.

The towers used on this line were of two distinct types. The first of these, known as the snow-type tower, provided for only a single circuit, and this was carried on the tower in a horizontal plane, the conductors being 46 feet from the ground at point of support. Each tower weighed 4200 pounds. This tower was used on the section of line where heavy snows prevail and constituted 13 miles of the line. The second type, known as the standard tower, provided for two circuits. One circuit is carried on each side of the tower in a vertical plane. The standard tower is 82 feet high and the lower wire is 54 feet from the ground at point of support. The towers placed were in three weights and designated as A, B and C towers.

Method of setting templates to hold footings for towers while concrete is being poured.

The A tower weighs 4600 pounds and is used between all standard spans, which are 800 feet in length. The B tower weighs 5200 pounds and is used in spans up to 1200 feet and on angles less than 15 degrees. The C tower weighs 7200 pounds and is used where the spans exceed 1200 feet, on angles in excess of 15 degrees and at points where dead ends occur. All of these towers were made in New York and were shipped to San Francisco via Panama. The first shipments began to arrive early in March but it was April before any of the steel was in the field, a good deal of time being taken up in segregating and checking up the steel in San Francisco before it was ready for reshipment by rail to its ultimate destination. Some of the accompanying photographs show the way these towers were received from the ship's side and what had to be done before the towers were ready for reshipment by rail.

As soon as the tower-steel began to arrive on the ground the assembling and erecting crews were set to work. Wherever possible the towers were assembled

Various stages of tower construction, from assembling of parts to completion.

on the ground and then raised to place on the foundations. However, much of the country crossed by the tower-line was very rough and it was found economical to build up, piece by piece, about thirty per cent of the total number of towers used in the line. An assembling crew constituted five men, and they would put a tower together complete in a working day of nine hours. The assembling crews were diverted to building crews when necessary. Some of the best crews were able to build a tower up from the ground in one day when everything fitted well, but more often it would require a day and a half to complete a tower.

To raise the towers that were assembled on the ground a light gin about 32 feet in height was used, supported by three guys. The rig was light and proved very satisfactory. The power used to raise the towers was a three-ton truck when available. When this was not available two horses were substituted. The raising crew consisted of seven men, and they would raise from eight to twelve towers in a day. The variation was due to the character of the country over which they were working and the distance they were from camp. Several photographs are here given showing towers in their various stages of construction.

In addition to the standard towers described above, sixteen special towers were used, twelve of them being for crossing over navigable streams or sloughs. These towers, ranging from 123 feet to 200 feet in height, were of the same general type as the standard two-circuit tower previously described. The towers weighed from twelve to twenty-five tons each.

In the high mountains there were two very deep canyons to cross. One of these required a span of 4000 feet and the other 3600 feet. They are in the snow belt, and conductors of sufficient tensile strength had to be provided to withstand a considerable snow load, in addition to their own weight in these spans. The conductor used was copper-clad cable composed of nineteen strands and measured three-fourths of an inch in diameter. The cables were pulled up to a strain of 8000 pounds, and special towers had to be provided at each side of the canyon to take the load. The cables were kept in a horizontal plane. The towers were constructed in the shape of an A of heavy angle and were but 25 feet high and weighed seven tons each.

The first towers were erected on April 12, 1913, and the last tower of all classes was completed October 25th the same year.

The insulators used were the suspension type, seven units being placed in a string. The units are eleven inches in diameter and about six inches in length, the normal working voltage for each unit being 25,000 volts. As the normal voltage at the power-house will be 110,000 volts, you will note that a liberal factor of safety has been allowed. This is an extremely strong feature from a transmission standpoint, and the additional units add but a very small percentage to the total cost of the line. The insulators were always put in place while the towers were lying on the ground and raised with the tower. Both aluminum and copper were used on this line, the line being divided into three sections as follows: The mountain section where heavy snows are apt to occur, the valley section and the fog belt section. 3/0-7 strand copper was used on the mountain and fog sections. On the valley section, which constituted a little over fifty per cent of the total length of the line, 266,800 circular mills, 19 strand aluminum was used, this aluminum being of the equivalent conductivity of 3/0 copper.

Special carts were provided for reeling this wire out on the ground to avoid the damage that would naturally be caused by dragging it out, and as the aluminum came in lengths of 9000 feet it was essential that the reels should be carried along the line rather than having them set up at a fixed point and the wire dragged out.

To support the conductors on the tower while it was being pulled to tension, patent roller snatch-blocks were hung from each cross-arm at a point corresponding to the ultimate position the conductor would occupy. The conductors being placed in the snatch-blocks, the crew was ready to pull the wire up to its final resting-place. The wire was first pulled about twenty per cent above tension and slackened back to the tension desired. A special come-along was provided for clamping to the conductor while it was being pulled to tension. After the wire had been pulled to the tension desired, it was a simple matter to transfer it to the clamp supported from the insulators, as it was supported by the snatch-block in the same relative plane.

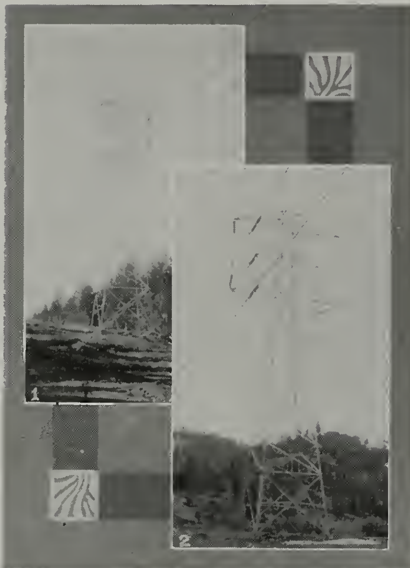


Fig. 1, Standard tower; fig. 2, Transposition tower; both completed.

In the snow sections the copper was pulled to a tension of 8000 pounds per square inch. On the balance of the line it was pulled to 15,000 pounds per square inch, while the aluminum was pulled to 4000 pounds. All tensions calculated at 70° Fahrenheit.

The first wire was strung July 15, 1913, and the line completed November 15th. It was tested November 17th, found O. K. and went into service on November 26th. Below are given a few comparative figures to enable the reader to form an idea of the magnitude of the work involved in a line of this kind:

The Drum-Cordelia line cost one-sixth of the total outlay of the Bear River-Spaulding development to date.

In excavating for tower foundations 17,000 yards of earth and rock were removed, all by handwork.

In placing the foundations 7600 yards of concrete were used. All of the mixing was done by hand, and the water to mix this concrete had to be hauled by teams from one to five miles.

The amount of gravel and cement that had to be hauled to the tower-sites to make this concrete amounted in weight to 27,000,000 pounds, or 13,500 tons, with an average haul by team of about five miles.

The steel for the towers weighed 5,000,000 pounds, or 2500 tons, with an average team haul of about eight miles.

The wire weighed 664,000 pounds, or 332 tons.

In putting the towers together 200,000 individual pieces of steel had to be handled, requiring 600,000 bolts.

20,000 insulators were used on the line.

In conclusion, I wish to state that the high efficiency of the work which was secured on this line was largely due to the loyalty of the men and the personal interest taken by each in the particular work to which he was assigned. This interest was shown in both the field and office staff.

Results such as were secured could not have been hoped for had we been forced to work under the conditions existing prior to May 7, 1913.

Features of the Tower-Line Construction

By WILL T. JONES, O. & M. Department, Hydro-Electric Section


W. T. Jones

IT had been determined that this line was to pass through three different sections of country, speaking from geographical and climatic standpoints: The first section, rough and mountainous, being subject to heavy snows and frosts in winter; the second section crossing the Sacramento Valley, where the winds blow very strong at times, and the summer is exceedingly warm; the third section covering the rolling hills of the Coast Range, where heavy fogs are encountered at various times during the year, in addition to trade winds.

It will be seen from this that several matters needed consideration before a decision could be made as to the proper type of tower to be used. The company was particularly fortunate in being able to inspect several types of towers in actual use throughout the United States, each entirely different from the other, and each embodying some good point. After careful inspection of all designs submitted, with bids, Milliken Bros. of Staten Island, New York, were given the contract for the steel.

There were 731 towers required for this line, 110 of which were to be of the "snow" type for installation in the first section, the balance to be of the "standard" type. Both types are shown herewith. The "standard" towers are divided into three classes, "A," "B" and "C"; the first for straight line, the second for longer spans and light angles and the third for heavy angles and dead-ends. With the type of towers decided upon, the next consideration was to proceed with the construction of the line.

It is intended to describe the construction of this tower line in the order in which the work was done. For this reason, sub-headings will be made and the proper cuts and illustrations will appear, showing various portions of the work as it was done.

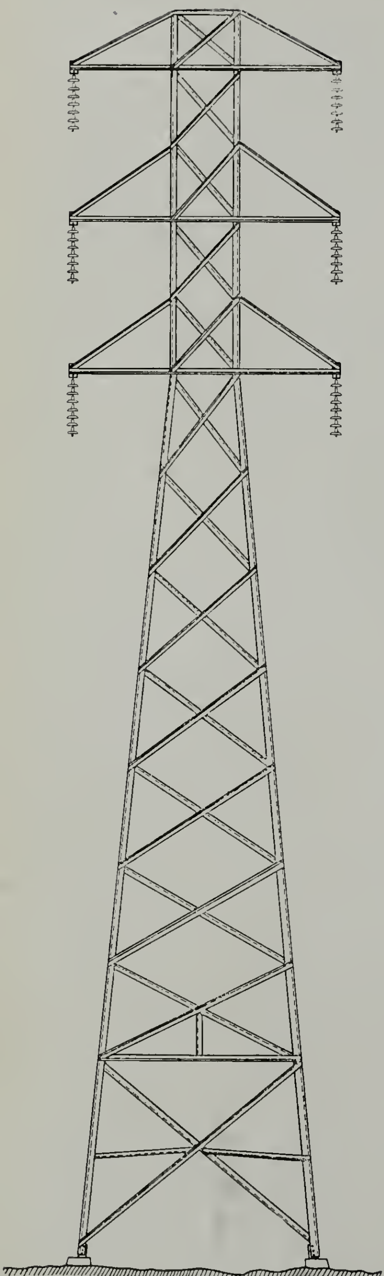
THE RIGHT-OF-WAY.

This part of the work came under the exclusive jurisdiction of the Land Department. The first thing to be done was a preliminary survey and selection of a route. (The map on page 267 shows the location of the line in its entire length.) With the route determined upon, it was decided to provide a right-of-way of sufficient width to care for a double steel-tower line, the entire distance between Drum power-house and Cordelia, the towers to be spaced approximately 800 feet apart.

Given this information with height of towers, etc., the Land Department was able to proceed with securing the necessary rights-of-way. We take a great deal of pride in recording that a very amicable settlement was effected with the 273 owners through whose property the line crosses, not a single condemnation suit being necessary. The promptness with which rights-of-way were given speaks volumes for the general good-will shown toward the company, and the appreciation by the public of the effort being put forth by the company to improve the service now given and to supply the necessary power for the reclamation of vast tracts of land and the building up of the State in general.

CLEARING THE RIGHT-OF-WAY.

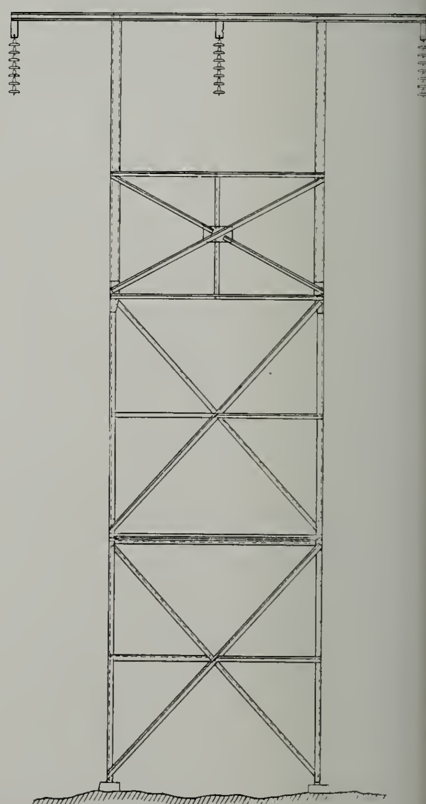
As soon as the necessary rights-of-way were secured, work was at once commenced clearing the path of the tower line of all trees and brush to a width of 80 feet. In the lower sections and through the valley very little clearing work was necessary, but in the moun-



tainous country a great deal of timber was encountered. This all had to be removed in order that teams could work along the right-of-way and, also, to facilitate the handling of the wire later on. By referring to our illustrations one can get an idea of the amount of work which was necessary under this heading, and in order to further impress upon the reader the vast amount of clearing which is sometimes required in the mountainous sections, it might be interesting to note that a saw-mill ran all last summer on the timber that was felled along the right-of-way for a short distance.

LOCATING THE TOWERS.

Having cleared the right-of-way, next came the work of locating the towers.



Types of towers—The tall tower is standard, 82 feet high; the smaller is a snow-tower, 49 feet in height.

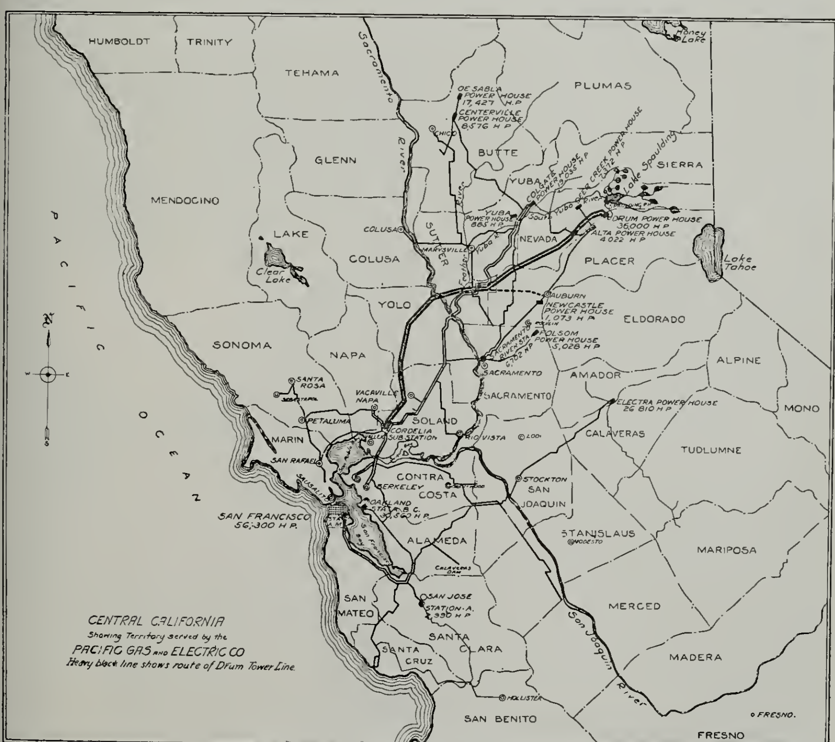
This is perhaps one of the most, if not the most, important feature. The location of the tower decides the clearance of the wire above ground, determining the angles and length of the the spans.

On the Drum-Cordelia line one instrument man with two helpers located all of the towers. A profile was made of the country through which the line was to pass, the point at which each tower was to be located being indicated, giving the exact distance in feet between towers. There was also shown the type of tower to be used. As soon as each profile was made up it was handed to the engineers in charge of the construction, who immediately went over the ground in question, and if the locations were proper, taking into consideration every item necessary in the construction work to follow, it was O. K.'d and sent into the main office for final approval.

Each profile was given a corporation number and the tower locations were numbered consecutively from one up, commencing at the Drum power-house. From each profile could be made as many prints as wanted and these were found to be absolutely necessary to the crews that followed. Plan maps were also furnished the various crews and these maps gave the names of the property owners, together with various roads in the vicinity of the line.

BUILDING ROADS AND TRAILS.

The locations for the several hundred towers being decided upon, the next question was the construction of roads and trails to deliver to each tower-site the necessary material. Gravel, cement,



Map on which the route taken by the Drum-Cordelia line is traced.

Views along the tower-line right-of-way during progress of construction work.

Washing gravel-bank with a monitor to procure gravel for tower foundations.

water, steel, wire, insulators, tools, etc., would have to be hauled to and delivered at each location, and in the mountains between Chicago Park and Drum power-house it was necessary to construct several miles of road so built as to stand up under considerable travel by two and four-horse teams. The cost of building these roads ran into a large sum of money, and some of them have been adopted as regular roads by the ranchers in the vicinity in place of older roads near by which were in bad shape.

Large quantities of giant powder were used in building the new roads and several thousand tons of gravel were hauled on existing old roads. The successful completion of the work which was to follow depended in a great measure upon these roads, as construction work was to continue unabated throughout the winter months.

Across the Sacramento Valley very little road work was necessary, but through the hills back of Vacaville and on to Cordelia it was out of the question to construct roads to the top of those steep inclines. Each team would take its load as far as possible and the teams would then double up and, in some instances, it was necessary to put 16, 18 and 24 head of horses on a single dump-wagon containing 1¼ cubic yards of gravel.

Permanent trails were cut on the mountain sides to permit a man on horseback to patrol the line after completion. Good substantial iron gates were installed in each fence crossed by the line. These gates were four feet high by ten feet wide, securely fastened by a chain and padlock.

DIGGING HOLES.

At each tower location a center stake or "hub" was driven from which point the holes necessary for the four legs of each tower were located. For this work an instrument man was necessary and he had charge of the hole-diggers. The nature of this work is such as does not need any great amount of explanation, no skilled labor being necessary. The size of the holes, however, made it necessary to resort to the use of several thousand pounds of giant powder, there being only a very few instances in which this was not needed.

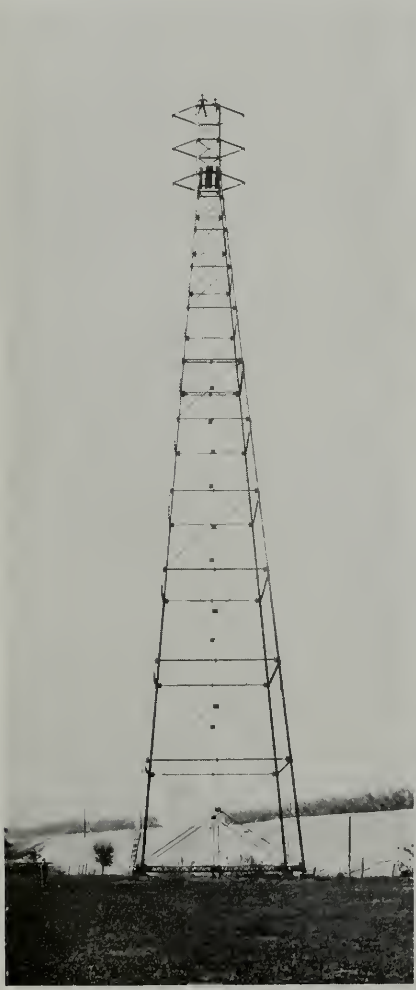
As each hole was finished it was covered over by a wooden cover to prevent any possible injury to live stock by their falling in them. These covers were removed by the concreting crew and then hauled ahead for further use by the hole diggers.

PUTTING IN FOUNDATIONS.

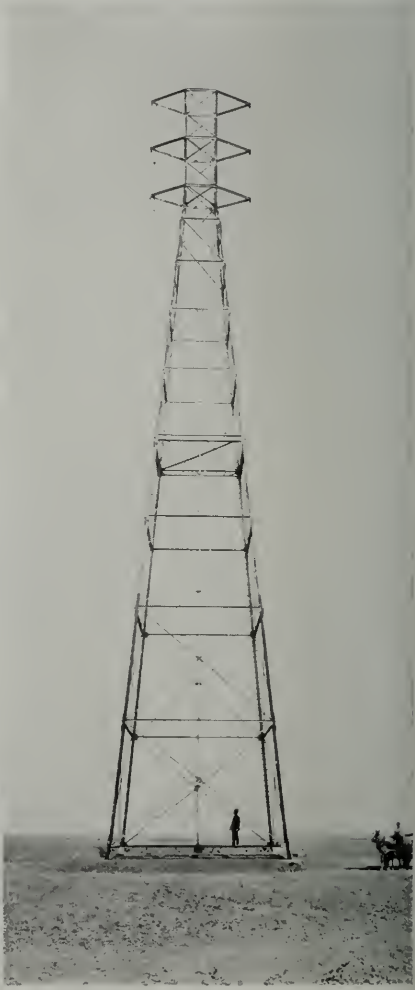
Immediately following the hole-diggers came the concreting gang to put in the tower foundations. This part of the work was probably the most important one. If the foundation was wrong the tower would fit.

As the concrete was to be mixed by hand a wooden platform was needed. In the mountainous country the hills were very steep and considerable grading was required.

Putting in these foundations in a satisfactory and an economical manner pre-



High tower on the Nicolaus side of the Feather River.



High tower on bank of Sutter Basin drainage canal.

sented quite a problem. From eight to fifteen cubic yards of gravel was necessary for each tower foundation, and in the mountainous section two methods of securing this gravel were found. The first was to secure it from the immense gravel deposits of Bear River. To utilize this gravel in the upper section of the line meant that every yard would have to be raised to a vertical height of 1500 feet and, in addition, hauled several miles. It was found that this method would make the cost of gravel extremely high.

The second plan, and the one that was adopted, was the offer made by a man who owned a large placer mine near the right-of-way by which the desired quantity and quality of gravel could be obtained by hydraulicing. Arrangements, therefore, were made with him to furnish the water and labor, the company to take the gravel and he to take the gold that was washed down from the banks. It is needless to add that this arrangement was mutually profitable.

Some of the tented cities that sprang up, sometimes, over night and as quickly vanished.

Pipe templates and metal forms were used to hold the tower footings and concrete in place, the concrete being allowed to set very firmly before any strain was put on it, and the accuracy with which the legs of the towers fitted when placed on the foundations speaks very highly for the efficient manner in which this portion of the work was done.

DELIVERY AND ERECTION OF TOWERS.

With the foundations in place everything was in readiness for the towers to be installed on them. As was previously noted in this article, the successful bid for the steel was submitted by Milliken Bros. of Staten Island, New York, and the contract called for delivery at San Francisco. The contractors chose to ship by water via the Isthmus of Panama, there being approximately 2500 tons of steel needed. This required the handling of the steel twice on the Isthmus and resulted in more or less damage and breakage for which the consignee was amply protected. However, it is worthy of note that the amount of damaged and broken steel compared with the total amount received was very small.

With the arrival of each shipment it was necessary to segregate the steel in order to properly check the number of complete towers received.

(To be concluded in our next issue.)

"Pacific Service" Pays Honor to Chief Engineer Baum and His Staff

THE evening of Friday, December 19th, marked an epoch in the life's history of "Pacific Service," for it was the occasion of a banquet given by our organization to Chief Engineer Frank G. Baum and the men who, under his direction, had made the good fight in the Sierra country, intelligence of the successful outcome of which has been spread broadcast through the land.

It was, by all odds, the most successful of all successful evenings of the kind. It was in the nature of a ceremony, of course, but the ceremonial feature was all but lost in the all-pervading atmosphere of brotherly sympathy and regard. It was a night of rejoicing, and every man of nigh two hundred members of "Pacific Service" who attended was made to feel that by his presence he contributed to that rejoicing. In other words, the affair took the character more of a club gathering than a company function.

The newly opened rose room of the St. Francis Hotel in San Francisco was the scene of the festivities. The delightful custom of distributing the diners at small round tables was followed, the sole exception being table "A," in the shape of a horseshoe, at which sat Messrs. Drum, Britton and several directors, besides Chief Baum and his associates who were the guests of honor. Mr. Britton presided, President Frank G. Drum supporting him on the right, while the chief guest sat at Mr. Drum's right. Of the directorate there were present Second Vice-President and Treasurer A. F. Hockenbeamer, Secretary D. H. Foote, and Messrs. John Martin, Eugene de Sabla, W. H. Crocker and George K. Weeks. At various tables in the room were placed gentlemen of prominence in San Francisco who had been bidden to the feast and these mingled in with the heads of departments, division superintendents, engineers and other members of our compact organization. It is worthy of note, also, that the press was well represented at the banquet.

Mr. Britton presided with his customary tact and breezy good humor. In his opening address he sketched briefly the marvelous progress made in power development in California during the very few years that have elapsed since its inception, and he predicted still greater strides in the near future. It was a proud moment for the guests of honor when the presiding officer read off the roll, containing the following names in addition to that of Mr. Baum:

P. M. Downing, H. C. Vensano, J. P. Jollyman, D. H. Duncanson, O. W. Peterson, E. M. Whipple, R. G. Clifford, C. H. Lusk, W. H. Harrelson, P. E. Magerstadt, G. C. Noble, P. B. Dawson, James Martin, E. H. Steele, G. M. Wehrle, J. A. Baker, George Burnside and W. C. Finely.

It was quite in accord with the fitness of things that there were present at the board two men whose names will go down into history in connection with the progress of hydro-electric development in California. The engineering world knows John Martin and Eugene de Sabla, Jr., as the pioneers in this work, and there would have been something wanting to the completeness of the occasion had either failed to attend. Needless to say each was called upon for some remarks. Mr. de Sabla spoke of early experiences with Frank Baum, who was just about graduating from college when the first big power-plant was designed, and who was employed by the two pioneers in the construction of the old Yuba plant in 1897. Mr. Martin recalled a number of humorous incidents from the early days of power development. Both gentlemen received enthusiastic welcome.

Mr. E. C. Jones, our chief Gas Engineer, spoke for his side of "Pacific Service" in offering greetings of the season to Mr. Baum. Then it came to Mr. Baum's turn, and the sturdy engineer who had stood like a rock against all difficulties and whose quick judgment had more than once saved the situation up there amid the mountain tops was fain to admit that speech-making was not his forte. He has reduced to writing his acknowledgement of the courtesies of that evening, and here it is:

"I thank those who were present for their attendance, and especially thank them on behalf of the engineers and construction men.

"I cannot tell you how much I appreciate the privilege of having been connected with the hydro-electric development of the State, and especially grateful for the privilege of coming in contact with the men that made the development of the company possible. For, from Mr. de Sabla I have had an opportunity to learn imagination and enthusiasm, and from Mr. Martin decision and action; from Mr. Britton I have had an opportunity to learn caution and fairness, and from Mr. Conlisk system and concentration; from Mr. Drum I have had opportunity to learn patience and to keep my mouth shut, and from Mr. Anderson I have been able to learn the value of keeping my promises. From Mr. Hockenbeamer, and from one or two trips to Wall Street, I have had the opportunity to learn how highly money is valued, and, from its after effects on some of my friends, I have learned not to value it too highly. From these men and the finance committee I have had the opportunity to learn the secret of the God-like wisdom that they display when we are perplexed and do not know what to do. For every decision they make must pass the test of what effect it will have on *the service, the securities*, and *the surplus*, and if we will apply these tests we will not make decisions to 'put one over on some one,' or some other department; and ambition, bull-headedness and conceit will not lead us into actions that will make us ashamed of ourselves and make others ashamed of us.

"We need imagination, enthusiasm, decision, action, caution, fairness, system, concentration, faith, patience, confidence and harmony, and we need to know the value of money. If we have these qualities, and keep faith with our patrons, our investors and our employes, we will have friends, friends such as these with us tonight. If we can hold the interest of the strong men who are responsible for the beginning and can enlist the help of our friends, I believe that the pests, parasites, pessimists and politicians can never quite catch up with the products, progress and profits of the optimists."

Mr. Baum also delivered an illustrated lecture upon "Pacific Service," using a number of lantern slides. This was listened to with great interest. There were some professional entertainers, besides, who kept things going between courses. Altogether, as said before, it was the most successful of all successful affairs of the kind.

An item of interest in connection with the new municipal building in New York City, which has just arrived at point of completion, is the system of piping, the various lines including steam, hot water, ventilating, cold water and ice water pipes. The magnitude of this item will be appreciated when it is known that one contract alone for covering the vast maze of piping involved twenty-seven carloads of pipe-covering material.

This contract was awarded to the H. W. Johns-Manville Company of New York City and, needless to say, the job was well done. On account of the restricted space and the number of bends the work of covering these pipes presented unusual difficulties which required both skill and patience to overcome.

What Eminent Engineers Say of Our Latest Achievement

A. P. DAVIS, Chief Engineer U. S. Reclamation Service:

"The rare natural opportunities for secure hydraulic structures developed by equally remarkable skill, energy and ability have resulted in an everlasting monument in the Yuba Canyon forming the initial organ of a vast system of a power development whose perfect concert of operation is equalled only by that of the faithful corps who built it. All connected with this work may justly be proud of it."

W. R. ECKART, Consulting Engineer:

"It goes without saying that I never had a doubt from the start, but what you would make a success as well as a record in handling this important power plant and dam. At certain times I was afraid that the elements might delay you in some of the concrete laying, but even in this you were successful."

HERMAN SCHUSSLER, Hydraulic Engineer:

"The rapidity of the construction exceeds any work of similar magnitude that I know of."

PROFESSOR C. L. CORY, Consulting Engineer:

"Probably the most important single development of the natural resources of Central California, producing a practically perfect conservation and control of the water supply of the South Yuba drainage area, making possible the generation of electric power with maximum efficiency and unequalled economy under practical operating conditions, supplying water after it is used for the generation of power for the irrigation of thousands of acres of land now unproductive; an enormous addition to the real wealth of the State."

W. A. DOBLE, inventor of the Doble water-wheel:

"A high standard of construction has been carried throughout. In this respect it is one of the most notable developments I have seen."

PROFESSOR HARRIS J. RYAN, Professor of Electrical Engineering, Stanford University:

"With greatest interest I've just read your report in the PACIFIC SERVICE MAGAZINE on *Starting Drum Plant.* I rejoice with all others at the happy completion of this plant. This great work, financed and engineered by Californians for California, is an enormous help to the Coast. Such work on the Coast should always be done by men of the Coast who know conditions and exert a loyalty that strangers cannot.

"It was your own work originally that demonstrated the unlimited stability of the high-voltage power network and that it may be extended everywhere to unite waste powers and waiting markets.

"Your last work has abundantly demonstrated that Pacific Coast talent for power development is not excelled anywhere. To have the banking world in the largest centers know this through the great illustration you and your organization have wrought, is indeed a royal Christmas gift to the Coast."

BENJ. F. PEARSON, General Superintendent So. Cal. Edison Co.:

"I wish to express to you, and through you to your organization, my appreciation of the courtesies extended to me during my visit to the Lake Spaulding dam and Drum power-house project. I do not know when I have enjoyed a journey of this character in a greater measure, or appreciated the character of the work and the manner in which it is being executed more thoroughly; being particularly struck with the very compact and efficient organization, and the spirit of hearty co-operation existing among your forces on the ground, my only regret being that I could not spend at least a week or ten days in leisurely taking it all in, particularly the dam at Lake Spaulding, and the manner in which the work is being carried out.

"I consider it one of the finest pieces of work I have ever seen, and the methods employed, the most efficient I ever had brought under my observation, and it must be to you a sincere source of pleasure to have under your general direction men who are able to do things, and do them in this way."

RUDOLPH VAN NORDEN, Consulting Engineer:

"The first unit of the South Yuba power development of the Pacific Gas and Electric Company, known as the Lake Spaulding-Drum system, has been completed and placed in operation within an actual construction period of less than one year.

"The conception and design of this system represents conservation in its highest sense, in the most complete utilization of a watershed for power, irrigation and domestic supply, while it is undoubtedly the most perfect example of hydro-electric engineering, *per se*, in present existence or under development.

"To the personnel of the engineering force of the company, by which the entire work has been designed and executed, must be given the credit for the excellence in design and the rapidity with which the work has been accomplished. Within the engineering force, a splendid spirit of responsibility has been manifested, while strong personal interest in the advancement of the work has made possible an *esprit de corps*, unusual even in high class developments of this sort, and an enthusiasm inspired by the chief engineer, Mr. Frank G. Baum, has made possible the accomplishment of an operating system within a period which had been freely predicted as being impossible, when judged by the methods and progress of other large engineering works."

PIERRE ZUCCO, Consulting Engineer:

"The construction of this great work, the largest of its kind in the whole country, by local talent, in the briefest time and within the original estimate, should be a matter of great satisfaction to every one concerned in enterprises of this or a similar nature this side of the Rockies. This remarkable undertaking was not completed without a thorough understanding of all the latest and most approved methods known to engineering science. Works of this kind have, in the past, consumed several years and the public have always regarded them as a more or less uncertain undertaking. Engineering science, however, has in the hands of competent persons and efficient organization made it possible to undertake and complete, within the estimates of money and time required, developments of great magnitude, the work not only being great in extent, but of a most lasting and permanent character.

"The writer has been connected with undertakings of this and related works, in both this country and Europe, and feels safe in saying that this splendid example of the engineering art has been a revelation to a great many pessimistic people who are skeptical of this kind of work being done both rapidly and well. That such a work as this embodying, as it does, a vast amount of detail as such a work must, the changing and necessarily uncertain conditions of strata, soil, water, labor, machinery and plant, etc., should be carried out, not only on time to fulfill all agreements for the delivery of electric power, but within a few hundreds of dollars of the original estimates, is certainly a matter for sincere congratulations for all concerned, especially for Mr. F. G. Baum."

Industrial Gas Burners for the Manufacture of Varnish

By JOHN B. REDD, Industrial Fuel Engineer

J. B. Redd

AN installation of industrial gas burners to be used in the manufacture of varnishes, which was recently completed at the South San Francisco factory of the W. P. Fuller Paint Company, is interesting, not only to the gas fraternity and to the manufacturers of high grade varnishes, but particularly interesting to those people who have the habit of using Fuller and Company's varnishes to brighten up around the house.

W. P. Fuller & Company are the largest manufacturers of paints and varnishes west of the Mississippi River, and maintain stores in every Pacific Coast city of importance from Spokane, Wash., to San Diego, California.

The first picture accompanying this article is a general view of varnish room, showing the operators stirring the ingredients which eventually become varnish. Sixteen gas furnaces have been installed for boiling the varnish and kettles of 100 gallons capacity are used for the work. The kettles are placed on iron trucks which are wheeled directly over the fire, and after the mixture has been heated to a temperature of from 400 to 700 degrees Fahr., depending on the kind of varnish being made, the trucks hold-

Varnish room, showing operators stirring ingredients.

Portion of the system of piping, with connections.

ing the kettles are removed from the fire and wheeled to the mixing tanks. After the varnish has cooled sufficiently, it is thinned and then pumped from the mixing tanks to storage tanks, where it remains until ready to be placed in drums or small cans.

Coke was formerly used for this work, and the average time necessary for heating a kettle containing fifty gallons of the mixture was one and one-half hours, while with gas furnaces the same work can be accomplished in about thirty minutes. The actual fuel cost in the preparation of one hundred gallons of varnish is practically the same as with coke, but when the saving in time is considered, gas as a fuel is by far perferable. Besides, varnish heated quickly is of a lighter color, and is much better in many ways than when allowed to be heated slowly; especially is this true with the higher grades of varnishes.

The gas burners used for this work are of the blast type and of special design, the bodies being thirty inches in diameter with twenty holes tapped for standard three-fourth inch nipples. The nipples connect to a burner head three and one-half inches in diameter. Forty-one sixty-fourth of an inch holes are drilled in each burner head. An even heat is obtained over the entire bottom of the kettles and the small holes give out a short blue flame which is not destructive to the kettles. A General Electric centrifugal compressor supplies air at one pound pressure for combustion, and is connected to a six-inch air line which extends completely around the room. A four-inch gas line also extends around the entire room which makes a complete circulating distribution system.

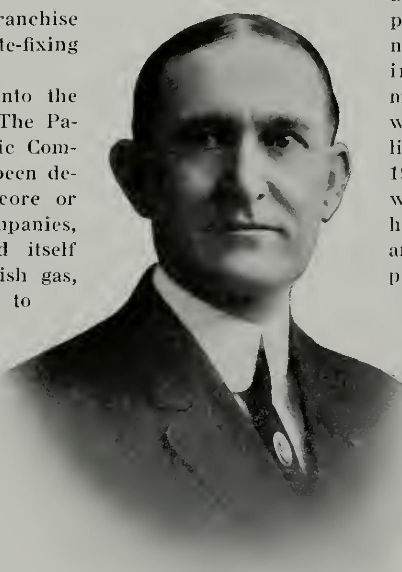
The second picture shows a portion of the system of piping with the connections taken off for both gas and air to

(Continued on page 279)

MEN OF THE COMPANY

William Henry Kline, General Agent

ONE of the important figures in the affairs of the Pacific Gas and Electric Company is Wm. H. Kline. Mr. Kline represents the company in most of its relations with the official public, and in particular solves its tax difficulties, its franchise problems and its rate-fixing complications.



Mr. Kline came into the company in 1906. The Pacific Gas and Electric Company had then just been developed out of a score or more of smaller companies, and suddenly found itself called upon to furnish gas, electricity or water to more than half the cities and towns of Central California. Everywhere it went it discovered its properties subject to a variety of assessments. In one locality its gas works and electric stations would be given one value for county purposes and another for city purposes. In another section, a school district would assess its holdings one way and an assessment district another. Considered as a whole, the complications seemed unending; the situation demanded the services of an expert.

The problem was to find the right man. A dozen were canvassed, but without result. Finally, Mr. Kline was suggested. He was then Chief Deputy Assessor of the City and County of San Francisco. His work gave him a comprehensive knowledge of all assessment and tax matters, and he seemed especially fitted to undertake the task in hand. But when first asked to join the company, in 1905, he could not do so owing to the importance of some municipal assessments which he was then handling. However, early in 1906 he had his public work in such shape that he could turn it over to another and accept employment with the company.

Mr. Kline entered the service as Tax Agent, and for two years labored unceasingly on tax problems. He went into every county served by the company, and by furnishing accurate appraisements and bringing town, city and county assessors together, worked out a scheme of assessment which placed the properties of the company on an equitable rating in every county. This done, he brought the assessors of the different counties together, and developed a standard assessment of pole and transmission lines which placed these properties on an equality of value throughout the entire territory served by the company. Before this it was not uncommon to find three or four adjoining counties, each with a totally different valuation on pole and transmission lines that cost but one price and traveled rights-of-way of but one value.

About the time Mr. Kline finished putting the varied assessments of the company on an equal footing, the law of assessments as to public service corporations was entirely remodeled. From a tax on property values the State changed to a tax on gross income, payable wholly to the State. This change demanded an entirely new system of tax and assessment reports, in many ways more com plicated than before. But Mr. Kline had made a study of the new law in the making, and when it went into effect was fully prepared for it. His first reports to the State Board of Equalization were the most complete filed with that body. They were among a very few that did not have to be sent back for amendment or correction. Since then Mr. Kline has kept his record and has each year anticipated rather than answered the wants of the State officials.

So successful was Mr. Kline with the company's tax problems that in 1910 he was advanced to the position of General Agent, and his authority extended over franchise and rate-fixing questions. In that capacity it has since been his duty to arrange for the company's entrance into new territory and to work out with town and county officials all the details of new franchises. It has also been his task to represent the company before Boards of Supervisors and town councils whenever questions have arisen concerning rates or service. In all these matters Mr. Kline has made a deep and lasting impression by his probity and fairness, and it has yet to be said of him that any request made by him of a public officer has been denied.

Mr. Kline is truly Californian. His parents came across the plains from Iowa in an ox team just after gold had been discovered. They settled in Solano County and were among those who laid the foundation of the town of Dixon.

Mr. Kline was born on a farm just outside of Dixon. After graduating from the local schools he went to the Vanderbilt University of Nashville, Tennessee. There he studied and graduated in law. On obtaining his sheepskin he returned to California and settled in San Francisco, where for a time he practiced his profession. He gave his attention largely to questions of municipal law, and was thus brought in touch with the different departments of the City Government; so favorably that when Dr. Washington Dodge was elected assessor in the late 90's he invited Mr. Kline to join him in organizing his office. Mr. Kline soon became Assessor Dodge's chief assistant, and in that position had much to do with the great tax problems of the city for a period of ten years.

Mr. Kline is married and lives a simple home life, made pleasant and attractive by a very estimable wife. He is still in the early years of a vigorous manhood and has before him a long period of active serivec, which it is to be hoped will be spent with the Pacific Gas and Electric Company.

Industrial Gas Burners for Manufacture of Varnish

(Continued from page 277)

four of the burners. The maximum gas consumption with all sixteen burners in operation is 9,600 cu. feet per hour, and in that length of time it is possible to produce 1,600 gallons of varnish.

W. P. Fuller & Company are much pleased with the change from coke to gas, and have nothing except the highest praise for the new method used in boiling the varnish.

A GLIMPSE OF FAIRYLAND—

At night, the Exposition buildings and grounds will be illuminat
effect, very restful to the eyes. This view is looking north
and in the background San Francisco Bay, with w
Tamalpais and the Marin County hills in t

ITION GROUNDS BY NIGHT

arrangement, which will give a beautiful glowing, yet subdued
ussian Hill. In the foreground is the great south garden
at anchor, displaying their searchlights; Mount
nd the Golden Gate to the left, in the west.

Items of General Interest

The Drum Power Division has been added to the list of territorial divisions of the O. and M. department, hydroelectric section. Its official creation was announced a few days ago by Chief Paul Downing. It is described as follows:

"To include the Spaulding dam, the Drum canal forebay, pipe-line and power-house; the Drum-Cordelia tower line from the power-house to Tower No. 157; the Alta power-house and pipe-line; the Deer Creek-Alta line from Steep Hollow to Alta; the Grass Valley-Alta line from Steep Hollow to Alta; the Alta-Sacramento line from Alta power-house to pole 25/10, located about midway between Colfax and Auburn; the Alta-Spaulding line, and the distributing circuits in the vicinity of Alta, Dutch Flat and Colfax." Tower No. 157, referred to above, stands at the point where the line from Drum crosses the main road from Auburn to Grass Valley, in early days a favored stage-route from Sacramento to Virginia City.

Mr. James Martin is appointed superintendent of the Drum Division with headquarters at Colfax. Up to the present time Mr. Martin has been in charge of the Colfax Water District, but this is now merged into the Drum Division, which, in addition to the power properties, includes all of the lakes, reservoirs, canals, etc., of what was formerly the South Yuba Company, to points on the Boardman and Bear River canals south of Colfax, which marks the northern boundary of the Placer Water District; not including, however, the main canal from the Bear River divide to Deer Creek, which will remain a part of the Nevada Division. The other power divisions remain as heretofore, with the exception that Alta power-house and that portion of the transmission line between Alta and the point of junction with the Sacramento Division are removed from the Nevada Power Division and made part of the new district.

The station formerly known as Orel, on the overland line of the Southern Pacific, at which point connection is made with the Drum power-house, is now called Forebay. The change was made by the railroad company in December.

The following news items come from Manager Poingdestre of the Marysville District:

"Our new holder foundation is completed, and iron workers will be here soon to start construction on our 150-000-foot gas holder, which we expect to have completed by the end of this year.

"Owing to new bridge being constructed across the Feather River between Marysville and Yuba City, we are laying new 4-inch C. I. pipe in ground underneath same to take place of 4-inch casing at present supported by bridge."

From Mr. E. C. Johnson, superintendent of the Marysville Power Division, comes the following:

"This is to advise that Dredger No. 14, recently built by the Yuba Consolidated Gold Fields Company of Hammonton, will soon join the fleet of gold boats on the Yuba, supplied by "Pacific Service." This boat is one of the largest and most modern boats built, the hull being built entirely of steel; 800 H. P. is the installed capacity."

To the many expressions of congratulation upon the successful outcome of our power project in the Sierra country is added a word from Mr. John P. Coghlan, our claims agent:

"Provision was carefully made for the care of the sick and injured on this work and hospitals were established at the dam and at the power-house and at important points along the canal, wherever large bodies of men were employed. A doctor and a hospital steward were permanently stationed at Lake Spaulding and at Drum.

"As a result of this system, every workman on the project received prompt and high-class medical care. And not a man left the work with any defect or disorder that medical science could cure. As an incident to the hospital service, every camp was regularly inspected for sanitation and food supply. Ventilation and drainage were especially guarded. In consequence, there was an entire absence of camp disorders or epidemics of any kind. In hand with this complete medical care, every man injured on the work, whether through negligence or not, was compensated for his injuries. And out of it all—nearly two years' work on a giant undertaking—there was but one personal injury action, and that was decided in the company's favor. All of which shows that the work was carried on with humanity and kindness as well as with speed and efficiency."

Item of news from Mr. R. H. Gentis, assistant superintendent Oakland Power Division, follows:

"During November the installation of the new 1000 K. W. motor generator set at Station "D," Oakland, was completed. A similar set was put in operation at Station "E" on September 9th, and another one of the same capacity will be put in service at Station "E" about December 15th.

"The total motor generator capacity for railway service in the Oakland Power Division will then be 10,400 K. W."

In the article appearing in the December number on "Thomas A. Edison, Wizard of Electricity," the picture of Mr. Thomas A. Edison is credited to Harpers and Brothers. This picture should have been shown as copyrighted by the New York Edison Company, the error being made in photographing the picture from a lantern slide, the copyright of the New York Edison Company appearing under the binding of the slide which was not removed.

A contract has recently been closed with Reclamation District 341 on Upper Sherman Island for a 125 H. P. motor for drainage purposes. This motor takes the place of a 150 H. P. gas engine plant which was recently destroyed by fire. It is supposed that this fire was started by the heat of the sun causing one of the drums of distillate to explode. The electrification of this plant completes the displacement of gas engine plants by this district.

THE JAMES HUGH WISE LIBRARY.

The following report concerning progress of the James Hugh Wise Library is to hand from Honorary Secretary Joseph P. Baloun:

"The number of volumes to date on file is: 302 bound books, 645 pamphlets. The welcome donation from our genial manager of the Sacramento District, Mr. C. W. McKillip, of an elegantly bound book entitled "History of Sacramento County," came at the time of making up the numerical index of the library. We gave Mr. McKillip's gift the number of 1 on the the records. It is a handsome volume as well as a most interesting historical compilation.

"The following magazines have been ordered for the use of the office reading table of the library, where visitors can make themselves happy in a warm room these wintry days while feeding themselves mentally: 'Scientific American,' 'World's Work,' 'Popular Mechanics' and 'Popular Electricity'."

Pacific Service Magazine

PUBLISHED IN THE INTERESTS OF ALL EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

JOHN A. BRITTON - - - - EDITOR-IN-CHIEF
FREDERICK S. MYRTLE - - MANAGING EDITOR
A. F. HOCKENBEAMER - - BUSINESS MANAGER

Issued the middle of each month.
Year's subscription $1.50
Single copy .... .15

Published by the
PACIFIC GAS AND ELECTRIC COMPANY
at 445 Sutter Street, San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. V. JANUARY, 1914. No. 8

EDITORIAL

The year 1914 has been ushered in with the customary joyous demonstration. It is significant of the hope that is said to spring eternal in the human breast that every annual celebration of the kind carries with it a sort of tacit understanding that no matter what the quality of the old year that is passing out, something better all round is expected of the new year that is passing in. And so it goes on through the ages.

As a matter of fact, however, the signs in the sky reveal something more than ordinary in the way of good omen for the year that is just born. For one thing, there are evidences of a decidedly healthier tone throughout the country. Last year a depression, to use a mild term, filled the atmosphere and business enterprise suffered in consequence. It was felt everywhere—at home and abroad. But as the year 1913 drew to a close the temporary scare seemed to be abating. There was talk of a general restoration of public confidence. And now the press, that never-failing indicator, is loud in its message of hope for the near future.

In California the outlook is bright as ever. Already the dread of a third successive dry winter has been dissipated and the snow is piled up high at the Sierra summit. The welcome rains have drenched our valleys from end to end and fully one-half an average season's rainfall has been gobbled up by the greedy ground. In little more than a year from date the gates of the Panama-Pacific International Exposition will be flung wide to visiting thousands. It is agreed by one and all that this will be an epoch-making event of far greater moment to the Pacific slope than anything so far recorded in history. It is to bring to our shores men of energy and resource who may see for themselves what California has to offer and who, seeing, will believe and, believing, take advantage of the blessings at hand. It is not San Francisco alone that is of consideration at this time. It is the great interior whose sweeping valleys and cozy hillsides promise rich reward for careful and intelligent cultivation. This is the moment of opportunity and it must not be allowed to pass unheeded; nay, it shall not, for the people of our State have awakened and are preparing to meet the issue.

We of "Pacific Service" feel the responsibility that is on the very eve of being cast upon our shoulders, but we are confident that we will be ready to obey the call when it comes. We are keeping abreast of the times and with the immense additions to our equipment, the first installment of which has recently been brought to so successful a completion, we expect to play no ordinary part in the general scheme of progress and development. Cheap electric power has already done wonders in California, and today it is recognized as the great factor in modern advancement. We might, with advantage, quote here from an editorial in a San Francisco newspaper:

"Moses smote the rock and found water, and that gave nourishment to the desert. The modern California engineer harnesses the water as it flows from the rock and that gives industrial nourishment to California.

"Coal, to be transported from the mountains to the manufacturing plant, must have railroad tracks, rolling stock, the elaborate and expensive machinery of transportation. The electric spark, caught when the falling waters turn the dynamos in the distant power-house, can be transported for hundreds of miles on a thin streak of wire.

"What need we with coal when we have electricity? A runnel in the Sierras is better than a vein of coal, for the coal can become exhausted, but the mountain stream is fed year after year by the snow that falls, and until snow ceases to fall and rain is no more California will have all the power—and the glory—that will come with industry, commerce and factory enterprise."

It will interest our readers to know that we have been requested by the City and County of San Francisco to supply "Pacific Service" for the operation of the Presidio and Ferries Railroad in San Francisco, the old Union street line that, upon the expiration of its franchise in December, passed into the hands of the city and is now a municipally-owned and operated system.

Just a year ago the current number of Pacific Service Magazine contained an announcement that our company had secured the contract to supply electric energy for the operation of the Geary street road, the first municipal railway in San Francisco. That our service has given satisfaction is evidenced by this new demand upon our electric service and, just as when we were awarded the Geary street contract we made considerable additions to our substation equipment in order to insure the traveling public uninterrupted service of the highest quality, so, now, it is incumbent upon us to see that our service to the Union street line is of equal standard.

Connection has been made between our substation "C," on Jessie street, between Third and Fourth, and the Union street trolley line, at Montgomery and Washington streets; also, there has been installed a 400 K. W. motor-generator at station "F" on Buchanan and North Point streets, adjacent to the exposition grounds. This equipment, it is believed, will be sufficient for the operation of the road as it stands at present.

An ingenious method of giving sound advice to employes is found in the following list of suggestions "How to Get Hurt." This originally appeared in the Safety Bulletin of the Illinois Steel Company and was published later in the Baltimore Gas and Electric News with the announcement that it had been adopted by the Baltimore Gas and Electric Company's safety committee:

HOW TO GET HURT—A BAKER'S DOZEN OF 'EM.

Don't mind the safety signs—they're for decoration.

Don't wear goggles when using an emery wheel or chipping—then the chips can get into your eyes.

Don't use both hands when climbing a ladder, or you are liable to get to the top without falling.

Don't pay attention to your feet when dropping material—if you do it may not hit them.

Don't report the careless workman—he may hurt you next.

Don't be neat about your work—untidy conditions cause accidents.

Don't report a dangerous place—you may be the one it will get.

Don't pay attention to a slight cut, or you won't get blood poison.

Don't pay attention to safety rules—you won't get hurt if you do.

Don't hunt for gas leaks by smelling or using soap-suds—use a match or you won't have an explosion.

Don't test a pole before climbing it to see if it will sustain your weight—it may fall when you are at the top.

Don't use rubber gloves when handling wires—you may get the "juice."

Don't give a darn about safety first—you may not be found out.

A Few Facts About Gas Combustion

By F. C. JONES, Chemist, Pacific Gas and Electric Company.

F. C. Jones

ILLUMINATING gas, wood and coal are composed essentially of the same elements—oxygen, nitrogen, carbon and hydrogen; the four most important elements in the make-up of all organic compounds. Indeed, all organic compounds contain two, three or all four of these elements.

Gas, then, is simply a fluid coal, for the four elements of coal are found in gas, only in different proportions and somewhat different arrangement. Now as to gas, wood and coal, the only elements that make these useful to us as light and heat givers are carbon and hydrogen, for carbon and hydrogen are combustible. Carbon, in burning, develops 14,550 British Thermal Units per pound, hydrogen 62,100, and the different combinations of carbon and hydrogen give an intermediate heat value.

The combustion of gas is simply the union of oxygen with all the carbon and all the hydrogen that the gas contains which are not already united with their full supply of oxygen. In the case of carbon monoxide (CO), we have carbon already united with half the oxygen it will carry; combustion supplies it with the other half. By the combustion of illuminating gas, there are formed carbon dioxide (CO_2), water (H_2O), and from the little sulphur present, sulphur dioxide (SO_2).

The composition of coal gas is as follows:

C_nH_{2n}	6.5		
CH_4	31.9		
H_2	45.6	Specific Gravity	.435
CO	6.6	B. T. U.	683.
CO_2	3.7	Candle Power	16.
N_2	2.7		

Carburetted water gas:

C_nH_{2n}	13.0		
CH_4	16.0		
H_2	32.0	Specific Gravity	.630
CO	29.0	B. T. U.	641.
CO_2	4.5	Candle Power	24.
O_2	0.5		
N_2	5.0		

Natural gas is found with compositions that vary greatly in per centage of CO_2 and CH_4. Some contain 100% CH_4; some 20% CO_2 and 80% CH_4; while some contain hydrogen and oxygen and nitrogen and some ethane. From some of the California gas now being produced, they are successfully compressing liquid hydrocarbon like gasoline.

To calculate the amount of air for complete combustion when the analysis of gas is known, first move the decimal points two places to the left—that is, make the constituents hundredths of unity. Then multiply the illuminants by 15., the CO and H_2 by 5/2 and the CH_4 by 10. Add the products thus obtained and the sum is the volume of air required by one volume of gas.

If the heat units of the gas are known, the amount of air for combustion can be easily calculated by dividing the B. T. U. by 100, and subtracting 1. For example, gas contains 650 B. T. U., divided by 100, we get 6.5; subtract 1 and 5.5 will be the number of volumes of air required by one volume of gas.

The composition of air is as follows:

	WEIGHT.	VOLUME.
Oxygen (O)	23.024	20.941
Nitrogen (N)	75.539	78.122
Argon (A)	1.437	.937

(SIR WILLIAM RAMSEY.)

When incomplete combustion occurs, some carbon monoxide (CO) is formed, and, if the supply of air is further limited, as in the "striking back" of a Bunsen burner, acetylene (C_2H_2) is formed.

The UNIT of HEAT, or British Thermal Unit, as you will remember, is the heat required to raise the temperature of one pound of pure water one degree F. at the maximum density of water 4° C. 39.2° F. One British Thermal Unit equals

778. foot pounds. Therefore the calculation of work in terms of heat is a simple one.

There are three or four laws governing the behavior of gases, which all gases, unlike liquids or solids, obey in the most exemplary manner. For example, following the law of Charles or Gay-Lussac, the volume of a gas varies directly with the absolute temperature, the pressure being constant, absolute zero being minus 460° F. and minus 273° C. Also by Avogadro's law equal volumes of all gases under like conditions of temperatures and pressures contain the same number of molecules. From this law it is evident that the specific gravity of a gas is proportional to its molecular weight; and the specific gravity of any gas compared with hydrogen is the molecular weight of that gas divided by 2, because the molecular weight of hydrogen is 2. Boyle's or Mariotte's law states that, the temperature being constant, the volume of a gas varies inversely with the pressure. Even the specific heats of the different gases are functions of their atomic weight, for if the atomic weights are multiplied by the specific heats the result is always the same number.

The SPECIFIC HEAT of a substance is the amount of heat required to raise the temperature of a pound of the substance 1° F. Water, of course, is 1.000, since by definition one British Thermal Unit accomplishes this result. Most other substances have specific heats of less than one.

LATENT HEAT is the heat that disappears when we melt or boil a substance. The amount varies with different substances. It is really the heat that does the internal work of separating the molecules when a solid becomes liquid or a liquid becomes a gas. For example, to melt 1,000 pounds of zinc from 60° F.: First, we must raise its temperature to its melting point 772° F. or 712 degrees. With water there would be 712,000 British Thermal Units; but the specific heat of zinc is only .0956. Multiplying .0956 x 712,000 we get 68,067 British Thermal Units. Now when the zinc reaches its melting point, the temperature remains stationary until all is melted, and for each pound melted 50.63 British Thermal Units disappear or become latent. This is the LATENT HEAT OF FUSION. 1,000 pounds would cause the disappearance of 50,630 British Thermal Units. Added to 68,067 we have the answer 118,697 British Thermal Units.

SPECIFIC HEATS

Cu (Copper)	.0950
Fe (Iron)	.1138
Pb (Lead)	.0306
Hg (Mercury)	.0319
Ag (Silver)	.0560

Each gas has two specific heats known as SPECIFIC HEAT AT CONSTANT PRESSURE and SPECIFIC HEAT AT CONSTANT VOLUME. When the pressure remains constant, the gas must expand and this expansion means work done to overcome the pressure of the atmosphere. Consequently, the specific heat at constant pressure is always higher than the specific heat at constant volume.

Specific Heat at Constant Pressure:

C^2H^4 (Ethylene)	.404
CH^4 (Methane or Marsh-gas)	.5929
H^2 (Hydrogen)	3.409
CO (Carbon Monoxide)	.2479
CO^2 (Carbon Dioxide)	.217
N (Nitrogen)	.2438
O (Oxygen)	.21751

To calculate the specific heat of a gas from analysis, multiply each constituent by its weight per cubic foot; then multiply this product by the specific heat; then divide the sum of the second product by the sum of the first.

Gas becomes heated by compression. It is important, therefore, to know the specific heat of a gas to calculate the amount that can be delivered at a given pressure.

We now come to the different modes by which heat is transferred.

Heat passes from one body to another by convection, by conduction and by radiation.

CONVECTION is the bodily carrying of heat from one point to another as when hot water or heated air rises.

CONDUCTION is the transference of heat by the molecules from one part of a body to another.

RADIATION, the most important of all, is the least understood. It is the transference of heat by ether waves. It is the means by which the earth receives all its heat from the sun.

In the combustion of gas, all three of these processes come into play.

The combustion of gas is a subject of vast interest. The varying amounts of the different constituents have a most remarkable effect on the candle-power and heating efficiency of the flame. Candle-power is due to heat. In the case of the incandescent mantle, it is a blue, hot, non-luminous flame, only, that causes the mantle to become luminous with its white heat.

In the open flame burner, it is the heat of the flame, causing the particles of carbon to glow, as they are being converted to carbon dioxide, that gives the candle-power. Now, a certain per cent of hydrocarbons will give a certain candle-power, only as it is mixed with a favorable composition of other gases. While the heating value can be calculated from the analysis, the candle-power depends on the favorable amounts of all the constituents. One per cent of air added to a volume of gas will reduce its candle-power 8 per cent; 3 per cent air, 16 per cent, and so on up to 15 per cent, which will reduce the candle-power 71.1 per cent. That is to say, 15 per cent of air instead of reducing a 20 candle-power gas to 17.4 by increase of volume will reduce it to 5.8 candle-power. It upsets the proper conditions for the glowing of the particles of carbon. It introduces oxygen into the midst of the flame and the carbon is consumed without giving light.

No less interesting is the effect that methane has on the candle-power. Methane in itself has no more than three candle-power, but has the high heating value of 1073 B. T. U. per cubic foot. It not only contains carbon which must be burned, but hydrogen which requires oxygen and will blanket the hydrocarbons and render the access of air slow. The burning of the methane causes such a high flame temperature that the carbon of the hydrocarbons glows with greater and probably prolonged brilliancy. The effect of methane is such that a gas may have with the same amount of illuminants either 12 or 16 candle-power, according as the methane is 28.0 or 35.0 per cent.

Of the other gases concerned, hydrogen and carbon monoxide add heat to the flame, while nitrogen and carbon dioxide steal it. The combustion of gas, then, is a rather complex process and until people become so enlightened as to have only a heat unit standard, gas must be made with the greatest care to get a maximum candle-power with a maximum quantity.

Manager Neely of the Fresno District sends word that Mr. Carl Bolfing, register clerk in the Fresno office, married Miss Ethel Forsyth of Gilroy on December 22nd. He had made no announcement of the wedding previous to its occurrence, but the office force got "wise" and gave him a great reception.

Manager Hall of the Santa Rosa District reports that his foreman of gas mains, Oscar Abrahams, was married New Year's Day to Miss May McCormack. The bride hails from Melbourne and came all the way across the Pacific to be married. The ceremony took place at the Presbyterian church at First avenue and Lake street, San Francisco.

PACIFIC GAS AND ELECTRIC COMPANY

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Contra Costa	Martinez	Don C. Ray
Fresno	Fresno	M. L. Neely
Grass Valley	Grass Valley	John Werry
Marysville	Marysville	J. E. Poingdestre
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Petaluma	Petaluma	H. Weber
Placer	East Auburn	H. M. Cooper
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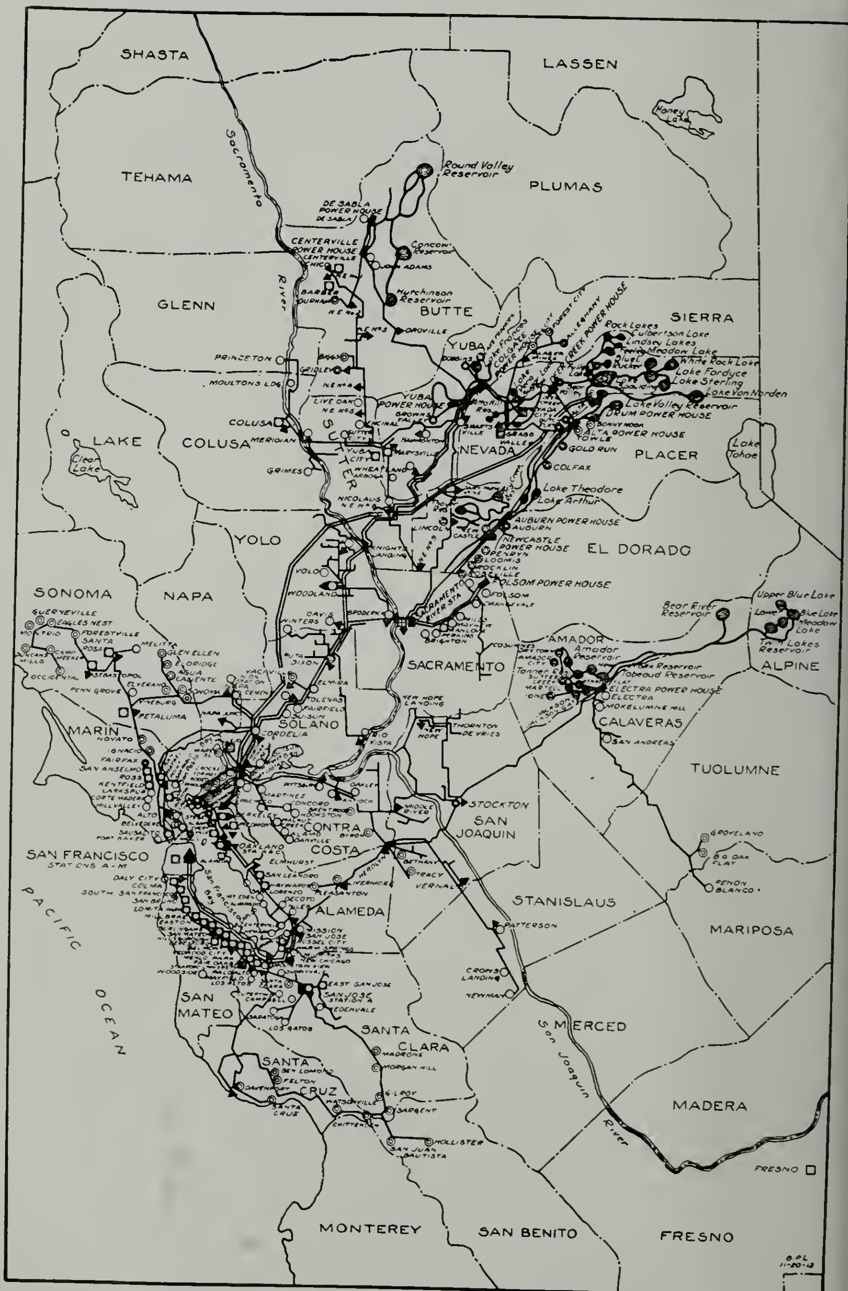

SHASTA
LASSEN
TEHAMA
PLUMAS
Sacramento River
Round Valley Reservoir
Honey Lake
DE SABLA POWER HOUSE
CENTERVILLE POWER HOUSE
Concow Reservoir
Hutchinson Reservoir
GLENN
BUTTE
SIERRA
OROVILLE
YUBA
PRINCETON
MOULTONS LDG
Rock Lakes
Culbertson Lake
Lindsey Lakes
Meadow Lake
White Rock Lake
Lake Fordyce
Lake Sterling
Lake Van Norden
Lake Valley Reservoir
DRUM POWER HOUSE
ALTA POWER HOUSE
YUBA POWER HOUSE
COLUSA
LAKE
Clear Lake
SUTTER
NEVADA
GOLD RUN
PLACER
Lake Tahoe
COLFAX
GRIMES
Lake Theodore
Lake Arthur
NICOLAUS
AUBURN POWER HOUSE
AUBURN
LINCOLN
YOLO
NEWCASTLE POWER HOUSE
EL DORADO
KNIGHTS LANDING
FOLSOM POWER HOUSE
FOLSOM
WOODLAND
SONOMA
NAPA
DAVIS
SACRAMENTO RIVER STA
Bear River Reservoir
Upper Blue Lake
Blue Lake
Meadow Lake
Twin Lakes Reservoir
AMADOR
Amador Reservoir
Tanner Reservoir
Tabeaud Reservoir
ELECTRA POWER HOUSE
ELECTRA
ALPINE
SACRAMENTO
PETALUMA
MARIN
SOLANO
CORDELIA
CALAVERAS
SAN ANDREAS
TUOLUMNE
STOCKTON
SAN JOAQUIN
CONTRA COSTA
SAN FRANCISCO
STATIONS A-M
OAKLAND
PACIFIC OCEAN
GROVELAND
BIG OAK FLAT
PENON BLANCO
ALAMEDA
STANISLAUS
PATTERSON
MARIPOSA
SAN JOSE
SAN MATEO
SANTA CLARA
MERCED
San Joaquin River
SANTA CRUZ
MADERA
WATSONVILLE
GILROY
HOLLISTER
SAN JUAN BAUTISTA
FRESNO
MONTEREY
SAN BENITO
FRESNO

PACIFIC GAS AND ELECTRIC COMPANY

CITIES AND TOWNS SUPPLIED WITH GAS, ELECTRICITY, WATER AND RAILWAY

Service Furnished	Number of Towns	Total Population
Electricity	209	1,093,992
Gas	51	989,167
Water	25	52,865
Railway	1	71,000

Place	Population
Alta	20
[1]Alameda	25,000
Alamo	50
[2]Albany	800
[5]Amador City	200
Adams John	25
Alleghany	200
Alto	25
Angel Island	280
[5]Auburn	2,375
Agua Caliente	100
Alvarado	900
Antioch	3,000
Arboga	100
[2]Barber	500
[2]Belmont	350
Ben Lomond	800
Belvedere	1,000
Benicia	3,360
[2]Beresford	25
[2]Berkeley	40,000
Biggs	750
Big Oak Flat	20
Brentwood	200
Brighton	100
Broderick	200
[5]Brown's Valley	50
Byron	200
[2]Burlingame	4,000
California City	25
Camp Meeker	200
Campbell	600
Centerville	1,000
Centerville	20
[2]Chico	13,000
[2]Colma	3,500
[2]Colusa	1,500
Concord	1,500
Cement	1,500
[5]Colfax	500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Cupertino	50
Daly City	250
Danville	250
Davis	750
Decoto	350
de Sabla	25
[5]Dixon	1,000
[5]Dobbins	50
Davenport	1,000
[5]Drytown	20
Durham	500
[5]Dutch Flat	500
Duncan's Mills	150
[2]Easton	300
[2]East San Jose	1,660
Eagle's Nest	50
Edenvale	500
Eldridge	500
Elmira	150
El Verano	400
Electra	50
[2]Emeryville	5,000
Encinal	100
Fairfax	500
Fairfield	834
Forestville	100
Felton	300
[1]Fresno	30,000
[2]Fair Oaks	250
Folsom	1,800
Gilroy	2,000
Glen Ellen	500
[5]Gold Run	100
[3]Grass Valley	4,500
Gridley	1,800
Grimes	250
Groveland	125
Guerneville	500
Hammonton	500
[2]Hayward	4,000
[2]Hillsborough	1,000
Hollister	3,000
Hookston	75
Ignacio	100
[5]Ione	900
Irvington	1,000
[5]Jackson Gate	100
[5]Jackson	2,035
[5]Kennedy Flat	20
[2]Kentfield	250
Knight's Landing	350
[5]Lake Francis	5
Lathrop	300
Live Oak	200
Livermore	2,250
Los Gatos	3,000
[2]Larkspur	600
[5]Lincoln	1,400
[2]Lomita Park	100
Los Altos	500
[5]Loomis	400
Maletta	30
Manlove	50
Martinez	5,000
[5]Martell	150
[2]Marysville	7,000
Mayfield	1,500
Mayhew	50
[2]Menlo Park	1,500
Meridian	300
[2]Millbrae	300
Mills	50
Milpitas	300
Mill Valley	2,500
Mission San Jose	500
Mokelumne Hill	150
Monte Rio	50
Moulton's Landing	30
Mountain View	2,500
Mt. Eden	200
Mare Island	500
[2]Napa	7,000
[3]Nevada City	2,700
[5]New Chicago	10
Newark	700
[5]Newcastle	750
Newman	1,000
Niles	800
Nicolaus	75
Novato	250
[2]Oakland	230,000
Oakley	80
Orange Vale	100
[2]Palo Alto	6,300
Pacheco	200
Penryn	250
Patterson	300
Penn Grove	300
Perkins	50
[2]Petaluma	5,500
[2]Piedmont	1,720
Pike City	200
Pinole	1,500
Pittsburg	2,372
Pleasanton	2,000
Point San Pedro	20
Port Costa	600
[2]Redwood City	3,200
[2]Richmond	10,000
Rio Vista	884
[5]Rocklin	1,000
[5]Roseville	2,600
Rodeo	500
[2]Ross	500
Russel City	250
[4]Sacramento	71,000
San Andreas	200
[2]San Anselmo	1,500
[2]San Bruno	1,500
[2]San Carlos	100
[2]San Francisco	416,912
[2]San Jose	30,000
[2]San Leandro	4,000
San Lorenzo	100
[2]San Mateo	6,500
[2]San Quentin	2,500
[2]San Rafael	6,000
San Pablo	1,000
Santa Clara	6,000
Santa Cruz	16,000
Saratoga	50
[2]Santa Rosa	12,000
[2]Sebastopol	1,200
Sausalito	2,500
Smartsville	500
[2]South San Francisco	2,500
[2]Stanford University	2,600
Sonoma	1,200
Stege	1,000
[5]Stockton	30,000
Suisun	1,200
Sutter City	150
Sutter Creek	1,500
Sunnyvale	1,500
Tiburon	400
Tormey	20
Towle	100
Tracy	1,200
Union Station	40
Vacaville	1,200
[1]Vallejo	15,000
Vineburg	200
Walnut Creek	350
Warm Springs	200
Watsonville	4,500
Wheatland	1,400
Winters	1,200
[2]Woodland	3,200
Woodside	200
Yolo	400
[2]Yuba City	1,200
Total	1,148,992

Unmarked—Electricity only.
1—Gas only.
2—Gas and Electricity.
3—Gas, Electricity and Water.
4—Gas, Electricity and Street Railways.
5—Electricity and Water.

EMPLOYS 4,800 people.

OPERATES 11 hydro-electric plants in the mountains.
5 steam-driven electric plants in big cities.
16 gas works.

SERVES $^2/_3$ of California's population.
30 of California's 58 counties.
An area of 37,775 square miles.
$^3/_5$ the size of New York State.
$^1/_2$ the size of all the New England States combined.

VOL. 5 FEBRUARY 1914 No. 9

Pacific Service Magazine

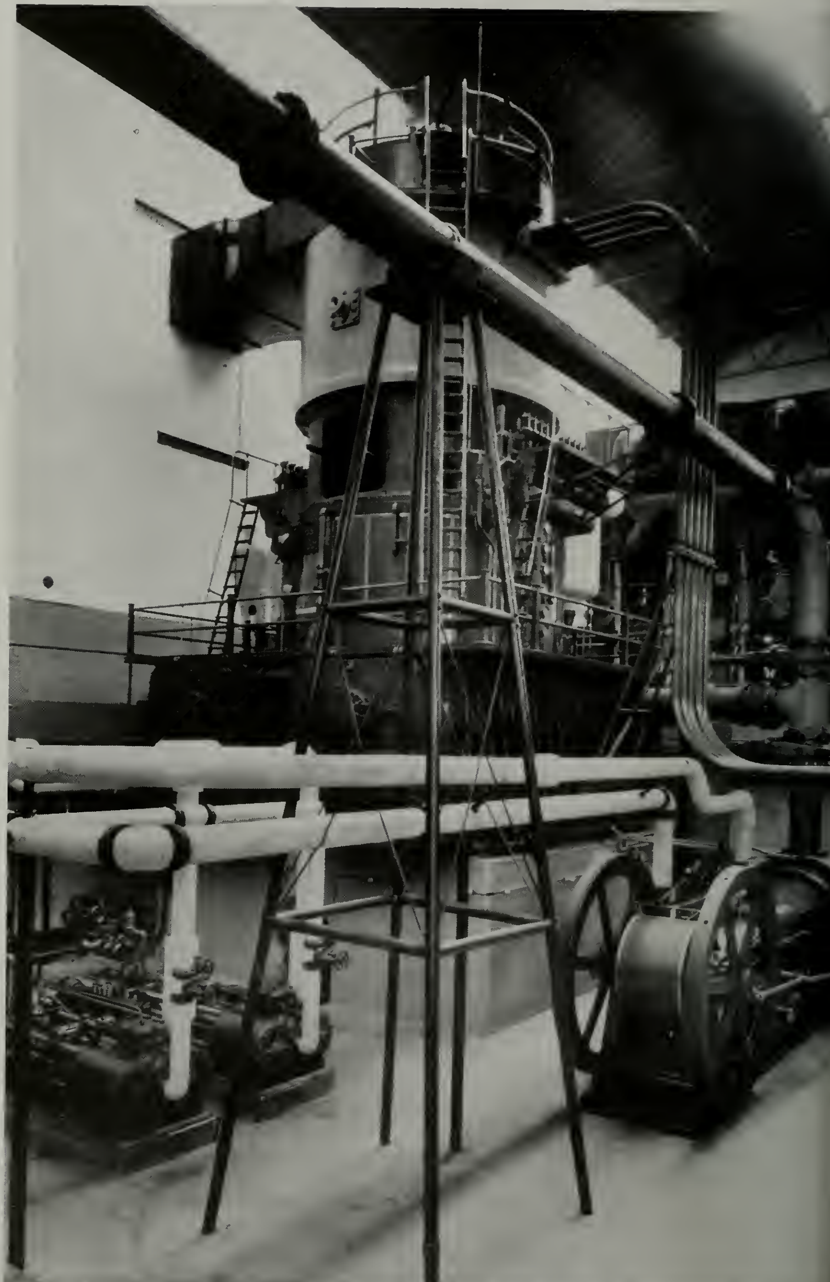
PUBLISHED MONTHLY BY THE
PACIFIC GAS AND ELECTRIC COMPANY
SAN FRANCISCO, CALIFORNIA

Pacific Service Magazine

VOL. V No. 9

Yearly Subscription $1.50 :: :: Single Copies, Each, 15 Cents

Contents for February



The new 15,000 K. W. turbo-generator installed at station "A," San Francisco.

PACIFIC SERVICE MAGAZINE

VOL. V FEBRUARY, 1914 No. 9

The Latest Addition to "Turbine Row" at Station "A," San Francisco

By FRANK H. VARNEY, Engineer O. and M. Department, Steam Section

F. H. Varney

ANOTHER turbo-generator has been added to the already formidable equipment of station "A" in San Francisco, the big steam-electric plant that stands guard, so to speak, over the metropolis of the West, insuring its citizens a full and uninterrupted supply of "Pacific Service" under any and all conditions.

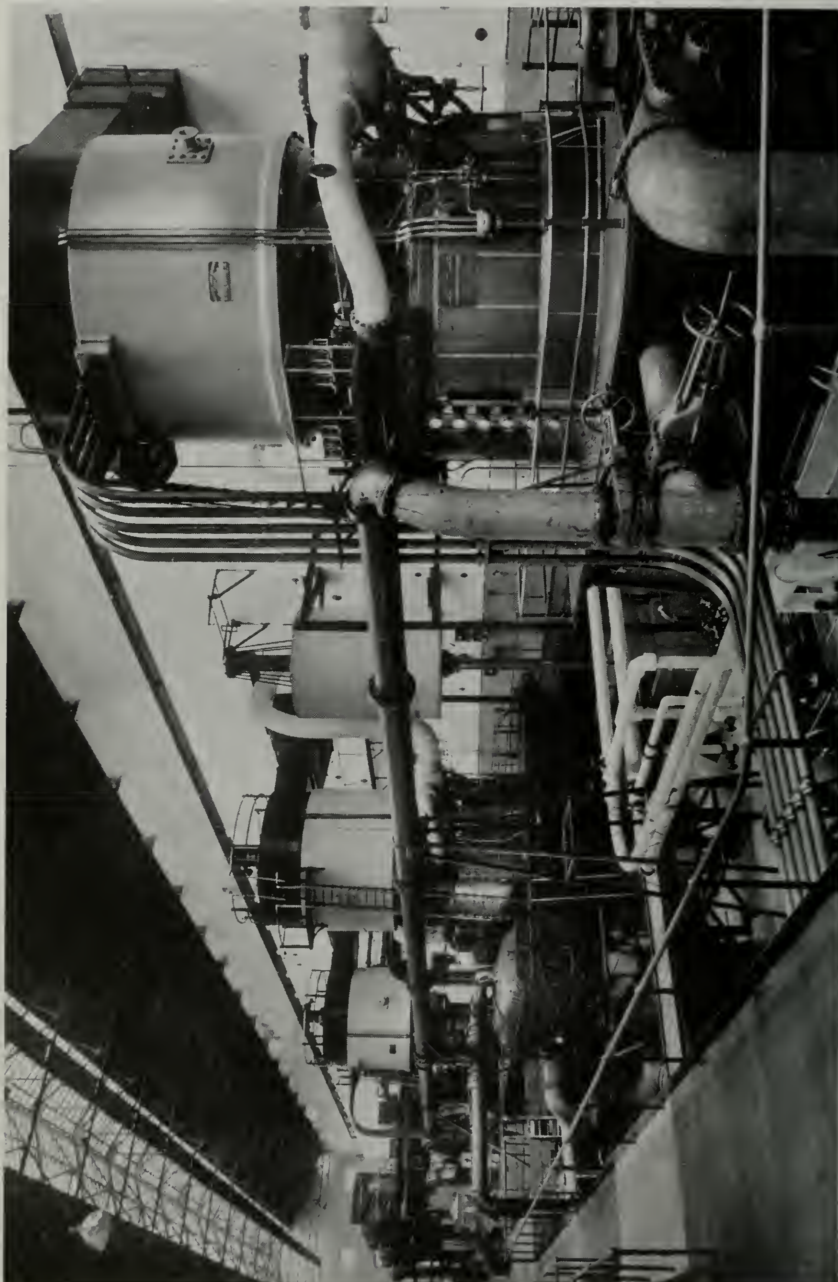
This latest addition to "turbine row" is of similar capacity to that which was installed in 1912, namely, 15,000 K. W. It is of the Curtis type, vertical, with seven stages, and represents the best efforts of the manufacturing company. The results of the test to which it was submitted showed it to be not only all but more than the manufacturers expected and claimed for it. While its rating is 15,000 K. W. we have demonstrated that it will carry 19,000 K. W. continuously without detriment to either the generator or turbine, and this at an efficiency even higher than was claimed for its most economical point of operation.

In the September, 1913, issue of Pacific Service Magazine attention was called to the pouring of the foundation and to the record made at that time, the foundation-pouring being completed in little less than twelve hours. Two of the old battleship-type reciprocating engines, each of 1500 K. W. capacity, were taken out to make room for the new turbine, and the work of making a place for it was done by a process known as the Eastwood method, named after our very able superintendent at station "A." Some gads, weighing 500 pounds apiece, were hammered into the rock with battering rams of three tons weight slung from an overhead crane. The action of the gads resembled that of a wedge splitting wood. Through this process the rock was broken up into comparatively small pieces, loaded on railroad cars and taken away. This was the first time that Superintendent Eastwood's method had been put into practical operation, and it proved to be a complete success in every particular.

Then came the pouring of the foundation and, meanwhile, parts of the turbine were arriving on the ground from the works of the General Electric Company in the East. Next came the putting together and, most important of all, the testing. The final tests were made January 21st, just a month ago, a 15,000 K. W. load being carried from about 11 o'clock a. m. to 5 p. m., at which time the load was increased to 19,000 K. W. and operated till 9 p. m. During this run the greatest temperature in the generator, as read by the temperature instrument connected to exploring coils in the armature slots, reached 70 degrees C., while the manufacturers' instructions state that 90 degrees C. can be carried safely.

With regard to the steam consumption of the turbine the guarantees were exceeded by almost three per cent. And now the big generator stands beside its two companions, a testimonial to engineering and manufacturing skill in its latest development.

The distinctive features of this tur-



"Turbine row" at station "A," San Francisco. The new turbo-generator is in the foreground, and the other 15,000 K. W. installation is at the other end of the row, the center turbine being of 12,000 K. W. capacity.

bine are the seven stages, and the extremely large condenser shell. Our other vertical turbines have but five stages, with the single exception of the installation of 1912, which has six, and while the new turbine has exceeded the others in the number of stages, this has been accomplished without any material increase in height.

With regard to the condenser, it has been customary to install auxiliary wings at the sides of the turbine-base in order to get enough cooling surface for the quantity of steam consumed by the turbine; but, in this case, at our solicitation the base was so designed that enough surface could be installed in the base itself, resulting in a considerable saving in first cost, a large reduction in the amount of floor space required and a more economical unit.

It now becomes evident that the power-plant and the load demands have outgrown the distribution system, and in order to allow for this increase it becomes necessary to enlarge the switching facilities at the station.

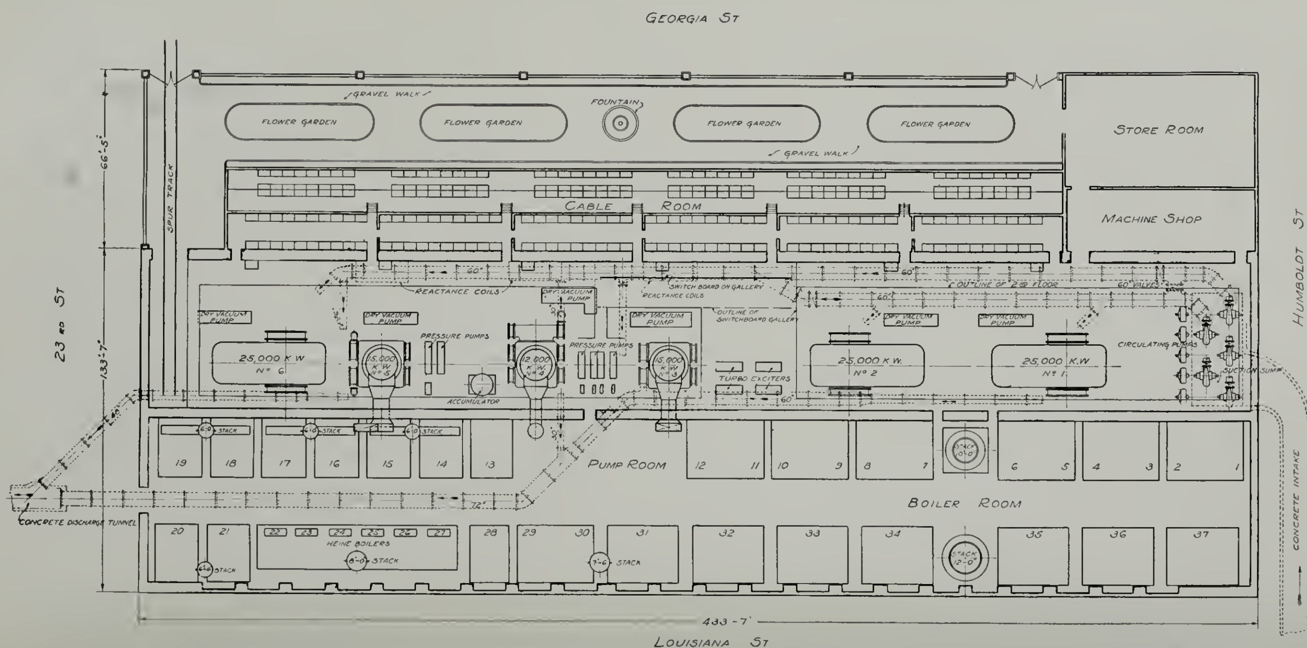
As the cumulative system grows, the extra generating capacity demands more cable capacity, which, in turn, means more switching facilities, more salt water and more boilers. Accordingly, plans for a completed station have been worked up, with the idea of developing the maximum capacity which is considered advisable to generate at this point. The completed plans show a feasible and economical development of 120,000 K. W. This means an ultimate capacity of three times the present turbine capacity of the station.

Indeed, we are even now planning for a fourth turbine installation at station "A," and are in hopes that the day is not far distant when we may be allowed to set about preparing a place for it. What we have in mind this time is a turbo-generator of 25,000 K. W. capacity, and which, on account of the higher rotative speed, will be of the horizontal type. We have one of this type in our River Station at Sacramento, but this is a comparatively small installation, being of but 5,000 K. W. rating.

Now with regard to the present plant and the reason for allowing our ideas to soar to the dizzy heights of a station of such capacity. It has been considered essential that San Francisco shall have enough steam-generating capacity to carry its maximum demand. In making this statement it should not be construed to mean that no hydro-electric power is to be used in San Francisco, but that in cases of emergency, such as line trouble, this city will not be without service in any section. Furthermore, if such emergencies occur at "off-peak" hours, it will be possible to supply the hydro-electric system with current to the station's capacity. Thus, for example, San Jose will have three sources of supply; that is, from the Electra lines, the lines from Oakland (steam and hydro) and from the San Francisco steam station.

It is an apparent fact, also, that the greatest assistance to the hydro-electric department, in case of shortage of capacity on that system, is first to relieve it of load on the extreme ends of the lines, and, second, if necessary, to supply current from these terminals. Thus, with a steam-plant in San Francisco of sufficient capacity to carry the San Francisco peak, the first load to take off the transmission lines is the San Francisco load; and if this shortage of current occurs at "off-peak" times, it is possible to feed back on the line from station "A."

Station "A" has the distinction of being the largest single generating plant owned by the company, and in emergency cases has generated one-third of the entire K. W. H. of the company's output. Its overall efficiency compares very favorably with the best managed stations in the United States, and the class of service given is equal to any, notwithstanding the fact that the station is used very largely as a standby for the hydro-electric system and generates only



General plan of station "A," San Francisco, showing prospective arrangement under ultimate development. Equipment as set forth in the plan includes six turbo-generators, thirty-seven boilers, and complete switch-house divided into six sections, allowing a separate section for each turbine, with sufficient cables to carry the full load from each. Each section of the switch-house will be a fire-proof compartment, arranged with double buss-bars and sectionalizing switches.

what that system cannot supply. In the meantime, it stands ready to absorb a load of 10,000 K. W. instantly, in case the hydro-electric supply is cut off.

This efficiency of standby service is impossible with reciprocating engines, and has only been made possible by the advent of the steam-turbine. The steam-turbine has an efficiency curve that is practically flat from one-third load to full load; that is, there is very little difference in efficiency in that range of load. This high steam efficiency under all conditions, coupled with the small cost of labor to operate, the low cost of maintenance, and the perfect synchronous operation, due to evenness of the impulse on the turbine blades and the rotary motion, make it the operator's ideal, which a very few years ago was considered a dream.

The high efficiency in steam consumption due to the possibility of expanding the steam indefinitely, in the multiple number of stages, and to accomplish this expansion a high vacuum is necessary. Therefore, it is customary to install with the turbine a wet vacuum pump to rid the condenser of water, and a dry vacuum pump of high efficiency to carry off the non-condensible vapors. This would appear to increase the number of auxiliaries in proportion to the turbine capacity. It does not do so, however, as tests have shown that the dry vacuum pump on a 15,000 K. W. turbine requires only 25 H. P., which is practically the same as the vacuum pump on the former 1,500 K. W. engines.

In figuring steam consumption, from tests made in our reciprocating engines and turbines there is apparently a saving in steam of forty per cent with turbines; but, due to the less number of auxiliaries used with the turbines, in proportion to the capacity, the turbines show an operating efficiency approximately ninety per cent greater than the engines. Owing to this remarkable saving in the amount of steam required we have been able to almost double the capacity of station "A" without adding any more boilers.

The time has now arrived, however, when more generating capacity necessitates more boilers, and to install more boilers it is necessary to remodel the boiler room. In doing this, a very fine plan has been developed, which not only allows of more capacity, but also simplifies the boiler room, and makes it possible to install more capacity at a very low first cost, and a subsequent low operating cost.

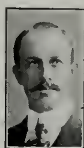
The superiority of the steam turbine over reciprocating engines has led to its adoption for many purposes besides prime movers, and small turbines are found scattered all through station "A." Turbine-driven exciters are now being substituted for the old-fashioned engine-drive, and turbine-driven pumps are used for the water from the condensers. Even in the boiler room it will be found that the reciprocating motion is becoming a thing of the past and the old style plunger-pumps are giving place to turbo-driven centrifugal pumps.

"The building of the Spaulding dam high up in the Sierras near Emigrant Gap ranks among the great engineering works of modern times. The project is staggering in its immense proportions and aside from the natural difficulties encountered in building so colossal a structure, the work was beset by dangers and difficulties from the rigors of the winters in that high altitude. A number of things new in engineering practices were done in building the Spaulding dam, as, for instance, the use of wide belt conveyors to carry wet concrete up grade."—California Industries Magazine.

The Economic Value of Electric Transmission

By F. G. BAUM

[*This interesting article upon the effect of electric power on modern conditions was published in a recent number of the Journal of Electricity, Power and Gas, and is copyrighted by the Technical Publishing Company. It is reproduced here by special permission.*
EDITOR PACIFIC SERVICE MAGAZINE.]


F. G. Baum

THE men who built the first electric-power transmission systems in California did not realize how rapidly and to what magnitude the business would grow; yet, in a general way, they did appreciate the great advantages to be gained by a transmission system furnishing power to operate various industries from large, efficient power-plants, instead of each industry supplying its own power from a small, inefficient plant.

The economy to the consumer in any particular case could, of course, be determined and the saving to the power user effectively shown, but as the power transmission lines operating as a unit have become larger and made to cover more and more territory, the additional advantages of having the large power system supported by a varied series of industries have added additional economy and stability to the large systems, and have also added general benefits to the industries and communities. The total result gives strong rea-

Drum canal, showing Spaulding dam in distance.

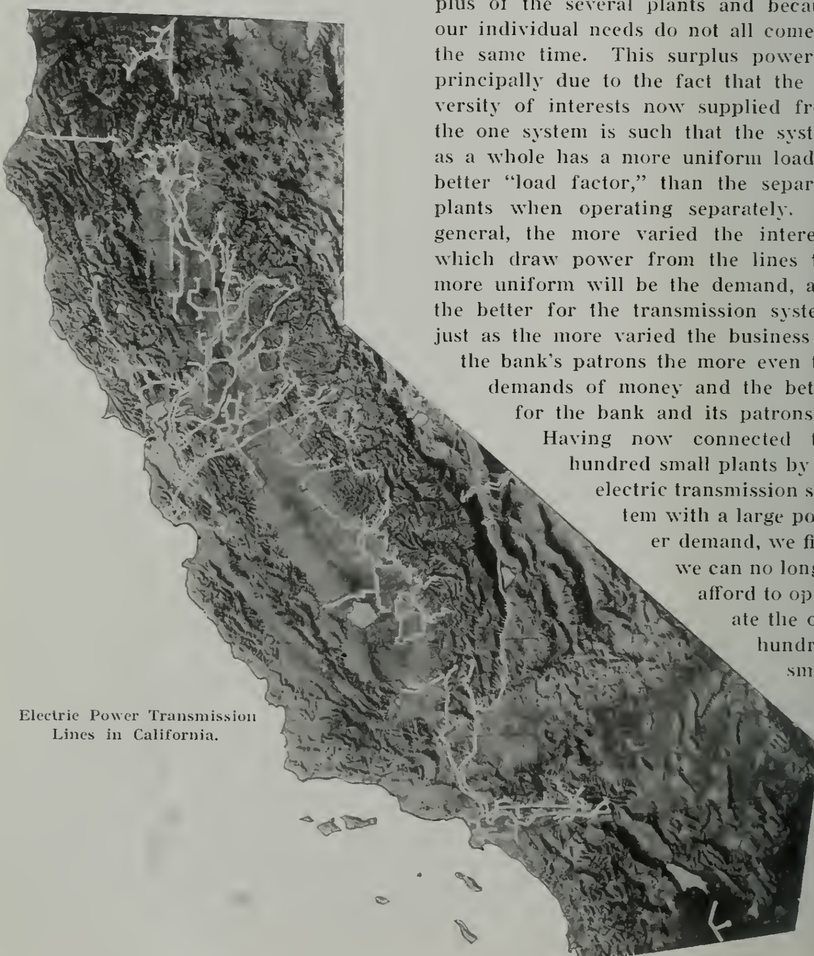
sons for the increase of the electric transmission systems to cover generally a wider territory and more diversified industries.

To understand the reasons for this favorable condition resulting from the introduction of the electrical transmission systems is not difficult, and we need only remember that any form of mechanical power can be efficiently converted into electric power and economically transmitted over long distances, subdivided into any number of parts, and instantly reconverted into some form of useful power at the place where it is wanted, in order to begin to appreciate that what is occurring is in response to fundamental economic laws. The high efficiency at which electric power may be generated, transmitted, subdivided and reconverted into mechanical or other useful power at any point along the transmission system is responsible for the use of electricity as the medium of modern power transmission and the continually increasing area covered by the electric transmission systems. This widening of the territory and the increased amount of power drawn from the transmission systems have been met by higher voltage transmission lines and by the installation of larger and larger generating units, until single units of 10,000 to 20,000 horse-power are now common, and operate continuously for days and weeks with less attention than is required by a 100-horse-power engine unit in a small factory.

Drum power-house and pipe-line.

In order to more thoroughly appreciate the advantages obtained by a large system, we must understand that no great amount of electricity can be stored. This means that the output of the power plants feeding into the transmission system must at each instant balance the power supply drawn from the lines, plus the transmission losses. Furthermore, the electric medium of power exchange between points of production and consumption operates instantly and efficiently.

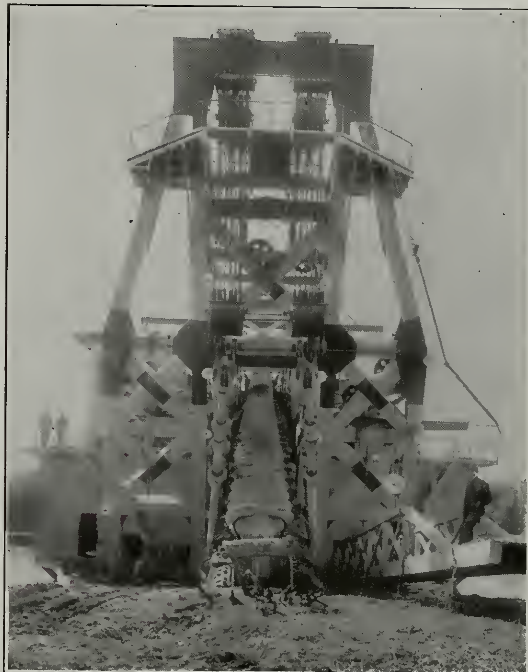
To use an illustrative analogy, the large electric system may be compared to a bank in its economic function, and the electric medium of transmission may be compared to money, the medium of property exchange. If we had no money we would have to trade by direct exchange of property, and if we had money, but no banks in which to deposit our funds from which those of us who need it might draw, the difficulties of doing business may be imagined. Without a central power distributing system each consumer must develop his own power and have some surplus power. Hence there is no medium of exchange, no means of "banking" the total power of all on the transmission system, and no drawing at such points and in such amounts as may be needed from time to time. Electric transmission provides the elastic medium for exchanging any one form of mechanical power to any other form of mechanical power at some point on the system.



Electric Power Transmission Lines in California.

If one hundred isolated power-plants are connected together by a transmission system and their power-producing possibilities concentrated we will then be able to supply the demands of the one hundred original consumers and have a fair-sized surplus always on hand. That is, by "banking" the individual energies through the medium of the transmission system, we all can get the convenience of the power facilities, and the system will be able to meet the demands of all its patrons—and carry a surplus. This is because we have concentrated the surplus of the several plants and because our individual needs do not all come at the same time. This surplus power is principally due to the fact that the diversity of interests now supplied from the one system is such that the system as a whole has a more uniform load, a better "load factor," than the separate plants when operating separately. In general, the more varied the interests which draw power from the lines the more uniform will be the demand, and the better for the transmission system, just as the more varied the business of the bank's patrons the more even the demands of money and the better for the bank and its patrons.

Having now connected the hundred small plants by an electric transmission system with a large power demand, we find we can no longer afford to operate the one hundred small plants, but, instead, we install a few large power units to supply the entire system, and by this means produce a large saving in operating expense. The economies resulting from large power systems with large central stations is in this way working a revolution in America, especially in California, and also in other countries. That this revolution is progressing from economic reasons which are fundamentally sound is certain, and, therefore, larger and larger electric power systems may be expected.


Electric-driven gold dredge.

We may well inquire if these large power systems are to the advantage of the community as a whole, as one can see that in this revolution, as in other stages of progress, individual industries may be temporarily injured. A few simple considerations will show that electricity is one of the greatest influences for the stability of a country; for, as is well known, to be stable a country must be efficient, and it is now being more and more recognized that to be efficient it must use electric power; also, it is now becoming recognized that the most stable country is one in which the industries are diversified and widely distributed, and especially one having a prosperous and stable farming interest.

To bring about this diversion and distribution of interests and population the influence of the electric power systems (and especially the water-power systems) is probably as great as that of the railroads, and some day nearly all railroads will be simply electrically-operated mechanical devices for the transportation of such things as must be moved in bulk; that is, practically all railroads will in time be electrically operated.

The stability of any civilization depends, also, on the fact that it consumes less than it produces, and as it is necessary with an increasing population (the natural resources of a country being fixed and limited and the population increasing) to operate more and more efficiently in order to produce more than is consumed, the most efficient methods must be employed for all operations. Nature's naturally replenished sources of power must be used instead of consuming wood, coal, oil, etc., and the most natural source of power is falling water, which nature is annually reproducing.

This water power, converted into the electric form for distribution and supplied to electric appliances for conversion into the form desired at the place desired, is the most efficient and convenient system imaginable and the electric method of doing a thing also tends inherently to remain efficient, for inefficiency makes its appearance as heat, and heat means trouble in the electric system; and as the human being wants to avoid trouble, there is inherent reason for efficiency. Starting with water power converted to electric power we can go on producing forever any mechanical operation; we can fertilize our lands, cultivate them, harvest and transport the crops to market, cook our meals, light, cool and heat our homes, etc., and do it efficiently. In concentrated centers electricity will not, however, displace gas.

Reclamation and irrigation by electricity.

The great problem of all ages has been to connect the producer and the consumer, and the greatest loss in efficiency has been in this step between the producer and the consumer. If we could produce, distribute, and consume all other products as efficiently and as simply as we can electricity, this great loss between production and consumption would be reduced eighty to ninety per cent. For this reason the electrical method of doing a thing will always be the ideal, and some time in the future a nation's civilization will be measured largely in terms of kilowatt hours consumed per human being per year, because as the kilowatt hours consumed are large, so the non-productive inefficient labor will be small. Therefore a nation having large natural water-powers need never fear decay. Hence, we see the general benefits accruing to all the people, an unearned increment, so to speak, as a result of the electric transmission systems. The electrical transmission systems will ultimately form a network all over the country just as the railroads have gridironed the states in the past, and electric service will be necessary for economic farming.

To illustrate the saving of capital and operating expenses, and the distribution of industries throughout an area, let us consider the conditions in California, especially the central part of the state, where one of the largest systems in the world has been built up in the last fifteen years. In order to more thoroughly appreciate the changes wrought in California by the hydroelectric power transmission systems, we must go back to 1897 and 1898. At that time there were independent and local steam plants in all the cities and towns of California. These plants supplied current for lighting only, and manufacturing concerns provided themselves with power from small, inefficient plants which rapidly depreciated. The cost of lighting was fifteen cents per kilowatt hour in the small towns, and power costs to manufacturing companies in most cases about two hundred dollars per horse-power per year.

The mines on the Mother Lode had largely been abandoned, gold dredging had not yet proved feasible, no cement plants had been established, and wheat farming was rapidly declining. In a few isolated cases the farmers had begun to pump water for irrigation by means of gas engines, and lands were held at ridiculously low prices, but could not be sold, and Southern Pacific common stock, which is an index of California prosperity, was held at $25 to $30 per share because it could not be sold. It will be recalled that 1897 and 1898 were dry years, so that the farmers were praying for rain, the merchant for business—and, on the whole, conditions were as discouraging as seemed possible.

The only signs of hope were the several electrical plants that were starting about that time in the Sierras. "Brain storms of de Sabla and Martin," they were called. Small hydroelectric plants were installed to supply power to the Grass Valley mines, and to the Mother Lode at Sutter Creek, Jackson, etc. The success of these plants caused the installation of a plant to supply power to Marysville, and caused the extension of a line from the Mokelumne River to Stockton, and the building of the first part of Colgate and a transmission to Sacramento. As each plant was installed and the lines extended, careful measurements and tests were made to answer the question, "Is it feasible to transmit power commercially successful from the Sierras to the bay of San Francisco?" The answer being in the affirmative, these bold pioneers proceeded to raise money to build the plants and lines to Oakland and San Francisco.

It was my privilege to make these measurements, and I cannot adequately express my appreciation of these men in doing the work they did. California and the world owes them many times any profit they made out of these developments, for they freely published, or gave permission to be published, the results of the measurements and results of the actual operation commercially. The company has ever since maintained a record for bold pioneer work that has added much to the world's knowledge and wealth. What has been the net result of the hydroelectric developments in California no one can possibly say, but it has no doubt added many hundreds of millions of dollars to the wealth of the state; for the result has been to revive the mines of the Mother Lode, to make gold dredging and the cement industry possible, and to give the manufacturer and farmer a cheap source of power, so that land values have recovered, and the

Electrically-driven cement plant.

prices of lighting and power have been reduced to less than one-half the earlier figures, with the result that California is at least ten years ahead in its development—all due to the hydroelectric systems, which necessarily built transmission lines across the valleys on their way from the mountains to the cities.

Most of the power is produced on various mountain streams from water power, the sources of power being about one hundred and fifty miles from San Francisco. From each of these plants lines are built in the general direction leading to Oakland and San Francisco. Considering Oakland or San Francisco as the hub of a wheel, the power lines would appear as the spokes, the plants being located at the ends of the spokes. In some cases lines connect also from one plant to the other, or several plants are connected together on the rim of the wheel, bearing out the further resemblance to a wheel, the connecting lines between the plants being the felloes, or the tire connecting the spokes. On the rim of this wheel are also large power consumers, made up of some large mining communities, etc., and on the spokes of the wheel are a number of cities, towns, factories, etc., for example, Sacramento, Stockton, Oroville, Marysville, San Jose, Woodland, and many others; also several large cement plants, numerous gold dredgers, large street car systems, innumerable small factories, many small pumping plants both for irrigation and drainage, and the numerous consumers requiring light for stores, homes and almost every conceivable use.

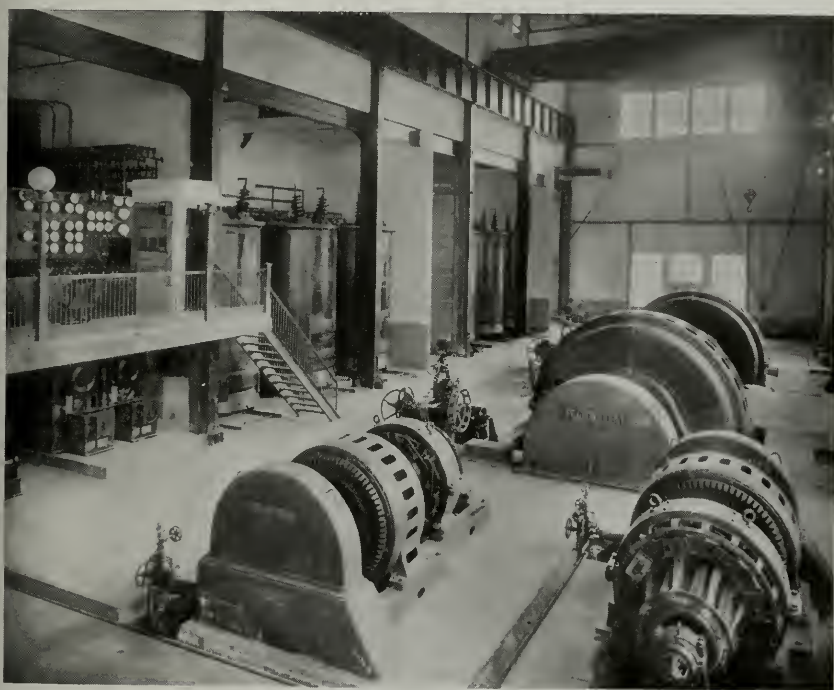
The result is, then, that power is transmitted over the transmission lines to the various points of use, the last of the water-power being carried to the hub of the electric wheel, to Oakland and San Francisco. At these points large steam-plants are provided for power-service insurance, and to balance up the power supply and demand so that the water-power plants may as nearly as possible deliver their maximum output at all times. The arc of a circle covered by this large electric system is about three hundred and fifty miles long and the area covered is nearly forty thousand square miles, or an area sixty per cent as large as the state of New York. The average load on this

Lake Spaulding dam and construction plant. Present height, 242 feet; ultimate height, 322 feet.

system has grown to over 100,000 horsepower. This power and transmission system has since the beginning maintained its lead over all others in the world.

The result of such a system is that the same service in electric power is available at the mining camps in the mountains and to the small towns and industries in the central part of California as is supplied to the larger cities. Aside from the economies mentioned of such a system, resulting from the "banking" of the facilities, the power conditions throughout this area tend to become equalized, resulting in a distribution of population and industries not otherwise possible; and resulting, also, in adding to the general stability of the country, and in great saving in capital and operating expenditures for the industries and cities served. Very often il enables the establishment of an industry; for example, a small factory, a rock quarry, a cement plant, a farm, at a point otherwise prohibited, adding to the economic value of the district. The tendency is also to equalize rates for light and power and to reduce rates to the lowest level, as is evidenced by the fact that in small California cities the consumer of electric light or power gets much lower rates than ordinarily obtained in Eastern cities having local power stations. Electric service to farmers is almost unknown in the East.

In consequence of this electrical development industries are being established in many of the smaller towns and outlying district where the employes can live more advantageously, and the natural effective result is a healthy growth of all parts of the state, a large saving in operating expenses, capital and resources, a general equalizing of opportunities, and,



Interior of Drum power-house.

on the whole, a tremendous economic gain for the communities and increasing in geometric ratio. It is naturally to the interests of the people that the power systems be extended as rapidly as conditions warrant, as the resultant economies from the extension of the business will of necessity redound to their benefit. For this reason, as I said before, California or any state or nation having available cheap power, need never fear decay.

In California several practical illustrations may be seen in the conservation of water resources and the extension of the power systems. In one of these, flood waters are to be stored in a huge dam 300 feet high at an elevation of 5050 feet above sea level, the dam alone costing over $2,000,000. After being released from the dam the water is successively passed through a series of six power-houses, utilizing a total drop of 4140 feet for power purposes, generating more than one hundred thousand constant horse-power, the water being discharged from the last power-house at an elevation of 400 feet and at this point the stored water is diverted into irrigation canals and more than 60,000 acres will be irrigated. This is practical conservation and of enormous value to the State.

A glance at the map of California showing the development of electric transmission systems in the last fifteen years, and a knowledge of the undeveloped resources will give an idea of what has been accomplished and what may be the result twenty-five years hence. It follows that every encouragement should be given to develop water power as against steam power, in order to gain the advantages for California of the highest type of civilization—one that will endure to the end of time.

It requires no prophet to predict that within the life of most of us the steam locomotive will largely disappear, and that in its place will be the electric motor, quietly, rapidly and effectively doing the future work of transportation; and it requires no prediction that the electric motor and other electrical devices will be largely responsible for future progress and advancement of civilization generally. In fact, civilization and philosophy will be very much influenced and directed by electricity and its accomplishments. The philosophy of Marcus Aurelius and Confucius, who lived two thousand years ago, is as sound as that of our modern philosophy; yet Rome decayed and China now sleeps. The electric transmission of intelligence and power would have prevented the decay of the former and would arrest the sleep of the latter. It is impossible to judge the future by the past without making full allowance for changed conditions resulting from the modern electrical transmission of information, power and products.

The transmission and distributing systems are gradually covering the entire state, forming an electrical metallic screen over the country. This is a screen of equal and constant potential under which service, opportunities, rates tend to become equal. By building the transmission systems across and through the valleys of California there is formed a system which makes for the uniform and stable development of the state as a whole. Not only this, but the hydro-electric companies use a waste to reduce a want, and in using this waste energy to lift the burdens of humanity we make a net gain for civilization and do not merely transfer a burden from one set of shoulders to another. That is, electric power tends to make masters of men and to eliminate slavery. This gives us assurance for the future, for an increasing population requires progress, progress requires profits, profits require efficiency—and we may claim in all modesty that modern business could not be carried on efficiently without electric power.

Features of the Drum-Cordelia Tower-Line Construction

By WILL T. JONES, O. & M. Department, Hydro-Electric Section

[*Continued from our January issue*]

DELIVERY AND ERECTION OF TOWERS.

With the foundations in place everything was in readiness for the towers to be installed on them.

W. T. Jones

With the arrival of each shipment it was necessary to segregate the steel in order to properly check the number of complete towers received. The man in charge of this checking was given a copy of shipping notices sent out by the consignor, and as each piece of a tower was designated by a special number or mark, the steel was arranged in piles accordingly. In this manner it was an easy matter to check with the steamer bills of lading, exceptions being made in all instances where the angles were bent or broken or there were pieces short.

At the railroad stations or steamer landings it was necessary to have the material segregated again in order to facilitate loading on wagons, to be hauled to the proper point on the line. Each class of tower was kept separate, and this segregation of the steel and loading of teams was a matter that required very careful attention. Some of the towers were a quarter of a mile apart, and as one tower was a load for a four-horse team, and at several points required a day or more for a trip, it will readily be seen that failure to deliver the necessary and proper parts at the various locations meant considerable expense, and corresponding delay to the crew which followed to build up the tower. By having sufficient and competent help and with careful checking, the extra expense in this connection during the erection of the towers on the Drum line was reduced to a minimum.

With the steel delivered to the various sites, work on assembling and erecting the towers commenced. Through the valleys and, in fact, wherever possible, all of the towers were assembled first on the ground. Through the orchards of the prosperous Vaca Valley and throughout the entire mountain section it was necessary to build up each tower in the air piece by piece. In the orchard country this materially increased the cost of erecting the towers, but was absolutely necessary in order not to injure or destroy the growing fruit trees. In the mountainous section, the hillsides were as a rule steep and all towers were built up. The accompanying pictures will give an idea of the steepness of some of the country through which the line was built.

Throughout the valley country where the towers were raised after first being bolted together on the ground some very interesting methods of raising them were tried, and the one which finally proved the most successful was the use of a 32-foot gin pole with a sheave at the top and a snatch-block at the bottom with a three-ton truck for the motive power. By using the truck to carry a maximum number of 48 men to and from work, and by keeping it employed constantly during the day raising towers and moving tools and equipment from one location to another, there was provided one of the most economical uses a truck could be put to, and by this means the company was able to erect the towers much more rapidly and at a decided decrease in cost.

Camp-moving, and the trucks used to transport crews.

INSULATORS AND CONDUCTOR.

The insulators on the line are the Standard Suspension type manufactured by the Ohio Brass Company, and represent the best and latest thing in the development or evolution, so to speak, of the high tension insulator. There are seven units in a string, suspended from the cross-arm by a tower hook.

When it came to the selection of a conductor for as important a line as the Drum-Cordelia was destined to become, very careful consideration was given to the various elements that would be encountered. It was finally decided to use No. 3/0-7 strand M. H. D. bare copper throughout the mountainous section and, also, from Putah Creek, in Yolo County, to the Cordelia substation. Across the Sacramento Valley the conductor was aluminum, of equal conductivity. The cables are held to the insulator by means of a suspension clamp and in each clamp is fitted a protecting sleeve, either of soft aluminum or soft copper, so that the cable itself does not come in direct contact with foreign metal. It is believed that by use of these sleeves, the danger of line failures at these supports will be entirely overcome since the bearing surface will be smooth and the corrosion, if any, will be between the clamp and the sleeve rather than between the clamp and the conductor.

SPECIAL TOWERS.

There are twenty-four special towers on the Drum-Cordelia line. The first four of these are installed in the mountainous section of the line, where, in the winter time, heavy snows prevail, the balance being at river-crossings, other line-crossings and over dredge cuts, and they will be described in the order in which they are located in the line. The first four mentioned are of the same size and design and are known as special snow towers. The line in its course as laid out had to cross two very long and steep canyons. The first one is known as Steep Hollow and the second is known as Green Horn, both named from the creeks which wind their way through them. Both of these canyons have a low hill in the center of them.

The plan decided on was to span these canyons with one stretch of wire, using an ordinary snow-tower with longer arms for a spreader in between. To give the readers some idea of these long spans, the towers at Steep Hollow are 4056 feet apart, while at Green Horn the distance between them is 3620 feet. As stated above, there is a spreader tower near the center of each of these spans, and the accompanying pictures describe more fully than could any words at my command the full details of these towers. The conductor in these long spans is specially selected and is known as ¾-inch diameter copper-clad steel, and at each dead-end is held securely by ten ¾-inch Crosby clamps. These spans will be subject to considerable snow at times during the winter months, and the successful operation of this portion of the Drum

Construction camp conditions in the snow period.

line will be closely watched by the engineers of this company who were responsible for the design and construction.

The next location at which will be found special towers is at the point where the 100,000 volt line of the Great Western Power Co. is crossed near a small railroad station known as Trowbridge, located on the Western Pacific line. These are 123 feet high and together with the balance of the high towers, the design is similar to the Standard tower. The highest towers on the line are located on either side of the Feather River. They are 200 feet high and, being visible for many miles, will no doubt serve as landmarks to many of the farmers in this section of the Sacramento Valley.

Crossing the river from Nicolaus we are now at the point where the line crosses the great Sutter Basin. The water in this basin does not recede until sometime in August of each year and at the first big rainstorm is impassable again. This great basin is now being reclaimed, the project embracing about 66,000 acres. Huge dredgers are at work, and in the course of another year that great inland lake known as the Sutter Basin will be a thing of the past.

As already mentioned, the water in the basin did not recede until August. Imagine, then, the vast amount of work necessary to be done to survey the line across here, locate the towers, put in the foundations, build up the towers and string the wire before the water again covered this section. This portion of the line was practically the *"worry spot"* in the entire construction work. The exact location of the levees and drainage canals which would be built by dredgers was not known until the basin was practically dry. At these points it was absolutely necessary to put in towers holding the wires to a sufficient height to permit the dredgers to pass underneath.

The reclamation of this basin finally provided for a levee 28 feet high to be thrown up parallel to and at a distance of two miles from the Feather River, it being the intention to confine and force through this section all of the water that was formerly spread out over the entire basin. It would not be amiss to here call attention to the wonderful help that the Lake Spaulding dam is going to be to this reclamation project in storing a large quantity of the flood water that would find its way into this basin by means of the Yuba and Feather rivers, the former being a tributary of the latter. The Pacific Gas and Electric Company is, therefore, going to serve this district twofold: holding back flood waters and supplying power to operate pumps and will of necessity be located on the drainage canals.

Between the Feather River and the 28-foot levee will be found eight towers 110 feet high. These were standard "B" type of towers with special 28-foot extensions. During the major portion of each year these towers will be surrounded by water. Their foundations are sufficiently heavy, however, to withstand the strong current that will be there with the winter rush of water.

Various types of towers. Fig. 1 shows method used in building up high towers; Figs. 2 and 2A are of snow towers on steep hillsides; Figs. 3 and 4 depict special towers on long spans, Greenhorn Creek and Steep Hollow. In Fig. 3 Mr. Downing is seated by the tower, with Mr. Steele standing beside him.

Not so easy to work when the snow lies four feet deep on the ground.

At the Sutter Basin levee crossing the two towers are 167 feet high, the same design as the 200-foot towers at the Feather River crossing. During the construction of these two towers considerable friendly betting was done, for the reason that a huge dredger was plowing its way toward the point at which the tower line would cross. The ones who placed their bets on the towers being up first won, thanks to someone for the fact that the dredger had a break-down for a few days. If this had not happened it would have been necessary to have a boat to cross the 70-foot cut the dredger was making, besides climb over a bank of nice soft blue mud 28 feet high and 100 feet wide at the base, every time men had to pass from one tower to the other, parts of the same crew helping on both towers as they were going up. This incident is mentioned merely as one of the unusual happenings chronicled during the construction work across this basin.

Between the 28-foot levee, which is the beginning of the reclaimed land of the basin, and the Sacramento River, are located two 143-foot towers. These are built on either side of what will be known as the Sutter Basin drainage canal. At the Sacramento River crossing will be found two 167-foot towers which give ample clearance for any vessels that ply up this river. At the canal and levee crossing of the Sacramento River Farms Co. there have been installed two 167-foot towers. All of these canals are traversed at times by dredgers having masts from 75 to 100 feet high. The accompanying cut gives an idea of the method used in the construction of the towers, a gin pole being suspended in the center held securely to the four legs by means of eight sets of double blocks.

After these towers were erected they were painted with silica graphite paint.

MAINTENANCE OF CAMPS.

There was probably no portion of the Drum power project that presented for consideration the difficulties for properly caring for the stock and men as did the building of the Drum-Cordelia line. In every other branch of this great development the camps were stationary, wooden cook-houses and sleeping quarters, stables and warehouses were put up and it was known that they would be in the same spot until the work was done. With the tower-line, conditions were entirely different. Stretching over a distance of 110 miles, with every climate and wind condition that is found within the confines of California, this was by no means an easy task. Men had to be well fed and cared for, as well as the stock, if there was to be any work accomplished.

A camp located at a certain point one day was liable, by the time the sun set the next day, to be twenty miles further ahead. It was necessary, therefore, to provide portable outfits, easy of transportation, yet strong enough to stand up under all conditions of weather. For this purpose 10-ounce duck tents were selected, different sizes being used for various parts of the work. For the benefit of the readers of this article who are interested in the camp and commissary end of construction work, the following information as to size of tents used, etc., is given:

Combination kitchen and dining tents, 24 x 40 feet with 6-foot walls.

Sleeping tents, 16 x 18 feet with 4-foot walls.

Office and foremen's tents, 10 x 12 feet with 4-foot walls.

Stable tents, 30 x 40 feet with 7-foot walls.

Engineer Paul Downing of the O. & M. Department, Hydro-Electric Section, who had charge of the Drum-Cordelia line construction.

In cases of extremely wet weather, it was found advisable to raise the tents several inches above the ground, fastening the bottom to a 1x12-inch board.

There was universal satisfaction among the men with the general quality of the food furnished, and this was principally due to good cooks and careful and judicious buying. This department prides itself in that it was able during the year and a half the line was under construction to not only furnish such satisfactory meals, but also to know that the boarding-house was self-supporting.

The 24 x 40-foot tents, besides providing a kitchen with considerable storeroom, also took care of from 75 to 80 men at one sitting of tables. In fact, the number was increased on a few occasions to 100.

Each sleeping tent contained seven folding iron cots, together with a shibley camp stove 24 inches in diameter, whenever the climate needed one.

One 10x12-foot tent was provided each timekeeper for an office tent, and each foreman was furnished with a similar outfit. Each cook and his helper were given one of these tents, it being advisable, on account of their retiring and arising much earlier, to have them away from the other men.

Each stable tent cared for eighteen head of horses, an additional tent being necessary to store the hay and grain.

The larger size of tents were open at both ends and all were furnished complete with poles, pins and necessary ropes. In addition to this, each tent was equipped with a fly in order to afford more protection in keeping the rain out in stormy weather and, also, to help deflect the sun's rays in the warmer weather.

The feeding of the stock was also an important problem. Hay and grain had to be hauled, in some instances, twenty miles, so it kept some teams busy in the mountain section bringing in this material. In addition to the horses there was used, commencing with August, 1913, two 3-ton Packard motor-trucks, and they rendered very efficient service.

CONCLUSION.

In bringing this article to a close, it is desired to call attention to the fact that not a single accident occurred. There were no tower failures, or towers dropped, during the entire construction of the line, and there were only a very few minor injuries to the men, these in every case being self-inflicted ones.

This record is remarkable in view of the large number of men employed, and the character of the work they were called upon to perform.

The Drum-Cordelia tower line is today in successful operation, and is a fitting and lasting monument to the men who designed and built it.

Business Enterprise vs. *Conservation*

The following address was delivered by Mr. John A. Britton at the annual banquet of the San Francisco Chamber of Commerce, held at the Palace Hotel on the evening of Monday, February 2d. Guests of honor on this occasion were the Hon. William A. McAdoo, Secretary of the Treasury, and the Hon. David F. Houston, Secretary of Agriculture. All present listened with keen interest to Mr. Britton's vivid presentation of the case for the public service corporations.

BUSINESS and business men have of late been crowded into the cellars of oblivion to escape the whirlwinds and cyclones of manufactured public contumely. The clowns of industry have occupied the center of the stage from the days when the muck-rakers began to ply their vocation, crying aloud in the temples of literature while they held a pen dipped in vitriol, writing down the reputations of successful men and enterprises. And, now that big business and little business have each received the flagellation which they deserved or undeserved, it is just as well that we survey, on the cool morning of afterthought, the battlefield of endeavor, and contemplate what we have gained in this battle of divergent views—with the hope fervently expressed that as between the great masses of performers and reformers, of saints and sinners, of captains of politics and captains of industry, we have each learned a salutary lesson, and very devoutly pray for the millenium, if even only for a brief time, so well expressed in Holy Writ:

"When nation shall not lift up sword against nation, neither shall they learn war any more," and when the word of honestly-intending corporations will not be discounted, nor the soap-box orator taken at a premium.

When men of business in good faith and belief in each other's integrity quarrel, no lessening of confidence in each other is felt—and very often they are thereafter better friends. When politicians quarrel they patch their differences up so far as the needs of their party may justify; but when business and politics quarrel, then is the hand of destruction raised, for which ill there is no specific. To prevent this most unfortunate of events should be the aim of such a body as this.

The great and enduring quality of our American people is the spirit of fair play. The masses will not interfere with the general progress of any issue as between capital and labor or politics; but let either seem, by force or unfairness, to be getting the better of the other, the umpire, the great American public, will stop the game and send the recalcitrant one to the clubhouse. So, we may now congratulate ourselves that from out the recent darkness of doubt and uncertainty are seen rifts of sunshine betokening the passing of the storm.

When the temper of the people will permit discussions to be had in the public forum of both sides of a question, that question is then settled—it has become arbitrated; and when a body of men so conservative as the San Francisco Chamber of Commerce desires at its annual banquet to have business men speak frankly of business problems, even though they may be specialized, there is good hope that misunderstanding of motives, ambitions and desires will be cleared away.

In the great crash, and out of the turmoil engendered largely by irresponsible statements from the press, the pulpit, and the desk of the theorist, there has emerged the figure of the toiler who in the great battle between business and regulation has been the main sufferer.

Where, let me ask you, is the glad smile of the toiler gone, and why in its place has come the sullen look, the squared jaw of offense and defense? Mayhap, in the days that are to come we may smooth out these wrinkles of hate and fate, and with a better understanding of the responsibilities of each, beget again the confidence of those who toil. Master and man have passed into the dark ages from which they came; now, rather let us look to the designations of comrade and friend, so that there shall be no division of class and caste, composed only of bitterness.

The topic assigned to me tonight is "Electrical Development in California," and this topic must in its discussion and final analysis embrace the history of the development of all business interests in this state. Business, concretely considered, may be likened to a huge, human, highly nervous organization, the integral parts of which are so closely allied that let the finger of depression rest but for a moment on any part of it and the shock is felt uniformly throughout. In dealing with the subject of electrical development, the consideration of the factors entering into it must be separately considered, and among them in this State stands out as most important the question of conservation. I am here reminded of what Carlisle said:

"National suffering is, if thou wilt understand the words, verily a judgment of God; it has ever been preceded by national crime." And, after some of the sufferings of the past may we not well add, "Oh, Conservation, what crimes have been committed in thy name!"

Long before conservation became an issue, the busy builders of our pioneer days were engaged in building dams and structures to hold back the flood waters of our Sierran slopes and to harness those waters for the recovery of gold by hydraulic mining. Later, these dams, and the ditches which conveyed the water, were used, and newer ones were also built, and the silent snowflake was transformed into that energy which has revolutionized and vastly increased the potential industries of our state.

From extremest North to farthest South, and from East to West, every industry that makes for the wealth, productivity and economical development of this State is dependent upon the falling waters and the cobwebby lines from power-houses that interlace our mountains and valleys. Touch but one spot on this nervous organization of business so as to stop or impede the flow of this life-giving electrical energy, and you stop the progress of the State; hinder or stop the progress of electrical development, and you stop the onward march of civilization.

There are in this State millions of acres of land dependent on irrigation and reclamation for their fertility by electrical energy; the mines that deep down from the bowels of the earth produce gold; the dredges in the river-bottoms that pick up the elusive material; cement mills that produce the material that builds your city; interurban electric roads that transport your people and materials; oil-wells that produce your fuel; a thousand other industries; and so interlocked are all of them with the production of this energy that an effect on one has an immediate effect on another, and, should there be a hindrance of ability to produce this energy, then will come the intensity of silence in the world of business and shops will cease their hum of industry. For, the necessity of cheap power creates such a continuous series of links between the mountains and the consumers of the product of the farm, and of the manufacturer, that the breaking of one link must of necessity cause inestimable injury to all.

To build up this industry that has brought California to the fore has taken but a brief time as lives of men are measured; but eighteen years having elapsed since the first effective long-distance transmission was introduced into this State. It has, moreover, taken nerve, patience, confidence, skill and, withal, money. Money, that fluttering nervous commodity that does not come at call but must be coaxed, cajoled and nurtured; it is that money invested that needs must be protected, and, moreover, it must be, when applied to the development of quasi-public enterprises, fully understood. Frightened by antagonistic legislation, it flutters away and is only lured back by promises of great reward. Money, in the ordinary and normal condition of times, is, when wanted for public enterprises, to be had cheaply; attacked, it soars away. In investments of a quasi-public nature, such protection and guaranty should be given as will make these investments secure; such as, for example, the investments in the securities of our national banks. In the report of the Government for the year ending June 30, 1913, it appears of record that an average of 11.40 per cent was paid in dividends on the capital stock of all national banks in the United States. If under governmental regulation capital may be so employed in the business of banking, with the confident expectation of such profits, to say the least, capital invested in electrical enterprises should not be limited to any smaller rate of return.

A rate of return which would tempt investors to engage as owners in any public utility must be more than that afforded to bond-holders, who are preferred creditors; and unless so afforded, capital cannot be found to undertake the burden of public utility financing, construction and operation. The ability to market securities, depends largely upon the net profits remaining, after providing for the payment of interest upon securities, and this margin of safety marks the limitation of financing. Besides, it must be remembered the hazards of public utilities are manifold; there is actual and potential competition—private and municipal; diminution of revenue and retrogression of plants by progress of the art; growing burdens of labor and taxation, and unjust regulation of rates.

In this connection let me say right here that, notwithstanding the very generally conceived idea to the contrary, men in charge of public utility corporations in this State have been praying for State control for many years past, and, at the risk of doing politics, let me also say, unreservedly, and speaking for the majority of public service corporations of this State, that the present State Railroad Commission, by reason of the broad view it has taken of present situations, has been to corporations of this character a godsend. The commission has recognized the need of financing and has liberally treated all applications for the issuance of securities for increase of plants.

It may be set down as axiomatic that a regulated monopoly is an asset to the people; unregulated, it is a menace. No less an authority than Sam Insull, in charge of enormous electrical properties in the City of Chicago, has the following to say:

"Personally, I think that state regulation is the best thing that can possibly happen to this industry. Public control of charge for service, based on cost plus a reasonable profit, and eliminating the factor of competition, is the proper safeguard for the interests of users, taxpayers and investors, and, so far as I have seen, in almost every case where regulating commissions have been created, whilst there may have been isolated cases of injustice to one or another of the companies regulated, generally speaking the results obtained have been good for the industry, have been good for the securities, and have been good for the people of the communities in which we operate.

"Stability of rates is one advantage we get from regulation and regulation must necessarily be followed by protection against competition. The great economic waste of competition in a business which is naturally a monopoly must be brought home by the establishment of commissions of some other form of regulation."

I cannot lay too much stress upon the importance of the industry for which I speak tonight. The stability of any civilization depends on the fact that it consumes less than it produces, and to accomplish that the most efficient methods must be employed. Water-power solves this problem. To develop water-power is like taking crops from the farm, which is annually refertilized to replace all the elements, and productive power, taken from it the previous year.

A nation's progress, and, therefore, its stability, is not dependent so much upon its philosophers and preachers, as the last few decades have shown, as it is upon its scientists and engineers—those who create business. It was Edison who said, "A nation's civilization is measured by the height of its smoke-stack." That was said by this great scientist from the knowledge of the Eastern rim of our country where coal is abundant. I say to you that the strength and stability of California, and its progress, is measured largely by the number of its hydro-electric plants and the miles of its transmission lines; for, by electricity we can transmute the roar of the waterfall into the roar of the spinning-wheel, we can change an endless time into a hurried telephone call, and we can dispel an awful darkness by a flood of light.

To revert again to the question of conservation: Conservation as practised and preached by those who have studied its problems within the four walls of an office building, has become the means by which the full development of the potential possibilities of water-power in this State has been retarded, where of all other States its possibilities are beyond present measure.

Conservation can never be brought about by conversation; and, for all practical purposes, the best efforts made by those in authority have resulted in mere words, and obstruction, and absurd and ridiculous legislation and regulation have accomplished nothing but acts of a deterrent nature. Capital, timid and retreating, has been found, however, in a limited way, with confidence in the fairness ultimately of the American people, so that it has partially builded up some of the possibilities of the storage of flood-waters, and by harnessing them to water-wheels and electro-generators is serving the people of this State with the product of real conservation. A few figures will show more graphically than words the growth of this industry in the past eighteen years.

The State of California can claim the honor of having been pioneer in hydro-electric development. The first plant operated in the State followed closely the first one operated in the world, which was at Frankfort on the Main in 1894, and the first commercial hydro-electric high-tension transmission in the State was the plant erected in the town of Folsom and supplying the City of Sacramento; this occurred in the year 1895. The voltage of the line was 11,000; the fall of water 56 feet. Today developments are in operation carrying on lines as high as 150,000 volts, and operating at heads of over 2000 feet, or at a pressure of approximately 875 pounds per square inch.

In the 155,000 square miles embraced within the State of California there are today 16 companies operating and supplying electrical energy to the people of this State. The total horse-power installed in all of the 84 plants is 978,823, serving 596 cities and towns. These plants have a total valuation of $301,502,506.02, with securities outstanding in the hands of the public, both here and abroad. There is paid annually to the bond-holders $7,723,962.02, while the stockholders, the real owners of the plants, received in dividends in the year 1913 but $2,849,433.00, a return of less than two per cent on their equity. There was paid by these corporations in the year 1913 to the State of California in taxes the sum of $1,174,109.10. There are 111 reservoirs in use, holding and impounding a total capacity of 31,424,-352,971 cubic feet of water, equalling 251 billion gallons, or sufficient to last the City and County of San Francisco, on its present rated consumption of 50,000,000 gallons per day, 15 years. In their activities these companies employed during the year 1913 an average of 12,000 people, representing an annual expense in labor of $12,500,000. The total load connected upon the lines of these companies for power purposes only amounts to 631,000 horse-power, and its lighting load represents in horse-power demand 464,707, making a grand total of 1,096,597 horse-power which these companies stand ready to serve at any moment of the day; and the above mentioned load is connected on the premises of 392,741 consumers.

It is of record that the reduction in rates charged to consumers of electrical energy in this State since 1903 amounts to an average of forty per cent, which, on the basis of the annual earnings, represents an annual saving for the last ten years to the people of this State, by generally a voluntary reduction by the companies, of over fifty million dollars.

What California wants is not so much conservation as conversion; conversion and utilization free and untrammeled to the fullest extent of its God-given rights, and to the end that we may people our valleys and hills with the myriad of souls that our natural advantages have provided for; that this great commonwealth may become the empire among empires when its millions of acres of arable land will blossom as the rose, peopled with the select of all nations of the earth.

Long life and more power, men of San Francisco, to the Chamber of Commerce, that has put on the armor of progression and that will with its power and strength nurture the industries and activities of this State; recommend and stand behind the potential possibilities of the business interests of this State, and aid in their protection and its growth. May its following increase and multiply, and may it have the courage to increase the resources of our State so as to be builders; to adopt the policy of construction and help to abolish the powers of destruction in this our State of California.

In Memoriam
O. M. GREGORY

On the evening of January 21st, Mr. O. M. Gregory, a collector for the San Francisco District of our company, was run down and killed by a taxicab on Mason Street, San Francisco.

Mr. Gregory had been employed as a collector since December, 1908. Previous to this, for nearly the entire period from 1888 to 1904, he was superintendent of the old San Jose Light and Power Company, which is now a part of "Pacific Service." He was born in Ontario, Canada, in 1854, and came to California about 1870. He was a member of the National Union Benefit Society and the Independent Order of Odd Fellows. A widow and two children, a son and a daughter, survive him.

Through his good traits of character Mr. Gregory won the respect of his fellow workers and employers, and was always found reliable and conscientious in his work.

Pacific Service Magazine

PUBLISHED IN THE INTERESTS OF ALL EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

JOHN A. BRITTON - - - - Editor-in-Chief
FREDERICK S. MYRTLE - - Managing Editor
A. F. HOCKENBEAMER - - Business Manager

Issued the middle of each month.
Year's subscription $1.50
Single copy .... .15

Published by the
Pacific Gas and Electric Company
at 445 Sutter Street, San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

Vol. V. FEBRUARY, 1914. No. 9

EDITORIAL

There is general talk of an all-round improvement in conditions throughout the State of California since the new year. It seems to be admitted that the signs of the sky to which we referred in our January issue have already developed to such an extent as to give an impetus to business enterprise such as would have been deemed out of all question but a few months ago. Eastern financial writers are commenting upon the remarkable buoyancy which has come over the security market since the opening of the year and are busily attributing this to various causes.

The New York state bond issue is an instance in point. It came as a revelation to the pessimists when the news was sent out that this issue of $51,000,000 four and a half per cents had been placed at above par and subscribed for six times over. This was rightly regarded as a transaction calculated to do much toward imparting a further extension of public confidence, for it demonstrated that money was to be had for suitable purposes at reasonable rates. The natural result, then, was a general improvement in the tone of the money market and this general improvement has found its way to the Pacific Coast. Securities that fell victims to the general slump last year appear to be recovering and if nothing occurs in the way of a set-back they may be expected to return to normality ere long.

All this is very encouraging, indeed. In California we have had some winter. There has been a perfect deluge of rain, from one end to the other of the State, and in the Sierra region the temperature has remained sufficiently low to allow the snows to bank up high. There can be no dearth of water this year. Cities, irrigation districts, power-plants, are all insured against drought not only this year but, also, for the all-important period twelve months hence when the great Universal Exposition will open to the world.

For all this, however, conditions are far from being what they should be in this Golden State of ours. The political agitator is still abroad in the land and there seems to be no way of holding him responsible for the vicious, unbridled statements to which he gives vent from time to time. In his address delivered at the San Francisco Chamber of Commerce banquet recently our Mr. John A. Britton produced some statistics the recital of which, as evidenced by general comment, sank deep into the hearts of the majority of his listeners. The full text of his address is reproduced elsewhere in this issue, but for our purpose now we take from it the following figures:

"Companies operating and supplying energy to the people of California, 16; total horse-power installed in 84 plants, 978,823; total valuation of plants, with securities outstanding in the hands of the people here and abroad, $301,502,506.02; paid to the State of California in taxes for the year 1913, $1,174,109.10; paid annually to bond-holders, $7,723,962.02; received by stockholders in dividends in the year 1913, $2,849,433."

This last item is the one to which we desire to call attention. It represents a return of less than two per cent to stockholders upon their equities. Now contrast this picture with the following table showing conditions in the State of Massachusetts. Seventeen companies operating in that state are contained in the following list which is furnished under the significant heading:

VALUE OF CONFIDENCE.

	Par	*Bid*	*Asked*	*Dividend*
Brockton Gas Lt. Co.	100	140	150	1½ Q.
Cambridge Gas Lt. Co.	100	278	280	5 S.A.
Charleston Gas & Elec. Co.	50	125	130	4 S.A.
Fall River Gas Works Co.	100	290	300	3 Q.
Fitchburg Gas & Elec. Co.	50	123	127	10 A.
Gardner Gas, Fuel & Lt. Co.	100	150	160	7 A.
Lawrence Gas Co.	100	190	200	4 S.A.
Lowell Gas Lt. Co.	100	285	295	3 Q.
Lynn Gas & Elec. Lt. Co.	100	460	475	4 Q.
Malden and Melrose Gas Co.	100	180	190	1¾ Q.
New Bedford Gas & El. Lt. Co.	100	280	290	12 A.
Newburyport Gas & El. Co.	100	185	195	8 A.
Salem Gas Lt. Co.	100	---	250	2 Q.
Springfield Gas Lt. Co.	100	275	285	3 Q.
Taunton Gas Lt. Co.	50	125	130	5 S.A.
Worcester Gas Lt. Co.	100	290	295	3 Q.
Washington (D. C.) Gas Lt. Co.	20	84	84⅛	

Nothing could be more significant, in our judgment, than a comparison between conditions here and in the Eastern State referred to. Conditions there are the actual result of regulation—and the situation would be the same in this State if one regulating board had full control over all utilities.

During the month of January we had as a visitor to California Mr. Charles L. Edgar, head of the Boston Edison Company. In the course of an address upon public service conditions in his State, Mr. Edgar told us of a law which requires that in all questions dealing with municipal ownership the people vote two years in succession; in other words, the first vote being recorded a second is taken for the purpose of affirming the action in the first instance. So that, if the people, roused to a point of enthusiasm by the spell cast upon them either by the political agitator or those opposed to him, shall register an opinion at the polls and afterward regret the action taken they have the opportunity of repairing the damage.

That is, at least, something in the direction of quieting popular clamor and giving both sides of the argument a fair chance.

In this time of outcry against invested capital it is refreshing to note one publicly expressed opinion of confidence in "Pacific Service" on the part of a body of California citizens. Recently the city council of Palo Alto proposed to enlarge the limits of that municipality by annexing certain farming lands just outside its boundaries. The agriculturists directly interested raised an outcry against the proposed annexation, and under the heading of "A Plea for Justice" presented a written argument against it. The argument, signed by the committee on non-annexation, contained seven clauses and we take great pleasure in quoting therefrom:

"The present electric company now in the field has treated us fairly, reducing their rates from time to time. We believe all their customers are satisfied."

It is of record that the annexation election failed to carry.

The Pelton Water-Wheel Company has just issued a new book which is remarkably well gotten up and, with its illustrations and descriptive matter, is of unusual interest to engineers all over the world.

The latest designs are featured in this book, also, recent installations of more than ordinary importance. Four pages are given to "Pacific Service," with illustrations featuring Lake Spaulding dam, the Drum power-house, the Drum-Cordelia tower line and the interior of the de Sabla power-house. "Pacific Service" is a customer of the Pelton Water-Wheel Company to a considerable extent, the Pelton-Doble tangential water-wheel being installed in various of our power plants.

The Pelton Water-Wheel Company is a California corporation, with its headquarters at San Francisco. The company's president is Mr. Edward L. Brayton and its chief engineer Mr. Will A. Doble, known to the engineering world as the inventor of the deflecting needle nozzle and the ellipsoidal bucket for impulse wheels.

Lake Spaulding Filled by Winter Storm

Lake Spaulding now fills the landscape. Picture shows water pouring over the north spillway.

It will be interesting to our readers to know that Lake Spaulding is now a great storage reservoir of some 45,600 acre feet capacity. To those acquainted with the hitherto unpretentious sheet of water nestling cozily amid the mountain peaks, it comes as a veritable revelation to go up there now and gaze upon an expanse

Lake Spaulding, looking toward dam.

that takes in the landscape and covers eminences that once rose away from the lake like frowning bluffs. The following report is from Chief Engineer Baum:

"As shown by accompanying pictures, Lake Spaulding was filled by the severe storms of January, and water is now wasting out of the spillways. The engineers report the dam acting perfectly. The upper forty feet of the water-face of the dam will be plastered this summer with the "concrete gun," as was done to the lower part of the dam last year. "Grout" will also be forced into the expansion joints and practically all leakage cut off. This could not be done

Looking down upon Spaulding dam.

until the dam had taken its final position after being filled. Some slides occurred on the Drum canal, as had been expected, but the forebay, pipe-line, power-house and pole-line stood the winter exceptionally well.

"F. G. BAUM."

"February 10, 1914."

Items of General Interest

James Hugh Wise Library

Hon. Secretary Baloun presents the following report for the current month:

"It gives me pleasure to announce that the library records now show 319 volumes and 828 pamphlets.

"Engineer Lisberger of the electrical distribution department has donated eight bound volumes of the Transactions of the American Society of Electrical Engineers, as follows: Vol. XXIV of 1905, one part; Vol. XXV of 1905, one part; Vol. XXVI of 1907, two parts; Vol. XXVII of 1908, two parts; Vol. XXVIII of 1909, two parts.

"Mr. F. R. Sellman of the drafting department has made the welcome addition of a volume on 'Tables of Properties of Steam,' by C. H. Peabody.

"Mr. Harry Bostwick, Secretary to the President, has given the two complete volumes of 1911 and 1912 of the 'Journal of the American Society of Mechanical Engineers.'

"Mr. Charles H. Lusk, chief clerk of the engineering department, donated a Car Builders' Dictionary, which is profusely illustrative of all the various equipments and details that are necessary to explain the 'make up' of various types of cars.

"All of the above books have been acknowledged, as well on the usual printed slips on the inside of the book cover.

"Doubtless there are many of us within this great corporation of the Pacific Gas and Electric Company who at some time or other have used some book or publication and have put it on the top shelf or to one side rather than throw it away.

"Now, if the truth were known, that book might be used by others to great advantage; it certainly would be the means of making our library more complete as well as satisfying the wants of another member. So, brothers and sisters, just look around you and if there is anything in the book line that can be given a permanent home just send them to me, without prepaying charges, and your aid will be acknowledged and appreciated."

Mr. Charles L. Edgar, President of the Boston Edison Company, and his son, Mr. L. L. Edgar, were guests of honor at a luncheon given by Mr. John A. Britton at the Bohemian Club in San Francisco, January 16th. The luncheon was held in the Red Room, covers being laid for some thirty guests, who included directors, officers and heads of departments of "Pacific Service." In replying to a toast by Mr. Britton, Mr. Edgar paid our organization a handsome compliment.

"We think we are some company in Massachusetts, seeing that we operate over a territory of some 700 square miles," he said. "But when I look into your records and find your great system spread over a territory of nearly 40,000 square miles, I have to throw up my hands."

Mr. Edgar and his son thoroughly enjoyed their visit to the Coast.

Commencing in the middle of January and continuing until the end of April, a series of Thursday evening lectures upon "Advertising and Salesmanship" are being given at California Hall on the University campus at Berkeley.

These lectures are under the auspices of the University Extension Division and the College of Commerce and afford an excellent illustration of the progressive policy of the University and those who have charge of its affairs. The lecturers are all practical business experts and the program for the year is the result of a consultation between Mr. George H. Eberhard, chairman of the Education and Research Committee of the Advertising Association of San Francisco and of the National Sales Managers' Association, Professor Carl C. Plehn, Dean of the College of Commerce of the University of California, and Director Ira W. Howerth, University Extension Division.

In this connection it is worthy of note that the Hon. David F. Houston, Secretary of Agriculture, in the course of his brief address at the Chamber of Commerce banquet in San Francisco paid a very high compliment to the administration of the University of California. He stated that he considered the University the greatest single institution engaged in the process of the up-building and development of this section of the country; and in this he referred particularly to the agricultural and medical departments, in both of which the progressive policy of the Board of Regents has set a mark not only for the State of California but for the entire country.

The following communication from one of Oakland's prominent business men was read at a recent meeting of the Rotary Club of Oakland:

"California (Electric) Crematorium,

"4499 Piedmont Avenue, Oakland Cal.

"Mr. Frank A. Leach, Oakland, Cal.

"Dear Sir:

"In this season of Thanksgiving we give thanks to 'Pacific Service'.

"During the period when your men were strained to the last nerve to keep up the distribution of current, your service to the Crematorium was uninterrupted when needed. Before making repairs to wires which affected our supply your people phoned us so that their work would be done at hours which would not interfere with our funeral arrangements.

"Recently we put in a gas heating system. Your gas department also gave us 'Pacific Service'. The street gang arranged its trench work so that our driveway was never obstructed—the deportment of the laborers was quiet and no services were disturbed—the opening and closing of our lawn was accomplished so that hardly a trace of the work could be found—and the street surface restored to its original condition.

"Our negotiations with your department heads and office force have shown us that the spirit of 'Pacific Service' runs through your entire organization.

"We feel that we speak on behalf of those who have come within the scope of *our* service—(which is, in a peculiar sense, Pacific — peaceful) — when we thank you for these things.

"Very truly yours,

"LAWRENCE F. MOORE,

"Manager."

Our Mr. George C. Holberton, manager of the San Francisco District, lectured upon "Pacific Service" at a gathering of the Men's Club of the First Unitarian Church of San Francisco on the evening of Friday, January 23rd.

Meetings of this club take place monthly and are held in the parlors of the church at the corner of Geary and Franklin streets. A program of entertainment is always provided, with some interesting topic of the day as the feature of discussion. Mr. Holberton's lecture gave all present an insight into the workings of a great light and power corporation, and it was set off by a series of lantern slides showing the progress of electric energy from its point of development in the snow-waters of the Sierra Nevada down to the various points of distribution scattered around the Bay of San Francisco. It was heartily enjoyed by all present, including club members and their guests, and at its conclusion a vote of thanks was tendered Mr. Holberton and "Pacific Service" for the courtesy extended.

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Standard (Electra)...........W. E. Eskew
Stockton (Stockton).........J. W. Hall

SUPERINTENDENTS OF POWER DIVISIONS

Colgate......................Miles Werry
De Sabla....................I. B. Adams
Drum.......................James Martin
Electra......................W. E. Eskew
Marysville...................E. C. Johnson
Nevada......................George Scarfe
North Tower.................C. D. Clark
Oakland.....................William Hughes
Sacramento.................J. O. Tobey
San Jose....................F. G. Maynard
South Tower.................A. H. Burnett
Stockton....................E. C. Monahan
Solano......................J. W. Coons

SUPERINTENDENTS OF STEAM ELECTRIC STATIONS

H. N. Mosher...Chief Engr. Station "C," Oakland
C. A. Eastwood..Supt. Station "A," San Francisco
J. W. Varney...................Supt. of Sub-Stations, San Francisco.

SUPERINTENDENTS OF ELECTRIC DISTRIBUTION

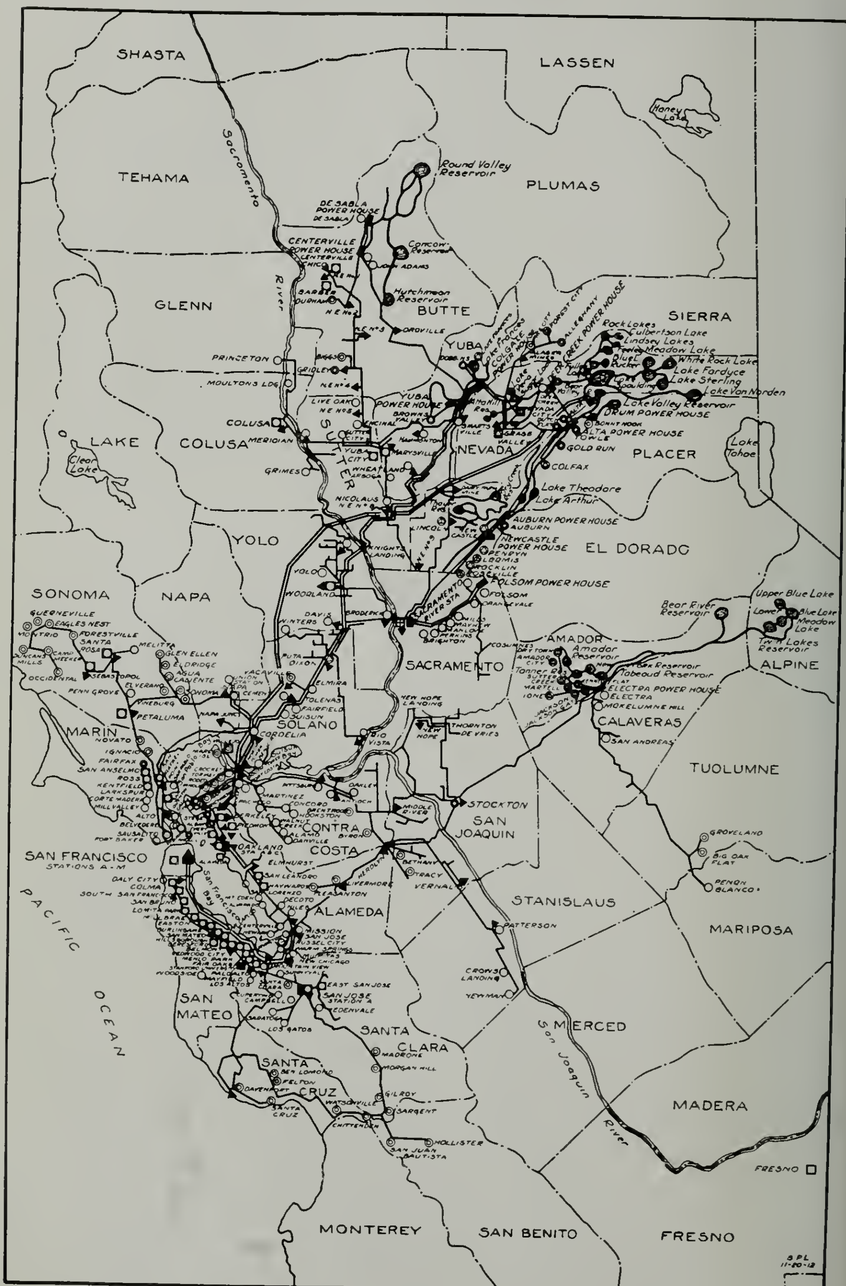
Berkeley...................J. H. Pape
Oakland (Underground)......R. C. Powell
Oakland and Alameda (Ovrhd) A. U. Brandt
Sacramento.................C. R. Gill
San Francisco..............A. R. Thompson
San Jose...................A. C. Ramstad
Marin......................Chas. Dallerup

SUPERINTENDENTS OF GAS WORKS

Oakland....................A. C. Beck
Sacramento.................Edward S. Jones
San Francisco..............Dennis J. Lucey
San Jose...................R. H. Hargreaves
Fresno.....................Paul C. Funk

SUPERINTENDENTS OF GAS DISTRIBUTION

Oakland....................George Kirk
San Francisco..............D. E. Keppelmann
Superintendent of Railway Department..................N. J. Hullin



SHASTA
LASSEN
Honey Lake
TEHAMA
PLUMAS
Sacramento River
Round Valley Reservoir
DE SABLA POWER HOUSE
CENTERVILLE POWER HOUSE
Concow Reservoir
Hutchinson Reservoir
GLENN
BUTTE
OROVILLE
SIERRA
YUBA
Rock Lakes
Culbertson Lake
Lindsey Lakes
Meadow Lake
White Rock Lake
Lake Fordyce
Lake Sterling
Lake Van Norden
Lake Valley Reservoir
DRUM POWER HOUSE
ALTA POWER HOUSE
YUBA POWER HOUSE
PRINCETON
COLUSA
LAKE
Clear Lake
COLUSA
SUTTER
NEVADA
PLACER
Lake Tahoe
COLFAX
GOLD RUN
Lake Theodore
Lake Arthur
AUBURN POWER HOUSE
AUBURN
NEWCASTLE POWER HOUSE
EL DORADO
YOLO
FOLSOM POWER HOUSE
FOLSOM
SONOMA
NAPA
Bear River Reservoir
Upper Blue Lake
AMADOR
Amador Reservoir
Tabeaud Reservoir
ELECTRA POWER HOUSE
ALPINE
SACRAMENTO
MARIN
PETALUMA
SOLANO
CALAVERAS
TUOLUMNE
STOCKTON
SAN JOAQUIN
CONTRA COSTA
SAN FRANCISCO
STATIONS A-M
OAKLAND
ALAMEDA
PACIFIC OCEAN
STANISLAUS
MARIPOSA
SAN MATEO
SAN JOSE
SANTA CLARA
MERCED
San Joaquin River
SANTA CRUZ
MADERA
HOLLISTER
SAN JUAN BAUTISTA
FRESNO
MONTEREY
SAN BENITO
FRESNO

PACIFIC GAS AND ELECTRIC COMPANY

CITIES AND TOWNS SUPPLIED WITH GAS, ELECTRICITY, WATER AND RAILWAY

Service Furnished	Number of Towns	Total Population
Electricity	209	1,093,992
Gas	51	989,167
Water	25	52,865
Railway	1	71,000

Place	Population
Alta	20
[1]Alameda	25,000
Alamo	50
[2]Albany	800
[5]Amador City	200
Adams John	25
Alleghany	200
Alto	25
Angel Island	280
[5]Auburn	2,375
Agua Caliente	100
Alvarado	900
Antioch	3,000
Arboga	100
[2]Barber	500
[2]Belmont	350
Ben Lomond	800
Belvedere	1,000
Benicia	3,360
[2]Beresford	25
[2]Berkeley	40,000
Biggs	750
Big Oak Flat	20
Brentwood	200
Brighton	100
Broderick	200
[5]Brown's Valley	50
Byron	200
[2]Burlingame	4,000
California City	25
Camp Meeker	200
Campbell	600
Centerville	1,000
Centerville	20
[2]Chico	13,000
[2]Colma	3,500
[2]Colusa	1,500
Concord	1,500
Cement	1,500
[5]Colfax	500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Cupertino	50
Daly City	250
Danville	250
Davis	750
Decoto	350
de Sabla	25
[5]Dixon	1,000
[5]Dobbins	50
Davenport	1,000
[5]Drytown	20
Durham	500
[5]Dutch Flat	500
Duncan's Mills	150
[2]Easton	300
[2]East San Jose	1,660
Eagle's Nest	50
Edenvale	500
Eldridge	500
Elmira	150
El Verano	400
Electra	50
[2]Emeryville	5,000
Encinal	100
Fairfax	500
Fairfield	834
Forestville	100
Felton	300
[1]Fresno	30,000
[2]Fair Oaks	250
Folsom	1,800
Gilroy	2,000
Glen Ellen	500
[5]Gold Run	100
[3]Grass Valley	4,500
Gridley	1,800
Grimes	250
Groveland	125
Guerneville	500
Hammonton	500
[2]Hayward	4,000
[2]Hillsborough	1,000
Hollister	3,000
Hookston	75
Ignacio	100
[5]Ione	900
Irvington	1,000
[5]Jackson Gate	100
[5]Jackson	2,035
[5]Kennedy Flat	20
[2]Kentfield	250
Knight's Landing	350
[5]Lake Francis	5
Lathrop	300
Live Oak	200
Livermore	2,250
Los Gatos	3,000
[2]Larkspur	600
[5]Lincoln	1,400
[2]Lomita Park	100
Los Altos	500
[5]Loomis	400
Maletta	30
Manlove	50
Martinez	5,000
[5]Martell	150
[3]Marysville	7,000
Mayfield	1,500
Mayhew	50
[2]Menlo Park	1,500
Meridian	300
[2]Millbrae	300
Mills	50
Milpitas	300
Mill Valley	2,500
Mission San Jose	500
Mokelumne Hill	150
Monte Rio	50
Moulton's Landing	30
Mountain View	2,500
Mt. Eden	200
Mare Island	500
[2]Napa	7,000
[3]Nevada City	2,700
[5]New Chicago	10
Newark	700
[5]Newcastle	750
Newman	1,000
Niles	800
Nicolaus	75
Novato	250
[2]Oakland	230,000
Oakley	80
Orange Vale	100
[2]Palo Alto	6,300
Pacheco	200
Penryn	250
Patterson	300
Penn Grove	300
Perkins	50
[2]Petaluma	5,500
[2]Piedmont	1,720
Pike City	200
Pinole	1,500
Pittsburg	2,372
Pleasanton	2,000
Point San Pedro	20
Port Costa	600
[2]Redwood City	3,200
[2]Richmond	10,000
Rio Vista	884
[5]Rocklin	1,000
[5]Roseville	2,600
Rodeo	500
[2]Ross	500
Russel City	250
[4]Sacramento	71,000
San Andreas	200
[2]San Anselmo	1,500
[2]San Bruno	1,500
[2]San Carlos	100
[2]San Francisco	416,912
[2]San Jose	30,000
[2]San Leandro	4,000
San Lorenzo	100
[2]San Mateo	6,500
[2]San Quentin	2,500
[2]San Rafael	6,000
San Pablo	1,000
Santa Clara	6,000
Santa Cruz	16,000
Saratoga	50
[2]Santa Rosa	12,000
[2]Sebastopol	1,200
Sausalito	2,500
Smartsville	500
[2]South San Francisco	2,500
[2]Stanford University	2,600
Sonoma	1,200
Stege	1,000
[5]Stockton	30,000
Suisun	1,200
Sutter City	150
Sutter Creek	1,500
Sunnyvale	1,500
Tiburon	400
Tormey	20
Towle	100
Tracy	1,200
Union Station	40
Vacaville	1,200
[2]Vallejo	15,000
Vineburg	200
Walnut Creek	350
Warm Springs	200
Watsonville	4,500
Wheatland	1,400
Winters	1,200
[2]Woodland	3,200
Woodside	200
Yolo	400
[2]Yuba City	1,200
Total	1,148,992

Unmarked—Electricity only.
1—Gas only.
2—Gas and Electricity.
3—Gas, Electricity and Water.
4—Gas, Electricity and Street Railways.
5—Electricity and Water.

EMPLOYS 4,800 people.

OPERATES 11 hydro-electric plants in the mountains.
5 steam-driven electric plants in big cities.
16 gas works.

SERVES ⅔ of California's population.
30 of California's 58 counties.
An area of 37,775 square miles.
⅗ the size of New York State.
½ the size of all the New England States combined.

'ACIFIC SERVICE MAGAZINE

MARCH • 1914

No. 10

Published Monthly by the Pacific Gas and Electric Co., San Francisco, Cal.

Pacific Service Magazine

VOL. V · No. 10

Yearly Subscription $1.50 :: :: Single Copies, Each, 15 Cents

Contents for March

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The new "Pacific Service" building in Sacramento. It is situated at Eleventh and K streets and represents the most modern type of office building, four stories high and constructed of reinforced concrete, faced with brick and terra cotta. The architectural design is Italian Renaissance, adapted to modern requirements. Note the ornamental entrance and the spacious public offices on the ground floor.

PACIFIC SERVICE MAGAZINE

VOL. V MARCH, 1914 No. 10

Our Sacramento Office Building a Credit to the Capital City

By FREDERICK S. MYRTLE, Manager Publicity Department

OUR Sacramento District is at last established in headquarters worthy not only of "Pacific Service" but of the progressive, up-to-date capital city that is growing in importance every hour. The new office building is situated at Eleventh and K streets, is of the latest type, the most modern construction, and from basement to roof is occupied solely by officials and employes of the company.

F. S. Myrtle

Manager "Charlie" McKillip beams with pride as he sits at his desk in a cozy, well-furnished, well-lighted, private office to receive callers and transact the business of the day. Without one pang of regret he had bidden good-bye to the old time-worn structure at Second and J streets that was his official home for many years. Through glass partitions he looks out from his sanctum upon the busy office beyond where bookkeepers, clerks and stenographers are hard at work. An elevator with a uniformed attendant is close at hand. The entire office force wears a smile of cheerful contentment. The dull, dark days of confinement in cramped space and insalubrious atmosphere are over, and now all is bright and full of promise.

This new office building is well worthy of more than a passing notice. It ranks among the finest structures of modern Sacramento, and that, in view of the achievements of recent years, is saying more than a little. For the benefit of those of our readers who have not enjoyed an inspection of the new building, I append the following details:

The building is of class "A" construction, four stories high, with a flat roof and protecting wall three feet in height which can easily be made into a beautiful roof garden. It has fifty feet frontage on K Street and eighty feet frontage on Eleventh Street. It is built of reinforced concrete, faced with brick and terra cotta, and is absolutely fire-proof as well as earthquake-proof. The design is of the Italian Renaissance style adapted to modern requirements. The building is well lighted, having plenty of good, large windows on both street fronts, also large fire-proof windows opening on the court in the east wall.

The main entrance is on K Street, and here one is attracted by the ornamental doorway, which stands six feet back from the street line. The frame is of hardwood, and has a classic architrave and cornice. Surmounting the entrance door is a group modeled in relief, two sturdy cherubs, representing Light and Power, supporting a cartouche, or scroll. The whole is surmounted by the sign "Pacific Gas and Electric Company" carved into the building wall.

Passing the entrance the visitor finds himself in a spacious public office, where the general business of the company is transacted. Here the company's Sacramento customers pay their bills, give their orders, obtain advice, register any complaints they may have and are given prompt attention by an ample force of employees. There is a waiting room for the public, and there are offices for new business and for the street-railway department which, as is generally known, is a part of "Pacific Service" in Sacramento. To the left of the entrance is a stairway of ornamental bronze and marble; also, a high-speed elevator of the latest design. This conveys us to the second floor, where are located the offices of Manager McKillip, Assistant Manager Weymouth, and Mr. Robert F. Robinson, the latter official presiding over a force of bookkeepers and stenographers in the large adjoining room which is open and well-ventilated.

Again taking the elevator we reach the third floor, which has been entirely given over to the appliance department. Here are displayed stoves and all manner of gas and electric appliances. The fourth floor is set apart for telephone operators and the addressograph room. This floor is only partly tenanted, there being plenty of bare space for future departments.

There is yet another floor that has not been mentioned—the basement. This should not be overlooked, for from here the building is given heat, light and water. The Rector heating system is installed, consisting of a series of radiators, fifty-two in number, placed all through the building, all connected together and attached to an electric motor in the basement. Gas is also piped to each radiator, which is provided with a burner; the motor is set going, the burner lighted and the air circulating through soon becomes heated, so that in a very short time the entire building, or any part thereof, has a plentiful supply of "hot air."

There is also a water-heater which supplies the building with hot water at all times. The water supply is from our own well, 182 feet deep, pumped by two American twin centrifugal pumps. Drinking fountains of the "Hawes" sanitary type are located throughout the building.

A vacuum cleaner is also provided for the building and can be set in motion from two four-way switches on every floor. All dirt and dust is sent to the basement by suction through a two-inch pipe, a big labor-saving device.

The light and power of the building is electric. Each and every light is controlled by three separate switches, its own individual switch, the floor switch and the main board switch in the basement. The total number of lights in and around the building is 255. The lighting system is treated at length elsewhere in this number.

The following details of construction

Assistant Manager E. A. Weymouth has a pleasant room to himself.

Manager "Charlie" McKillip at his desk, prepared to receive visits from customers, actual and prospective.

are from notes supplied by the architect, Mr. Hemmings:

The face brick used on the second and third floors of the building was furnished by the Carnegie Brick and Potteries Company of San Francisco. The brick is of a light buff color laid up in one-half inch, raked-out horizontal joints, and one-quarter inch flush vertical joints, all in colored mortar. The terra cotta used on the first and fourth stories was furnished by N. Clark & Son and matches the color of the face brick. The granite base was furnished by the California Granite Company of Rocklin.

The main cornice is highly ornamental in the Italian Renaissance style. The soffit has inlays picked out in reds and blues and the crest is studded with electric lights.

The main office floor is of grey Tennessee marble with a Belgian black border. The columns that occur on this floor are of marble and ornamental plaster. Marble is on the columns from the floor up seven feet and is of Tavernelle marble with Belgium black and gold marble base. The wainscot on the first floor is of the same marble, being three feet six inches high. The counters and office partitions are of marble and quarter-sawed oak. The oak is finished in a tone to match the Tavernelle marble. The walls are treated in an ivory tone to match the oak and marble. The plate glass and in the upper parts of the office partitions has a sanded design carried around the borders. The upper part of the counter screens facing on the public space has a verde bronze facing. Each wicket opening has iron and glass doors.

The dealing plates of the two cashiers' windows are of Belgian black marble. The marble work on the building was done by the Vermont Marble Company. The stairways are of ornamental bronze and marble. Adjoining the stairway is the elevator. The machine is a high-speed car and new and modern in every respect. The front is of ornamental bronze and plate glass with a marble casing around it. The elevator was furnished by the Van Emon Elevator Company. The elevator cab is of bronze. The ornamental iron work is by the Monarch Iron Works, San Francisco. The ceiling of the first story is of ornamental plaster. The mezzanine floor is also a feature of the building. The front has an ornamental bronze railing. The ceiling lights on the east wall over the mezzanine floor are of opalescent glass set in metal frames. This art glass as well as all other glass in the building was furnished by the W. P. Fuller Company of Sacramento.

The floors on all upper stories are all of maple, except in the elevator hall, which has a terrazzo floor and marble base. The walls and ceilings are of hard wall plaster, decorated in an ivory color painted finish. The third floor finish is similar to that of the second floor.

The roof is a composition roof furnished and put on by the Paraffine Paint Company. Board walks and platforms are around the roof so that it may be used as a roof garden by the employees. The basement has a cement floor and is used for storage, elevator machinery, men's locker room and toilet and boiler room. In the boiler room is located the vacuum cleaning machine, Kewanee pneumatic water supply system, deep well and pumps, Rector gas heating system fan and motor, switchboard and ventilating fans and motors. The vacuum cleaning machine is the "Little Giant" machine made by John Breuner Company. The toilet-rooms are all of marble and terrazzo, having terrazzo floors and marble partitions. The fixtures such as lavatories, water-closets, urinals, drinking fountains, etc., are all of the latest type and make.

The cost of the building, including counters and partitions, was $90,954.00.

Murcell and Haley of Sacramento were the general contractors. The structural engineering was done by Pierre Zucco of San Francisco. The plumbing, heating and sheet metal work was done by the

The third floor is given over to the appliance department. On the second floor are spacious, offices occupied by officials of the company, bookkeepers and clerks. In the basement there is an up-to-date equipment of machinery.

Latourette-Fical Company of Sacramento. The plastering was done by Andrew Knowles of San Francisco. The painting was done by W. R. McGrew of Sacramento. The hardware is Yale & Towne make furnished by R. O. Kimbrough of Sacramento. W. P. Fuller & Company of Sacramento furnished and set the glass. The roofing was done by the Paraffine Paint Company of Oakland.

The electrical work was done by the General Electrical Construction Company of San Francisco. Our Mr. S. J. Lisberger, Manager of the Electric Distribution Department, and his assistant, Mr. F. C. Piatt, worked out the general lighting scheme with Mr. F. D. Ryan of the General Electric Company. The building is wired for a telephone system and also arranged for a dictaphone system. There are large fire-proof vaults on each floor. The lighting fixtures throughout are of the semi-indirect type and were designed and furnished by the General Electric Company, Mr. F. D. Ryan of that company having given them his personal supervision. They are of real bronze, with opalescent glass bowls.

The interior wood finish was done by Taylor & Company of Alameda. The vault doors are by Richardson Bros. of San Francisco.

Our company had four of the leading architects of Sacramento compete on designs for the building. Vice-President and General Manager John A. Britton gave the designs careful study and finally chose that of Mr. E. C. Hemmings, who was appointed the architect. Our Mr. R. J. Cantrell, property agent of the company, was appointed by Mr. Britton to take charge of the various details and arrangements of the building and to work with the architect and contractors in carrying the building to completion. Mr. C. K. Aldrich of Sacramento was employed as building inspector throughout the construction of the building.

Lighting the New Building

By F. C. PIATT, Electric Distribution Department


F. C. Piatt

In making plans for the illumination of our magnificent new office building in Sacramento it was desired that this feature should not only harmonize with the splendid appointments of the building but should set the highest possible standard of illuminating excellence in the community. For, we who supply "Pacific Service" should surely lead in making the best possible use of that service.

The semi-indirect method of lighting was adopted for the entire building, this being the latest and most pleasing development in interior lighting. In this method the light source is concealed by a translucent shade which permits only a portion of the light to pass through, the remainder being thrown against the ceiling and there reflected, thus obtaining a well diffused, shadowless light.

The semi-indirect fixtures used on the first floor of our Sacramento building are of particularly handsome design, the metal work being of heavy bronze, richly ornamented, while the bowl is a very beautiful type of white opalescent glass. The large fixtures on the first floor, of which there are eleven, are spaced approximately fifteen feet apart, and each fixture contains four 100-watt Mazda lamps. These fixtures are well illustrated in the photos. For the mezzanine floor and lobbies an adaptation of the design of the main fixtures, of smaller size and without the supporting chain, is used. These first floor fixtures are probably as handsome as any office building fixtures on the Pacific Coast, and have elicited many favorable comments.

On the second, third and fourth floors the convertible Mazda Monolux units are used. These fixtures are quite efficient, present a good appearance and are comparatively inexpensive. In practically all these fixtures one 250-watt clear Mazda lamp is used, the spacing of the fixtures being approximately fifteen feet.

Due to the evenly distributed, shadowless lighting secured by the use of the semi-indirect fixtures a considerable saving in the cost of wiring was obtained, because desk lights were not required, nor were bracket lights except in a few cases for stairways, lockers, etc. For the benefit of those who may wish to install lighting of a similar nature the following figures, based on photometer tests at the Sacramento building, are given:

	First Floor	Third Floor (Second) and Fourth Floors similar
Floor area, inside...	18′x78′=3740 sq. ft.	3560 sq. ft.
Height, Ceiling.....	20 ft.	11 ft.
Color Ceiling.......	Light Cream	Cream
Total number outlets (not including Vaults, Stairs, etc.)	15	17
Total number Lamps of each size.......	44–100 watt 16–60 watt	12–250 watt 4–100 watt 1–60 watt
Total watts in use..	5360	3460
Watts per sq. ft. of floor............	1.43	972
Average illumination	4.0 ft. candles	3.4 ft. candles
Foot candles per watt per sq. ft....	2.8	3.5

No elaborate provision was made for the exterior illumination of the building, the only special lighting used being cornice lights, of which there are seventy-two 10-watt, 120-volt Mazda lamps. These lights are set in sockets concealed in ornaments at the top of the cornice, the ornaments also serving as reflectors for the lights, thus putting a crown of white light around the top of the building.

Electroliers of the standard Sacramento pattern are installed along the curb, and serve to illuminate sidewalk and street. As viewed from outside the building the semi-indirect lighting of the interior is very effective, the brightly lighted ceilings and warm glow of light through the windows presenting a most cheerful appearance, as well as attracting the attention of the passer-by to the splendidly fitted interior.

"Down the Penstock"

(These have all passed the Grizzly.)

By J. P. BALOUN.

One obstruction in a ditch makes nine.

The Company does not have to "Drum" up a demand for the energy being delivered from the station of that name.

The "governor" of the water wheel is not appointed by the people.

The "primary" wires of a transformer boast of no political bosses.

A "hot" circuit looks cold whereas a cold reception often makes one "hot."

If all the people of California used "Pacific Service" what a happy State this would be.

Some candle-power illumination makes us dubious as to the kind of candle.

Some "light" diets would give us as much satisfaction physically as diet on light.

The ordinary mountain "grizzly" allows less to pass it than those used at the power-house.

The switchboard is not the one where the whip is hung for the use of the wayward boy, nor is it the place where the hank of hair is kept for milady.

The difference between a "spillway" and a "transmission line" is that the water flows over the one and electricity over the other.

Nothing gives us such short notice as a "short circuit."

The "spider" in the armature has no sting.

The "field" of the generator helps to raise "currents."

Construction Features of the Drum Canal

By O. W. PETERSON, Assistant Superintendent of Canal Construction

DRUM canal carries water from the outlet tunnel below Lake Spaulding reservoir to the forebay at Drum. The canal starts at a small elevation above the south fork of the Yuba River, follows around a mountain side of solid granite, swings into the canyon of the Bear River, and in a distance of eight miles comes to the end of a mountain spur, 1400 feet above the river. On the summit of this last spur the forebay for the Drum power-house is perched. The word "perched" is the only one that properly expresses the location of this remarkable structure. From this mountain-top to the river-canyon, 6200 feet distant, the penstock carries water to the power-house.

The country which the canal traverses is heavily timbered, and in constructing it the first work was to clear an ample right-of-way. The next work consisted of trail-building, in order that powder, tools and various other supplies could be transported along the ditch. Much of this preliminary work was done in 1912, together with some hand and shovel excavation.

At the opening of 1913 it was decided to excavate the canal entirely with steam shovels, and in June the first shovel started up the canal from the forebay; late in July a second was started from the upper end of the canal, and later two more shovels were started at intermediate points, in order to complete the work of excavation as quickly as possible. Before excavation could be started,

Drum canal, showing Spaulding dam in distance.

however, it was necessary to find a water supply for the shovels. This was done by developing springs and delivering water from them through pipe-lines. But the big job was to properly "shoot up" the canal prism, that the material might be sufficiently loose for the shovels to excavate. As the formation ranged from cemented materials, in which many large boulders were imbedded, to hard solid granite, much of the drilling was done with machine-drills operated by compressed air furnished by the Bear Valley compressor plant. This drilling, as well as the excavation, was carried on day and night until finished.

After the excavation of the canal was complete it was trimmed to neat, true lines, so that there might be as little friction loss as possible for the flowing water. In order to avoid seepage losses a rock wall was built at the face of the outer bank. In fair ground a dry wall was constructed; in leaky formations a mortar wall was put up. These walls have a footing one foot or more below the bottom of the ditch, and they extend to a foot above high-water level. They are eighteen inches wide at the bottom, twelve inches at the top, and the face is built on a batter of one in two. By running muddy water through the new ditch these walls soon become entirely impervious. Five miles of the canal is walled, and the workmanship is at all places excellent. An advantage of this wall-work, which will be lasting, is the fact that in building it all the loose rock of all sizes along the immediate mountain slope above has been used, and there is none left to be carried into the ditch by the snows.

The canal averages 11 feet in bottom width, 7 feet in depth, with side slopes of from one-half to one to one to one, depending upon the formation. Its capacity is 400 cubic feet per second. It has five flumes, constructed of sugar pine and redwood, one siphon of steel-pipe, one of wood-stave and steel-pipe combined. There are five wastegate structures. Altogether, the canal has been constructed in the most substantial manner without losing sight of economy in

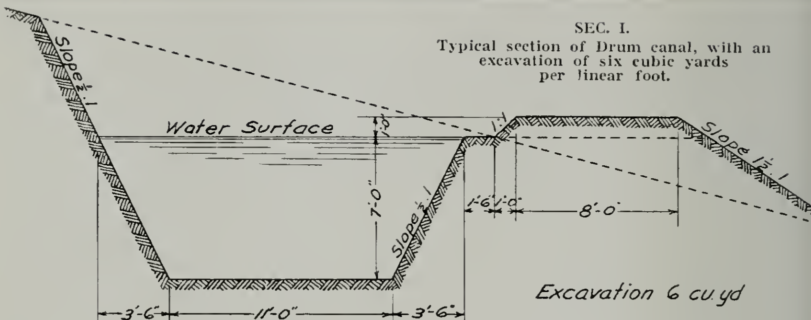
Hand-labor used in construction work.

construction or the purpose to be served in operation.

In building the rock wall in the canal some remarkable progress was made. It was decided to put in an additional two miles and a half of wall, ranging from 6 to 11 feet in height, on October 31st, and by the 7th of November the work was finished, even with the drawback of considerable bad weather. A force of eighty masons with several hundred additional men as helpers, quarrymen, teamsters and others was organized in a few days. Stone masons were soon exhausted from the Sacramento valley and the San Francisco market had to be drawn on. This work, as well as all the other canal work, was carried on by two separate camp organizations which started from the extreme ends of the canal. During the last few days of the job a speed contest was worked up and 800 feet of wall was ptaced each day by the masons. One has to see this well-fitted and well-shaped tight rock-wall to appreciate how smooth a water-face it furnishes.

Another job that seemed pretty large for an end of the season job was the building of the Tahoe Forest Reserve siphon. This is an engineering freak. At one place about midway down the canal a strip of forest reserve 1200 feet in width is encountered. As the conditions under which a temporary permit for a right-of-way could be obtained were not of a character to insure permanency, and as practically the entire system of this company would be placed under conditions of control that were considered extremely obnoxious, especially in view of the fact that the water system had been in operation since the early mining days and the present construction was merely a movement to conserve the flood waters of the South Yuba River, which required a canal at a higher level, it was decided to drop the water down the mountain side 230 feet in elevation through a large pipe-line and, after clearing the lowest boundary of the reserve, have the pipe-line carry it up again to the canal line. The trenching of hard materials on the steep slopes

Upper end of Drum canal, fourteen and one-half feet wide, with masonry lining.



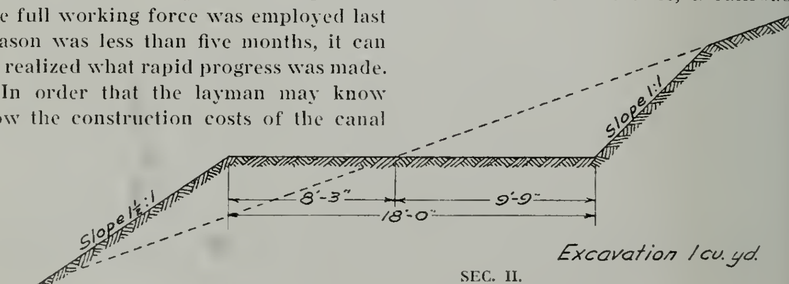
SEC. I.
Typical section of Drum canal, with an excavation of six cubic yards per linear foot.

had to be done largely by hand and the 200 and more tons of pipe materials had to be "snaked" up the slopes from the county road below on 6-horse stone boats. Fourteen hundred feet of 8-foot diameter wood-stave pipe, with redwood staves four inches in thickness, was required, and at the bottom of the siphon where the pressure was greatest, 400 feet of 7-foot diameter riveted steel pipe was used. The work was all finished without any delay to the general project. The brief outline given is only a part of the work this job caused, for in order to obtain sufficient grade for the siphon, which no one ever expected would be built, and consequently did not plan for, it was necessary to raise the canal bottom above the siphon and lower it below, which meant a lightening of grade at both sides with a consequent considerable enlargement in section.

The average force employed on the canal work was from 500 to 900 men, 100 head of stock, and four steam-shovels. Considering that the period during which the full working force was employed last season was less than five months, it can be realized what rapid progress was made.

In order that the layman may know how the construction costs of the canal excavation arise, a brief comparison will be made with the building of an ordinary railroad grade through the same country. It will be shown, first, that the quantity of excavation is three times greater for the canal than for a railroad grade; second, that the unit cost for excavating each yard on the canal work is at least three times the cost for a railroad grade.

It will be observed that the amount of material excavated down to the water line in the canal equals the total amount of material excavated for the railroad grade. In short, it is necessary to build the equivalent of the railroad grade before starting to build the canal proper. Furthermore, it is shown that on this average mountain side slope the canal yardage is six times the railroad yardage. However, a railroad grade requires cuts and fills, due to the fact that it cannot operate on such sharp curves as a canal. Much excess yardage beyond plain benching is required on this account. At the same time, a railroad is



SEC. II.
Railroad grade on the same side-hill slope, with an excavation of one cubic yard per linear foot.

not rigidly held to a fixed grade. It can rise as well as fall, and in building from Spaulding to forebay the route could be placed largely in the valley floor, thus avoiding much solid rock benching entirely. However, for the sake of carrying out the comparison, it will be assumed that instead of the canal yardage being six times that for a railroad grade it is only three times as much.

When it comes to an analysis of comparative unit costs in handling the yardage on each class of work, the advantage is entirely in favor of the railroad, for three distinct causes: First, the materials handled in any mountain side cut get harder from the surface down. In fact, except for about two miles of the Drum canal line, a railroad grade could have been excavated by a steam-shovel entirely without any drilling to loosen up the cut. On the canal work fully seven miles had to be drilled and shot. Second, the removal of materials from the canal cut, even with a steam-shovel, is a very different matter from benching off of a railroad grade. In canal work, a specially equipped shovel is required, and every bucket of material has to be lifted twelve feet above the canal sub-grade and swung clear over the bank before dumping, while on railroad work the shovels need to raise only high enough to fill the bucket. The dumping line is on a level with the sub-grade. The third difference between canal and railroad work is one of carefulness. Unnecessary over-shooting must be avoided for a canal, as the banks must be left solid, and also both banks must have a neat finished face. There is but one respect in which the unit costs on railroad yardage would suffer and that is by reason of the fact that the yardage is so small that these small quantities would carry a higher relative unit price.

To briefly summarize: The canal yardage is three times as great as for a railroad, and considering the fact that the unit cost it at least treble, the total cost would be at least nine times that of a railroad grade.

In Memoriam

WILLIAM KIRK CHALMERS

On Tuesday, February 17, 1914, William Kirk Chalmers, who until the time of his illness was employed as a bookkeeper in the Oakland District, passed into the great beyond. He was a native of Oakland, age 31 years and 10 months.

He entered the employ of the Company as a ledger clerk March 2, 1905. He was a baseball enthusiast and lover of outdoor sports. Up to the time of his illness he was hale and hearty, and always displayed much energy and enthusiasm in any matter he undertook. Because of his sterling character and honest nature, he had many friends.

In July, 1912, he was taken ill with rheumatism, and on account of this illness it became necessary for him to take a leave of absence. We regret to say he was never able to resume his duties. He leaves a widow and daughter.

History-Making by the Gas Distribution Department

By D. E. KEPPELMANN, Superintendent Gas Distribution, San Francisco

D. E. Keppelmann

FROM its inception the Pacific Gas & Electric Company has been a pioneer. The saying is that if there is anything new under the sun you are certain to find it within the ranks of "Pacific Service." In its efforts to assist in maintaining this prestige the Gas Distribution Department is now making history, as will be observed from the following:

Owing to change of grade and property lines, it was recently found necessary to change the position of our 16-inch high pressure main in San Francisco, carrying a pressure of forty pounds to the square inch. Since this main is the source of supply for a greater portion of the city, conditions would not permit of shutting off the supply for a very long time, and since it would be an exceedingly dangerous procedure to change the position of the main under pressure, we were compelled to install a new line entirely.

Until recently, high pressure mains were installed and the lengths of pipe coupled together with couplings and rubber gaskets. Due, however, to the disintegration of the rubber gasket by the gas, couplings proved to make an expensive and unsatisfactory joint, so that our chief engineer had to find other methods of jointing the tubes together.

Following the initial work of Mr. L. B. Jones, Assistant Engineer of the Gas Department, and after exhaustive tests, the problem was solved; with the result that instead of using couplings the pipes are

Preparing to install new 16-inch high pressure main, Shotwell Street, at Army, San Francisco.

now welded together with the oxy-acetylene process, creating a permanent joint at considerably less cost, and requiring no further maintenance.

Welding by the oxy-acetylene process.

A portable conveyor with an acetylene tank at 300 pounds pressure and a capacity of 500 cubic feet of acetylene, and an oxygen tank at 250 pounds pressure, capacity 100 cubic feet of oxygen, together with reducing governors, gauges, tubing and welding torch, constitute the outfit in its entirety. It will be readily observed how advantageous this method is over the old and the apparent ease with which the joint is made. The proper mixture of acetylene and oxygen, when lighted, creates a heat of 6300° F. at the torch, and by bringing both ends of the pipes to a cherry-red heat, and melting a rod of Norway iron, allowing it to flow between, the tubes are knitted together, thus welding autogeneously.

Figue 1 shows a portion of the old main in the trench, with a piece of the new main above it, and the operator at work. Figure 2 gives a closer view of the welding outfit and process. Figure 3 affords some idea of the tensile strength of the joint. Six lengths of 16-inch pipe, each twenty feet long, were welded together over the trench and then lowered into position. It will be observed that the last length, weighing 1000 pounds, is not supported in any manner, practically hanging on a welded joint. No attempt is made to lower the pipe carefully; on the contrary, as a matter of fact, it is just dropped in the trench. This is done as a further test and to bring out any possible defects, it being infinitely better to ascertain any defects before the pipe is covered.

1000 pounds of pipe hang on a welded joint.

This new main, now being installed, is the first welded 16-inch main in the world, bearing out the contention that "Pacific Service" is making history.

That the welding of high-pressure gas-mains by the oxy-acetylene process is no longer to be regarded as merely an experiment is proven by the wonderful results already obtained, and further evidenced by the number of inquiries received daily from various gas companies throughout the country. "Pacific Service" through its progressive policy has created a new field, destined to know no bounds; for the welding process with its great flexibility has no limitations. It will, beyond the question of a doubt, revolutionize the method of installing gas-mains throughout the universe. We are only too glad to point the way.

"Pacific Service" Operates the San Francisco Disposal Works

By J. E. VAN HOOSEAR, Industrial Department


J. E. Van Hoosear

THERE has been constructed in the Potrero district of San Francisco a large plant that is working over all the kitchen refuse from the hotels and restaurants of the city, in fact, any material of vegetable or animal composition, and converting the same into commercial products, the grease part being used in the manufacture of soap, the bones and vegetable parts made into fertilizer. In this way waste material is reclaimed and turned into useful channels.

Previous to the construction of this plant the waste material had two sources of disposal, either by the incinerator or in feeding hogs. The incinerator company did not like to handle it, however, because it is wet and deadens the fires, so the greater part was carried off by the hog ranchers. Now, it is insanitary to keep hogs in large numbers in thickly populated sections, and laws have been enacted making it unlawful to carry on that business; but as there had been found no other way of disposing of this waste the laws were not enforced, and so people were compelled to put up with the nuisance.

This plant in the Potrero is built from plans of similar institutions now in use in most of the large eastern cities, where daily hundreds of tons of waste are being disposed of, and a description of the process may be of interest to the reader.

Owing to the great quantity of material to be handled, the machinery has to be operated with the least amount of labor, in order to reduce the expense of handling to a minimum. To make this possible the machinery is all driven by individual motors, arranged in such a way that from the time the material is hauled up to the building until it is shipped away, a finished product, it requires no hand labor. It passes from one part of the process to the other by means of motor-driven elevators.

The process starts with the gathering of the material, which is done at night with the aid of motor trucks which carry enclosed iron tanks into which the refuse is placed. When the trucks arrive at the factory the tanks, or body of the truck, being detachable from the running gear, each containing five tons of material, are raised by means of a motor-driven crane to the top story of a building where the material is dumped into steam-jacketed enclosed tanks and boiled for five hours, until it is thoroughly cooked; from here it is run through a powerful press where most of the water and oil are driven out and caught in skimming tanks, the oil being separated from the water. The solid matter is then run through a large boiler-shaped affair which rotates by means of a motor and contains a spiral that forces the material out of the end opposite to which it enters. While in this machine all of the moisture is driven out by means of a fire blast, the smoke fumes and odor be-


Plant of the San Francisco Disposal Works at the Potrero.

ing carried away by means of a 200-foot stack, thereby making this factory free from all insanitary odors. From this point a carrier takes the dried material to the upper floors of a building where it is forced through the tanks containing gasoline, which absorbs all of the oil and grease remaining. The oil, in turn, is separated from the gasoline by means of a small refinery, the oil going into barrels. The gas, in turn, is condensed and stored to be used again.


Grinding-room, showing a Williams grinder driven by a 50 h. p. motor.

The dried material is now run past a powerful magnet, which extracts metals, such as nails, can-covers, etc., before it is put through a grinding machine driven by a 50 h. p. motor, which reduces it to a powdered form; after which it is mixed with certain chemicals to be used as a fertilizer. The oil and grease, which form the most valuable part of the refuse, are used for soap and find a ready market.

This plant is exceedingly well lighted, both inside and out, with an installation of 5 K. W. in Mazda lamps, ranging in size from 25 to 100 watts. This, with the 100 h. p. in motors, backed by "Pacific Service," makes it possible to give San Francisco clean service in one of the many important problems to be handled.

Something of a Gas-Meter Installation

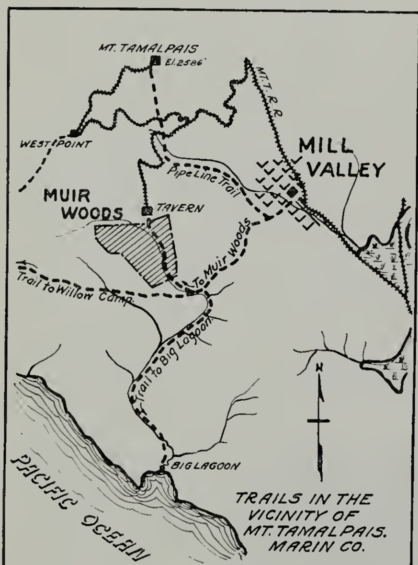
What is probably one of the largest gas-meter installations on the Pacific Coast, consisting of four 300-light meters in series, was made recently for the American Can Company plant in San Francisco. The new oxy-acetylene welding process, described elsewhere, also played an portant part, for, upon close observation, it will be seen that both the service and house rise are welded into position, permitting of doing the work both expeditiously and at considerably less cost.


Four 300-light meters in series.

The Gas Distribution Department in San Francisco, under the leadership of our Mr. D. E. Keppelmann, is an energetic branch of "Pacific Service." The accompanying illustration depicts its latest achievement in the line of gas-meter installation.

From Women of "Pacific Service"

It is a well known fact that people can work with a great deal more zeal if they are more or less contented, that is when they can look on the bright side of all their work. To make the best of our environment we must be bright and cheerful, and to be that we must naturally be in good health, and to have good health, we must have exercise. "The man worth while is the man with a smile when everything goes dead wrong," is quite true, but then it is a very difficult thing to outwardly smile when the body is ailing, so we should advocate plenty of exercise.



TRAILS IN THE VICINITY OF MT. TAMALPAIS. MARIN CO.

There are a great many ways to obtain this physical need. One could belong to a gymnasium, attend once a week, get instructions, then follow them out daily at home. Dancing is also good and there are lots of dancing schools, or clubs, throughout the city, which one might belong to. "Hiking" is in most cases one of the best exercises and to get out in the open air, dressed free and easy, for a good long tramp is certainly performing a pleasure as well as doing a duty for oneself.

Comfort in dress is the main item to keep one from overtiring, and the less bundles the more freedom in walking. A good-sized knapsack, fitted up with a canteen, tin plates, forks, knives and spoons, together with a luncheon, either of sandwiches or the ingredients for a hot lunch, if one is going where a fire may be built, can easily be carried strapped onto one's back and, with the weight quite evenly divided, it is comfortable and neither impedes nor tires the "hiker."

There are a great many picturesque walks in the vicinity of San Francisco, especially in Marin County where one can find either short or long trips to suit.

Starting out from Mill Valley (where superfluous packages, etc., may be checked) you walk uphill quite steadily, first the stairs and on up to the top of the hill, then, taking the road between the house and the barn until you get to the top of this incline, cut down over the hill to the refreshment stand which is on the road you can follow into the Muir Woods After lunching by the stream in the woods, it is a very beautiful walk and easier, to start out from Muir Woods Tavern along the railroad track to the bridge, then up the hill to the "pipe line" trail which winds in and out the mountains. The path is heavily wooded and is a cool and refreshing return trip. This is followed until you reach the hill a little past the reservoir, that takes you down to the stairs and then you are soon back in Mill Valley ready to return home and all enthusiastic over "hiking" and promising yourself a repetition the next available day.

Another walk is to follow the beginning of the above "hike" until just before reaching Muir Woods, where you cut down over the hill and turn to the left instead of the right. Going along a little way here you will soon come to a path which is on the left-hand side of the stream, up a little bit on the hill. Following this path it brings you to "Big Lagoon," where is a beach right along the ocean. Wading here greatly refreshes you for the return tramp. Also here can be found a great deal of drift wood, which makes a splendid fire by which to cook lunch. To get to Big Lagoon you could also start out from Manzanita station.

The accompanying map gives an idea of the trails to West Point, Tamalpais, Muir Woods and Big Lagoon. These are but a few of the trips in which Marin County abounds.

Letitia A. Curtis.

February 27, 1914.

Miss Alice Strycker, of the Engineering Department, has announced her engagement to Mr. Clayton King Hamilton. The wedding is expected to take place some time this coming July.

A "pajama" masquerade party was tendered to Miss Rosa Lamont of the Drafting Department on Friday evening, the 13th ult. Those residing on this side of the bay took the 7:40 p. m. Key Route boat, and after meeting the rest of the party at Fortieth and Grove streets they all repaired to Miss Lamont's home on West Street. The young lady was taken completely by surprise and it was some time before she discovered the identity of the participants. Games and music were enjoyed, after which supper was served. Those present were: Grace Brandt and Hazel Moulthrop, Land Dept.; Queenie Derry, Publicity Dept.; Letitia Curtis, Blanche Sonneborn, Alice Strycker, Tessie Ryan and Emma Ehlinger, Engineering Dept.; Effie Brandt and Emily Loewenguth, General Manager's Office; May Murphy, Grace Glazier and Mazie Curtis, Oper. & Main. Dept.; Jean Doub, Law Dept.; Mrs. Margarete Holton, Claims Dept.; Rosa Lamont, Drafting Dept.; Julia Small, Appliance Dept.; Loretta Vanderwhite, Distribution Dept.; Mesdames P. A. McCarthy, G. W. Taylor and Violet Lamont, formerly of the company.

Miss Genevieve Wells, superintendent of the addressograph department of the San Francisco District, was married on January 21st to Mr. Richard Frahm of San Francisco. The young lady entered the service of the company prior to the fire of 1906, and while "Pacific Service" regrets the loss of an efficient worker it wishes her happiness in her new life. Mr. and Mrs. Frahm left San Francisco shortly after their marriage to make their home in Southern California.

This from our Placer County correspondent:

"Miss Letitia Curtis and sister were recently made the occasion of a most enjoyable evening at the home of Mr. and Mrs. James Martin in Colfax. Many of the younger set of Colfax were present to meets the Misses Curtis. Superintendent Martin had his work cut out to keep his injured ankle out of trouble and, even as it was, his complete recovery was put back just two weeks, according to his doctor's statement.

"A feature of the evening was the P. G. & E. quartet, which vied with the domestic cat for vocal supremacy.

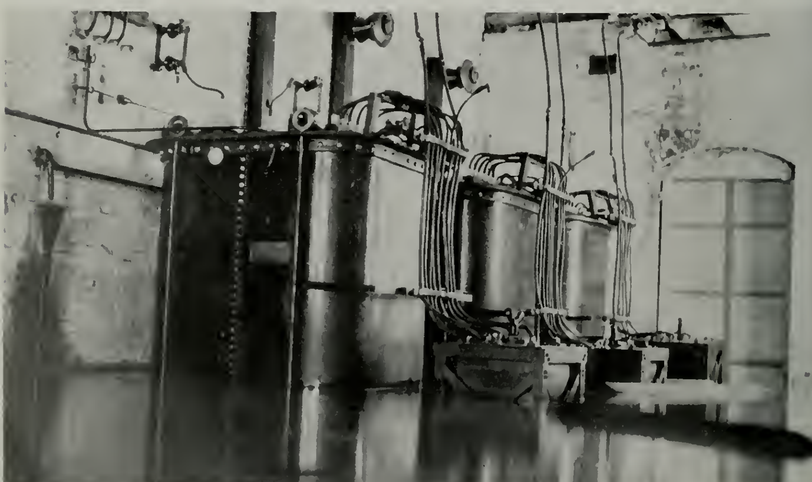
"On the eve of the anniversary of George Washington's birth the interior of the Martin home was decorated in honor of the occasion, and there was a jolly party in which boys and girls took part. One of the many schemes to keep the jollity going was the hunting for suitcases in each of which was a costume to be worn. Then, by a novel method partners were gotten together, and it was by the merest chance that George Washington and Martha Washington found themselves hand in hand, thus proving the adage that history repeats itself."

Notes from the O. and M. Department Hydro-Electric Section

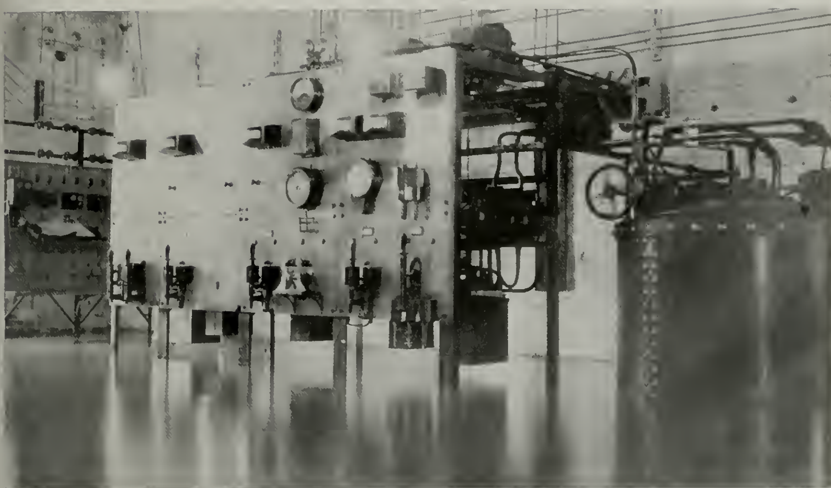
Superintendent C. D. Clark of the North Tower Power Division had his troubles during the rainstorms that ushered in the new year.

The town of Napa as it looked from the swollen river during the recent storms.

We reproduce here some pictures of Napa sub-station taken on New Year's day. The sub-station is situated on the bank of Napa River, which flows right through the town, and about seventy-five feet from the water line. Ordinarily it is high and dry and safe against the average seasonal disturbances, but the unusual storms last winter swelled the river to such an extent that the waters rose over the banks and flooded parts of the town. Our sub-station, as will be seen from the picture, got its share of the trouble, for the water stood three feet



Napa sub-station during the flood. Note regulators raised from the floor on stools to prevent their filling.



Napa sub-station during the flood. Water threatens the switchboard with annihilation.

deep on the floor. As Superintendent Clark wrote, "we came near having a new type of sub-station—the submarine." Mr. Clark had to move his office upstairs.

In connection with this, however, it is worthy of record that "Pacific Service" went on uninterrupted. The waters came and the waters went, but there was never a check in the regular flow of electric "juice."

On the evening of February 18th a lightning storm of considerable severity descended upon Contra Costa County and for a while played mischief with "Pacific Service."

The trouble took place about 11:15 p. m., the lightning coming in contact with our high-tension wires and completely destroying a 500 K. W. transformer in Pittsburg sub-station. For a while everything went out of service, and it was some three hours before everything on the high-tension line side was clear and service was re-established.

The local damage done included the loss of eight transformers in the Pittsburg district. In the town of Antioch the electric disturbance shorted the street-lighting circuit and burned up every lamp on it, also destroying two small transformers. Needless to say everything was put right as soon as possible.

We are pleased to record that Superintendent E. C. Johnson of the Marysville Power Division, who met with a serious accident while doing some line work and is laid up with a broken leg, is improving rapidly, although it may be some time before he is able to be about again.

During his disability Mr. J. H. Fagg has been appointed acting superintendent of the Marysville Power Division.

A new 60 K. W. line is being constructed between Moraga Valley and Elmhurst, in Alameda County, a distance of nine and one-half miles.

A new line is in process of construction to give service to the Placer and El Dorado Dredging Company's new dredger, located on the American River near Auburn.

Electric vs. Diesel Engine Power

(Excerpt from *Ice and Refrigeration Magazine*, February, 1914, Vol. 46, No. 2)

THOSE who are using, or contemplate using electric power for their refrigerating or ice-making plant, will be interested in the experience of the Arkansas Cold Storage Co., Little Rock, Ark., who operate a cold storage warehouse of 100,000 cubic feet capacity and in connection a 40-ton ice-making plant, raw water-freezing system, and also a street pipe-line system of refrigeration. The company first installed two 120 h. p. vertical, 3-cylinder Diesel oil engines. But considerable difficulty was experienced because the engines would at times lose in efficiency, due sometimes to a slight wear in the fuel valves causing a "lag" in operation and consequent reduction in power, and sometimes to necessity for shut-downs caused by trouble with valve-rod or safety-valve springs and similar troubles.

When it was decided to change the power system the local electric lighting company made a proposal to furnish electric current at the primary rate of $1.00 per kw. of maximum demand plus an energy charge of one cent per kilowatt hour for electricity consumed by the motors, provided the demand for current would not be made during the peak load hours of the central station business. This tender was accepted. The two Diesel engines were then replaced with two 100 h. p. adjustable speed, 2200-volt induction motors.

Full records of operating costs had been kept and these, as published in the *Electrical World*, were as follows: Dur-1912, when the Diesel oil engines were in use, the company's books showed—

Tons of refrigeration produced.......	13,123
Kilowatt-hours, total	497,608
Kilowatt-hours, per ton refrigeration.	37.9
Fuel oil for power, per ton refrigeration	$ 0.124
Wages for power, per ton refrigeration	0.170
Lubricating oil and waste, per ton refrigeration	0.074
Water, per ton refrigeration..........	0.030
Electricity purchased, per ton refrigeration	0.012
Maintenance of oil engines, per ton refrigeration	0.013
Maintenance of refrigerating plant, per ton refrigeration	0.008
Maintenance of electric equipment, per ton refrigeration	0.013
Maintenance of auxiliary equipment (pumps, air compressors, etc.), per ton refrigeration	0.007
Total engine-room expense per ton of refrigeration	$ 0.451

It should be stated that the Diesel engines in addition to driving the compressors, also actuated, by belt from the flywheel, a 3-phase a. c. electric generator for operation of the auxiliaries.

In 1913 when the power was all furnished by electricity from the central station, the Diesel engines having been disposed of, the power costs figured out as follows:

Tons of refrigeration produced.......	19,899
Kilowatt-hours, total	750,401
Kilowatt-hours, per ton refrigeration..	38.
Wages for power, per ton refrigeration	$ 0.106
Lubricating oil and waste per ton refrigeration	0.030
Electricity purchased, per ton refrigeration	0.235
Water, per ton refrigeration..........	0.005
Maintenance of electric plant, per ton refrigeration	0.010
Maintenance of auxiliary equipment, per ton refrigeration.............	0.024
Maintenance of refrigerating plant, per ton refrigeration	0.035
Total engine-room expense per ton of refrigeration	$ 0.445

There was thus a slight reduction per ton of refrigeration when electric power was substituted for the Diesel engines, but it is significant that considerably more refrigeration was produced on a lesser investment in power plant. According to a statement by the cold storage company the electric drive cost about $10.00 per horse-power installed, while the oil-engine drive cost approximately $70.00 per horse-power installed, including foundations, and if the rates of depreciation were the same the fixed component of operating unit costs would be just seven times that of the electric. In the matter of maintenance and reliability the electric equipment proved much better, especially for a plant having a pipeline refrigeration—a *quasi* public service business. The company also states that repairs on the Diesel oil engine equipment, including air compressors, had proved much smaller than expected. The repairs on the electric equipment, with all motors self-oiling, amounted to but a few dollars. Under oil-engine power the plant paid but little more than expenses; under electric power it earned an eight per cent dividend, after allowing for all fixed charges and expenses.

"Pacific Service" Section N. E. L. A.

"Pacific Service" section of the National Electric Light Association resumed activities last month. The executive committee got together February 4th and resolved to resume the regular monthly meetings. Notices were sent out and the result was a highly successful gathering on the evening of Wednesday, February 18th, in the rooms of the Engineers' Club, San Francisco.

Chairman A. R. Thompson presided and Harry Bostwick resumed his duties as secretary. About 125 members were in attendance from San Francisco, Oakland and the bay counties. Reports were received from the standing committees and the whole machinery of "Pacific Service" section was set going in a manner that augured well for future developments. It is to be remembered that the N. E. L. A. will hold its big convention in San Francisco next year and that "Pacific Service" section must be ready to do its duty in entertaining its brethern from all parts of the country and helping to make their stay here a most pleasant remembrance for all time.

Under the head of old business the suggested amendment to Article 5, Section 2 of the By-laws, referring to voting by proxy, was brought up again, but after some discussion was laid on the table. A suggestion was made by Mr. Furniss of Oakland that it might be well to have a standing committee on constitution and by-laws to which all such matters should be referred for consideration and recommendation before being put before the main body. The suggestion was adopted and Chairman Thompson appointed the following committee: Messrs. G. B. Furniss, H. Bostwick, W. G. Vincent, Jr., F. H. Varney, W. S. Coleman, and Geo. H. Bragg.

No special program was provided for the meeting but various members were called upon for remarks and suggestions. The following were heard from: Mr. F. S. Myrtle, Manager Publicity Department; Mr. John Clement, Claim Adjuster, Oakland District; Mr. W. S. Coleman, Manager Contract Department, San Francisco District; Mr. George B. Furniss, Assistant Manager, Oakland District; Mr. Fred Maynard, Division Superintendent, San Jose Power Division; Mr. John Pape, Manager Berkeley District; Mr. Don Ray, Manager Contra Costa District; Mr. W. G. Vincent, Jr., Valuation Engineer, and Mr. H. P. Pitts, Industrial Engineer, San Francisco District.

Mr. S. V. Walton, Chairman of the Papers and Meetings Committee, announced the intention of the committee to advise the secretary in advance of papers or lectures arranged for specified dates in order to give all members ample notice of the proposed subject of discussion.

Considerable enthusiasm was shown in the proceedings. The meeting closed with a vote of thanks to the Engineers' Club for extending the privileges of the club rooms to "Pacific Service" section for the purpose of holding these monthly meetings.

Pacific Coast Gas Association

Office of the Secretary
445 SUTTER STREET, SAN FRANCISCO

San Francisco, February 7, 1914.

"INTERNATIONAL GAS CONGRESS, SAN FRANCISCO, 1915."
TWENTY-SECOND ANNUAL CONVENTION, LONG BEACH, CAL.
SEPTEMBER 15th, 16th, 17th, 18th, 1914.

To the Members of the Pacific Coast Gas Association:

In keeping with the old adage "Coming events cast their shadows before," hence this our opening announcement calling your attention to our Twenty-Second Annual Convention, which will convene at Long Beach, California, in September.

Mr. Champ S. Vance, our President, is leaving no stone unturned toward making this convention "the convention of all," but to accomplish this end he must have the hearty co-operation of all members.

At this early date we are in a position to announce that some very strong papers are already receiving consideration at the hands of the authors, and which papers will be of untold benefit and interest to the fraternity at large.

Our Committee on Gas Exhibits, composed of Messrs. C. B. Babcock, San Francisco; R. J. Thompson, San Francisco; B. S. Pedersen, San Francisco; Paul Haugh, Los Angeles, and Mr. H. P. Pitts, San Francisco, have already put their irons in the fire and state that they will be prepared to give an account of their stewardship surpassing all previous efforts in that direction.

Our Wrinkle Editor, Mr. H. W. Burkhart of Los Angeles, will be glad to hear from all members who may have anything to impart through his department that may be of interest to the fraternity, and Mr. John Clements, of Oakland, Cal., our Experience Editor, is looking for new experiences.

Our members will be interested in knowing that everything is progressing satisfactorily in so far as the course of Gas Engineering Degree at the University of California is concerned.

All matters having to do with the 1915 Gas Congress are receiving the attention of our Vice-President, Mr. E. C. Jones, of San Francisco.

Remember the dates—September 15th, 16th, 17th and 18th—noting them as "Red Letter Days" for the year 1914, and arrange your affairs to answer to the roll call when the Twenty-Second Annual Convention is called to order at Long Beach, California, on Tuesday morning, September 15, 1914, at 10 o'clock, by Mr. Champ S. Vance, of Los Angeles, California, our President.

Yours in the faith,

HENRY BOSTWICK, Secretary.

Jottings from the District Offices

IMPROVEMENTS AT MARYSVILLE.

"We have just completed our 150,000 cubic feet gas-holder," writes Manager Poingdestre from Marysville. "It consists of a reinforced concrete foundation and a steel water tank 66 feet 7 inches in diameter and 25 feet 6 inches in height. The gas-holder is a two-lift holder, the first lift being 63 feet in diameter and 24 feet 8 inches in height, and the outer lift 64 feet 7 inches in diameter and 25 feet 2 inches in height.

"Gas was turned on in our new holder on February 20th and already there has been a marked improvement in our gas distribution, in addition to which we look for a reduction of our distribution and operating expenses. We enclose copy of recording gauge showing difference in pressure before and after the installation of the new holder.

"The re-construction of the Feather River bridge will be completed in about two months. This caused us much trouble in the past through the breaking of our 4-inch main which was carried underneath the bridge when it went out.

"The Merchants' Association of Marysville and Yuba City has recently been formed for the purpose of advancing the interests of the two towns. We have subscribed to the new organization.

"In the Electric Department, owing to the very wet season, pumping plants will not be in operation until a later date this season than last. We have, however, received several applications for new business in this direction, notably 175 h. p. in District 10, Yuba County, and over 100 h. p. in Sutter County.

"A contract has been signed with Yuba City for five years for a series system of lighting the streets, comprising fifty-one 60 c. p. lights and modern up-to-date brackets. These will be completed this month.

"All indications are at present favorable for a season of renewed prosperity."

POWER FOR RICHARDSON SPRINGS.

District Manager Heryford reports from Chico:

"The Chico District, has just entered into a contract with the management of Richardson Springs to furnish electricity and power to the famous resort. The Springs has heretofore been lighted principally from gas supplied from a natural well situated near the Springs, the gas hereafter will be utilized entirely for cooking and heating.

"The initial installation will consist of 35 h. p. Mr. Richardson will build about six miles of line to meet ours on Shasta Road, we run out this road from Chico for a distance of five and one-half miles."

OAKLAND'S "PACIFIC SERVICE" CLUB.

The Oakland "Pacific Service" Club held the first meeting of the New Year Wednesday evening, January 21, 1914, with a large and enthusiastic attendance.

Mr. Burdette Cornell of the Commercial Department was elected chairman of the club for the ensuing term. The subject for the evening was an illustrated lecture on "The Drum Development and the Company's Hydro-Electric Plants" by Mr. F. R. George, Chief Load Dispatcher of the Pacific Gas and Electric Company. After the lecture a general discussion was entered into by those present.

Mr. C. H. Oliver, of the Collection Department, assisted by Mr. Marcelous Steward, favored the gathering with several barytone solos, which concluded the evening's program.

District Manager Leach informs us:

"Dan Cupid has evidently been working overtime in the Oakland District.

"With the opening of the new year, we learned of the marriage of C. L. Cadan, of the Commercial Department, to Miss Marion Howe, of Chicago, Ill.

"Mr. John A. Zech, of the Commercial Department, and Miss Alma Rickaby, until recently in the District Manager's office, were united by the bonds of matrimony Sunday, February 15, 1914. We extend to the newly-weds our best wishes.

"We also have the announcement of the engagement of Miss Alice C. Johnson and Mr. Alfred Earl Jeffery. Mr. Jeffery is a member of the Oakland District Collection Department."

Vice-President and General Manager John A. Britton lectured upon the "Policy of Public Service Corporations" before the San Francisco Chapter of American Institute of Electric Engineers at the Engineers' Club in San Francisco on the evening of Friday, February 27th. The lecture was attended by a gathering of over one hundred and was listened to with evident interest.

In Memoriam

GEORGE SUTHERLAND COLQUHOUN

BORN SEPTEMBER 26, 1872 DIED FEBRUARY 8, 1914

IN the death of George S. Colquhoun the gas industry has lost an earnest worker who devoted his life to its interests.

He was born in Oakland, California, September 26, 1872, and in 1881 his parents moved to Fresno, where he attended the public schools and early became an apprentice to the plumbers' trade. Immediately after the death of his father in 1894 he entered the employ of the Fresno Gas and Electric Company and through a wonderful adaptability and liking for the business he was promoted until he attained the position of manager of the company in 1901.

George Sutherland Colquhoun.
1872-1914.

His affiliation with the Pacific Coast Gas Association began with active membership at the Sixth Annual Meeting in 1898, and his skill as a mechanic and resourceful ability in gas works operation especially fitted him to conduct the Wrinkle Department of the association, a part which he filled continuously from 1902 to 1907, when he was elected vice-president of the association.

Early in 1906, before the great fire in San Francisco, he was made Assistant Engineer of the Pacific Gas and Electric Company, and stationed in San Francisco in charge of gas manufacture. It was in during the dark days following the earth- this capacity that he did heroic work quake, and as a result his health became impaired and he was attacked by the malady which brought this promising career to a close.

He was incapacitated for work for over six years, but during all this time he was sustained by a strong will power and unfailing hope.

During the period of his illness he was elected President of the Pacific Coast Gas Association, September 16, 1908, and had his health permitted he would have presided at the Seventeenth Annual Meeting September 21, 1909.

Mr. Colquhoun was married in Fresno July 16, 1904, to Edith Lynn, and the nobility of woman was exemplified by this faithful wife who nursed and tended him with loving hands throughout his long illness. His patience and fortitude while in the shadow of death was matched by her unselfish devotion. His last days were spent at the Potrero Gas Works in San Francisco, where he passed away on the morning of February 8, 1914. He is survived by his widow, his mother and two sisters.

The funeral services held in San Francisco were largely attended by his associates in the gas business, and the services in Fresno, where he was buried, were held under the auspices of Odd Fellows Lodge No. 186, of which order he had been a member for twenty years. E. C. J.

Hon. Secretary Baloun reports progress as follows:

"Last fall Room 720 of the Grant Building in San Francisco was assigned as temporary quarters for this library, and the entire length of the room was fitted with suitable shelving for the books. Due to the enthusiasm shown by members of "Pacific Service" and others in donating books and pamphlets this space has been filled, and I am now having additional accommodations provided at the end of the room. This expansion speaks well for this embryo library's progress.

"As our library has on file bound volumes 2 and 3 of the Company's magazine, Mr. R. J. Cantrell kindly donated volume 4 and all of the separate issues of volume 1 except the August number of 1909. I am anxious to secure a copy of this, No. 3, Vol. 1, and hope that one of our readers will be able to spare this particular copy so that I may bind volume 1.

"Mr. L. C. Williams of the O. & M. Department has presented four interesting pamphlets covering the use of plain and reinforced concrete.

"Mr. S. J. Lisberger, engineer of the electric distribution department, has given four maps covering the present and proposed water supplies of the Spring Valley Water Company and the city of San Francisco.

"A very valuable addition to the library has been presented by Mr. Paul E. Magerstadt, one of the engineers who worked on the Drum-Spaulding project. It consists of a complete set of bound volumes, from No. 1 to 35 inclusive, covering the engineering data and records of the period of 1869 to 1886 of the Van Nostrand Engineering Magazine. As so much of the engineering construction in existence today was installed during the above period, these reference works are an excellent acquisition. Many thanks to you, Mr. Magerstadt.

"Mr. E. O. Shreve, an electrical engineer of the General Electric Company, was instrumental in securing for our files the monthly copies of the General Electric Review, commencing January 1, 1914. These copies are now on file and can be drawn upon by the employees.

"The legal, commercial, engineering and other scientific departments both of this and the Canadian governments have responded to our requests for interesting literature most bountifully, and their contributions are available to patrons of the library. It is noteworthy that many of our employees from the different departments use our library when they are "off watch." The circulation of the filed publications at their homes is also beginning to show an increase.

"The volumes on file to date are: Books, 365; pamphlets, 1756; circulating magazines, 5; maps, 5.

"Please note that all books and pamphlets may be retained from the library for a period of one week with the privilege of a renewal. All periodicals of a circulating nature may be retained for a period of three days.

"It will no doubt be interesting to all our readers, members and employees of this Company, to know that I have just received a very lengthy letter from Mrs. Clara B. Wise, the mother of our dear Jim, from the town of Haifa, Syria, and wherein she begs to be remembered to all of you, whom she calls 'The large family.' After visiting Jerusalem and Palestine she is to turn her face homeward."

Pacific Service Magazine

PUBLISHED IN THE INTERESTS OF ALL EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

JOHN A. BRITTON - - - - - EDITOR-IN-CHIEF
FREDERICK S. MYRTLE - - MANAGING EDITOR
A. F. HOCKENBEAMER - - BUSINESS MANAGER

Issued the middle of each month.
Year's subscription $1.50
Single copy .... .15

Published by the
PACIFIC GAS AND ELECTRIC COMPANY
at 445 Sutter Street. San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. V. MARCH, 1914. No. 10

EDITORIAL

"SAFETY FIRST" is getting to be a universally adopted slogan among the public service corporations. It is in line with an up-to-date policy of mutual protection. This policy is carried out not merely in the interest of employees but, just as particularly, in the interest of the public.

It is now generally recognized as a wise plan to lock the stable door before the horse is stolen. In other words, that prevention is better than cure. Those whose business it is to operate factories, machine shops and other institutions where the element of danger is present in a greater or lesser degree have taken up the problem of "SAFETY FIRST" not alone in obedience to existing laws upon the subject but in a spirit of progressiveness that is characteristic of the age in which we live.

A deal is being written upon the subject and a liberal campaign of education is being carried on throughout the world. Our attention has been called recently to a publication entitled "Accident Prevention" issued by the United Gas Improvement Company of Philadelphia. It consists of an amplified revision of an illustrated talk on "accident prevention in certain public utilities" delivered before the annual convention of the National Electric Light Association in Chicago last June. The particular value of this is that it calls attention to a number of accidents due not so much to failure of machinery or apparatus nor to electric or mechanical hazard but to "seemingly needless number of simple and trivial hazards or practices, easily recognized by one *not daily on the premises.*"

We may with advantage quote from the general introduction to this little work:

"When thought is given to the innumerable activities of everyday life, it is remarkable how little the average man seems to think or care about the hazards surrounding him on every side. As a rule he does not see how they affect him. Even when a man has witnessed an accident due to carelessness, the lesson is shortlived at best. He may have his own ideas as to who or what was to blame for the mishap, and, thinking that he will not repeat the mistake, becomes possessed by a feeling of security and self-sufficiency which at times results in the happening of the very accident for which he should have been prepared through the experience of his fellow-man.

"It has been well said that *accident prevention saves misery and money.* Until within the last few years this twofold saving has not been appreciated, and in striving to increase outputs and sales the avoidance of accidents has been overlooked. Efforts have been directed mostly toward reducing costs and increasing sales, with little and, at times, apparently, no regard for the saving coincident with intelligently directed work in the prevention field. It surely pays to concentrate on prevention; the *safe* way is the *progressive* way of protecting both employee and employer. A catastrophe avoided may mean lives saved and receiverships averted."

The policy of locking the stable door in time is humorously and, at the same time, effectively illustrated in a poem which appeared first in the "Travelers'

Standard" and has since been made use of in the prosecution of the "Safety First" campaign. The poem is entitled "The Parable of the Dangerous Cliff" and, as its name implies, is written about a cliff over whose terrible edge there had slipped many persons to their destruction. It was agreed that something would have to be done, but the people would not come together upon the course to be pursued. Some suggested putting a fence around the edge of the cliff and others an ambulance in the valley beneath. The ambulance project carried the day, and the only protection afforded the people was a warning to them not to go too near the edge of the cliff. One day there arose one among that community strong enough to present a plan for prevention, but when he seriously suggested that

"The mischief, of course, should be
stopped at its source,
"Come, neighbors and friends, let us
rally;
"It is far better sense to rely on a
fence,
"Than an ambulance down in the
valley,"

he was at once jumped upon by his fellow townsmen who pronounced him wrong in the head. They argued that so long as they sent out a rescue party to pick up the people that fell down the cliff and always had the ambulance on hand to render "first aid" they were doing their duty by the community. And so the matter was allowed to rest.

This parable, so-called, presents a picture of conditions as they have been in the past but that are being altered with all twentieth century speed. It is a process of evolution, in which "First Aid" gives way to "Safety First."

"Pacific Service" is an active participant in this "Safety First" campaign. A visit to any of our power-plants, steam-stations, sub-stations, an inspection of any detail of our system, will afford ample evidence of what is being done not only to safeguard the employee against the possible results of his own carelessness but, also, to protect the public against possible defects in construction. Some months ago an expert from the East went over the important centers of our system. His full report is in process of compilation and, in the meantime, the practical advice he gave at the conclusion of his investigation has been followed in every particular.

In addition, another expert following on the heels of the Eastern expert is busily engaged in taking up district by district and making a full and complete report upon each, giving the minutest details, in which no element of danger, no matter how trivial, how slight, is overlooked. To all purposes it is a regular housecleaning, and what "Pacific Service" is doing today in this direction is what every public service corporation and every employer of labor, every person, firm or corporation engaged in an enterprise in which the element of danger is present, is doing or must do in the immediate future.

Through the columns of Pacific Service Magazine it is our purpose from time to time to help along this campaign of "Safety First." There will be published details of reports, suggestions, descriptions of new devices, everything that comes to our knowledge that, in our judgment, is calculated to help out the good cause. It is a campaign along right and progressive lines and is worthy of all the interest and attention that can possibly be devoted to it.

It gives us much pleasure to record the news contained in a dispatch from Sacramento, dated March 4th, announcing the re-appointment of our Mr. John A. Britton as a member of the Board of Regents of the University of California for the full term of sixteen years. In making this re-appointment Governor Johnson said: "Mr. Britton has been an active Regent, devoting himself at all times and under all circumstances to the University, and his services entitle him to re-appointment."

Noting Progress of the World's Fair

THE Panama-Pacific International Exposition, which opens in San Francisco in just eleven months, is assuming definite proportions at a rapid pace. On the Fair site, but a few months ago a stretch of waste land, with but the framework of a building or two here and there, appeared before the visitor; today he may stand upon an eminence in the Presidio near by and gaze upon a city of domes and towers.

It is not claiming too much for this great enterprise of ours that the amount of work already accomplished is marvelous. Men from the East stand amazed as they behold for the first time in history on international exposition well ahead of its construction schedule. President Charles C. Moore time and time again has assured the people of California that the exposition will be ready on time; nothing short of a miracle or disaster can now prevent his making good his assurances.

The gigantic Palace of Machinery is completed, the Palace of Education is all but finished, and all of the eight exhibit palaces in the main group have passed the fifty per cent mark in points of completion, according to the latest building report on building progress issued by Director of Works Harris D. H. Connick. The palaces of Mining and Metallurgy, Varied Industries and Agriculture are next in line for completion. As to the State buildings, the Idaho Building is nearing completion, the New York Pavilion and the Canadian Building are under way, while construction of the Indiana State Pavilion will be begun early in April.

The first shipment of steel for the Palace of Fine Arts, which will be one of the most magnificent in the exposi-

View of the Palace of Education from across the Fine Arts lagoon. A feature is the half-dome of Philosophy.

The way buildings are constructed on the waterfront lots. Piles being driven for the foundation of the Transportation Building.

tion, reached San Francisco in January. The foundation of the palace is about completed and the steel work is next in order. The Palace of Fine Arts will stand to the west of the main group of exhibit palaces overlooking a lagoon. The building will be crescent-shaped, and will cost about $580,000. Blossoming fruit trees will be growing along the shores of the lagoon in front of this structure when the exposition opens in February next year. Cherry, apple and other fruit trees will be transplanted from California orchards for the purpose.

Steel work on the dome of the Palace of Horticulture is commenced. Plans are completed for Festival Hall, which will be the scene of many congresses and conventions held during the exposition. Festival Hall will occupy an imposing place on the east side of the south gardens and will cost about $270,000. Plans for the California Building have been drafted and bids are about to be advertised for. This building will border the bay, standing just east of the sites set aside for state pavilions.

Former Governor David R. Francis of Missouri, who was president of the Louisiana Purchase Exposition at St. Louis in 1904, delivered an address on the exposition before the San Francisco Chamber of Commerce February 20th, after having been shown over the grounds by President Moore and the directors. He declared his belief that the exposition will be the greatest the world has ever seen and spoke strongly of the educational benefits that must result therefrom. "The ten months of your exposition," said Governor Francis, "will do as much for the young people as will two years in a university." Speaking of progress he said, "Your exposition is now much nearer to completion than our was a year before the opening. Your progress is greater at this stage than was that of any other exposition, and it promises to be the greatest exposition of all times."

Two hundred and six conventions have been formerly booked to meet in San Francisco in 1915. Two of the most important of these, doubtless, will be the National Electric Light Association convention and the International Gas Congress.

Engineers of the exposition, under the direction of Chief Guy L. Bayley, have evolved a new plan of lighting large buildings which has already caught the attention of students of illumination and promises to become one of the most valuable scientific features of the exposition. Mr. Bayley described his new method, which will be used in the Palace of Horticulture and Festival Hall, in a lecture before the San Francisco chapter of American Institute of Electrical Engineers. The plan provides for lighting the huge buildings by a soft, diffused light from a hidden source, which will not only give adequate illumination but will obviate the usual beam lighting which, in its lack of diffusion, has not been entirely satisfactory in the lighting of large assembly halls. In the center of Festival Hall will be an ornamental well, at the bottom of which will be placed searchlights, directed toward the great dome of the building. The rays of these lights will be passed through a large "diffusion plate," capping the well, and composed of a number of small lenses which, while causing a beautiful dispension of the rays by refraction, will not break them into their prismatic colors. Two of the beams will be reflected from mirrors before passing through the plate, in order to bring them to bear on the lower areas of the building walls. The light will be reflected back from the dome and walls, filling the building with an even, blended illumination, with the source entirely hidden.

The principle will be the same in the illumination of the Palace of Horticulture, although the diffusion plate will be borne on an eighteen-foot tower in the center of the building, instead of capping a well. The glass dome of this building will be the largest in the world and will be 150 feet in diameter and 185 feet high. The interior illumination will provide a brilliant exterior effect, as in front of one of the searchlights hidden at the base of the light tower will be a revolving glass plate of red, green and yellow sections, which will send a constantly varying surge of color against the glass dome.

Another revolving plate, opaque with the exception of one quadrant, will break the waves of color with a pulse of white light. The dome will be built of a thick glass, which has the effect of softening light passing through it, and the effect will be exactly that of a great opal, shot through with warm, changing colors.

Following are some notes on progress in the electrical department:

Working drawings are now made of the device to be used for suspending the

Group, "Nations of the East," that will surmount the Arch of the Rising Sun in the Court of the Universe.

jewels from the various buildings. A metal ring one-eighth inch wide will encompass the jewel on the outer edge at an angle and a second holder at the back will bring a small mirror against the apex of the jewel. It is estimated that the brilliancy will be increased more than forty per cent by the use of this mirror.

The jewel is hung by a small handle with a one-quarter inch hole on a one-eighth inch hook, which permits of free movement in any direction and practically amounts to point suspension.

As has been explained before, the jewels are forty-seven millimeters in diameter and are molded from an exceptionally hard flint glass in Austria and are afterward farmed out to the peastry to be hand-cut and polished. The cut is an imitation of a well-known cut of diamond.

Complete orders have been placed for all auxiliary equipment required for the operating of the three main D. C. generating sections for the control of D. C. power for the exhibitors and decorative lighting.

An order was placed during the week with the Wheeler Reflector Company of Boston, Mass., for 2154 reflectors varying in size from seven to eleven inches. They are to be made of steel with lacquered aluminum finish and will be used in the various exhibit palaces.

Experiments are now being made to determine the extent to which it will be advisable to use electrical substitute for firework displays. Imitations of waterfalls will be used which will show gold and silver showers in the day and at night these will be displayed to advantage by searchlights.

The department is developing a new form of receptacle for use in gala and festive lighting. These are in the form of Mission bells and more than 25,000 will be used in decorative lighting. Special lamps will be grouped so as to imitate the various forms of fruits and flowers. The lamps to be used in this feature work will be similar to those in common use for Christmas tree lighting.

Orders for the remainder of the electrical apparatus to be used in buildings and on the grounds will be placed soon. The draughting department is now making a final check of lists to determine quantity and character of apparatus required.

The plans and specifications for the electrical work for the California Building are almost completed. The contract for the electrical work in the Court of Palms and the Court of Flowers has been awarded to Nebery Bandheim.

A group of world famous mural decorators, headed by Edward Simmons, Robert Reid, Childe Hassam and Frank Du Mond, of America, and Frank Brangwyn, of England, who have been engaged to supply the mural decorations that will adorn the interior courts of the exposition, are in San Francisco completing their canvases. An exhibition of paintings by "The Chosen Ten" was opened in the Palace Hotel in San Francisco March 5th.

Chief John E. D. Trask of the Department of Fine Arts has appointed the following advisory committee to his department: Professor Eugene Neuhaus, head of the art department of the University of California, chairman; Mrs. Harriet Foster Beecher, Seattle; G. L. Berg, Seattle; Mrs. Lillie V. O'Ryan Klein, Portland; Miss Clara Stephens, Portland; Henry F. Wentz, Portland; C. E. S. Wood, Portland; William Wendt, Los Angeles; Mahonri Young, New York City; E. C. Peixotto, New York City; Captain Robert H. Fletcher, San Francisco; Arthur F. Mathews, San Francisco; Bruce Porter, San Francisco; Mrs. Mary Curtis Richardson, San Francisco.

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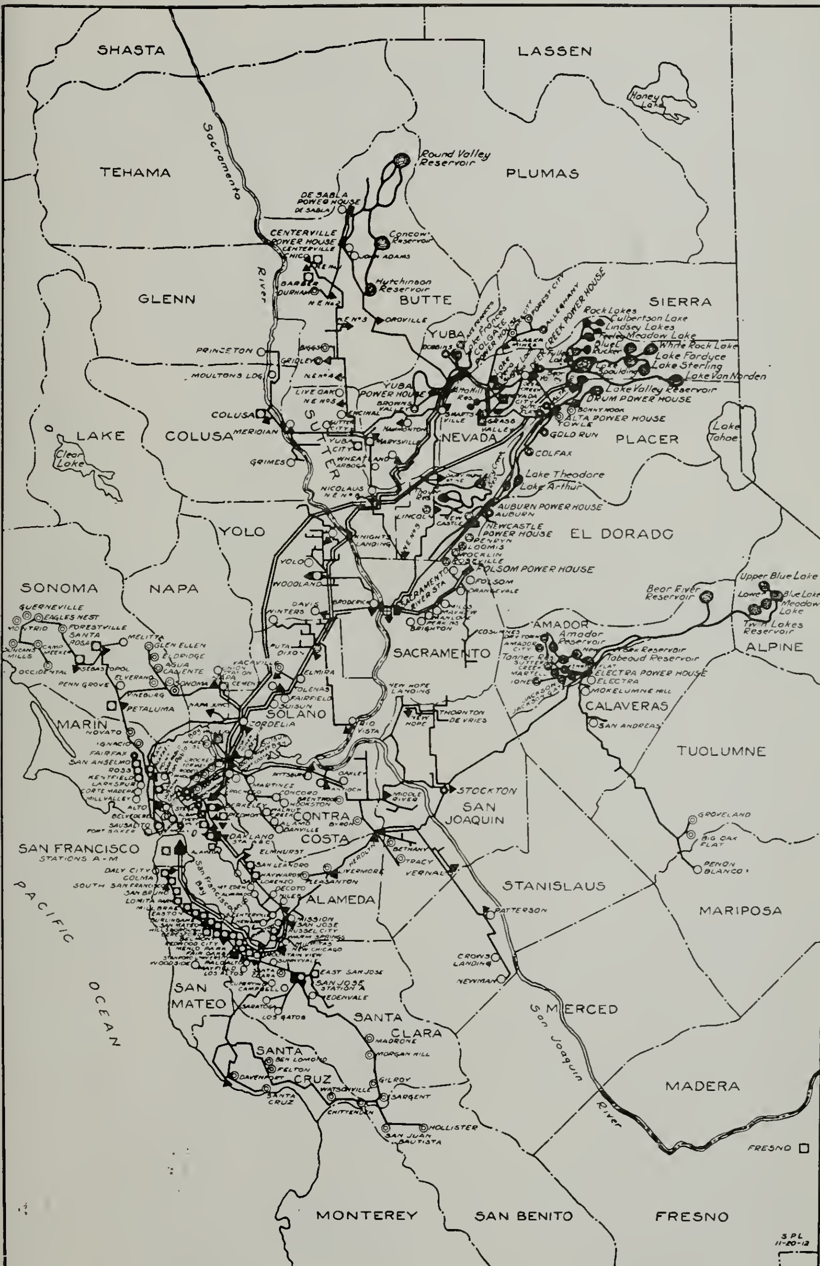
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TEHAMA
PLUMAS
Round Valley Reservoir
Sacramento River
DE SABLA POWER HOUSE
CENTERVILLE POWER HOUSE
Concow Reservoir
Hutchinson Reservoir
GLENN
BUTTE
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OROVILLE
YUBA
COLGATE POWER HOUSE
Rock Lakes
Culbertson Lake
Lindsey Lakes
White Rock Lake
Lake Fordyce
Lake Sterling
Lake Van Norden
Lake Valley Reservoir
DRUM POWER HOUSE
ALTA POWER HOUSE
PRINCETON
COLUSA
LAKE
Clear Lake
COLUSA
SUTTER
MARYSVILLE
NEVADA
PLACER
Lake Tahoe
GRASS VALLEY
GOLD RUN
COLFAX
GRIMES
Lake Theodore
Lake Arthur
NICOLAUS
AUBURN POWER HOUSE
AUBURN
YOLO
LINCOLN
NEWCASTLE POWER HOUSE
EL DORADO
PENRYN
LOOMIS
ROCKLIN
ROSEVILLE
FOLSOM POWER HOUSE
FOLSOM
SOMONA
NAPA
WOODLAND
Upper Blue Lake
Bear River Reservoir
DAVIS
WINTERS
SACRAMENTO RIVER STA
Blue Lake
Meadow Lake
Twin Lakes Reservoir
GUERNEVILLE
EAGLES NEST
FORESTVILLE
SANTA ROSA
SACRAMENTO
AMADOR
Amador Reservoir
Tabeaud Reservoir
ALPINE
GLEN ELLEN
VACAVILLE
DIXON
ELECTRA POWER HOUSE
ELECTRA
SEBASTOPOL
SONOMA
NAPA
ELMIRA
OCCIDENTAL
PENN GROVE
MOKELUMNE HILL
PETALUMA
SOLANO
FAIRFIELD
SUISUN
CALAVERAS
MARIN
NOVATO
CORDELIA
RIO VISTA
THORNTON
SAN ANDREAS
TUOLUMNE
SAN ANSELMO
MARTINEZ
CONCORD
ANTIOCH
STOCKTON
SAN JOAQUIN
CONTRA COSTA
GROVELAND
BIG OAK FLAT
SAN FRANCISCO STATIONS A-M
OAKLAND
PENON BLANCO
DALY CITY
COLMA
SAN LEANDRO
TRACY
VERNAL
HAYWARDS
LIVERMORE
PLEASANTON
PACIFIC
ALAMEDA
STANISLAUS
San Francisco Bay
NILES
MISSION SAN JOSE
MARIPOSA
PATTERSON
CROWS LANDING
NEWMAN
OCEAN
EAST SAN JOSE
SAN JOSE STATION A
SAN MATEO
CAMPBELL
LOS GATOS
SANTA CLARA
MERCED
San Joaquin River
MADRONE
MORGAN HILL
SANTA CRUZ
BEN LOMOND
FELTON
DAVENPORT
WATSONVILLE
GILROY
SARGENT
MADERA
CHITTENDEN
HOLLISTER
SAN JUAN BAUTISTA
FRESNO
MONTEREY
SAN BENITO
FRESNO
S.P.L. 11-20-12

PACIFIC GAS AND ELECTRIC COMPANY

CITIES AND TOWNS SUPPLIED WITH GAS, ELECTRICITY, WATER AND RAILWAY

Service Furnished	Number of Towns	Total Population
Electricity	209	1,093,992
Gas	51	989,167
Water	25	52,865
Railway	1	71,000

Place	Population
Alta	20
[1]Alameda	25,000
Alamo	50
[2]Albany	800
[5]Amador City	200
Adams John	25
Alleghany	200
Alto	25
Angel Island	280
[5]Auburn	2,375
Agua Caliente	100
Alvarado	900
Antioch	3,000
Arboga	100
[2]Barber	500
[2]Belmont	350
Ben Lomond	800
Belvedere	1,000
Benicia	3,360
[2]Beresford	25
[2]Berkeley	40,000
Biggs	750
Big Oak Flat	20
Brentwood	200
Brighton	100
Broderick	200
[5]Brown's Valley	50
Byron	200
[2]Burlingame	4,000
California City	25
Camp Meeker	200
Campbell	600
Centerville	1,000
Centerville	20
[2]Chico	13,000
[2]Colma	3,500
[2]Colusa	1,500
Concord	1,500
Cement	1,500
[5]Colfax	500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Cupertino	50
Daly City	250
Danville	250
Davis	750
Decoto	350
de Sabla	25
[5]Dixon	1,000
[5]Dobbins	50
Davenport	1,000
[5]Drytown	20
Durham	500
[5]Dutch Flat	500
Duncan's Mills	150
[2]Easton	300
[2]East San Jose	1,660
Eagle's Nest	50
Edenvale	500
Eldridge	500
Elmira	150
El Verano	400
Electra	50
[2]Emeryville	5,000
Encinal	100
Fairfax	500
Fairfield	834
Forestville	100
Felton	300
[1]Fresno	30,000
[2]Fair Oaks	250
Folsom	1,800
Gilroy	2,000
Glen Ellen	500
[5]Gold Run	100
[3]Grass Valley	4,500
Gridley	1,800
Grimes	250
Groveland	125
Guerneville	500
Hammonton	500
[2]Hayward	4,000
[2]Hillsborough	1,000
Hollister	3,000
Hookston	75
Ignacio	100
[5]Ione	900
Irvington	1,000
[5]Jackson Gate	100
[5]Jackson	2,035
[5]Kennedy Flat	20
[2]Kentfield	250
Knight's Landing	350
[5]Lake Francis	5
Lathrop	300
Live Oak	200
Livermore	2,250
Los Gatos	3,000
[2]Larkspur	600
[5]Lincoln	1,400
[2]Lomita Park	100
Los Altos	500
[5]Loomis	400
Maletta	30
Manlove	50
Martinez	5,000
[5]Martell	150
[2]Marysville	7,000
Mayfield	1,500
Mayhew	50
[2]Menlo Park	1,500
Meridian	300
[2]Millbrae	300
Mills	50
Milpitas	300
Mill Valley	2,500
Mission San Jose	500
Mokelumne Hill	150
Monte Rio	50
Moulton's Landing	30
Mountain View	2,500
Mt. Eden	200
Mare Island	500
[2]Napa	7,000
[3]Nevada City	2,700
[5]New Chicago	10
Newark	700
[5]Newcastle	750
Newman	1,000
Niles	800
Nicolaus	75
Novato	250
[2]Oakland	230,000
Oakley	80
Orange Vale	100
[2]Palo Alto	6,300
Pacheco	200
Penryn	250
Patterson	300
Penn Grove	300
Perkins	50
[2]Petaluma	5,500
[2]Piedmont	1,720
Pike City	200
Pinole	1,500
Pittsburg	2,372
Pleasanton	2,000
Point San Pedro	20
Port Costa	600
[2]Redwood City	3,200
[2]Richmond	10,000
Rio Vista	884
[5]Rocklin	1,000
[5]Roseville	2,600
Rodeo	500
[2]Ross	500
Russel City	250
[4]Sacramento	71,000
San Andreas	200
[2]San Anselmo	1,500
[2]San Bruno	1,500
[2]San Carlos	100
[2]**San Francisco**	416,912
[2]San Jose	30,000
[2]San Leandro	4,000
San Lorenzo	100
[2]San Mateo	6,500
[2]San Quentin	2,500
[2]San Rafael	6,000
San Pablo	1,000
Santa Clara	6,000
Santa Cruz	16,000
Saratoga	50
[2]Santa Rosa	12,000
[2]Sebastopol	1,200
Sausalito	2,500
Smartsville	500
[2]South San Francisco	2,500
[2]Stanford University	2,600
Sonoma	1,200
Stege	1,000
[3]Stockton	30,000
Suisun	1,200
Sutter City	150
Sutter Creek	1,500
Sunnyvale	1,500
Tiburon	400
Tormey	20
Towle	100
Tracy	1,200
Union Station	40
Vacaville	1,200
[2]Vallejo	15,000
Vineburg	200
Walnut Creek	350
Warm Springs	200
Watsonville	4,500
Wheatland	1,400
Winters	1,200
[2]Woodland	3,200
Woodside	200
Yolo	400
[2]Yuba City	1,200
Total	1,148,992

Unmarked—Electricity only.
1—Gas only.
2—Gas and Electricity.
3—Gas, Electricity and Water.
4—Gas, Electricity and Street Railways.
5—Electricity and Water.

EMPLOYS 1,800 people.

OPERATES 11 hydro-electric plants in the mountains.
5 steam-driven electric plants in big cities.
16 gas works.

SERVES ⅔ of California's population.
30 of California's 58 counties.
An area of 37,775 square miles.
⅗ the size of New York State.
½ the size of all the New England States combined.

'ACIFIC SERVICE MAGAZINE

CORDELIA SUBSTATION, NORTH TOWER POWER DIVISION

'ol. 5

APRIL • 1914

No. 11

Published Monthly by the Pacific Gas and Electric Co., San Francisco, Cal.

Pacific Service Magazine

VOL. V No. 11

Yearly Subscription $1.50 :: :: Single Copies, Each, 15 Cents

Contents for April

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Main entrance to Cordelia substation. Note the four imposing Doric columns, each surmounted by a cement post supporting a 14-inch globe containing a 250-watt lamp. At night the substation is plainly visible for miles.

PACIFIC SERVICE MAGAZINE

VOL. V APRIL, 1914 No. 11

Cordelia Substation From an Architectural Standpoint

By IVAN C. FRICKSTAD, Architect Civil Engineer's Office

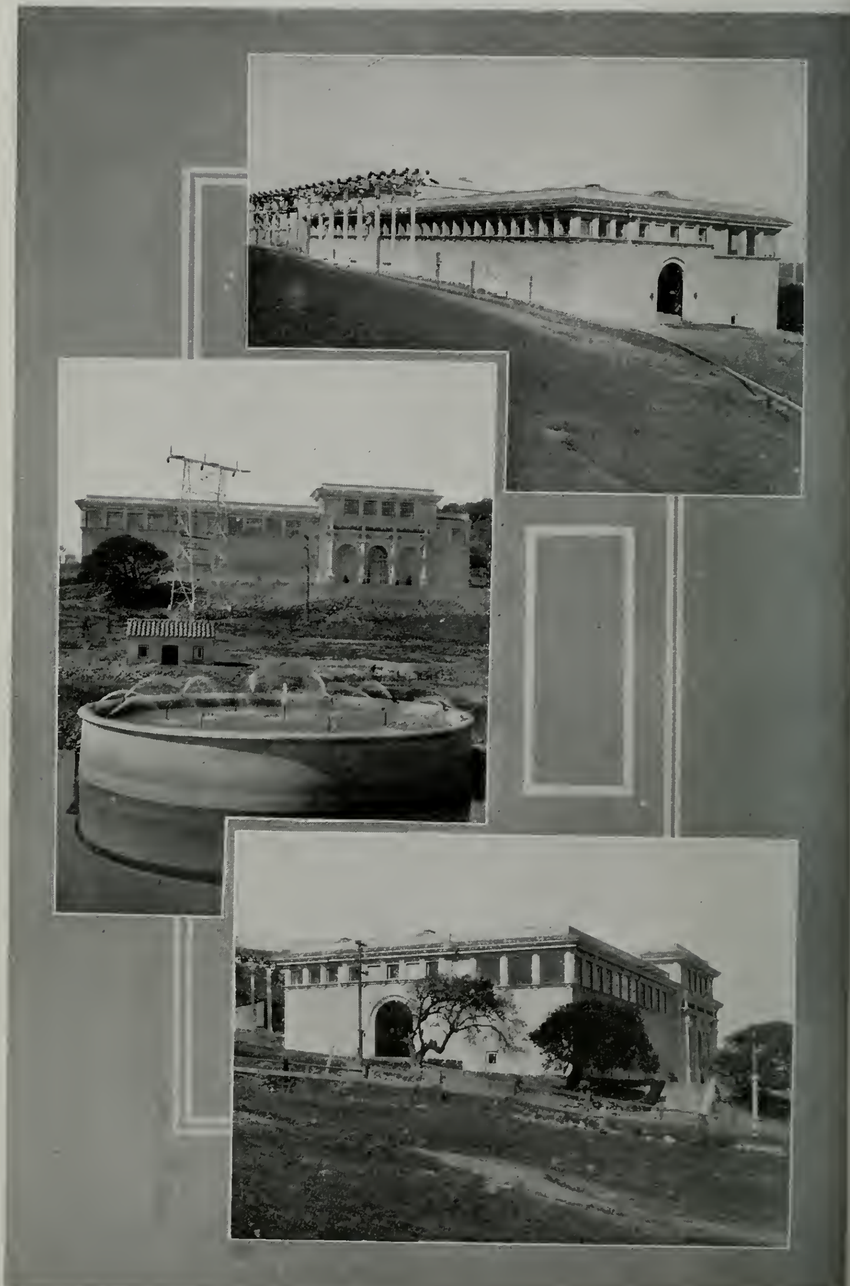
I. C. Frickstad

IN this description of Cordelia substation the writer will also briefly treat certain other buildings that have been either erected or planned recently by the Civil Engineering Department of the Company under the direction of Mr. H. C. Vensano, and which are a part of the system of power-plants and distributing stations rendering "Pacific Service." An effort will be made to show that while each has been given an individuality of its own they are architecturally related, the dominating features of each being united and combined in the composition of Cordelia, the central station of the system.

It is fitting and proper that the buildings comprising a system made up of a number of plants which are dependent upon one another for the perfect fulfillment of their specific mechanical functions should be made to express this relationship by carrying a consistent architectural theme throughout the system which fulfills the mechanical requirements as well as the function of utility.

Spanish Renaissance style of architecture has been chosen to accomplish this, because of its adaptability to the many exacting conditions and requirements of each station, the climatic conditions and the environments of the field in which the system operates. As to its adaptability to the mechanical requirements of each station, the interior installation is best taken care of when the walls are unperforated, since it is important to protect the highly-charged apparatus, to say nothing of the lives of the ignorant and thoughtless. Solid walls, too, are necessary for attaching the switches and other parts of the installation. This point in utility gives us in the exterior treatment large, flat, unbroken surfaces and agrees well with the fundamental principle of Spanish Renaissance, i. e., the universal concentration of ornament at a few salient points. This principle is justified by that most important canon in art of carrying the attention from the general to the particular. When developed carefully in the composition of a building the beholder receives at first a general impression of the character of the building through the large effects of mass, form, outline and proportion. Then he becomes aware of the finer structural points which are explanatory, elucidative and illustrative of the function and purpose of the work, the whole imparting a feeling of permanence and repose.

The early traditions of the State have had much to do with the selection of this style, for the Spaniards have left their influence everywhere. In fact, so well, although so crudely, did they build that the Missions standing today as a monument to their work are the foundation of a new style of architecture peculiar to this section of the country, the crudeness in their building being due only to lack of material, tools and skilled workmen. Such being the case, it is not the crudeness we should use as a motive in the development of this style, but the underlying principles of the compositions, obtaining our refinement of form



Upper picture gives a rear view of Cordelia substation from the south end, showing the system of pole switches; the center is a front view of the substation, with cooling pond and pump-house in the foreground; the lower shows south end and entrance of the building.

and detail from either the Spanish Renaissance in Spain or the Spanish Colonial in Mexico.

The purpose of Cordelia substation, i. e., the stepping down of the electric current from the high voltage necessitated by the great distance of the power-houses from the field of distribution to a lower voltage, and its distribution to the smaller substations located with reference to various distributing centers, determines the motive of its design.

The entrance of the high voltage lines to the plant is through windows seven feet square. These windows, placed so as to have a certain overhead clearance, are brought immediately under the cornice. This arrangement led to the use of the continuous window course, which accomplishes all that is desirable in the way of light and ventilation while providing an entrance for the wires. The window openings are separated by pilasters, around each of which breaks the sill-course as a base, and the members of the cornice, beneath the corona, as a cap. Spanish tile have been placed on the slope from the crown member of the cornice to the parapet wall, their scalloped edges showing plainly over the crown member, emphasizing the Spanish treatment. The same window and cornice treatment prevails around the entire building, but on the opposite side from which the wires depart the windows through which they must pass are only three feet square, and to meet this difference the two-size windows are brought together at the ends of the buildings by breaking out the portion in which the large opening occurs against which the sill courses stop. An additional break is made enclosing this large opening as a central feature and the smaller window course is carried across, allowing the sill to return around the corner and die against the surface of the first break.

The treatment of the large end openings as central features further emphasizes Cordelia's central position in the system. The requirements of the building called for greater height on the entrance side than on the outgoing side. This does not show, however, in the skyline, but was accomplished by carrying one floor level lower than the other. This was the most economical method as the building is located on a hill-side and the shelving off had to be made in solid rock.

The fact that the building is designed for the entrance of two high voltage lines, and that the relation of the station in the system is that of a central switching-station, is indicated in the composition by the central feature which projects beyond the face of the two wings and also breaks the skyline. This marks definitely the division of the two lines entering, the location of the switchboard controlling the station and is the main entrance to the building. At this salient point is placed the only ornament used on the building. This is composed of four Doric columns in between which are three arches springing from imposts. The central one is the entrance and is glazed throughout. The two side arches are niches in which will be placed formal trees in cement vases. The trees selected bear a white flower and produce a small red fruit. Above the cornice has been placed a grill of ornamental iron work such as is used for various purposes on nearly all Spanish or Latin-American buildings. This grill cuts in between cement lamp-posts which center over the columns. While the treatment of this central feature as a whole is quite simple, an ornate appearance is obtained by contrast with the greater simplicity of the balance of the building and with the absolutely plain walls.

These plain walls, however, will have their bareness moderated in time by a growth of shrubs at the base. The plain surfaces of the buildings are finished in white cement, colored a light buff and roughened slightly by a stippling process. The mouldings are smooth finished.

giving them an effect of being lighter, and the whole is crowned with varying tones of red tile.

The building stands on the side of a hill, with hills rising at either side and a higher range in the back ground. On the slope in front, a number of oak trees grow a little below and to either side of the entrance. A pond for cooling the transformer water and the pump-house with its tiled roof and buff colored walls, a necessary adjunct to the plant, are also adjacent. Utilizing these natural and necessary features as a setting, some very fine landscape effects are possible. For instance, with Boston ivy softening the severity of the walls, red flowering plants at the base, the slope in front dropping away in terraces and planted to natural grass, the graceful oaks standing out alone and clumps of shrubbery here and there to mark out paths and roads, with grasses and willows around the pond and shrubs about the pump-house, with the roads leading to the main highways laid on symmetrical lines and the buildings of permanent quarters for the operators on the grounds designed in keeping with the style of the building, the whole will present an appearance at once striking and harmonious—a symphony in soft greens, tans and reds.

Woodland and San Mateo substations, already constructed and, also, powerhouses Nos. 4 and 5 of the projected extension of the South Yuba-Bear River development, are four other buildings designed in the same style. Their motive in design corresponds with a similar motive at Cordelia, and is shown in the accompanying illustrations. Woodland is treated the same as the distributing side of Cordelia, with a window course under the cornice entirely around the building through which the wires come and go.

The same plain wall-treatment prevails and the same kind of tile covers the

A picturesque corner—the southeast—of Cordelia substation.

A group of "Pacific Service" employees at Cordelia substation. Reading from left to right, they are: Gus Eckberg, H. A. Peshon, D. McMillin, P. V. D. Neff, Duff Andrews, J. Fountainrose, Arthur Reedy.

cornice. The general treatment of the cornice and the roof lighting scheme constitutes Woodland's individuality. The ornamental iron work around the coping is similar to that used in a different way at Cordelia and is strictly in accordance with Spanish tradition. The lights on each post are in keeping with the purpose of the building, proclaiming "Pacific Service" to those of the night watches for miles around.

As the power-leads to the San Mateo substation are brought in underground the window scheme was not required. The cornice and parapet wall-treatment similar to those of Cordelia are the means

As Cordelia substation will appear when finally completed.

Samples of "Pacific Service" architecture.
Power-house No. 4, as planned. Power-house No. 5, as planned.

employed to show its relationship to the central station; the plain wall surfaces are pierced with openings, giving this station its individuality.

Power-houses 4 and 5, as now proposed, are twins, and being generating stations are related to Cordelia's entrance side by means of its seven-foot square windows and plain wall-treatment. The cornice treatment and the retaining wall on the reservoir side differentiate these buildings. These two stations will be further distinguished from one another by the treatment of the entrance and the retaining wall. Thus is a system being built up which will be complete not only in its mechanical aspects, enabling it to render "Pacific Service," but also in its architectural themes interpreting and proclaiming "Pacific Service."

Samples of "Pacific Service" architecture.
San Mateo substation. Woodland substation.

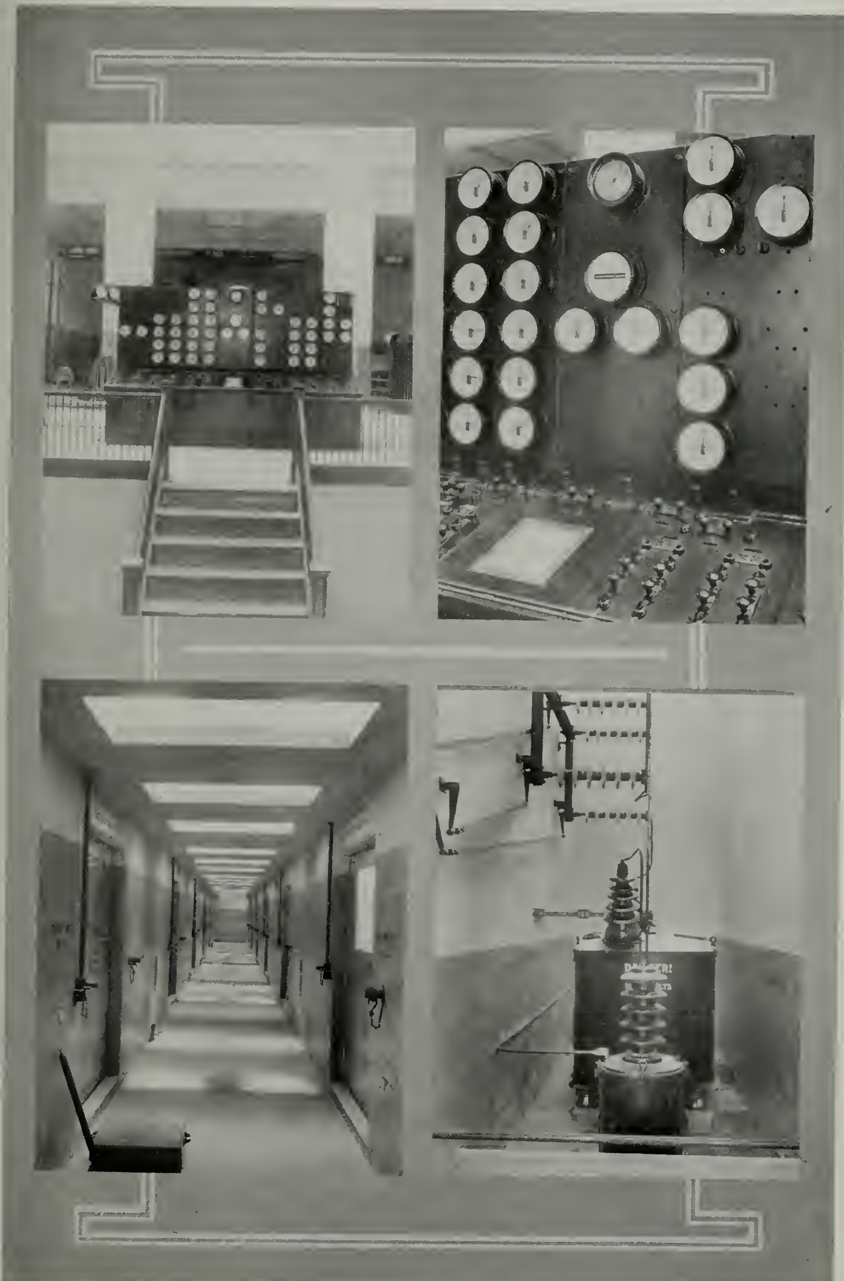
The Electrical Equipment of Cordelia Substation

By J. P. JOLLYMAN

J. P. Jollyman

THE principal purpose of the Cordelia substation is to transform from 100,000 volts to 60,000 volts the power generated by Drum power-house and transmitted to Cordelia over the Drum-Cordelia line. The transformed power is fed into the company's 60,000-volt lines, of which seven radiate from Cordelia. Provision is also made for local service at 11,000 volts and space is provided for motor generator sets should they ever be required for interurban railway service.

The main switchboard and the local substation apparatus occupy the central portion of the ultimate building. On either side of the center the



Views of the interior of Cordelia substation. The upper left picture shows the main control-board; the upper right gives a detail view of the same. The view at lower left is of the passage between rows of 60,000-volt oil-switch cells, that at lower right is of an 100,000-volt oil-switch, with current coil.

100,000-volt switches and busbars occupy the front or high section of the building, the main transformers and the main passageway are placed in the center of the building and the 60,000-volt switches and busbars are placed in the rear. Provision is made for future extensions should they be required.

Safety and service were the foremost considerations in planning the arrangement of the electrical equipment. Every passageway which may be used by the attendants in the operation of the station is covered wherever crossed by any high voltage wires. There are no "blind alleys." Every place a man may go has at least two ways out. The apparatus controlling any one line or bank of transformers is completely separated by barriers from the apparatus belonging to the adjacent lines or transformers. All the 100,000-volt apparatus is kept on one side of the main transformers and all of the 60,000-volt apparatus is kept on the other side.

The control of the entire station is centered in the main switchboard which is located opposite the main entrance in the center of the building. This switchboard is of the benchboard type. A diagram of the station is outlined on the bench by strips of polished copper. Every main oil-switch is represented by a small control-switch. If the main switch is closed a small red lamp burns above the control-switch; if the main switch is open a small green lamp burns below the control-switch. On the vertical panel above the bench are located the instruments which indicate the amount of power flowing in the various lines, also the voltage and the frequency. The operator thus has complete control of every part of the station from the main switchboard; he can open or close any oil-switch, he can put power on any line or take it off, he can see at a glance where the power coming in from Drum is going and if the voltage and frequency are normal. Architecturally, the center of the building is made the principal feature, and it is fitting that this should be so as it contains the switchboard in which is centered the control of the entire station.

Cordelia substation shares with Drum power-house the distinction of having the first 100,000-volt apparatus installed on the company's system. All of the 100,000 and 60,000-volt switches were designed by the company's engineers and manufactured in the company's shops at Sacramento

The main transformers are noteworthy for the fact that they are auto-transformers, or transformers having only one winding. This arrangement gives extraordinarily high efficiency, together with compactness and simplicity.

The pole top switches on the outgoing 60,000-volt lines at the rear of the station have attracted attention by reason of their neat appearance. A group of such switches does not usually add to the appearance of a fine building, but these switches show that a pleasing arrangement is possible.

On Saturday evening, March 7th, the employees of the General Construction Department at the new Cordelia substation gave a social dance. Supper was served at midnight and then dancing was continued until morning. The committee, finding that they had collected more money than they would need to defray the expenses of the affair, decided to have a prize waltz contest, giving \$10, \$5 and \$3 prizes; there was keen rivalry on this and the contestants had to dance three different times before the judges could decide on the winners. There still being a balance left from the dance, the money was spent for ice cream which was served to all the men at the company boarding-house next day.

Policy of Public Service Corporations

The following address was delivered by our Mr. John A. Britton before the members of the San Francisco section, American Institute of Electrical Engineers, at the Engineers' Club, San Francisco, on the evening of Friday, February 27, 1914. There was an excellent attendance, and Mr. Britton's analysis of a subject of vital importance to the public service corporations was listened to with eager interest. It was followed by a discussion, in which Professor C. L. Cory of the University of California, Mr. Allen H. Babcock, Electrical Engineer for the Southern Pacific Company, and Mr. Arthur Halloran, editor of the Journal of Electricity, Power and Gas, took prominent part.

THE subject of my address this evening is an hackneyed one, upon which volumes have been written and many theories advanced since ever corporations were.

Unfortunately, no two minds have ever agreed as to the question of the public or policy, and I am apprehensive that I will but add one more to the many diverse views, and that when I pronounce the benediction, you will be no farther advanced in your opinion, and may only have another theory to place in the dusty pigeon-holes of your memory.

Practice and theory are at the ends of two widely separated lines; sometimes if either one or the other becomes elastic they may touch each other, and it has been my purpose through life to at times grab both lines and force them together, satisfying myself that it can be done.

Practically at the present time corporations are not allowed to have any well canned and preserved policy of their own, they must follow those made for them, and this is best illustrated perhaps by the following excerpt from a Pittsburgh paper:

The office boy, responding to a visitor's call, had the following interview, as illustrating the activities of the personnel of a public utility:

"Where's the president of this company?" asked the man who called at the general office.

"He's down in Washington attendin' th' session o' some kind uv an investigatin' committee," replied the office boy.

"Where is the general manager?"

"He's appearin' before th' Railroad Commission."

"Well, where's the general superintendent?"

"He's at th' meetin' of th' legislature, fightin' some new bum law."

"Where is the head of the legal department?"

"He's in court, tryin' a suit."

"Then where is the commercial agent?"

"He's explainin' t' th' supervisors why we can't reduce the rates."

"Who's running the blame company anyway?"

"The newspapers and the legislatures."

Now, while regulation has brought about a very different and, it may be said, a vastly better condition of things generally as between most of the public service corporations and the public served, it has not deprived these corporations of the right and privilege of promulgating lines of policy, but rather has it forced upon the corporations the necessity of laying down hard and fast rules, that the public may understand with full knowledge that each member of the body politic stands in the same relation to the corporation as his fellow.

Public policy, as the phrase is understood, means the moral attitude of a corporation towards those with whom it comes into contact, and is generally measured by the mental length, breadth and thickness of each particular person contacted. It means, as a rule, pursuing the path of least resistance, a recognition to the ninth power of the other fellow's rights, without losing your own self-respect, a subordination of personal preferences to general orders.

Public policy is not a term, however, that should be applied to utilities exclusively, for it is applicable to all forms of business having private or personal or public relations with the masses, such as any kind of trade from the itinerant peddler to the banker; your grocer and haberdasher; your bootblack or your wholesale merchant, and all of the relations should have the deep and full significance of true friendship, for of a right certainty, no business, no trade, and no commerce, as between people, or between nations, can flourish, and ultimately succeed, unless it is founded and fixed on the rocks of friendship and true fellowship.

There are classes of men who perhaps do not need this talismanic guide to true success, and they are those of the vagrant rich and the vagrant poor, both undeserving and both intolerable, and both aiding and abetting in the retardation of all true principles of business and business growth.

Now let us analyze the conditions that create or destroy the friendship of the masses and thereby create or destroy the policy of corporations, for it is of that class I am supposed to deal in my remarks tonight.

To my mind, the most important factor entering into the creation of a favorable policy, and perhaps in its final analysis an unfavorable one, is the question of personal equation—and by that term I mean the atmosphere that surrounds each individual in his or her attitude toward, and conception of, the problems that each are daily and hourly confronted with.

Most, if not all of you before me tonight are young men, just entering upon your separate spheres of activities, as your early training, inclinations, or the fates have determined and directed. You are or should be unquestionably imbued with the sincerest of desires to make good in life, and to achieve your ambitions, for you would be less than men made of red blood and enduring fibre of bone and muscle did you not have that ambition and faith in yourself, and you will then succeed in that particular line of life which you have determined, and reach the goal that your ambition has set as the ultimate mark of your success in life.

As reasonable, thinking men, therefore, you must realize that alone you are helpless; that if you wanted to become an independent spirit, reckless of precedent, reckless of rules and customs, and reckless of the interests and feelings of your fellow men and women, you would soon become mere flotsam and jetsam on the world's swirling waters of business. You must, and I am sure do, thoroughly and sincerely realize the importance of so governing your lives and conduct in every day concerns that to assume any place of strong recognition in the marts of trade and commerce, you must be a close student of your fellow man, of his wants and desires, and above all must you realize that selfishness cannot in this world of progress become regarded as anything more than minuteness of intellect.

Assuming, therefore, that in the struggle for a position worth while in life, due consideration must be given to the desires and opinions of others, we reach a common plane from which we can coolly and dispassionately survey the situation and agree that beside ourselves there are others whose rights we must recognize and respect. Then, perhaps, will there be an approach to that millennium when the load factor and the power factor of human life will have reached unity.

This ability, through proper education of the personal equation, to recognize the rights of others is the first step that leads eventually to consummation of the ideal public policy.

It was the immortal Lincoln who said: "You can fool a part of the people some of the time, all of the people a part of the time, but you can't fool all the people all of the time," and no matter how brilliant you may be in your schemes, no matter how many times you may put something over, mark me the day will come when these chickens will come home to roost, and golden eggs will become gilded ones.

A corporation, in its determination of a policy that will place it before the public in a favorable light, is dependent for such public favor and its continuance, not altogether upon the men in the mahogany chairs but to a large degree upon such men as you, who daily come face to face with the public in all its moods and tenses, and while in a measure the men reflect the wishes of their leader, his wishes may be set aside by lack of that personal equation which I have before referred to. If a man arrives at his station the morning after, with a grouch (unfortunately some men do not require the night before to produce grouches—they carry them with them all of the time, like an elephant's trunk), and such grouch is due to a disordered stomach, or a merry tango or tangled night, if, therefore, you cannot smile without hurting your face or that of your neighbor's, you are setting an example before that portion of the public which meets you of a deficient interest in its behalf that is reflected as many times as the myriads of minute waves that are made by the pebble thrown into the center of the tranquil pool—the effect extends into infinity.

You are, by your daily conduct, establishing a reputation, not only for yourself but your firm or corporation, that thousands of words and other efforts, promulgated from the office of the general manager, cannot change or alter—be this reputation you establish for good or evil; how much better then to establish it for good, so as to create that public policy which is desired, for the poet well and truly says:

"The purest treasure mortal times afford
Is spotless reputation, that away
Men are but gilded loam, or painted clay."

It is often said "like master, like man," but that saying, in this age of wide diversity of activities of public utilities, coupled with the multiplicity of men engaged, is only partly true. Policies are seldom directed by the governing head; they arise, in the first instance, from the rank and file.

All of that which I have heretofore said leads up to, but at the same time forms an integral part of my subject, and outlines the matters and things that are important and fundamental to the man in the conning tower as he views the fighting and firing lines, for he must feel helpless and hopeless unless below him things are in shipshape, and team work is being pursued, from the stoker in the bilge hole to the captain on the bridge.

In seeking for the means whereby a proper public policy may be created my mind has continually harkened back to the days of my youth, when corporations as they are now known were an unknown quantity; but when we were taught the simple lessons of peace and goodwill, and when in the absence of the disturbing factors of daily life now so prominent, these lessons took hold and held fast like hoops of steel. For in the formative period of fifty years ago, as compared to the present era, the world was primitive, transportation was limited in scope and capacity, the world was indeed vast; there were no telegraphs to girdle the earth, no telephones to minimize distance, no electric lights to make, mark and mar the great white ways, the flickering candle, sputtering oil lamps and very occasionally the gas jet, were our only artificial means of light, and so in the absence of these diverting things of our twentieth century civilization, the mind had more time to ponder and reflect, and thus with me remains, and has and will remain, that which I was taught in Sunday School, of my duty towards my neighbor, and it comes nearer today to being a perfect answer as to what should constitute the public policy of a corporation that I will quote it for your benefit:

"My duty towards my neighbor is, to love him as myself, and to do to all men as I would they should do unto me: To love, honor and succor my father and mother: To honor and obey the civil authority: To submit myself to all my governors, teachers, spiritual pastors and masters: To order myself lowly and reverently to all my betters: To hurt nobody by word or deed: To be true and just in all my dealings: To bear no malice nor hatred in my heart: To keep my hands from picking and stealing, and my tongue from evil speaking, lying and slandering: To keep my body in temperance, soberness and chastity: Not to covet nor desire other men's goods, but to learn and labor truly to get mine own living, and to do my duty in that state of life unto which it shall please God to call me."

There is another rule of conduct usually designated as the Golden Rule: "Do unto others as you would have they should do unto you," and modern ethics has added "but do it first" and therein in this modern appendage lies the crux of our undoing.

Corporation policy should consist in so training subordinates that they will learn, teach and apply the foregoing precepts, that they will have faith in the integrity of those whom they represent and reflect that faith, and impress the public with their sincerity in the promulgation of such integrity, for personally I have no use for that man who is not loyal to the interests which he represents. He is, if taking compensation from a company whose actions he does not and will not defend or whose policies he does not or will not reflect, acting every day a living lie, and is therefore unworthy of confidence; and some day his misdeeds will be disclosed.

"I would rather be a dog and bay the moon than such a Roman," said Brutus; and any man false to his trust should be thought less of than a moon-baying dog. To such a man Benedict Arnold would by comparison be classed a hero.

Having dwelt upon the relation of the public policy of a corporation that is borne by the employees to the consumers of the corporation, and which relation it seems to me to be of primary importance, we will now take up the question of relation of the corporation itself to the public.

First and foremost as a factor overlying the broad question, is the matter of service given to the public by the corporation; for in these sensitive days, days of criticism and fault-finding, the service of a corporation must be, as was Caesar's wife, above suspicion. People are intolerant today of mediocrity; the standards of excellence in all of the walks of life have been so raised by necessities that nothing but service approaching perfection will be tolerated, and no public service corporation can hope to maintain the favor of the public—no matter how exact its every course of conduct may be—unless it gives to the people that which they have a right to demand and which the people expect by reason of the tax which they have to pay therefor.

This service in these days of transportation by means of electrically propelled vehicles, in the large manufactories dependent upon electric service, in the general lighting of buildings, both commercial and residential, and for gas in continuity of supply because of its uses for domestic and industrial purposes, makes for and emphasizes the necessity of this feature of public policy.

And aside from the question of continuity of service must, of course, be considered the larger question of perfect service and the furnishing of a stable, equal character of product. The reputation of firms manufacturing food products is maintained only by a constancy of the quality of the commodity furnished, and this should be more particularly so in the question of commodities furnished monopolistically by public service corporations, for there is generally no escape from the service rendered. The element of competition, while being largely destructive on questions of revenues to the corporation, is not largely extended in matters of service to many, one company usually retaining the service of the majority in any community. It should, therefore, be the duty of the corporation and its managers to see that its forces are so organized, its spirit of discipline so maintained, and its team work so arranged that its policy in the matter of service can never be questioned. And one of the ambitions of the young engineer of today, having to do with the service of corporations, should be to strive for the maintenance of that high standard that he knows the public is entitled to and requires; and it should be the policy of the corporations to so educate these engineers as to produce in them nothing but that desire.

Next to the question of service comes the question of personal contact with the consumer. That personal contact is reflected from the very highest by the personal equation, of which I have before spoken, in raising the individual to a realization of the deeper question of the corporation policy as going to the ideals of the management. Courteous treatment of consumers, to produce a feeling of interest in the corporation, cannot be fully engendered in the rank and file of employees unless that same personal feeling is brought about by the courteous treatment of the employees by the corporation head. This particular phase of social economics is being broadly viewed as a necessary self-protective measure by all large employers of labor. Rather let me here correct the ordinary expression, which I have unconsciously used, of large employers of labor, and say the paymasters of labor, because, concretely considered, corporations are after all but the fiduciary agents of their staff. The sale of their commodities to the public and the revenue obtained thereby, are retained largely in trust for repayment to those employed. It is a reasonably safe assertion to make that, in the corporations known as quasi-public, more than ninety per cent of their gross receipts annually are paid out in the form of payroll checks—not only to its own employees but to the employees of those from whom it buys materials and supplies. I had occasion to say, in a recent lecture delivered before the San Francisco Chamber of Commerce, that the stockholders of the public service corporations of this state receive less than two per cent upon their equities in the property, the bulk of the money received going back to the ultimate consumer—directly or indirectly.

Returning again to the subject of the courteous relation, as between the paymaster and the recipient, we will find that the moral tone, whether it be of a high or low standard, will more or less permeate the masses and be reflected in all relations with the public. The public as a general rule is an uncomplaining body, and will put up with many inconveniences without demur; the percentage of those needing close attention being the minimum, there is every reason, therefore, why the effort of public service corporations should be directed along the line of least resistance, for resistance provokes friction, and friction heat, and this element heat in argument and discussion must be reduced by the application of the lubricating oils of kindness and courtesy, and it takes but little time and effort to accomplish that most desirable end. Corporations, to provoke the proper public policy, should zealously guard every utterance, to see that nothing is said or authorized to be said on its behalf that is not an absolute truth. It should never forget an obligation, and no matter how burdensome it may become, due to errors of judgment, it should be carried out.

Little things mark men of greatness. The bigger things of life, and in the attitudes of men and peoples, generally take care of themselves. One of the little things which very often provokes an antagonistic public feeling is the disregard by responsible officials of a company of the ordinary courtesies that go toward acknowledgment of letters. In my experience of many years I have found more difficulties to overcome, more sores to heal, and more damage resulting from the indifference of officials of the corporation in replying to communications received from their business associates or from complaining customers. A signed letter to an appeal, whether right or wrong, acknowledging receipt and promising attention is often the salve which heals the wound, imaginary or otherwise, of the consumer; it paves the way to a better realization of the duties and obligations of each other.

The personal appearance of those coming into contact with the public is another one of the things that make for a public policy favorable in its character, and it is too often not appreciated—either by the management or by the men themselves. The man who is clean in his personal appearance is pretty apt to be clean in his habits and morals, while nothing discredits one so much as lack of pride in one's personal characteristics of this character; and friends are easier gained in contact with the public by one who approaches the public bearing evidence of that cleanliness of person and mind.

Summed up, the whole question as to whether a corporation can and will be popular with the people—to the same degree that a storekeeper seeking trade is—will come only from following the very fundamental principles that since the existence of time have been laid down for the betterment of the human race; and just as soon as corporations realize that they have no particular God-given rights, that they are the servants of the people, that they have a commodity to sell which can only be profitably sold by its presentation in an absolute business way, and just as soon as the public appreciates that a corporation serving the public is but an adjunct of the merchant class, that it is seeking to build up and not destroy, and as soon as politicians by proper regulation are made to feel that their sphere of public activity will no longer lie in the unwarranted and uncalled for abuse of corporations, no more than it would lie in the unwarranted abuse of the merchant or commercial class, then will come that era for which all honest men are striving, which is: To be permitted to do its business on a business basis, and to obtain for its commodity a proper return upon the moneys actually and honestly invested in service to the public. And as a proof that there is nothing new in the dissemination of questions of policy, and that it was preached and practised years ago and made the foundation for the betterment of man, it is perfectly appropriate at this time and in closing to recite to you, for your benefit and for your digestion and analysis, the advice which Polonius gave to Laertes, his son, as is set forth in the book of "Hamlet":

"Look thou Character—
Give thy thoughts no tongue
Nor any unproportioned thought his act.
Be thou familiar, but by no means vulgar
The friends thou hast, and their adoption tried
Grapple them to thy soul with hoops of steel
But do not dull thy palm with entertainment
Of each unhatched, unfledged comrade. Beware
Of entrance to a quarrel, but, being in,
Bear it that the opposer may beware of thee.
Give every man thine ear, but few thy voice;
Take each man's censure but reserve thy judgment.
Costly they habit as thy purse can buy, rich not gaudy,
For the apparel oft proclaims the man;
Neither a borrower, nor a lender be,
For loan oft loses both itself and friend
And borrowing dulls the edge of husbandry.
This above all: To thin ownself be true
And it must follow as the night the day
Thou canst not then be false to any man."

Landmarks and Types of the Spaulding Region

Evan Magnuson and the Cottage He Occupied for Eighteen Years on the Shores of the Old Lake

By FREDERICK S. MYRTLE

F. S. Myrtle

WHEN the waters rose against Lake Spaulding dam last Thanksgiving they swept over a portion of the old lake-shore that once held men and buildings. When, with the storms that ushered in the new year, they rose still higher until they poured over the north spillway, they wiped out the last remaining vestige of the early activities that first brought Lake Spaulding into prominence.

Among the vanished landmarks is Evan Magnuson's cottage. The queer, rambling, not wholly unpicturesque shack that for eighteen years was the sturdy laketender's habitat has been wiped out of the landscape—has given away before the resistless march of development. In an article I contributed to the August, 1912, number of Pacific Service Magazine I gave warning of the inevitable in these words:

"It has been his home for many years, but he has been served with notice to quit. He will have to move a few hundred feet higher up if he wants to be high and dry when the new Lake Spaulding takes the place of the old."

He has moved, all right. He is now living in more or less security in what was known as Camp 1 during the construction period, adjacent to the old Smart mill to which Lake Spaulding really owes its existence And he is bearing up wonderfully well, all things considered. It takes a good deal to upset the equanimity of a Norwegian. There is another of his race who has footed it over the trails between his cottage on Lake Fordyce and the nearest point of civilization two or three times a week for thirty-nine years, and his stock of enthusiasm in the open-air life of the Sierra country hasn't even begun to run out.

Evan Magnuson standing at his cottage door.

But the old cottage by the lake-side was Magnuson's home, day in, day out, for eighteen years, and he remembers the occasional good times he had there and, like a wise man, forgets the rest. During the summer months quite a number of fishing parties found headquarters there, and when I was up at Spaulding in the late fall last year I found Magnuson

The modest habitation which Evan Magnuson occupied on the shores of Lake Spaulding for eighteen years and until the waters rising to the new dam drove him out.

playing host to a couple of sportsmen from Nevada City who tramped the surrounding hills all day after game and lay at the cottage o' nights.

Of course, as a landmark, Evan Magnuson is a cipher in antiquity compared to his superior officer, Ed. Roening, the Lake Fordyce enthusiast referred to above; but as he has been washed out of hearth and home, wheras, Roening is still high and dry—barring a few feet of snow—he comes first in the picture. He was a rosy-cheeked, blue-eyed, curly-haired young man when first he descended upon the Sierra region from Norway, eighteen years ago; that he is still rosy-cheeked and young-looking speaks well for the climate and the life he has led since then. He worked for Burace and Smart, the mill-owners, during the summer and helped Ed. Roening during four winters in caring for the lakes of the South Yuba water system, which at that time included Fordyce, Peak's Lake, Meadow, Sterling, Van Norden, White Rock and Spaulding lakes.

Magnuson was put in charge of Spaulding. He doesn't remember the building of the old dam, for that was in 1892, some few years before his arrival, but he does remember when the mill-owners built the narrow-gauge railroad that crossed the lake by the dam and wound its way over in the direction of Fuller and Rucker lakes And, on Wednesday, October 15th last, assisted by a young native of the region named Charles Fowler, he obliterated one of the historical landmarks of his bailiwick by destroying the narrow-gauge trestle. This was done by blasting the supports at either end, lighting fires under the bents and, as they explained to me, "letting her go." It was, of course, part of the general plan to clear the lake-bed of all rubbish up to high-water mark. The plan included the cutting of a fire-line twenty feet wide clear round the lake.

The Smart mill was not always where it is now, nestling in the shelter of the snowsheds. Its first location was by the lakeside, and Magnuson's cottage was the old boarding-house. There isn't much more to say about this, except that I

Evan Magnuson discovering his boat-house and boat fast in the ice nearly a mile from the lake-shore and one hundred feet above their original elevation.

took the precaution to have the old place photographed before it went.

One possession of Magnuson's, however, has not gone the way of all things. The launch in which he and others were wont to explore the waters of Lake Spaulding survives, as does also the boat-house that belongs to it. The entire outfit, it appears, was constructed with the view of meeting just such a catastrophe as has descended upon the once sleepy lake-side. When the waters rose boat and boat-house rose with them, and I present herewith a picture of the sturdy Norwegian lake-tender taken the day he skeed over the lake's frozen surface and came upon his cherished belongings fast in the ice—but safe.

Mr. T. J. Tobin, who had been in charge of the South Yuba Construction Department accounting force, subordinate to General Auditor Bridges, since August 1, 1912, terminated his services with the company on February 10th to accept an appointment in the division of valuation of the Interstate Commerce Commission.

The appointment came as the result of a competitive civil service examination participated in by several thousand male citizens of the United States. Mr. Tobin received a rating of ninety-one per cent, which placed him second on the list of eligibles from the entire country. He is now in charge of the valuation accounting work for the Interstate Commerce Commission, with headquarters in Los Angeles.

On March 10th Mr. J. C. Thomson tendered his resignation as chief clerk to Auditor Bridges to accept a position as examiner of accounts in the Interstate Commerce Commission in the division of valuation of common carriers. This appointment, like the other, was the result of a competitive examination.

While we regret the loss of these gentlemen the Auditing Department of "Pacific Service" is to be congratulated upon the evident efficiency of its members.

"Safety First," and What It Means

SAFETY FIRST!

Does this slogan mean anything to you, Mr. Workman of "Pacific Service"?

If not, it is your misfortune. For *Safety First* means safety first to you. It means saving your fingers and hands and arms and legs; and oftentimes your life.

What do you do about it in your daily rounds, Mr. Workman?

How often do you think of your safety or the safety of your fellow workmen?

You don't know!

Of course not; you haven't thought much about it!

Well, "Pacific Service" is going to help you find out what you have been doing or not doing; it's going to help you think about "Safety First."

In fact, it has been laying the foundation for your thinking on this subject, these many months. Over a year ago it called on the big companies of the East for advice as to the best methods of preventing accidents—of saving men from injury and pain and deformity.

And, almost without exception, the word came back: "It's up to your men. It's their interest, their understanding of what safety means that makes *Safety First* worth while. All you can do is lead the way—give them light to see and do."

Considerable thought was given to the question of how to "lead the way" —how "to give light"—and finally it was determined to begin by finding out how "Pacific Service" stood as to safe operation and safe methods. To that end an engineer of the "Independence Inspection Bureau" of Philadelphia, which makes a business of safety inspections all over the United States, was employed to come out to California and advise us where we stood. The man selected for the work was the Chief Safety Engineer of the Inspection Bureau, Mr. Elmer B. Tolsted, formerly a safety engineer in the service of the government. Mr. Tolsted spent the best part of December and January going over our San Francisco and Oakland districts, looking into mechanical dangers and investigating operating risks. When he finished he returned home to make a report on conditions as he found them. His report will soon be available, and his recommendations, whatever they may be, will be carried out, no matter what the cost.

And while this report is in the making another inspector, of our own force, Mr. V. R. Hughes, is going over other parts of our system pointing out danger places and recommending cures.

But making plants mechanically safe is only one, and perhaps the smallest factor. The great thing is safety men, not safety devices.

And whether "Pacific Service" is to have safety men or not, is up to you, Mr. Workman. "Pacific Service" will do what it can to show the way. One guide to you shall be articles on this problem in this magazine.

Henceforth, this space is dedicated to *Safety First*.

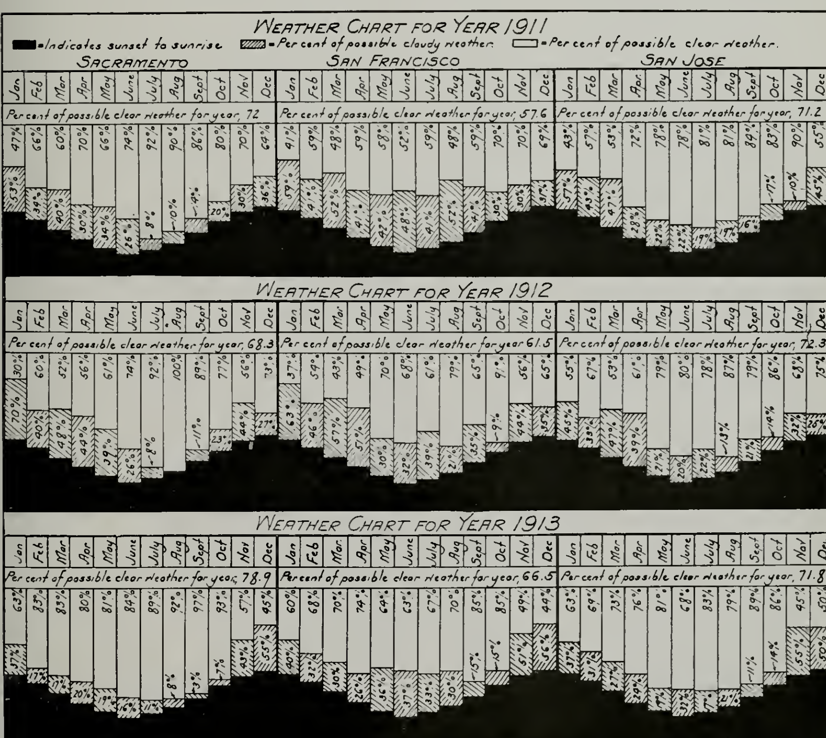
J. P. C.

One Reason Why Lighting Bills Vary

[As suggested by the weather expert of the Drafting Department.]

TRULY our monthly bills for lighting come as regular as any other items of our living expense. The proverbial butcher's and baker's bills are generally accepted as things that must be; on the other hand, bills for a commodity such as light, whether gas or electricity, seem to affect the nervous systems of most of our customers. Furthermore, nothing seems to ruffle some of our otherwise good-natured patrons so much as irregularity in the amounts of their lighting bills, notwithstanding Dame Nature sees fit to vary the sunshine and cloudy portions of each day at will. The accompanying charts, compiled for the last three years, illustrate the lack of uniformity of sunshine throughout the year. This is shown by averages, a month at a time and for the cities of Sacramento, San Francisco and San Jose.

A little study of these very interesting tables will readily convince one that a buffet, service-room, corridor or store will require more lighting at certain periods of the year than others; hence larger bills in some months than in others, all other things being equal.



Items From Women of "Pacific Service"

This section of Pacific Service Magazine *is open to any of our women employees who may desire to contribute notes on persons and events. The following have accepted appointment as contributing editors: Miss Letitia A. Curtis, Engineering Department, Hydro-Electric Section; Miss Bertha J. Dale, Auditing Department, San Francisco District.*—Editor Pacific Service Magazine.

HOW TO KEEP HEALTHY—"HIKE" TO TENNESSEE COVE.

TAKING an early morning boat to Sausalito and then the Mill Valley train to Manzanita station, you alight there to start on a tramp to Tennessee Cove.

Starting on the road leading out on the station-side you keep to the left, without crossing the bridge. If you follow this road to its termination you arrive at a dairy farm, but instead of going through the dairy you would better retrace your steps a little way and cross the ditch and then pick up a footpath on the opposite side. This is a comparatively level walk, winding in and out the valley—which is adorned only by dairies—to the ocean. Here is Tennessee Cove, a splendid beach, where a freshwater stream empties into the large salt water expanse. As is usual at most all of our beaches, wading can be indulged in, but the undertow is really too great to permit of safety in swimming.

If it is an easy matter for you to drop from the real into the imaginary you can readily feel the romantic spell of this spot and imagine yourself the finder of a treasure cove, for there are great masses of rock towering over the beach under which can be seen many small caves, and here and there a little spring issuing from what seems to be almost solid rock. This little wonder-beach is on the south side of the main beach, from which it appears to be divided by a rocky arm that at very high tide keeps trespassers out. In fact, at the time of the writer's visit this beach was utterly deserted, and on this account gave the appearance of having been previously unknown, which of course was not the case.

The return walk can easily be made in less than two hours, so that a good long day may be spent in the invigorating ocean breeze.

L. A. C.

Announcement has been received of the engagement of Miss Florence Kertell, one of the Receivers of the San Francisco District, to Mr. J. Clark Benson of Assistant Secretary Barrett's office. Both of the young people have been in the employ of the district for some time. No date for the wedding has as yet been set.

Announcement has also been received of the engagement of Miss Hazel E. Nonnenmann of the bookkeeping department, San Francisco District, to Mr. Eugene C. Thieme, who is connected with the City of Paris. Miss Nonnenmann is very reticent as to the wedding date.

To the great surprise of everyone comes the announcement of the engagement of Miss Alice Valpey, superintendent of the Addressograph Department, to Mr. Stanley Stephenson of Honolulu. The engagement is the outcome of a romance which began in the Islands over a year ago, when Miss Valpey was there on her vacation and where she met Mr. Stephenson. Miss Valpey sailed for Honolulu on March 31, 1914, where she will be married and make her future home. Although "Pacific Service" loses another efficient worker, we wish her bon voyage and much happiness.

Miss Elizabeth Casey, who left the service of the San Francisco District on March 31, 1914, was given a farewell luncheon in the lunch room at 445 Sutter street. The table was daintily spread, and a delicious luncheon was served. Places were set for the Misses Elizabeth Casey, Florence Kertell, L. Bliss, Florence Macdonald, Mazie Hurley, Sarah Ober, Mrs. M. Lacombe, Bertha Dale and Margaret Murphy.

Colonel W. E. Osborn, Manager of the Woodland District, has decided to try his hand at the chicken business. He has purchased an incubator heated by gas and out of the fifty eggs which it holds he expects to hatch forty-nine chickens. We are all looking forward to a fine chicken dinner.

Mr. James W. Douglass, accountant in the Woodland office, recently returned to his home after spending a week in Oakland on account of the illness of his wife. Mr. Douglass brought his wife home with him and from latest advices she is improving rapidly.

Miss Bertha Stern, stenographer in the Law Department, recently left for her old home in St. Louis, where she expects to reside permanently. Mrs. R. R. Barkley has succeeded Miss Stern as stenographer in that department.

Assistant Treasurer Jos. C. Love will have to look to his laurels in the horticultural line, as he has a keen rival in Harry Bostwick, secretary to the president. Thus far Harry has succeeded in raising a splendid crop of weeds.

The many friends of Mrs. C. B. Wise will be pleased to learn that she is expected home shortly, after a year of travel in the Orient.

Mr. *E. Lectricity* offers the following as an example of the *power* of *insulated* or *stored up* thought *energy* when *conveyed* toward its subject in a *direct transmission line:*

In order to relieve the *high tension* of his nerves and *shut off* the *current* of business thoughts, he had adopted the practice of each day walking to his office by a *short circuit*, at the same time concentrating on some particular *phase* of life.

On the day in question he had been considering the fact that thought by methods of *induction coils* itself most closely around its subject, and on this *line* had been endeavoring to *cut out* a special *type* of beauty by selecting the best features from the passing show, when his attention was *magnetically* drawn to a young girl on the platform of a street car, so unattractive as to *shock* him into directing toward her the full *voltage* of his newly *generated* image of beauty. The car stopped and in amazement he felt the girl *pick up the current* of his thought and saw his own mind image as she *stepped down transformer* into a most bewitchingly pretty girl. So charmed was he that he has ever since been wondering *watt hour* it were best to try to *meter*.

On March 17th Mr. John Spencer, assistant manager of the Placer District, was married to Miss Mildred Stevens in Sacramento. Mr. Spencer is a graduate of the engineering department of the University of California and has been one of "Pacific Service" for the last six years, three of which he has passed in Auburn office. His bride, a charming brunette, is an Auburn girl, a graduate of the Placer County High School.

Mr. J. H. Fagg, assistant superintendent of the Sacramento Power Division, but who at the present time is in charge of the Marysville Division during the illness of Superintendent Johnson, slipped quietly to Lodi March 18th and was married to Miss Marie Caroline Harney of that place.

The bride is one of Lodi's most beautiful young ladies, and was a favorite in society at the tokay center. Mr. and Mrs. Fagg will reside at Marysville for the present but expect to move to Sacramento within a short time.

ORGANIZED OCT. 7 1913

James Hugh Wise Library

Wanted—A suitable motto for the library. To encourage enterprise in this direction the Library Committee, composed of Messrs. John A. Britton, chairman; F. G. Baum, vice-chairman; S. V. Walton, treasurer, and Joseph P. Baloun, secretary, offer the sum of $5.00 as a prize for the best suggestion. This contest is open to all employees of "Pacific Service" and their families.

Suggestions for an appropriate motto should be sent in to the secretary at his office, 820 Grant Building, San Francisco, up to July 4th, on which date the contest will close. The committee will announce its decision in the July issue of PACIFIC SERVICE MAGAZINE, giving the name and address of the winner.

The volumes on file to date are: Books, 441, pamphlets 2143, circulating magazines 14, maps 6.

The circulating and reading room files have been increased by two very interesting magazines, "The National Geographic Magazine" and "Travel," commencing April 1, 1914. We have also received in exchange for PACIFIC SERVICE MAGAZINE the following house or corporation publications which are also kept on our files: "The Pacific Telephone and Telegraph Company's Magazine"; "Standard Oil Company's Magazine," by the S. O. Co. of California; "Valve World," by Crane Company; "Current News," by the Philadelphia Electric Company's section of the N. E. L. A.; "Engineer and Fireman," by the Penberthy Press; "Oildom," by the Standard Oil Company of New York, and "Ideal Power," by the Chicago Pneumatic Tool Company.

Mr. P. M. Downing, Engineer of the O. and M. Dept., has donated nine completely bound volumes, XV to XXIV, of the "Transactions of the American Institute of Electrical Engineers." Many thanks, Mr. Downing.

Mr. Chas. B. Turrill presented a 1912 volume from the State Water Commission and one of 1912 from the State Conservation Commission.

Copies of No. 3 of PACIFIC SERVICE MAGAZINE that were missing from our first volume have been received from Mr Barney Sronberg and A. E. Gilkey. The donations are highly appreciated.

J. P. BALOUN, Hon. Secretary.

"Pacific Service" Section of N. E. L. A.

The March meeting of the section was held on the evening of the eighteenth of that month at the Engineers' Club in San Francisco. Chairman Thompson presided, and there was an attendance of fully one hundred members.

The feature of the gathering was a discourse upon the principles governing hydro-electric development, in which Messrs. H. C. Vensano and George H. Bragg divided honors in the absence of Mr. P. M. Downing, who had been billed for the evening's lecture, but had been compelled to leave town on business. Both gentlemen illustrated their remarks with stereopticon views, and a most enjoyable as well as instructive session was had.

Jottings from Districts and Divisions

On the evening of March 14th Vice-President and General Manager John A. Britton delivered an interesting illustrated lecture at the Sacramento Hotel, Sacramento, on hydro-electric development in California, irrigation, reclamation, lighting, power, etc. It was the occasion of the annual banquet of the Jobbers' Association and of the Merchants' and Manufacturers' Traffic Association of Sacramento.

In his lecture Mr. Britton told of the achievement that was accomplished in Sacramento County in 1895 when 4,000 horsepower of electricity was brought to Sacramento from Folsom over a twenty-two mile transmission line, from which small beginning sprang the great progress of hydro-electric development in California today. In telling the story of our big work in the Sierras, Mr. Britton showed about 100 lantern slides of the Spaulding development, new transmission lines, Cordelia substation, De Sabla, Centerville, Colgate, Yuba, Rome, Deer Creek, Alta, Folsom and Electra powerhouses. He also showed pictures of the Sacramento gas works, new steam station, new office building—exterior and interior—and the car barns in Sacramento

The lecture was attended by a large audience. Mr. Britton received many compliments and thanks

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On the evening of March 25th Mr. Britton went over to Oakland and addressed the "Pacific Service" club of that city upon "Oakland, Past, Present and Future."

Oakland's "Pacific Service" Club is a thriving institution and a gathering of over 400 gave our Vice-President and General Manager heartiest welcome. The assemblage included employees from Oakland, Alameda, Berkeley, San Leandro, Hayward, Niles, Livermore, Pleasanton, Newark and Richmond.

Mr. Britton's was the comprehensive talk of a man who had grown up, so to speak, with Oakland; for, it is now just forty years since he first took service in the Modern Athens and there have been many changes since that time. He sketched the history of the lighting business since the organization of the Oakland Gaslight Company in 1865 and, assisted by a number of valuable views, he traced the city's progress up to the present day. Needless to say, the address was listened to with intense interest. (We hope in the very near future to reproduce the address for the benefit of our readers.—Ed. P. S. M.)

Mr. B. Cornell, president of the club, was in charge of the evening's entertainment which, in addition to Mr. Britton's address, included vocal selections by Messrs. J. J. Apostle, Clarance Oliver and E. W. D'Ombrain, all members of "Pacific Service."

Our Mr. Geo. C. Holberton, Manager of the San Francisco District, lectured on "The Progress of Hydro-Electric Development in California" at a gathering held under the mingled auspices of the Board of Education and the North Beach Improvement Association, at the Jean Parker school in San Francisco on the evening of Wednesday, February 25th last.

Mr. Holberton's lecture was illustrated by lantern slides showing views of "Pacific Service" in all its aspects, and afforded instruction of a most interesting character of which his audience testified its appreciation.

Our Mr. Frank G. Baum, chief engineer of the hydro-electric department, and under whose charge the Spaulding-Drum development was brought to successful completion, was scheduled to deliver an illustrated talk on the development before the Pacific Association of Consulting Engineers at the University Club on Friday evening, March 20th. Being suddenly called East, and rather than disappoint the association, he left his notes with Mr. C. E. Grunsky, the well-known civil engineer, who consented to take his place in describing the work done in the Sierra country.

Mr. Grunsky proved an able substitute and supplemented the notes and pictures supplied him with information obtained through a personal visit to the scene of development during the construction period. Some interesting inquiries and instructive discussions followed the talk. Our Mr. H. C. Vensano was present to furnish information of a technical nature.

Mr. R. A. Gentis, assistant superintendent Oakland Power Division, advises that during the month of February three 34 K. W. 2300-volt single-phase General Electric induction feeder regulators and three Westinghouse feeder regulators of the same type and capacity were installed in stations "D" and "H" respectively, making a total of 42 single-phase and 7 three-phase induction regulators in the Oakland Power Division, aggregating approximately 21,000 K. W. of regulated feeder capacity.

Electricity on the farm is becoming more and more widespread. Manager J. E. Poingdestre, of the Marysville District, says he is constantly receiving application from farmers throughout Yuba and Sutter counties for power to operate their motors. Quoting from the Marysville Democrat of March 10th:

"It was not many years ago that a pumping plant on the orchards of this district, especially the small ones, was much of a novelty and considered by many who trusted entirely to the elements of nature a useless expense in operation, but in the last few years pumping plants have been installed at such a rate that there are now only a comparatively few fruit-growers who cannot boast of a thoroughly equipped irrigation system, whether they own ten acres or forty. Alfalfa raisers consider irrigation almost as important a factor in their success as the sewing of the seed."

Mr. John P. Coghlan, manager of the Claims Department, announces the appointment of Mr. V. R. Hughes as safety inspector to work in co-operation with the Claims Department toward the prevention of accidents. It will be the inspector's duty to make frequent safety inspections of all plants, shops, yards and other places on the system where men are required to work or to go in the course of their employment, and, after such inspections, to report and advise how such plants, shops, yards and places of employment may be brought to the highest degree of safety commensurate with operating conditions.

Manager Coghlan invites the co-operation of all heads of departments, district managers, and division superintendents in this work. He says, "An accident prevented means suffering and disfigurement prevented, and oftentimes it means a life saved."

Mr. E. C. Johnson, superintendent of the Marysville Power Division, is rapidly recovering from the injuries he received on December 31st, when a pole broke under him near Smartsville. The cast has been taken off his injured leg and he will be removed from the Rideout Hospital in Marysville to his home within the next few days.

It is now believed that Mr. Johnson will have a complete recovery. Everything possible has been done to bring that result about. From the outset the company has furnished him, as it does all its injured employees, the best medical care to be had. It went so far as to send Dr. I. W. Thorne, one of the best surgeons in California, from San Francisco to Marysville to give Mr. Johnson expert treatment.

Manager Poingdestre writes from Marysville:

"We have completed the inlet connections to our new 150,000 cubic-foot gasholder, the outlet having been reported last month. All the gas being used in future in Marysville and Yuba City will be supplied through this large holder, which has improved conditions in every respect, besides reducing operating expenses.

"We have also in operation a new storage oil-tank of 10,000 barrels capacity.

"The work of supplying Yuba City with a new system of series street lighting has been completed and is giving good satisfaction to the residents of the town.

"Several new prospects are coming in for increased power service in Sutter and Yuba counties.

"We announce the engagement of Mr. Frank Trowbridge, meter inspector, to Miss Fawn Post of Sacramento."

A CASE OF CONSCIENCE MONEY.

Manager M. G. Hall of the Santa Rosa District a few days ago received the sum of $1.18 in postage stamps from some person unknown who used a consumer of "Pacific Service" as a go-between. Upon writing to the consumer for information so that he might know to whom to credit the amount, Manager Hall received the following reply:

"Petaluma, Feb. 15, 1914.

"Mr. M. G. Hall,

"Dear Sir: The person who sent me the stamps to forward to you did not disclose the name, but referred to it as 'conscience money.' So it may be a long standing debt.

"You can see that I don't know the name of the sender; if I did I would let you know unless told not to do so.

"With best wishes, I remain,

"Yours faithfully,

"F. Fletcher."

Superintendent I. B. Adams of De Sabla Power Division reports the following activities:

"We have installed our new waterturbine at Centerville, and it is working very satisfactorily. It is a Francis type turbine, manufactured by the Allis-Chalmers Company, and is of 8450 h. p. rated capacity. It took about three weeks to get the machinery into Centerville and set it up. We used our logging truck for the purpose with twelve horses. There were six pieces in all, and the total weight was 38,000 pounds.

"We are building two and one-half miles of 2300-volt three-phase line from camp No. 1 at De Sabla to the Nugget gravel mine, two and one-half miles to the northeast. This is a new mine being worked by San Francisco people."

Manager Heryford of the Chico District is very fond of taking his guests out to see the celebrated Sir Joseph Hooker oak, the pride of the Bidwell ranch. Mr. Heryford joins the natives of the district in calling this the largest oak in the world. It is hardly that; nevertheless it is a grand specimen and well worth a visit. Following are its dimensions:

Height, 105 feet; circumference of trunk at ground, 25.7 feet; 8 feet above ground, 24.8; length of limbs of south side, 101 and 105 feet, respectively; on the north side, 99 feet; circumference of circle outside branches, 446 feet. Allowing 2 sq. ft. to a person, the number that could take shelter under the spreading branches of this magnificent oak is estimated at 7885.

Pacific Service Magazine

PUBLISHED IN THE INTERESTS OF ALL EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

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Issued the middle of each month.
Year's subscription $1.50
Single copy .... .15

Published by the
PACIFIC GAS AND ELECTRIC COMPANY
at 445 Sutter Street, San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. V. APRIL, 1914. No. 11

EDITORIAL

ALL Northern California hails with joy the announcement that San Francisco has been selected as the site for the regional reserve bank of the Pacific Coast. As a matter of fact, from the moment the congressional legislation which provided for this national banking system was passed it appeared to be regarded as a foregone conclusion that San Francisco would be chosen as one of the twelve financial centers. The visit of Secretary McAdoo to the Pacific Coast last February was looked upon as a little more than mere formality in this respect. Nevertheless, it is comforting to know now that the stamp of official authority and approval has been placed upon the Queen City of the Pacific, which has been aptly described as "The city loved around the world."

The metropolitan press comments variously as to expression but as one in sentiment on the matter. The San Francisco Chronicle says: "The selection of San Francisco settles all arguments as to the commercial and financial centers of the far Western States." The Examiner declares: "The pre-eminence of San Francisco in the more than imperial region which embraces six of the forty-eight states of the Union is so marked that it is never even questioned. There are many prosperous, rich and growing cities between the backbone of the continent and the shore-line of the Pacific. But there is only one San Francisco."

Speaking for that portion, at least, of our Golden State that lies north of Tehachapi, it looks as if things were really coming our way at last. Time was—and it is not so very long ago—when the pleasant land lying West of the Rockies received but scant attention at the hands of the busy world on the Eastern side; the land of romance, yes, made so by Bret Harte, Mark Twain and others, but so far as went to the possibility of its ever being recognized as a competitor of the East in progress and achievement, why, that, of course, was too absurd to even merit a passing thought. Meanwhile, however, the hardy men who followed in the footsteps of the pioneers toiled on, always good-humored, never discouraged, and little by little a vast, up-to-date commonwealth grew up around them.

Nothing stopped them. The awful disaster of 1906 is too fresh in our memory to need dwelling upon, but the men of San Francisco rose superior to that when in the face of what at first seemed ininsurmountable obstacles they builded anew and better than ever. The result today fairly amazes the wise men from the East who have not had the opportunity to witness each stage of this new growth.

It has not been all plain sailing, by any means. For awhile financial panic hovered ghost-like over the ashes of the stricken city, and more than once since then has our Western Wonderland been made to feel the stress of conditions that have been anything but encouraging of achievement. But we are here today, and we are here in better shape than ever before, and we are spreading and reaching out in a way that no amount of pessimism, no set-back of any kind, can abate. Down where the waters roll in from the Golden Gate the domes of a colossal Exposition City glow red in the sunlight. Already the word has gone forth to the great world beyond that not only will this latest and greatest Western enterprise be an accomplished fact, but that in beauty, in character, in scope, in everything that goes to make a great World's Fair, it will be something to be remembered for all time.

Even that most capricious of deities, the Weather-God, is smiling upon us this year. Two dry winters in succession have we suffered under, and it would have gone hard with us indeed had Jupiter Pluvius withheld his countenance from us a third time. But the rains have fallen and the snow has piled high upon the Sierra summits; reservoirs are full, and there will be water in plenty. This second rainfall to which we have been treated since March has come when it was most needed and it may be said to have rounded off the winter season so as to insure us a glorious and fruitful spring. The prospects are for magnificent crops, and these should assist materially in lifting the depression that most men say lies upon our land. Great crops mean plenty of work, increased tonnage for the carrier and a greater distribution of money.

"It is going to be a good year in California," announces a San Francisco daily in bold prophesy. We are all looking forward to it, so that when the curtain rises upon the great international spectacle which is to be pulled off in the metropolis of the West next February, we may greet its rising with no forced smiles but with the wide-open, enthusiastic glow upon our faces that will reflect the perfect contentment of our souls.

"Pacific Service" joins with the rest of the world of enterprise and achievement in mourning the loss of Mr. George Westinghouse. Truly he was a great man, and if only for his inestimable service in insuring comparative safety to the traveler by railroad he is honored as one of the world's greatest benefactors. A tribute to his memory appears elsewhere in this issue.

FROM BLISS CARMAN'S
"SPRING SONG."

"Make me over, Mother April,
When the sap begins to stir!
And thy flowery hand delivers
All the mountain-prisoned rivers,
And thy great heart beats and quivers
To revive the days that were;
Make me over, Mother April,
When the sap begins to stir!

Take my dust and all my dreaming,
Count my heart beats one by one,
Send them where the winters perish;
Then some golden noon recherish
And restore them in the sun,
Flower and scent and dust and dreaming,
With their heart-beats every one!

* * *

For I have no choice of being
When the sap begins to climb,—
Strong insistence, sweet intrusion,
Vasts and verges of illusion,—
So I win, to time's confusion,
The one perfect pearl of time,
Joy and joy and joy forever,
Till the sap forgets to climb!

Make me over in the morning
From the rag-bag of the world!
Scraps of dream and duds of daring,
Home-brought stuff from far sea-faring;
Faded colors once so flaring,
Shreds of banners long since furled!
Hues of ash and glints of glory,
In the rag-bag of the world!

Let me taste the old immortal
Indolence of life once more;
Not recalling nor foreseeing,
Let the great slow joys of being
Well my heart through as of yore!
Let me taste the old immortal
Indolence of life once more!

* * *

Only make me over, April,
When the sap begins to stir!
Make me man or make me woman,
Make me oaf or ape or human,
Cup of flower or cone of fir;
Make me anything but neuter
When the sap begins to stir!

The Late George Westinghouse

Mechanic, inventor, financier, friend of labor, tireless organizer, founder of enduring industries.

BORN OCTOBER 6, 1846 DIED MARCH 12, 1914

[*The following tribute to the memory of the great inventor was prepared specially for* Pacific Service Magazine *by men of the company that bears his name. It was a labor of love with them.*—Editor Pacific Service Magazine.]

WHAT all the world knows of his many achievements:

The revolution in railroading wrought by the development of the air brake;

The development of the high-pressure transmission of gas in the Pittsburgh district;

The revolution of the electrical industry by the development of the alternating current system of transmission and distribution of electrical energy, both single and poly phase;

The late George Westinghouse.

The development of prime-movers of nearly every type, gas engine, steam turbine, electric generators and motors;

The making of travel by railroad safe, not only by use of the air brake, but also by the perfection of the electro-pneumatic block signal system;

The invention of the air spring to make automobile travel more comfortable.

He touched nearly everything, and everything he touched he adorned.

He was as happy over the discoveries of other minds as though they were his own. Great intellects have worked for him, been encouraged and protected by him. We name at random only a few: Shallenberger, Tesla, Scott, Nernst, Parsons, Rudd, Cooper, Hewitt, Thomas, Davis, Bremer, Lamme, Wurts, Lange.

His mind was constantly reaching out into the future, and after one had been much with him it became practically impossible to live altogether in the present, because there were brought to view at every turn possibilities of new things as yet undeveloped which were to serve future generations at a time when the world should be advanced far beyond its present stage. The imagination was constantly stimulated and interest kept alive by the new principle that was struggling on towards definite shape.

His foresight was phenomenal. His industries in this country grew up even faster than seemed wise to a great many who were associated with him. They did not see the value of what he was doing as clearly as he saw it, and time alone has justified the thoroughness with which his plans were laid, buildings designed and executed. Energy and expense were not spared upon any of his work. They were developed in such a way that they could be extended forever.

Great men cannot be compared with one another. They are moulded by circumstances and no two are alike, yet no man is great who lacks certain essential qualities: First, he must at all times be just, and in the case of Mr. Westinghouse this quality prevailed. A great nature shows itself by being kind and considerate. The underlying sweetness of his spirit was illustrated by the watchword that he used among all his interests—a constant repetition of a plea for harmonious action. Other virtues were shown by the cleanness of his life.

His mind was so quick that he saw the essential point in a complicated situation even before the story could be fully told him. Once determined upon his course, he was not to be laughed out of it, frightened out of it, or bought off.

A prominent business man recently made this statement: "To say that George Westinghouse was a man of a generation would be inadequate; he was a man of centuries." It is interesting to consider what were the qualities of a man of whom this could be so justly said. That he was a great inventor is a fact of world-wide recognition, but there have been other great inventors. We look then for further qualities, and it is in these, which rival even his unusual inventive genius, that we find the character of his greatness.

Prominent among these qualities, those who knew him well would place his powerful intellect, his tremendous will power, his indomitable courage—all being different manifestations of his strong personality. Large obstacles served only to intensify his interest in the pursuit. Small obstacles made no impression. Threatened defeat, which would often dishearten his associates, called into play only that dauntless courage which was so much a part of his being that he seemed not to recognize it as a quality distinct in itself. But even this persistence and this courage alone would not have availed to develop the numerous industries bearing his name nor to construct the acres of buildings in which the thousands of employees find continual occupation. Back of these forces was a far-sighted apprehension of not merely the possibilities but the certainties of future scientific and industrial development. A powerful scientific imagination gave to his opinion almost the character of accurate prophecy. He had, besides, a remarkable quickness of perception and clearness of vision, unhampered by the limitations of the average observer. These, backed by sound judgment and practical sense, made it possible for him to turn into material benefit to the world the various inventions which found their origin in his fertile brain.

Combined with these qualities of genius, will-force and far-sightedness, there was a personal charm which won for him the admiration and affection of those who labored with and for him, as well as of those who, in the struggle of commercial progress, were his business competitors.

His winning smile, his cordial grasp of the hand, evidenced a heart warm in its regard for mankind, loyal in friendship and gentle in affection.

The life and deeds of the man who was gifted with these qualities and who utilized them to their fullest extent have been an inspiration to those living in his own generation and will be an object of admiration to generations to come.

To establish his fame, George Westinghouse needs no literary monument. The products of his genius, known wherever there is an engineer, constitute monuments innumerable which assure his place among the great men of this world.

Noting Progress of the World's Fair

CONSTRUCTION of the great Universal Exposition continues to proceed at a rate unprecedented in history. The first week in April saw the completion of the steel work on the dome of the Palace of Horticulture. This is said to be one of the largest steel domes in the world, also the largest structure of its kind in the Exposition grounds. It is 180 feet in height and 150 feet in diameter, and contains 500 tons of steel.

The Palace of Education is the second of the exhibit palaces to be completed. This stands at the southwest corner of the main group and occupies over four acres of ground. Education is to be a most prominent feature of the Exposition, and this building will contain the most remarkable collection of exhibits ever displayed. This is upon the assurance of Mr. Alvin E. Pope, chief of the department of social economy and education, who returned to San Francisco March 19th after a four months' tour of the United States. Among the entirely new educational features will be a huge combination exhibit, a joint display by a motion picture corporation, a phonograph company and a school-book concern. It is said that this one exhibit involves an expenditure by the motion picture company of $1,500,000.

The exhibit will include a spacious model school room and a moving-picture hall, elaborately fitted up with the most modern appliances, especially for teaching the sciences, geography and industrial and vocational subjects. This will be surmounted by a roof garden, with model kindergarten schools, to be conducted with pupils from many nations, under the auspices of the National Kindergarten Association. Folk songs and dances will be accompanied by music and phonographs. Special text-books will be prepared by the book company to supplement this novel use of the moving pictures and phonographs. There will be six or eight model school rooms devoted to class work in elementary education, to agricultural, horticultural, commercial and industrial pursuits; in art and in special subjects. Special instruction will be given in the teaching of the deaf, dumb, blind, delinquent and defective pupils, and in physical education for children and adults.

A feature of the exhibits will be the use of two hundred stereomotorgraphs. These are automatic daylight stereopticons, each showing more than fifty pictures up to ten feet square, acting synchronously with phonographs.

Another wholly new feature of these displays appears in the announcement that each state, nation and city will show its one great specialty without duplication. New York for example, will spend $35,000 to show the benefits of its system of state educational supervision, whereby the issuance of all licenses and diplomas is regulated at Albany. A huge relief map, twenty by thirty feet in area, will show the effect of this central control over every school in the state. Ohio will specialize on the work in its agricultural and horticultural high schools. Massachusetts will devote $23,500 to showing the marvelous success of its great vocational and textile schools. Wisconsin's display, largely paid for by contributions of public school children, will be devoted to university extension work; while Oregon will specialize on rural schools, a feature of which is a credit system by which pupils acquire merit for labor performed at home.

Germany and France, among other nations, are expected to transfer their entire displays shown at the Lyons (France) Urban Exposition, which will close in May of this year.

While in the East, Mr. Pope procured the services of Mr. Wallace Hatch of Providence, R. I., as superintendent of special exhibits on education.

The enormous Palace of Machinery is still the scene of much activity in the decorating line. World-famous artists in the garb of house-painters are seen perched here and there on ladders executing the giant panels that promise to make this decorative feature one without peer in the annals of expositions. Great allegorical groups of sculpture occupy space in the great hall, awaiting transportation to their various resting-places in courts and palaces. But already the work of installing exhibits in the Machinery Palace is at hand, and from now on the huge structure will commence to fill up.

Mr. W. D. A. Ryan, chief illuminating engineer for the General Electric Company at Schenectady, N. Y., returned to San Francisco about the middle of March to resume his work on plans and installation of lighting devices for the Exposition. His company loaned a portion of its engineering staff to the cause, and under Mr. Ryan's leadership these clever engineers have invented some remarkably spectacular lighting effects. While in the East Mr. Ryan worked out details for the illumination of the huge glass dome of the Palace of Horticulture, which will be flooded with soft light from within, giving it the appearance of a great opal; of Festival Hall, which will have its entire light source beneath the floor of the building; of the forty-eight "scintillators," which will make the clouds and fogs above the Exposition veritable cataracts of brilliancy; and other details, such as the flood-lighting standards and the pendant jewel decorations of the Court of the Universe. In each of these works Mr. Ryan has achieved unprecedented results and utilized ideas not conceived in the illumination of previous expositions. The jewel pendants will, as the result of the special grinding process by which they were made in Austria, have forty per cent greater brilliance than any other prisms ever constructed.

One of the pyrotechnical displays will be the projection, by means of colored searchlights playing on clouds of smoke from exploding bombs, of an American flag 1,000 feet long. On the opening night of the Exposition a vast fountain of vari-colored light will be shot from the searchlight batteries, stronger in their combined candle-power than the combined searchlights of the navies of the world. The forty-eight scintillators, on the jetty in the yacht harbor, will be manned by sixty men, trained in the manipulation of spectacular lighting devices.

Virtually all the electrical fixtures and appurtenances for the Exposition are being specially manufactured under Mr. Ryan's direction, even to the wires. These wires will be made with specially manufactured colored insulations, so as to be unnoticeable either by day or night. As is generally known, "Pacific Service" supplies the electric "juice" for this and all illumination at the Fair grounds.

A twelve-month progress report submitted recently by Harris D. H. Connick, Director of Works of the Exposition, showed two exposition palaces practically ready for exhibits, several state pavilions well under way, and all the foreign countries lined up for rapid construction work, with one building finished and another partially built. Mr. Connick's report showed that the Exposition builders are about five per cent ahead of their schedule, and this should remove any last lingering doubt as to whether the Exposition will open on time. All of the palaces, says Mr. Connick, will be ready for exhibits by July 1st, seven months ahead of the opening day.

Honduras has the distinction of being the first foreign country to complete its pavilion. Canada is constructing its $300,000 building and plans have been received and approved for the Netherlands and Swedish pavilions. Denmark's plans have arrived.

Idaho's building is fifty per cent completed; New York's ten per cent, and Oregon's five per cent. Pennsylvania, Washington, Ohio, Massachusetts and Missouri are ready to begin work.

Of the total of $110,000 appropriated for sewers, $83,000 has been spent; water supply pipes have been laid in all parts of the grounds; $32,771 has been spent in moving buildings on the Presidio site to clear the ground for Exposition uses; $16,000 has been spent in constructing seawalls along the Exposition front and a breakwater protecting the ferry slips. Ten miles of high-pressure water system has been laid at a cost of $155,000.

The same able hands that have so successfully steered the Exposition toward the port of success will stay at the helm. On March 18th the following officials and directors were re-elected: President, Charles C. Moore; Vice-Presidents, William H. Crocker, R. B. Hale, M. H. de Young, I. W. Hellman Jr., Leon Sloss and James Rolph Jr.; Secretary, Rudolph J. Taussig; Treasurer, A. W. Foster; Directors—John Barneson, M. J. Brandenstein, John A. Britton, Frank L. Brown, P. T. Clay, George T. Cameron, William H. Crocker, R. A. Crothers, M. H. de Young, A. I. Esberg, Charles S. Fee, H. F. Fortmann, A. W. Foster, R. B. Hale, I. W. Hellman Jr., S. Fred Hogue, Homer S. King, Curtis H. Lindley, P. H. McCarthy, James McNab, Charles C. Moore, Thornwell Mullally, Dent H. Robert, James Rolph Jr., A. W. Scott Jr., Henry T. Scott, Leon Sloss, C. S. Stanton, Rudolph J. Taussig, and Joseph S. Tobin. Dr. Frederick J. V. Skiff was re-appointed director-in-chief, as were Joseph M. Cumming, executive secretary; Frank S. Brittain, general attorney, and Rodney S. Durkee, comptroller.

The special commission to Australia and New Zealand returned the last week in March from a tour of the Antipodes. Its report presented at headquarters assured the administration of hearty participation on the part of the countries lying on the other side of the equator. On the commission was Major Sidney Cloman, U. S. A., chief of the bureau of military affairs, who brought news of the participation of the nations across the seas in the great international military tournament to be held during the Exposition year.

Besides the usual record of unusual progress in construction work the following were important events of the past month:

On April 2d President Wilson sent a message to Congress urging an appropriation of $500,000 for government buildings at the Fair.

On April 6th the site for the Iowa State building was formally dedicated by the Governor of that State, and at the same time the Lieutenant-Governor of Nebraska laid the cornerstone of the building that will represent his state.

That San Francisco will have a million visitors to her Exposition is the prediction of the passenger traffic men of the transcontinental railroads. During the last week in March the Transcontinental Traffic Association held its convention in San Francisco, and not the least important feature of its business was the fixing of rates to and from the Exposition city in 1915. At a luncheon given the visitors by the Exposition directors, Mr. Barrit Fort, passenger traffic manager of the Union Pacific, said:

"It has been said by some one with statistics at hand that there would be 500,000 visitors. I think the statistician has figured it at about one-half."

Mr. C. A. Cairns, general passenger traffic agent of the Chicago and Northwestern, had this to say:

"If one-half the people who are now talking of this Exposition come to San Francisco your coffers will be overflowing, and I know they will return more than pleased. Now that we have seen the beauty and wonder of the Exposition, and the meaning of it all, we can work in earnest to bring the people here.

"The railroads will put the necessary push back of their reduced rates to bring the people of the East to California."

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H. Bostwick .... Secretary to President
F. S. Myrtle .... Manager Publicity Dept.
L. H. Newbert .... Manager Appliance Dept.
G. C. Holberton .. Chief Eng'r Stockton Water Dist.
W. B. Bosley .... Attorney
H. C. Vensano .... Civil Engineer
E. C. Jones .... Engr. Gas Dept.
H. P. Pitts .... Industrial Engineer
S. V. Walton .... Manager Commercial Dept.
S. J. Lisberger .... Engr. Electric Distribution
Sherwood Grover .... Asst. Engr. Gas Department
J. P. Jollyman .... Engr. of Electric Construction
P. M. Downing .... Engr. O. & M. Hyd.-Elec. Sect.
C. J. Wilson .... Asst. Engr. Electric Distribution
F. H. Varney .... Engr. O. & M. Steam Section
F. G. Baum .... Chief Engineer Hydro-Electric Dept.

DISTRICT MANAGERS

District	Headquarters	Manager
Alameda Co., Berkeley, Oakland	Oakland	F. A. Leach, Jr.
Chico	Chico	H. B. Heryford
Colusa	Colusa	L. H. Hartsock
Contra Costa	Martinez	Don C. Ray
Fresno	Fresno	M. L. Neely
Grass Valley	Grass Valley	John Werry
Marysville	Marysville	J. E. Poingdestre
Marin	San Rafael	W. H. Foster
Napa	Napa	O. E. Clark
Nevada City	Nevada City	John Werry
Petaluma	Petaluma	H. Weber
Placer	East Auburn	H. M. Cooper
Redwood	Redwood City	E. W. Florence
Sacramento	Sacramento	C. W. McKillip
San Francisco	San Francisco	G. C. Holberton
San Jose	San Jose	J. D. Kuster
Santa Rosa	Santa Rosa	M. G. Hall
Solano	Dixon	C. E. Sedgwick
Stanislaus	Newman	W. A. Widenmann
Vallejo	Vallejo	A. J. Stephens
Woodland	Woodland	W. E. Osborn

MANAGERS OF WATER DISTRICTS

Nevada (Nevada City) .... George Scarfe
Placer (East Auburn) .... H. M. Cooper
Standard (Electra) .... W. E. Eskew
Stockton (Stockton) .... J. W. Hall

SUPERINTENDENTS OF POWER DIVISIONS

Colgate .... Miles Werry
De Sabla .... I. B. Adams
Drum .... James Martin
Electra .... W. E. Eskew
Marysville .... E. C. Johnson
Nevada .... George Scarfe
North Tower .... C. D. Clark
Oakland .... William Hughes
Sacramento .... J. O. Tobey
San Jose .... F. G. Maynard
South Tower .... A. H. Burnett
Stockton .... E. C. Monahan
Solano .... J. W. Coons

SUPERINTENDENTS OF STEAM ELECTRIC STATIONS

H. N. Mosher .... Chief Engr. Station "C," Oakland
C. A. Eastwood ... Supt. Station "A," San Francisco
J. W. Varney .... Supt. of Substations, San Francisco

SUPERINTENDENTS OF ELECTRIC DISTRIBUTION

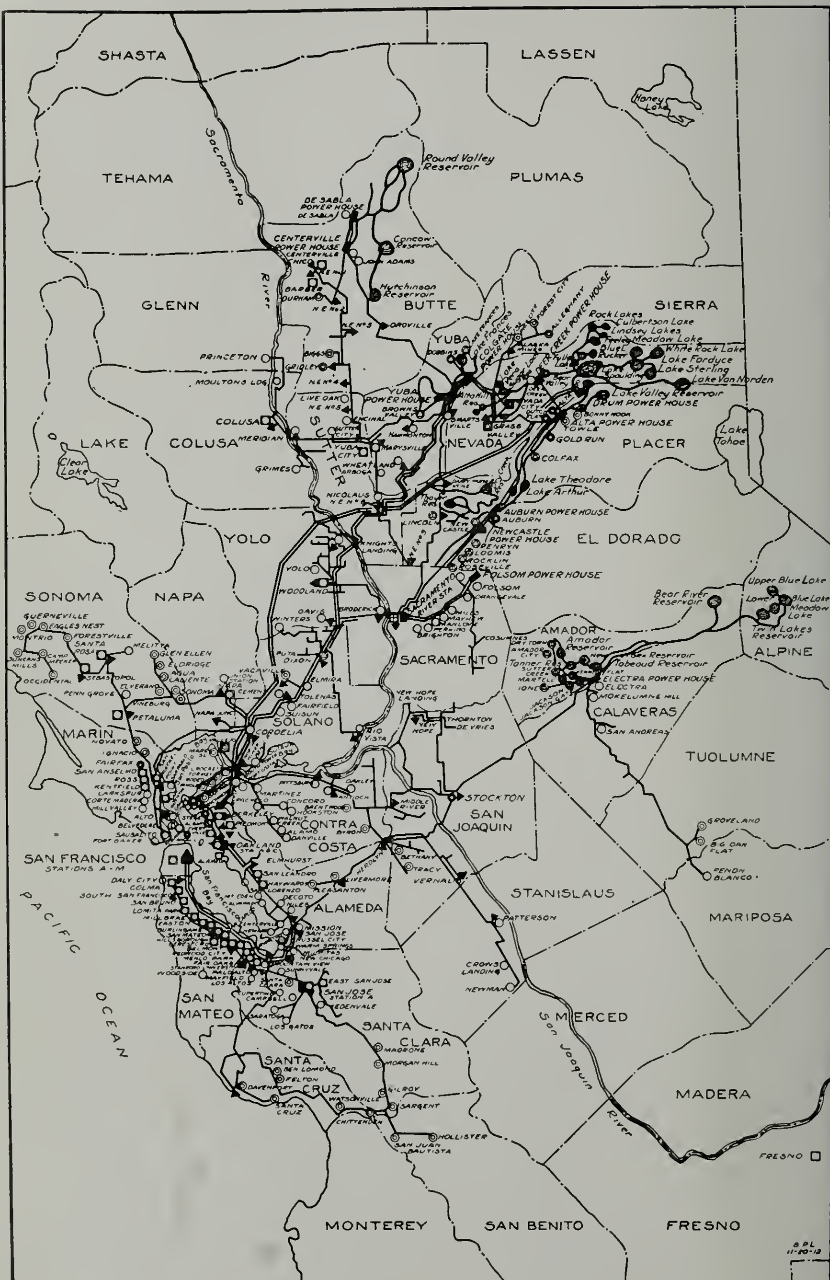
Berkeley .... J. H. Pape
Oakland (Underground) .... R. C. Powell
Oakland and Alameda (Ovrhd) . A. U. Brandt
Sacramento .... C. R. Gill
San Francisco .... A. R. Thompson
San Jose .... A. C. Ramstad
Marin .... Chas. Dallerup

SUPERINTENDENTS OF GAS WORKS

Oakland .... A. C. Beck
Sacramento .... Edward S. Jones
San Francisco .... Dennis J. Lucey
San Jose .... R. H. Hargreaves
Fresno .... Paul C. Funk

SUPERINTENDENTS OF GAS DISTRIBUTION

Oakland .... George Kirk
San Francisco .... D. E. Keppelmann
Superintendent of Railway Department .... N. J. Hullin


SHASTA
LASSEN
Honey Lake
TEHAMA
PLUMAS
Round Valley Reservoir
Sacramento River
DE SABLA POWER HOUSE
CENTERVILLE POWER HOUSE
Concow Reservoir
Hutchinson Reservoir
GLENN
BUTTE
SIERRA
OROVILLE
PRINCETON
COLUSA
MERIDIAN
GRIMES
SUTTER
YUBA
YUBA POWER HOUSE
COLGATE POWER HOUSE
DRUM POWER HOUSE
ALTA POWER HOUSE
Lake Fordyce
Lake Sterling
Lake Van Norden
Lake Valley Reservoir
NEVADA
PLACER
Lake Tahoe
LAKE
Clear Lake
COLFAX
Lake Theodore
Lake Arthur
AUBURN POWER HOUSE
NEWCASTLE POWER HOUSE
FOLSOM POWER HOUSE
EL DORADO
YOLO
SONOMA
NAPA
SACRAMENTO
SACRAMENTO RIVER STA
Bear River Reservoir
Upper Blue Lake
AMADOR
Amador Reservoir
Tabeaud Reservoir
ELECTRA POWER HOUSE
ALPINE
CALAVERAS
SOLANO
MARIN
PETALUMA
TUOLUMNE
STOCKTON
SAN JOAQUIN
CONTRA COSTA
OAKLAND
SAN FRANCISCO
STATIONS A-M
San Francisco Bay
ALAMEDA
STANISLAUS
MARIPOSA
PACIFIC OCEAN
SAN MATEO
SAN JOSE
SANTA CLARA
MERCED
San Joaquin River
SANTA CRUZ
MADERA
HOLLISTER
FRESNO
MONTEREY
SAN BENITO
FRESNO

PACIFIC GAS AND ELECTRIC COMPANY

CITIES AND TOWNS SUPPLIED WITH GAS, ELECTRICITY, WATER AND RAILWAY

Service Furnished	Number of Towns	Total Population
Electricity	209	1,093,992
Gas	51	989,167
Water	25	52,865
Railway	1	71,000

Place	Population
Alta	20
[1]Alameda	25,000
Alamo	50
[2]Albany	800
[5]Amador City	200
Adams John	25
Alleghany	200
Alto	25
Angel Island	280
[5]Auburn	2,375
Agua Caliente	100
Alvarado	900
Antioch	3,000
Arboga	100
[2]Barber	500
[2]Belmont	350
Ben Lomond	800
Belvedere	1,000
Benicia	3,360
[2]Beresford	25
[2]Berkeley	40,000
Biggs	750
Big Oak Flat	20
Brentwood	200
Brighton	100
Broderick	200
[5]Brown's Valley	50
Byron	200
[2]Burlingame	4,000
California City	25
Camp Meeker	200
Campbell	600
Centerville	1,000
Centerville	20
[2]Chico	13,000
[2]Colma	3,500
[2]Colusa	1,500
Concord	1,500
Cement	1,500
[5]Colfax	500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Cupertino	50
Daly City	250
Danville	250
Davis	750
Decoto	350
de Sabla	25
[5]Dixon	1,000
[5]Dobbins	50
Davenport	1,000
[5]Drytown	20
Durham	500
[5]Dutch Flat	500
Duncan's Mills	150
[2]Easton	300
[2]East San Jose	1,660
Eagle's Nest	50
Edenvale	500
Eldridge	500
Elmira	150
El Verano	400
Electra	50
[2]Emeryville	5,000
Encinal	100
Fairfax	500
Fairfield	834
Forestville	100
Felton	300
[1]Fresno	30,000
[2]Fair Oaks	250
Folsom	1,800
Gilroy	2,000
Glen Ellen	500
[5]Gold Run	100
[3]Grass Valley	4,500
Gridley	1,800
Grimes	250
Groveland	125
Guerneville	500
Hammonton	500
[2]Hayward	4,000
[2]Hillsborough	1,000
Hollister	3,000
Hookston	75
Ignacio	100
[5]Ione	900
Irvington	1,000
[5]Jackson Gate	100
[5]Jackson	2,035
[5]Kennedy Flat	20
[2]Kentfield	250
Knight's Landing	350
[5]Lake Francis	5
Lathrop	300
Live Oak	200
Livermore	2,250
Los Gatos	3,000
[2]Larkspur	600
[5]Lincoln	1,400
[2]Lomita Park	100
Los Altos	500
[5]Loomis	400
Maletta	30
Manlove	50
Martinez	5,000
[5]Martell	150
[2]Marysville	7,000
Mayfield	1,500
Mayhew	50
[2]Menlo Park	1,500
Meridian	300
[2]Millbrae	300
Mills	50
Milpitas	300
Mill Valley	2,500
Mission San Jose	500
Mokelumne Hill	150
Monte Rio	50
Moulton's Landing	30
Mountain View	2,500
Mt. Eden	200
Mare Island	500
[2]Napa	7,000
[3]Nevada City	2,700
[5]New Chicago	10
Newark	700
[5]Newcastle	750
Newman	1,000
Niles	800
Nicolaus	75
Novato	250
[2]Oakland	230,000
Oakley	80
Orange Vale	100
[2]Palo Alto	6,300
Pacheco	200
Penryn	250
Patterson	300
Penn Grove	300
Perkins	50
[2]Petaluma	5,500
[2]Piedmont	1,720
Pike City	200
Pinole	1,500
Pittsburg	2,372
Pleasanton	2,000
Point San Pedro	20
Port Costa	600
[2]Redwood City	3,200
[2]Richmond	10,000
Rio Vista	884
[5]Rocklin	1,000
[5]Roseville	2,600
Rodeo	500
[2]Ross	500
Russel City	250
[4]Sacramento	71,000
San Andreas	200
[2]San Anselmo	1,500
[2]San Bruno	1,500
[2]San Carlos	100
[2]**San Francisco**	416,912
[2]San Jose	30,000
[2]San Leandro	4,000
San Lorenzo	100
[2]San Mateo	6,500
[2]San Quentin	2,500
[2]San Rafael	6,000
San Pablo	1,000
Santa Clara	6,000
Santa Cruz	16,000
Saratoga	50
[2]Santa Rosa	12,000
[2]Sebastopol	1,200
Sausalito	2,500
Smartsville	500
[2]South San Francisco	2,500
[2]Stanford University	2,600
Sonoma	1,200
Stege	1,000
[5]Stockton	30,000
Suisun	1,200
Sutter City	150
Sutter Creek	1,500
Sunnyvale	1,500
Tiburon	400
Tormey	20
Towle	100
Tracy	1,200
Union Station	40
Vacaville	1,200
[2]Vallejo	15,000
Vineburg	200
Walnut Creek	350
Warm Springs	200
Watsonville	4,500
Wheatland	1,400
Winters	1,200
[2]Woodland	3,200
Woodside	200
Yolo	400
[2]Yuba City	1,200
Total	1,148,992

Unmarked—Electricity only.
1—Gas only.
2—Gas and Electricity.
3—Gas, Electricity and Water.
4—Gas, Electricity and Street Railways.
5—Electricity and Water.

EMPLOYS 4,800 people.

OPERATES 11 hydro-electric plants in the mountains.
5 steam-driven electric plants in big cities.
16 gas works.

SERVES ⅔ of California's population.
30 of California's 58 counties.
An area of 37,775 square miles.
⅗ the size of New York State.
½ the size of all the New England States combined.

ACIFIC SERVICE MAGAZINE

DE SABLA POWER-HOUSE, DE SABLA POWER DIVISION

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MAY • 1914

No. 12

Published Monthly by the Pacific Gas and Electric Co., San Francisco, Cal.

Pacific Service Magazine

VOL. V | No. 12

Yearly Subscription $1.50 :: :: Single Copies, Each, 15 Cents

Contents for May

Index to Advertisers

Constructing the Stockton street tunnel. Looking back toward the approach at Sutter street. Picture shows the dump cars running on incline tracks to the bunkers.

PACIFIC SERVICE MAGAZINE

VOL. V MAY, 1914 No. 12

The Stockton Street Tunnel

San Francisco's Project for the Relief of a Congested Section of the City and the Part "Pacific Service" Plays in Its Development

By H. P. PITTS, Industrial Engineer

[The writer has endeavored to treat his subject in a popular manner. Engineers looking for tangents, cosines and radii will have to seek elsewhere.—H. P. P.]

THE recent articles appearing in PACIFIC SERVICE MAGAZINE describing the "Big Dam" and the "Big Ditch" would seem to make the "Big Bore" of Stockton street, San Francisco, fade into insignificance. Its value to the transportation of San Francisco and the several unique features which enter into its construction, however, make it one of the important pieces of construction work now being carried on in the West.

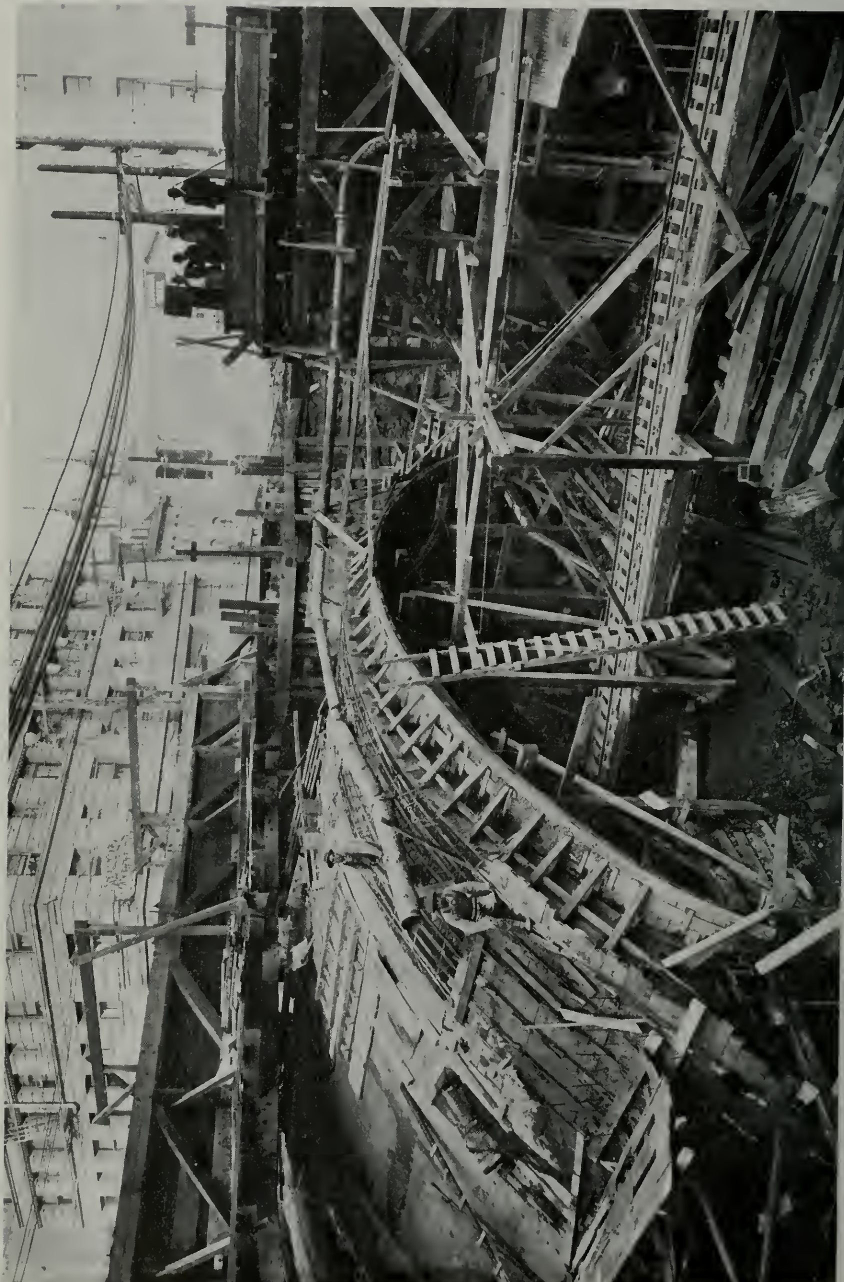

H. P. Pitts

It is interesting to know that right in the heart of our great city is at present being brought to completion a piece of work which embodies a number of different types of enterprise typical of California. Here may be seen the gold mine in operation—excepting that "drift" is more valuable than the mined product. Here are the air-drills at work drilling the holes for the blasting of the rock; the sawmill cutting up the timbers for timbering the "mine," and the electric locomotive with its cars conveying the material from the tunnel and carrying it up the incline to be dumped into bunkers, whence it is loaded on auto-trucks and carted away to some fill. The construction scheme of a tunnel goes farther, however, in that an enormous amount of concrete construction is necessary for the approaches, the arches and the lining of its entire length. In the Stockton street tunnel all of this work is being done by electricity which, if it has accomplished nothing else, has been a blessing to the adjacent tenants, in that the smoke from boilers has been eliminated, the noise of engines and escaping steam is not heard, and the work is being carried on without the slightest inconvenience to anyone.

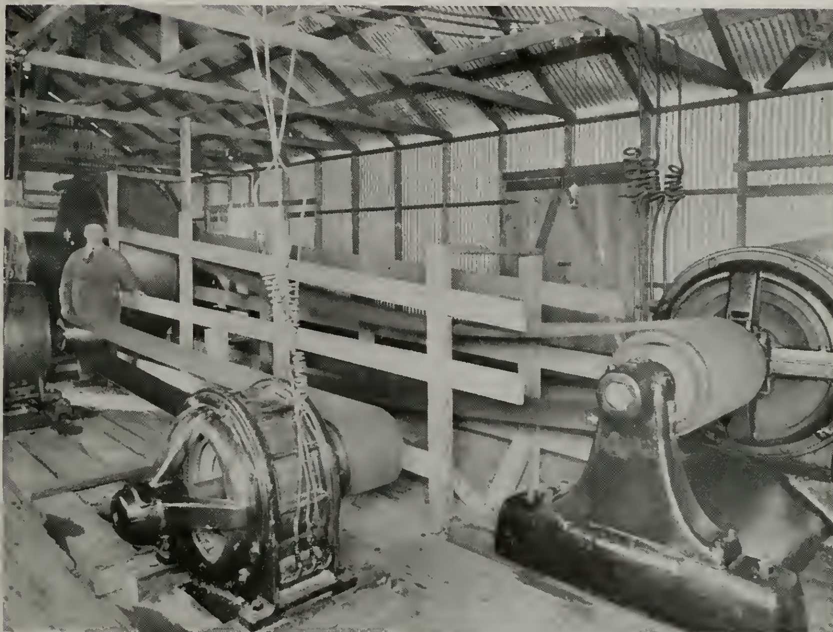
The tunnel, when completed, will be one thousand feet long, extending from its south portal at Bush street (with its approach on Sutter street) to its north portal at Sacramento street. It will have a width of fifty (50) feet with a seven (7) foot sidewalk on each side, with winding stairways on either side of each portal to the streets above.

Referring to the accompanying illustrations, one shows the temporary "powerhouse" which is located at the corner of Stockton and Pine streets. Installed here is the air-compressor of 1200 feet capacity driven by a 200 h. p. induction motor. The compressed air is used for rock drills and for pouring the concrete, the latter a novel system which will be described later. In the foreground is shown a 35 h. p. induction motor belt-driven to a direct-current generator, which generator supplies the direct current for the electric locomotive hauling the dump cars filled with dirt and rock taken from the tunnel up the incline, as shown in view No. 2. Notice in this view that the bunkers are located at Sutter street, elevated so that the dirt and rock will run by gravity through hoppers into auto-trucks to be carted away.

The method of construction is simple. Three drifts are being driven through the hill the full length, one on either side of the arch, or, to be more explicit, are located just where the sidewalks are to be, the third drift being central and



The Stockton street tunnel. View of the south portal, at Bush and Stockton streets, under construction.



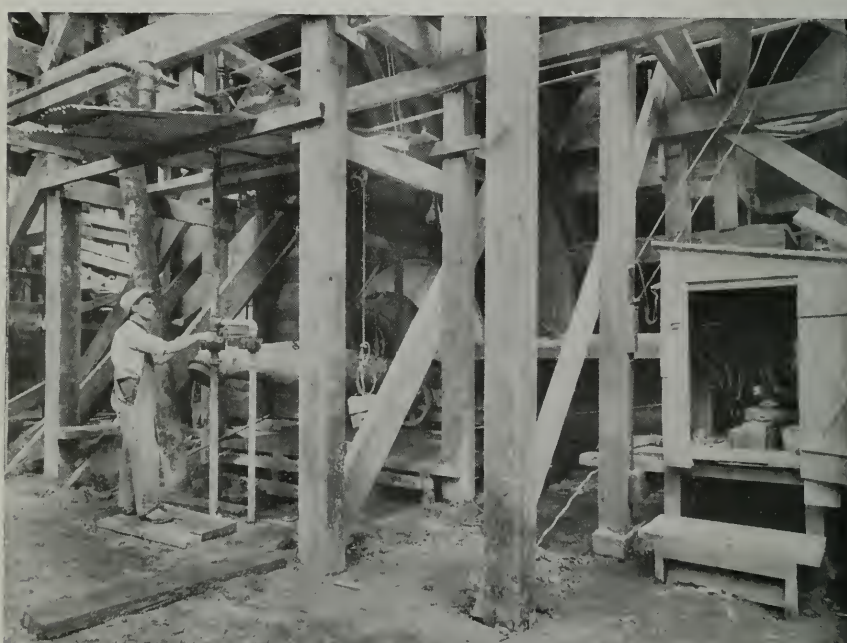
Power-house, showing 12-foot compressor belt-driven to 200 h. p. motor, also motor-driven generator.

at the top. As these drifts are driven, a segment eight feet wide of the entire tunnel is taken out; the outside of this segment is approximately two feet greater in diameter than the finished arch of the tunnel will be. This two-foot segment is being filled in with concrete as the work progresses. As these drifts are extended a "core" will be left in the middle of the tunnel six (6) feet smaller in diameter than the tunnel, which core will be removed after the cementing of the arch is finished and set. The reason this core is left is to save timbering, as it will be seen that much less timber will be required than if all the logs and timbers had to extend to the floor of the tunnel; the soft condition of the ground requires a large amount of timber as it is.

Another illustration shows the concrete-mixing machinery in action, and in the extreme right is shown the 15 h. p. induction motor driving the mixer. This is located near the south portal. All of the material (rock, sand and cement) is hauled up Bush street, dumped into hoppers and then dropped into the mixer automatically proportioned; after being mixed it is fed through the horizontal pipe shown directly in front of the operator and dropped into a large cylinder underground located at the operator's feet. The cylinder is then hermetically sealed (notice the cap just above the ground), and compressed air is turned on into the cylinder and the mixture is "shot" through the 8-inch pipe (shown at the operator's left hand) to any part of the construction work. A better view of the operation is shown in yet another picture. In the lower right-hand corner will be seen the discharge end of the concrete-mixer, and just a little to the left the vertical eight-inch pipe extending on to the arch. The concrete forms are laid to form pockets, so to speak, and the concrete is driven into place wherever the discharge end of the pipe is directed—like "food shot from the mouths of guns," with apologies to "Puffed Rice." When a section of the tunnel is completed, the pipe is merely lengthened for the next section. Just at this writing the concrete is being forced a distance of over one thousand feet (the entire length of the tunnel), there being only one mixing plant.

It is interesting to note that in the average day's run a charge of concrete (sixteen cubic feet) can be mixed and forced in place 1000 feet away by air every two minutes. At a distance of 300 feet, or less, a charge is placed every minute. Air is compressed to 110 pounds pressure, and when everything is working nicely the compressor never cuts off during the work; that is, it is estimated it requires 1200 cubic feet of free air compressed to 110 pounds per square inch to lay 16 cubic feet of concrete 300 feet from the mixer, with no extra labor, and 2400 cubic feet of air at 1000 feet distance.

The contractors, Jacobsen & Bade Company and K. G. Lundstrom, are fast bringing this work to completion, and they deserve great credit for their skillful methods. "Pacific Service" is turning every wheel in the construction work, and our Industrial Department is keeping in close touch with the contractors. When all is completed, it will be a magnificent piece of work, well lighted, sockets being located on both sides twenty-two feet apart, and the lamps will be of sufficient candle-power to make it as "light as day." The architecture of the portals will be a feature of beauty, conforming with the designs of the surrounding and other public buildings that help to make San Francisco such a beautiful city.



Motor-driven concrete mixer used in constructing the tunnel. "Pacific Service" drives the motor.

The Growth of Oakland, as Measured by the Development of the Gas and Electric Industry

Reviewed by one who grew up, so to speak, with the Modern Athens

A MEMORABLE meeting of the Oakland "Pacific Service" Club was that held at the club's headquarters in Moose Hall on the evening of Wednesday, March 25th, when Mr. John A. Britton, our Vice-President and General Manager, addressed a large audience on a subject always dear to his heart—that of the city across the bay from San Francisco that has come to be known as the modern Athens.

Just forty years have elapsed since Mr. Britton began a business acquaintance with the city that was his home during his early manhood, in which he married and raised a family, where he established friendships that have endured through the ups and downs of a busy life, and every stone of whose streets is as a familiar sign to him. For, it was in 1874 that he, as a young lad, entered the service of Oakland's gas company, then a very small concern indeed, and during a period of more than thirty years he remained in that service and grew up with it, rising step by step till he became the company's executive head. His memory holds Oakland's history, in the chronological order of the events that have marked its progress, with an accuracy possessed by few men living at the present time, and Oaklanders love to have him recall it to them.

The "Pacific Service" Club, established by employees of the Pacific Gas and Electric Company in Oakland, is a thriving, up-to-date organization numbering between 300 and 400 members; and its periodical meetings are always well attended. Special features of entertainment are provided for these occasions, and our district manager in Oakland, Mr. Frank A. Leach, Jr., is justly proud of the club spirit so enthusiastically displayed by his followers. On the night of Mr. Britton's address there was an extra large gathering, with a goodly sprinkling of the fair sex. Needless to say our general manager came in for an ovation when he was introduced by Burdette Cornell, the club's president. When it came to his turn he paid back with interest the compliments tendered him.

"The feeling is reciprocal between the 'Pacific Service' Club and myself," he declared. "The club is more than a slogan—it must be more; for if there is not a spirit of loyalty and a love of courtesy behind it, it will be meaningless. In the old days we of the gas company started those principles of efficiency and loyalty which have been handed down until they are behind this great club in this great corporation today. To know how to treat one's fellow man is an art, and you are cultivating it. One of the things I pride myself on is that you are courteous to the purchaser, and give the consumer the benefit of the doubt."

Mr. Britton then launched into his address. One thing that struck the listener with particular force was the list of big names, of men big in California history, that form the roll of the Oakland gas company's presidents down to the time when the company passed out of individual existence and became the Oakland district branch of the great corporation whose slogan is "Pacific Service." Such names as Antoine Chabot, Joseph G. Eastland, Henry H. Haight, W. W. Crane, J. West Martin, John W. Coleman and Daniel E. Martin awaken memories today. Views of Oakland as it was in the '60s and '70s, made from photographs in Mr. Britton's possession, gave additional interest to the reminiscences which made the substance of the lecture.

Mr. Britton spoke extemporaneously, and there is to hand no shorthand report of his address. The following synopsis, however, prepared by himself, touches the high spots in the way of historical interest:

Reading downwards from the top: The old gasworks at the corner of First and Washington streets, Oakland; group of old gas holders at the first Oakland plant; Station "C," Oakland (today); Station "B" and 2,000,000 cubic-foot holder, as seen from the Oakland estuary (today).

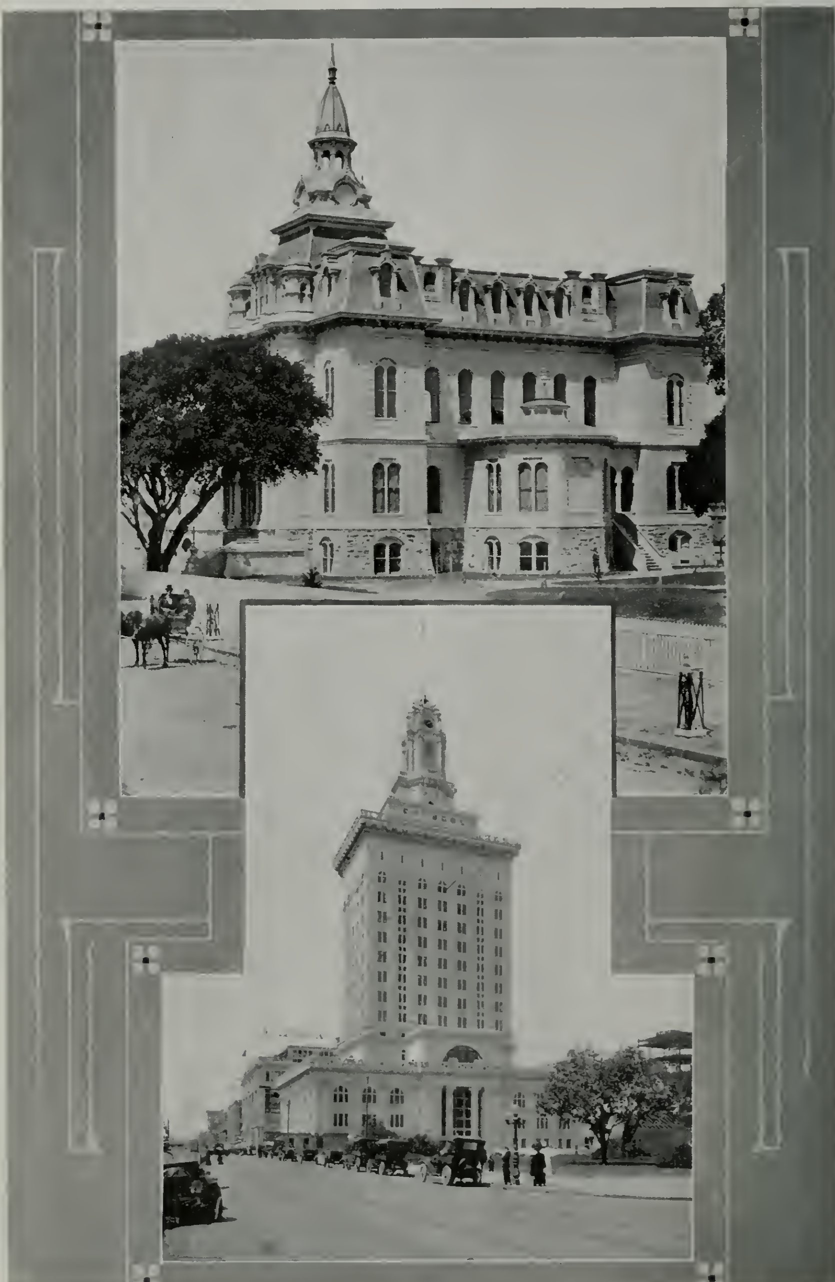
"The introduction of artificial gas into California was first made in the City and County of San Francisco by James and Peter Donahue. A company called the San Francisco Gas Company was incorporated in August, 1852, and the first gas was delivered through mains of the company on February 11, 1854. The rate charged consumers was $15 per thousand cubic feet.

"Associated with the Donahues at that time as a clerk in their employ was Mr. Joseph G. Eastland, who was subsequently made the secretary of the company, which position he occupied for nearly thirty years. In 1865 Mr. Eastland associated with him W. W. Beggs, who was then the engineer of the San Francisco Company, and they determined that the city of Oakland, situated across the bay from San Francisco, was an ideal location for a gas plant. Oakland at that time had a population approximating 2500 souls, and was a part of an old Spanish grant given to Vincente and Domingo Peralta. It was largely an agricultural country, devoted principally to the raising of grain and the pasturing of stock.

"Located on the estuary of San Antonio, which was an arm of the Bay of San Francisco separating the encinal of Alameda from the encinal of San Antonio, were a number of embarcaderos, prominent among which was the one called Oakland, that landing place being at the continuation of what is now Water street and Broadway; one Clinton, which was at the foot of Fourth avenue; and the principal one being Brooklyn, located at the foot of Thirteenth avenue. The produce of the country taken to Oakland was brought to these several embarcaderos for shipment to the larger port of San Francisco, and from each of these points stages took their regular routes to the interior, going as far east as Livermore and as far north as Concord, in what is now Contra Costa County.

"The settlement of Oakland was around the street called Broadway, the principal arteries running west along Eighth street and east along Twelfth street. At Twelfth and Fallon there was a drawbridge crossing the arm of the bay and separating the town of Oakland from the towns of Clinton and Brooklyn. This is now filled in and forms the beautiful Lake Merritt. All of this territory was covered with magnificent oak trees, and, excepting the

The Blake & Moffitt Building, at Eighth and Broadway, Oakland. This was the home of the Oakland Gas Light and Heat Company in 1888.



Old City Hall, Oakland, and the modern structure by which it has recently been replaced, on Fourteenth street, near Broadway, Oakland.

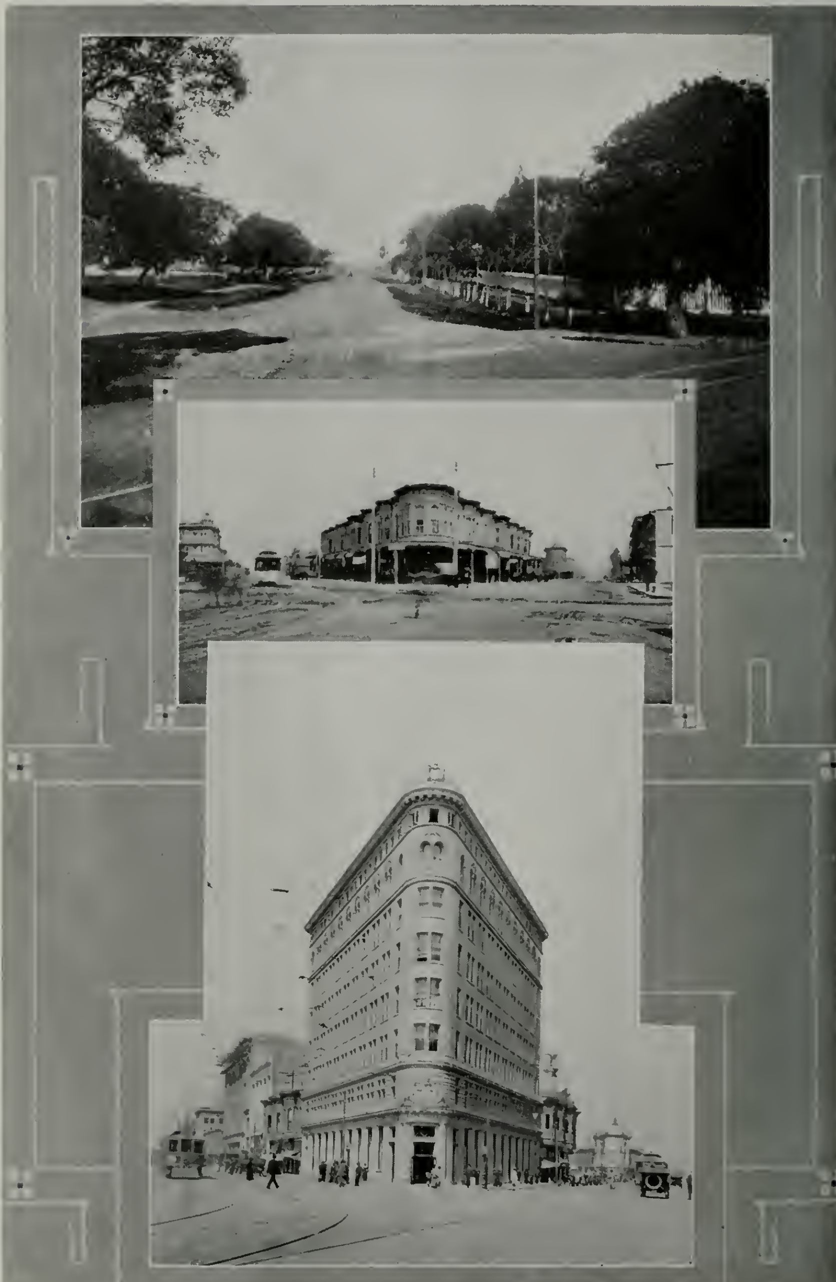
The Tubbs Hotel, East Twelfth street, between Fourth and Fifth avenues; destroyed by fire in 1893.

two highways mentioned, up until 1860 no streets were regularly laid out. On December 8, 1865, the city council of Oakland granted to Joseph G. Eastland and W. W. Beggs a franchise to erect a gasworks and use the streets of the city for the purpose of laying down pipes to supply the city and its inhabitants with artificial gas. On June 12, 1866, the Oakland Gas Light Company was incorporated with a capital of $150,000, and the directory was formed of the following named: Antoine Chabot as president, Joseph G. Eastland as secretary, and W. W. Beggs. On September 1, 1866, property fronting on First, Second and Washington street was purchased for the sum of $3,300 and work was immediately started on the building of the gasworks. In October, 1866, Mr. Chabot resigned as president, and Mr. Eastland was elected in his place. In November, 1866, Mr. Henry Adams was elected superintendent of the company at a salary of $125 per month.

"The first works built consisted of two benches of three retorts each, gas being made at that time from the only known process, namely, the coal gas process. A holder with a capacity of 10,000 cubic feet was erected. The outlet connections to the street were four inch, and mains were laid on Second street to Broadway, south on Broadway to Water street, east on First street to Franklin, northerly on Broadway to Twelfth Street, and westerly on Eighth street to Jefferson. On December 1, 1866, gas was served to the people of Oakland through the mains mentioned, and the total number of consumers then supplied was fifteen, namely:

"Hotel de France, First and Broadway.

"D. Ghirardelli, corner Second and Broadway.



Reading from the top downward: (1) The corner of Broadway and San Pablo avenue, Oakland, as it looked in the early 70's; (2) the same ten years later; (3) the same today. First National Bank Building.

"Peter Baker, Sixth and Broadway.

"Washington Brewery, Sixth and Broadway.

"Donnell's Restaurant, Seventh and Broadway.

"St. John's Church, Seventh and Broadway.

"F. W. Dorman & Co., Seventh and Broadway.

"Catholic Church, Eighth and Jefferson.

"Col. Woods, Eighth and Jefferson.

"Oakland Brewery, Ninth and Broadway.

"Jacob Letter, Ninth and Broadway.

"N. Rosenberg, Broadway between Ninth and Tenth.

"Mr. Spruance, corner Eighth and Clay.

"On February 23, 1867, a contract was made with the city of Oakland to light certain streets with gas, and the rate obtained for the same for lighting until twelve o'clock each night, by means of a lava tip burner consuming four cubic feet of gas per hour, was thirty cents per lamp per night, the light being of sixteen candle-power.

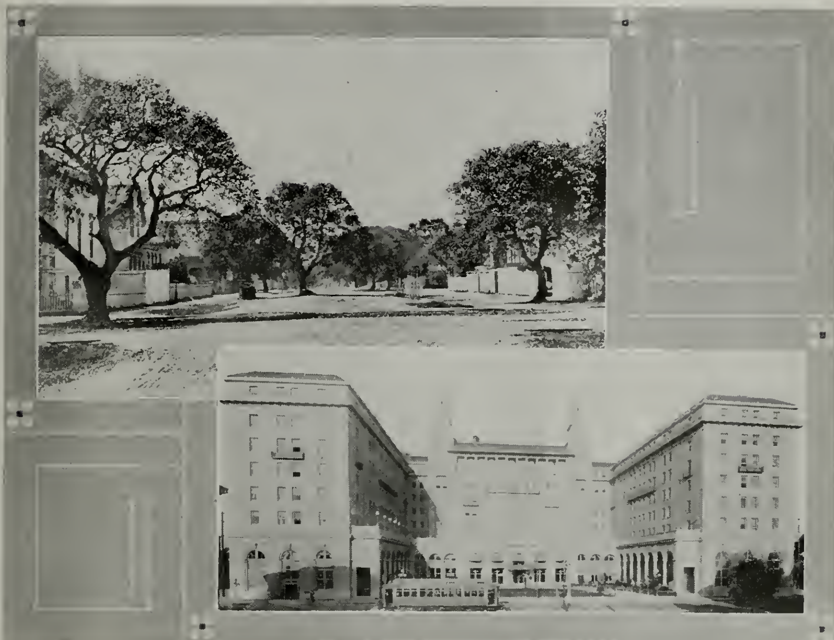
"Today gas lamps burning all night and giving one hundred and fifty candle-power cost but eight cents per lamp per night.

"On April 18, 1867, H. H. Haight, who afterwards became governor of California, was elected president of the company. In July, 1867, Van L. Eastland was elected superintendent to succeed Mr. Adams, who was transferred to Stockton, gasworks having been established there by Mr. Joseph G. Eastland and Mr. Freeborn. Mr. Van L. Eastland remained superintendent of the company until his decease in September, 1895.

"Among the men not so far mentioned who ruled as presidents during the period of the company's growth were: W. W. Crane, who also served the city of Oakland as mayor; J. West Martin, the banker, also mayor of Oakland in his turn; John W. Coleman, the miner, who also was president of the San Francisco Stock Exchange, and Captain Daniel E. Martin, the San Francisco banker. James Moffitt, father of Dr. Herbert Moffitt and Mr. James K. Moffitt, of San Francisco, was a director of the company.

Southern Pacific depot at Broadway and Seventh street, Oakland, in 1874.

Upper picture: Looking east on Twelfth street from Broadway, Oakland, in 1868.
Lower: The Oakland Bank of Savings, the corner of Twelfth and Broadway, today.



The corner of Thirteenth and Alice streets, Oakland, as it looked in the early 70's.
The Oakland Hotel occupies the site today.

"In 1872 property adjoining that first acquired, and fronting on First street and occupied by Captain Wall as a residence, was purchased by the company and the residence transformed into an office building.

"The average daily output of the plant for the year 1867 was 5000 cubic feet of gas. This may be contrasted with the average daily output in 1913 of approximately 7,000,000 cubic feet.

"At the close of 1867 there were sixty consumers of gas; at the close of 1913 there were 60,000.

"In September, 1877, the gas mains of the company were extended to the city of Alameda, the mains running along First street to Webster, and by a submerged pipe across the estuary at that point, thence along the causeway to Clement avenue and to the location of the present holder in the city of Alameda.

"In January, 1874, the first dividend on the capital stock was paid of twenty-five cents per share per month on 10,000 shares then issued.

"In January, 1875, there was purchased from the Ghirardelli estate block No. 3, bounded by First, Second, Grove and Jefferson streets, where are now located the present company's holders, compressor plant and purifiers.

"In July, 1878, the capital stock of the company was increased to $3,000,000, and on the same date the office was moved from the works on Second street to Ninth street, just east of Broadway. The gross revenue from sales of gas for the year ending July 1, 1878, was $181,122.44, and there were at that time 46 miles of mains laid and 1801 consumers served, the total output of gas being 44,250,000 cubic feet for the year—an average of 120,000 cubic feet per day. The price of gas during that year was $4 per thousand.

"In December, 1878, Twelfth street,

from Broadway to Harrison, was lighted with gas for the first time. In August, 1879, the first installation of gas stoves was made, these being stoves manufactured in England and known as the Fletcher stove. This marked the first use in California of gas for heating and cooking.

"In December, 1880, the Lowe process of water-gas manufacture was installed. It was the forerunner of the present oil gas process. Anthracite coal from Pennsylvania, with California crude oil, which had just then been discovered, being the fuel used.

The late Joseph G. Eastland, president and secretary, 1866-1895.

"March, 1881, discussion was had as to the advisability of installing electric lighting in the city of Oakland, but as it had not then reached a state of perfection the subject was dismissed, with the following comment contained in the minutes of the board of directors: 'The glow tamp is in an unfinished state, and will probably never be a direct competitor of gas for general lighting.

"About this time there appeared an itinerant pedler who had erected on a threshing machine platform a brush arc dynamo of ten lights capacity, which he

The late Henry Adams, first superintendent of the Oakland Gas Company, 1866-1867.

The late Van Leer Eastland, superintendent, 1867-1894.

set up on the public square on Broadway between Fourth and Fifth, and between Broadway and Franklin, and operated for a few nights this wonderful light. He tried to sell stock in a company that he was forming, but nobody apparently had confidence in the lamps and the project fell through.

"In September, 1882, the gas offices were moved to the southeast corner of Ninth and Washington streets.

"In September, 1885, the first high-pressure distribution of gas of which there is any record in the world was made from the gas plant at First and Washington streets to the holder in Alameda, a pressure of five pounds being used on the line and a delivery obtained of 4000 cubic feet per hour at the holder in Alameda.

"On January 1, 1885, the first electric lighting plant in Oakland was operated. This consisted of a 150 H. P. Thompson slide valve non-condensing engine, a battery of return tubular boilers and three 25-light arc machines, housed in the building at Second and Washington streets, now used as a warehouse.

"In June, 1888, the offices were moved to 904 Broadway.

"In September, 1888, a Westinghouse alternating machine of 1300 light capacity was installed and a new plant erected on the corner of First and Grove streets, where is now located Station 'C,' this plant being abandoned in 1909.

"In February, 1892, a holder, called Holder No. 7, was built on the lot on the corner of First and Jefferson streets.

"October 8, 1892, the cornerstone was laid for a new office building, at the corner of Thirteenth and Clay streets. In September, 1893, the company entered into occupancy of its new building, and 'Pacific Service' is housed there today.

"From 1892 to the present time the progress of the Oakland Gas Light & Heat Company has kept pace with the constantly growing advancement of both Oakland, Alameda and Berkeley.

Broadway, Oakland, from the railroad station, north, as it looked in 1874.

The old Grand Central Hotel, Oakland, destroyed by fire in 1880.

In the year 1903, Messrs. John Martin, Eugene J. de Sabla Jr., and R. R. Colgate, representatives of the California Gas and Electric Corporation, which had been formed to take over the operating hydro-electric companies in the north-central part of the state, approached the officers of the Oakland company and after some negotiations purchased the property of the company, and it has since been operated as a subsidiary company of the California Gas and Electric Corporation.

"Commencing in 1906, Oakland began to take tremendous strides in population and in business activity. From a little village, which I spoke of in the beginning as having a population of 2500 people, it has risen to a metropolis of over 200,000 people, and the territory supplied by the Oakland, Alameda and Berkeley districts represents a total of over 300,000 people.

"The one particular thing which has marked the Oakland company ever since its organization has been the loyalty of spirit displayed by the employees to the management. This dates from the time when there was but one bookkeeper, one clerk and statement taken, and four men manufacturing all the gas required for the city, down to the present time when more than 600 persons are in the employ of the company. The Oakland company has been pointed out very many times as one that adopted the policy of consideration, not only for its employees but for the consumers themselves. Its reputation in that respect is world-wide, and I am glad to be able to say that the policies instituted by me during my incumbency as the responsible head of that company have since been carried out in the fullest measure by your present manager, Mr. Frank A. Leach, Jr."

Mr. Britton took especial pride in the fact that Oakland had displayed unusual prominence in other directions of development. One marked illustration of this is its street-railroad system, a phase of development in which Oakland is credited with having shown more of the real progressive spirit than any other city in the northern section of California. It was about 1867 that the first street railroad was started in Oakland. It began at Seventh and Broadway and ran out to the old Tubbs Hotel already mentioned. From that date there commenced the building up of a system of urban and interurban lines, operated at first by cable process and until that process came to be replaced by the more modern electric motive power. In this, too, Oakland showed prominently to the front, for it was certainly one of the first, if not the first Western city to operate its street railroad system with electricity. Another matter to which Oaklanders point with pride is that in 1869 their beloved city was brought into the world's notice by being made the western terminus of the first transcontinental railroad. These are all milestones upon the road of Oakland's progress and, as such, are features of Mr. Britton's vast collection of reminiscences.

At the close of his lecture Mr. Britton showed upon the screen views of the old city of Oakland as it existed from 1874, the date when he first began employment with that company, down to the present time. The earlier views showed Broadway an unpaved street, with no street cars and no poles on the street. The corner of Fourteenth and Broadway (where is now the First National Bank building) was shown as a lot covered with oak trees and fenced with a picket fence. Old pictures of the gasworks now entirely dismantled, and various additions to plants during the years, leading up to the present thorough equipment in gas and electric stations, were fully set forth.

Present at the lecture were many of the men who for the last forty years have been companions with Mr. Britton in his management of the company, and it was noticeable with what ardent enthusiasm they greeted the pictures displaying scenes of their earlier activity.

It is perhaps more true of the Oakland company than of any other company in the list of the Pacific Gas and Electric Company, that it possesses more of the older men who have seen long service and who by reason thereof are instrumental in creating in the minds of those under them that strong feeling of loyalty before spoken of and devotion to the company's interests, sentiments that go a long way toward making any successful enterprise.

Readers of "Pacific Service Magazine," Take Notice!

The present issue is the last of Volume V, and, as was done with previous volumes, each district and division will be supplied with one bound copy for the office library.

Those who have all copies of Volume V, or any previous volume, in good condition, may have them bound by forwarding them, charges prepaid, to the Stationery Department, on or before June 20th.

The charge for binding will be sixty-eight cents. If the book is to be delivered outside of the Company's offices or stations in San Francisco there will be an additional charge to cover postage.

Collection will be made upon delivery of the bound copy. Packages containing magazines should be addressed:

Stationery Department, PACIFIC GAS AND ELECTRIC CO.
445 Sutter Street, SAN FRANCISCO

Name of sender with full and complete address must be plainly marked on each package.

No magazines will be accepted after June 20th.

The Importance of Good Order on Working Premises

ONE of the most important elements in accident prevention is system, or good order, on the working premises. Safety experts call this "good housekeeping," and say it means "providing a place for everything and the keeping of everything in its place."

In a report just made by the Independence Inspection Bureau of Philadelphia on the San Francisco and Oakland properties of "Pacific Service," considerable space is devoted to this subject. It is pointed out that bad order and lack of system not only directly produce accidents, but that they indirectly cause workmen to be careless and to bring accidents and injuries upon themselves.

For example, it is shown that injuries always follow in a certain ratio from leaving loose materials overhead in insecure places; from leaving loose or dangerous materials under foot; from the insecure piling of material; from the storing of material and tools in such a way as to make them obstructions in the way of workmen; from allowing nails to protrude from rubbish and other loose material; from allowing nails or bolts to protrude or project from walls or posts or uprights, or from bags or barrels used for storage; from allowing metal about with ragged edges, and from allowing oil drippings on floors.

The Inspection Bureau advises that:

"Each plant should be given a thorough inspection periodically, once a month or less, and that housekeeping should be considered of enough moment to warrant immediate attention, and that violations of housekeeping rules should always be a subject for discipline.

"New construction and repair work generally introduce a number of hazards due to poor housekeeping, and special attention should be paid to the men doing this work.

"Men working above the ground where other men may pass beneath them should be especially careful of their tools and materials. It is customary when removing bolts, nuts, etc., from apparatus to throw them carelessly on the floor, on the flanges of apparatus, or on the structural members, where they are left indefinitely. Means to prevent this practice should be taken, both in the way of education of the men and by providing devices and equipment which will necessarily encourage carefulness. Workmen should be required to carry light boxes with handles or baskets, and to keep their tools, bolts and other small materials in these boxes at all times, and remove the boxes when the job is completed or work is temporarily suspended.

"This will undoubtedly work toward economy, both of time and material, and is very important from the standpoint of safety."

In electric station "A," San Francisco, the Inspection Bureau found housekeeping conditions unusually good. It was pointed out, however, that a new turbine was being installed at the time the inspection was made, and that "the equipment and methods used by the construction men brought in from the outside were not equal to those used by the regular employes." These men and methods were described as introducing a new and additional danger. The suggestion was made that contracts for work of this kind in the future should carry with them very specific and strict rules in regard to these matters.

In one of the electric stations in San Francisco the Inspection Bureau found that construction men had thrown materials in the basement, and that station men had swept papers, dirt and rubbish into the same place. Dirt and papers cover boards with projecting nails, and offer obstructions over which men in a hurry sometimes trip and fall. "A thorough housecleaning and better housekeeping" were strongly recommended.

In another San Francisco station where the inspection was made on Sunday, and where construction work was going on, it was found that "although the gang was not working on that day, much material was lying around loose on the galleries in such a way that it might have been "kicked or knocked off on the floor below, injuring workmen and perhaps short circuiting some of the circuits back of the switchboard."

In one of the gas stations in San Francisco a scaffolding on the top of a bank of boilers was found with nails projecting upright in such a way that men might step upon them. Other nails were also found projecting downward through the scaffolding in such a way that a man's head and shoulders might be ripped open on them. Loose material was found on top of a gas holder, and in other high places, from which it might fall and do serious injury. In another station pipe fittings, short pipe, blocks of wood and loose sticks were found on a holder platform.

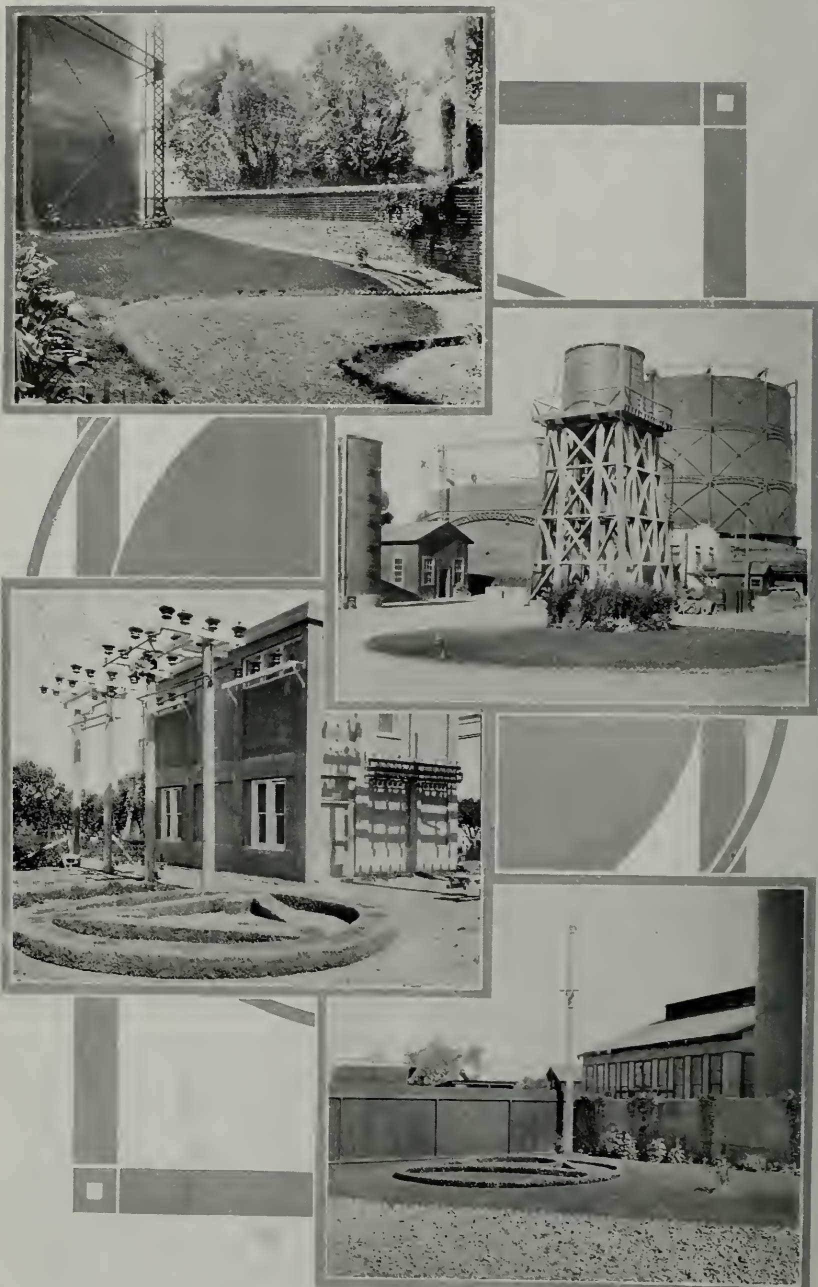
In the Oakland gas plant, housekeeping in several parts of the yard and on the tops of generators was reported bad. Among other things, hammers, wrenches, ropes, boards, bricks, wood blocks and bolts were found on the upper platforms of the generators. These materials were reported likely to be knocked down on to the heads of workmen below unless they were removed. At this station "clothing and lockers were found in many places, including the boiler room." As it is commonly admitted to be "good practice to keep as many men as possible out of the boiler room," the recommendation was made that these lockers be located elsewhere.

In the store room in the Oakland District, it was noted that "there was need for window washing." Some places were described as "unnecessarily dark on that account." Men can't work safely in dark places. "There were nails in boards on the ground and on the floor. This condition is frequently found in store rooms, but the number here was unnecessarily large. There were also nails projecting from the walls at various places, and as many of them were of the height of a workman's eyes, there was danger of serious eye injuries."

In an auto repair shop in the Oakland District, where the inspection was madė on Sunday, "there were a number of boards lying on the floor containing projecting nails." As the Inspection Bureau put it, "attention should have been paid to the housekeeping before the men left on Saturday afternoon.

In one of the substations in the Oakland District, where inspection was also made on Sunday, the gate to the station was found unlocked. "Owing to the location of the switch room in this station, it would easily have been possible to spend considerable time in the basement without having been noticed. Children or others could, of course, do this as well. Inasmuch as there is considerable high tension apparatus in the basement within easy reach," the recommendation was urgently made that the gate be kept locked.

J. P. C.



Beautifying the San Jose district. Reading downwards, the views are: Garden of the San Jose Gasworks; another view of same; Mountain View substation; a corner of the yard, San Jose Gasworks.

Jottings from Districts and Divisions

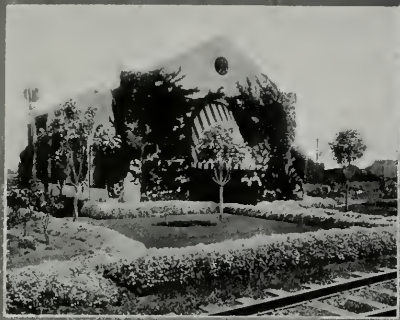
THE idea of beautifying plants, sub-stations and other habitations of "Pacific Service" throughout its territory has taken hold to considerable extent, and there is quite a rivalry among district managers and superintendents in the way of garden plots, shrubberies and wall decorations, with all manner of floral and arboreal designs.

The administration is encouraging just this kind of rivalry, and only a little while ago word was received from the president's office that the palm for decorative effect had been awarded to Mountain View sub-station, its principal feature being a reproduction of the "Pacific Service" trademark in evergreens. Mr. Britton now announces, however, that he thinks Mountain View sub-station has been eclipsed by the San Jose gasworks. Our publicity manager traveled to both places the other day and took some pictures, which are reproduced here. It will be seen that with a little care and attention even the most cumbersome, not to say naturally unsightly, structures can be set off in such manner as to turn them into veritable show-places.

District managers and superintendents, please take notice: You are invited to put your shoulders to the wheel and see what you can do in the way of landscape gardening effect which will call world-wide attention to your surroundings, whether they concern the output of gas or of electricity.

Mr. John D. Kuster points with pride to the fact that both Mountain View sub-station and the San Jose gasworks are within the limits of the district he calls his own. Also, he is not loath to acknowledge a similar truth concerning the Peninsula Railway Company's sub-station at Los Altos, for the operation of which "Pacific Service" supplies the power. There are, in fact, many beautiful spots in Mr. Kuster's district, which is quite extensive and takes in the incorporated towns of San Jose, Santa Clara, Los Gatos, Mountain View, Sunnyvale and Alviso, to say nothing of the unincorporated towns of Milpitas, Saratoga, Campbell, Cupertino, Berryessa, Ever-

View of the palm avenue leading to grounds of Agnews asylum.



Peninsular Railway Company's substation at Los Altos.

Los Gatos, from Glen Ridge.

green, Edenvale, Coyote, Los Altos, and Agnews.

Views are here presented of two important enterprises in the district—one the Agnews Asylum, the other the plant of the Western Grain and Sugar Products Company, whose main office is in San Francisco but whose factory is at Agnews.

This latter is a remarkably active concern. Its business is distilling alcohol principally from waste molasses from beet-sugar factories and cane-sugar refineries. The alcohol is used for drugs and blending purposes, also in the manufacture of denatured alcohol. It is run entirely by local French capital and is a large patron of Uncle Sam, for, with its output of 4000 barrels per month, it pays the United States government something like $3,500,000 a year; and Uncle Sam likes its trade so much that he keeps about eight storekeepers and gaugers on the premises, who live there all the time and are occupied measuring the raw material going into the plant, estimating the quality of alcohol produced, etc. The factory grounds take up seventy-five acres and some eighty men are employed. The same people also operate an animal feed-plant at Crockett, where they turn out a composition made from molasses and alfalfa.

There are 110.5 miles of gas mains in San Jose district, 370.9 miles of overhead electric distribution system and 1.1 miles of underground distribution system. On March 21, 1914, the town of Alviso was supplied with service for light and power. This is probably the smallest incorporated town in the United States, having a total population of 496 people. Its incorporation dates back to 1852. The population served by the San Jose District is about 60,000.

In this connection, it is worthy of note that the towns of Sunnyvale and Los Gatos, the former on April 13th and the latter the following day, decided by popular vote to hand over the control of the public utilities operating within their limits to the State Railroad Commission.

The Fresno District is now equipped with up-to-date conveyance vehicles, using electric and gas trucks and motorcycles. Last month they disposed of all their horses and wagons and replaced them with two Ford delivery wagons. The present equipment consists of three electric trucks, two Ford delivery wagons and five motorcycles. It is found that this improvement aids their work in point of speed and efficiency.

A banquet of almost unique character was held in Santa Rosa April 30th, when officials of the various public utility corporations operating in the city got together and organized a permanent association of the real get-together order.

Mr. W. W. Von Tillow, manager of the local office of the Pacific Telephone and Telegraph Company, presided, and various representative men responded to toasts, including: Mayor Charles E. Lee, who spoke on "The Men Representing the Corporations"; Mr. B. M. Levy, Great Western Power Company, on "The Public—How We May Serve Them"; Mr. Fred L. Wright, California Telephone and Light Company, on "Corporations and Their Debt to the State Railroad Commission;" Mr. C. Cumbers, Standard Oil Company, on "The Loyalty of Public Utility Corporations to Their Employers"; and, last but not least, our own Maitland G. Hall, district manager of "Pacific Service," who waxed eloquent upon "Why I Can't Talk."

The menu was characteristic of the occasion. It consisted of: "Juice" (All Wright); Oysters a la "Stone"; "Western Union" salad; Soup, a la "City Water and Standard Oil"; Filet of sole, au gratin, fresh from "McDonald" reservoir; "P. G. & E." juice (Vino Blancho); Scalopini (talk) a la Von Tillow; Raviolo and new peas; "G. W. P." juice (Vino Rosso); Spring chicken just "Hatch" (ed); Artichoke mayonnaise; Zabuion and cake; demi tasse; "Northwestern Pacific" smokes, freight (cigars), passengers (cigarettes). It was voted a most successful gathering.

Although "Pacific Service" has made it a practice for many years to pay for all hospital and medical care necessary to rehabilitate its injured workmen, expressions of appreciation have not been frequent. For that reason, two letters recently received by the Claims Department are of especial interest. One, addressed to the manager of the department by E. C. Johnson, superintendent at Marysville, injured on December 31st, says: "This is to advise that Dr. Thorne examined my leg and found it getting along exceptionally well, and that with plenty of exercise and massage treatment, I will soon be able to make it perform its former duties."

Mr. Johnson concludes with his thanks "for the very kind and careful attention" he received, and with the assurance that he "will have a lasting remembrance" of the Company's kindness to him.

The other letter, from J. V. Kyle, foreman in the Solano District, reads as follows:

"On February 21st, while unloading poles from a car in Dixon, I sustained an injury to my left knee due to car stakes breaking, thus allowing part of the load to shift, report of which has been turned in in the regular course.

"I wish to thank the Company through you for the kind attention, medical aid and all other aid furnished me during my disability."

Contracts have been awarded to the Westinghouse Company for motor-generator sets of an aggregate capacity of 6000 K. W. to be delivered in San Francisco before July 15, 1914, and to be installed for the operation of new municipal street-railway lines now under construction.

"Pacific Service" is already supplying electric power to the Geary street line, which forms the nucleus of San Francisco's rapidly expanding network of municipal street railways. The gross revenue to the company from the municipal lines already in operation is about $75,000 per annum, and this figure should be increased to more than $200,000 by the close of this year. At the present time "Pacific Service" supplies the power for the operation of 639 miles of city and interurban electric railways, being more than 47 per cent of all such lines in operation in central and northern California, including the Southern Pacific Company's lines in and about San Jose, the Oakland Traction Company, the Northern Electric Railway Company and others.

Our "Pacific Service" Record for 1913

The regular annual meeting of the stockholders of the Pacific Gas and Electric Company was held at the office of the company at No. 445 Sutter street, San Francisco, on the afternoon of Tuesday, April 14th. The following Board of Directors was elected to serve for the ensuing year:

Frank B. Anderson, Henry E. Bothin, John A. Britton, W. H. Crocker, F. G. Drum, John S. Drum, F. T. Elsey, D. H. Foote, A. F. Hockenbeamer, John D. McKee, C. O. G. Miller, Geo. K. Weeks, all of San Francisco; Wm. G. Henshaw, Oakland; J. E. Gladstone, New York; Samuel Insull, Chicago. The following officers were re-elected: F. G. Drum, President; John A. Britton, First Vice-President and General Manager; A. F. Hockenbeamer, Second Vice-President and Treasurer; J. E. Gladstone, Third Vice-President; D. H. Foote, Secretary and Assistant Treasurer; Jos. C. Love, Assistant Treasurer; Chas. L. Barrett, Assistant Secretary; M. K. Parker, New York, Assistant Secretary.

The following comparative statement of earnings and expenses for the years 1912 and 1913 was presented:

	1913	*1912*	*Increase*
Gross Earnings........	$15,869,006	$14,473,526	$1,395,480
Maintenance, Operating, and General Expenses and Taxes..........	9,331,207	8,431,562	899,645
	$ 6,537,799	$ 6,041,964	$ 495,835
Add— Profit on Merchandise Sales and Miscellaneous Income.......	333,331	271,126	62,205
	$ 6,871,130	$ 6,313,090	$ 558,040
Deduct— Interest on Funded and Floating Debt......	3,902,045	3,568,943	333,102
Balance............	$ 2,969,085	$ 2,744,147	$ 224,938

The following analysis of the year's business was prepared for the meeting by Mr. A. F. Hockenbeamer, Second Vice-President, Treasurer and Controller. Mr. Hockenbeamer has now on the press his annual report for the year 1913-14 and this will be dealt with in our next issue:

"The gain in gross earnings of $1,395,480 is extremely satisfactory, particularly when compared with the gain of only $140,042 in 1912 as against 1911 and indicates the recovery during the past year from the voluntary rate reductions which adversely affected the 1912 results by more than $1,000,000.

"The new business was well distributed over all departments, $558,211 of the increase having come from sales of electricity; $741,730 from sales of gas; $25,725 from street railway operation, and $69,815 from sales of water, etc. Miscellaneous income also increased $62,205.

"Total net income increased $558,040, notwithstanding increased taxes of $53,194 and the inclusion in operating expenses of the extraordinary expenditures incurred by reason of the strike which began in May and hampered the Company's operations for several months.

"During the year the Company invested $10,247,889 in plant additions, a large portion of which was absorbed in the new hydro-electric developments on the South Yuba and Bear Rivers, the first unit of which, comprising 33,333 horsepower, was brought into operation towards the close of the year and which it is anticipated will enable the Company to make substantial addition to its net revenues in 1914. Other important construction work during the year in addition to the usual extensions and improvements was the completion of a new steam turbine station at Sacramento of 5,000 K. W. capacity; the addition of a 15,000 K. W. turbo-generator at Station "A," San Francisco; the completion of a new four-story reinforced concrete office building in the city of Sacramento; the installation of two additional 6,000,000 gallon pumps for the domestic water supply system at Stockton; and the construction of new gas holders at Richmond and Marysville.

"From Jan. 1, 1906, to Dec. 31, 1913, a

period of eight years, the Company has made a cash investment of $38,481,177 in plant additions.

"The increase of $333,101 interest charges was brought about by the extensive addition to the Company's properties in 1913, many of which have not yet contributed their full quota to the earnings.

"There was 2,948 stockholders of record at the close of the year, and, including bondholders, it is estimated there are 17,000 owners of the Company's securities.

"349,417 consumers were connected to the Company's lines at Dec. 31, 1913, a gain during the year of 28,325.

"In the electric department the connected load during the year increased by 56,108 horse-power, making a total at the close of the year of 425,783 horse-power.

"Sales of gas increased 739,000,000 cubic feet, making the total sales for the year 7,430,000,000 cubic feet.

"The total length of the Company's electric transmission and distribution system was 5,090 miles and its gas distribution system comprised 2,374 miles of mains.

"The Company's gross revenue comprised 36% of the gross revenue of all gas and electric utilities operating in the State of California.

"The aggregate of the Company's payrolls in California in 1913 was $6,955,817, as against $6,157,528 in 1912; and the average annual compensation per employee in 1913 was $1,026 as against $1,008 in 1912."

"Pacific Service" Section, N. E. L. A.

There was an excellent attendance at the regular monthly meeting of this section, held on the evening of Wednesday, April 15th, at headquarters in the Engineers' Club, San Francisco. The special feature of the proceedings was a series of talks by members of the Steam-Electric Department upon the generation of electricity by steam and the distribution of steam for domestic uses, taking in, also, the early development of the steam engine.

Our Mr. Frank H. Varney, engineer in charge of the Steam-Electric Department, delivered an interesting address upon the working of the steam turbine and its efficiency in modern central station work. He showed some views illustrative of "Pacific Service" in the turbine line, principally at station "A" in San Francisco and at station "C" in Oakland; in addition to these he showed views of the principal stations of the Commonwealth Edison Company at Chicago, in whose equipment the steam turbine plays a leading part.

Mr. J. H. Godbold, engineer of steam distribution, Oakland District, discoursed upon the methods employed in the distribution of steam for domestic purposes. Mr. C. H. Delaney, assistant engineer of the Steam-Electric Department, read a paper covering the early development and uses of steam, illustrated by some interesting slides.

Members of the section are hereby advised that at the next meeting, May 20th, the report of the nominating committee will be received and a new board of officers and executive committee elected for the ensuing twelve months. A large attendance is looked for.

Pacific Service Magazine

PUBLISHED IN THE INTERESTS OF ALL EMPLOYEES OF THE PACIFIC GAS AND ELECTRIC COMPANY

JOHN A. BRITTON - - - - EDITOR-IN-CHIEF
FREDERICK S. MYRTLE - - MANAGING EDITOR
A. F. HOCKENBEAMER - - BUSINESS MANAGER

Issued the middle of each month.
Year's subscription $1.50
Single copy .... .15

Published by the
PACIFIC GAS AND ELECTRIC COMPANY
at 445 Sutter Street, San Francisco

The Pacific Gas and Electric Company desires to serve its patrons in the best possible manner. Any consumer not satisfied with his service will confer a favor upon the management by taking the matter up with the district office.

VOL. V. MAY, 1914. No. 12

EDITORIAL

Under the heading "Our Garbage Fiasco; a Shocking Example of Inefficiency in Municipal Service," the San Francisco "Chronicle," in its issue of May 2nd, editorializes somewhat strongly upon conditions that have arisen with regard to San Francisco's proposed municipal garbage reduction system.

"The objection to municipal ownership and operation of public utilities is not, as claimed, a desire that individuals may profit by private ownership, but the moral certainty that the public will lose by municipal operation," says the newspaper. "The condition of our municipal garbage reduction enterprise is a shocking example. The people voted some hundreds of thousands of dollars of bonds for the construction of incinerators, on the promise of the authorities that when in operation it would be unnecessary for householders to pay anything for the removal of garbage, as the city could afford to collect it free.

"The bonds were sold. We bought the land and plant of the private company for $400,000, which we now find to be worth not over $100,000. Private operators do not make such bargains. Certainly the owners of the property which the city bought made no such fool trade, but, on the contrary, unquestionably made a very neat thing on their turnover.

"The money voted for two incinerators has provided for one plant, which does not, however, incinerate, and, before we can get another, we must dig up from some source $200,000 more, and cannot get more than half of it out of the property we bought for $400,000. Meanwhile, a man, who says he knows, tells the authorities that if they ever get the destructor to destroy, the city will be out of pocket $2 for each ton of garbage handled, while he is ready to take all the garbage which may be delivered to him and handle it without any cost whatever to the city.

"And the householders are still regularly paying the scavengers for taking away their garbage."

This is not the first time that the attention of the people of San Francisco has been called to the unsatisfactory result of this attempt in the direction of municipal ownership and operation. Nearly four years ago the "Call" had an article upon the subject, directing attention to the fact that upwards of four years previous the electors of the western metropolis had voted bonds in the sum of $1,000,000 for the construction of this municipal garbage system, and pointing out that to date the only evidence of the system consisted of a graded lot on the Islais Creek site, $132,066 paid out in interest on bonds, announcement that the two plants would have a total capacity of 240 tons daily—less than half of the city's garbage accumulation—and the promise that one of the two plants would *probably* be ready for service some time before the end of the year or early in the following year. Said the "Call":

"The plants so far show that the cost will be double the estimate, and that the city will get a system of 240 tons' capacity instead of 700 tons' capacity, and that another bond election will be necessary to bring the system up to the capacity required for the city. * * * The only thing in the project which has been progressing regularly—and with painful regularity at that—is the payment by the city of the annual interest of 5 per cent on the $848,000 of the bonds sold."

Several public citizens were quoted upon this subject at the time, notably Supervisor Henry Payot, who attributed conditions to criminal negligence; Assistant City Engineer T. W. Ransome, who talked of red tape, and former Assistant City Engineer H. D. H. Connick, now chief of construction of the Panama-Pacific Exposition, who laid the blame to tardiness in furnishing machinery plans.

Under the circumstances we may be excused, perhaps, for repeating here the observations we offered in the August, 1912, issue of Pacific Service Magazine and which were prompted by the publication of the article in the "Call" referred to. They were to this effect:

"This case is one of many which have been called to the public notice since the municipal ownership craze started. It is not calculated to encourage further efforts in this direction, though the professional agitators keep insisting that no up-to-date municipality can be considered free and enlightened until it is invested with the ownership as well as the control of its own public utilities."

England appears to be involved in almost inextricable difficulties over her national telephone system. Following is an excerpt from an article upon the subject which appeared in a recent issue of the London Electrical Review:

"The British public, having now possessed its very own telephone service for some eighteen months, is awakening. It has dawned upon the intelligence of John Bull that perhaps, after all, national ownership is 'not all that it's cracked up to be,' and that expert management in the hands of a highly developed commercial and technical staff is not so detrimental to the public welfare as he has been told. Indeed, we fancy he would gladly find himself once more within the greedy clutches of the devouring telephone trust, which he has just recently succeeded in parting from its ill-gotten gains under conditions which, if suffered by himself, he would have characterized as extremely unfair.

"Last week the growing popular irritation was voiced by the London Chamber of Commerce, which sent a deputation to interview the postmaster-general on the subject of the injustice of the contracts with subscribers and the inefficiency of the service. Mr. Samuel admitted that the service was not all that could be desired—an admirably diplomatic way of putting the best face on the matter. He also detailed the sums of money that he was spending and would spend on the system, and expressed most praiseworthy views regarding the importance of efficiency rather than cheapness; but kind words butter no parsnips, and much as we respect and admire Mr. Samuel, who has done his best and deserved well of the country, we cannot accept his soft answers as compensation for the deficiencies of the telephone service.

"In London alone, he said, there were one million calls a day—and this he gave with charming inconsequence as a reason why subscribers should accept without question the postoffice record of the number of their calls! He proceeded to say that the number of calls that were ineffective, owing to the lack of sufficient junction lines, was extremely small—less than one-half per cent. But one-half per cent on a million is no less than 5000 calls a day wasted through this cause alone, to say nothing of the others—is not this a serious matter?"

In connection with the foregoing it should interest our readers to know that we are preparing to spend approximately $1,000,000 in improvements in the San Francisco district alone. These improvements include material additions to our electric sub-station equipment, and, on the gas side, extensions of mains and some important new construction work.

Out here a public service corporation is a public servant and must be ready when the public calls. Excuses avail not.

Items From Women of the Company

This section of PACIFIC SERVICE MAGAZINE *is open to any of our women employees who may desire to contribute notes on persons and events. The following have accepted appointment as contributing editors: Miss Letitia A. Curtis, Engineering Department, Hydro-Electric Section; Miss Bertha J. Dale, Auditing Department, San Francisco District.*—Editor PACIFIC SERVICE MAGAZINE.

IT was with sincere regret that we noted the death of John J. Williams, an employee of the Stockton Water District for twenty years. He was a good and loyal employee and highly respected by all who knew him. The company tenders to the widow and son its sympathy in the loss of a loving husband and father.

On April 7th Miss Estella Deicke, daughter of Wm. Deicke, Meter Inspector of the Stockton Water District, was married to Hunter Kinsey of Stockton. Mr. and Mrs. Kinsey have the well wishes of a large circle of friends.

Dan Cupid seems to be working overtime in the Oakland District, according to the following:

On April 25th, A. E. Jeffreys of the Collection Department was married to Miss Alice Johnson. The newlyweds are spending their honeymoon in the southern part of the state.

Mr. B. A. Dixon of the superintendent's office, Gas Station "B," and Miss Viola Northrup were recently wedded. After a week's sojourn in the south they are home again receiving the congratulations of their many friends.

On April 2d, Chester F. Smith of the Accounting Department was married to Miss Katherine M. Frederickson. Mr. and Mrs. Smith are comfortably settled in their new bungalow in Fourth Avenue Heights, receiving the congratulations of their friends.

Latest advices from Nevada City report the engagement of Miss Mary Lou Werry, daughter of genial District Manager John Werry, to Mr. William H. Hosking of Grass Valley. Miss Werry has been the motif for a number of affairs in her honor since her engagement has been announced. No date has been set for the wedding. Mr. Hosking, through energy and hard work, has reached in a few short years the position of city editor of "The Morning Union."

Operator O'Brien of Deer Creek Powerhouse, being the only bachelor on deck in that vicinity, says he is tired of single misery and is going to surprise us all one of these days.

The company tenders its sympathy to Mr. and Mrs. W. J. Agnews on the death of their infant daughter, Louise Walter, on March 30th.

A new manager for the Vallejo District, in the shape of a ten-pound baby boy, arrived at the home of Manager Stephens.

Miss Emily Ganske of the Pacific Auditing Department, who left the service of this company to return to her home in Chicago, was given a luncheon at Tait-Zinkand's Cafe Wednesday, May 6th. A very pleasant time was enjoyed. Those present were the Misses Emily Ganske, Edna McNulty, Olive Evans, Martha Roper, Irene Jordan, Margaret Dolan, Constance Martignoni, Reva Friedman, Alvie Rasmussen and Mrs. F. A. Dudley.

On April 22d, at high noon, in Ross, our Publicity Manager and Editor, Mr. Frederick S. Myrtle, was married to Mrs. Margaret Jardine, daughter of Mrs. G. J. Bucknall, in the presence of about twenty-five friends. Mrs. Myrtle is a woman of rare charm and refinement and is an accomplished musician. After a short honeymoon in the southern part of the state Mr. and Mrs. Myrtle have returned to Ross to reside during the summer months. The Company takes this means of extending hearty congratulations and well wishes.

The population of Deer Creek Powerhouse has been increased by the birth of a little daughter to the wife of Operator Hall, which is the cause of that everlasting smile Charlie wears.

Mr. W. G. Vincent, Valuation Engineer, and Mrs. Vincent, spent the first week's end of April in San Jose as guests of Manager John D. Kuster and Mrs. Kuster. They enjoyed a delightful motor trip around Santa Clara valley.

Manager E. B. Henley, of the Land Department, accompanied by Mrs. Henley, spent a portion of Wednesday, April 8th, in San Jose, and together with Manager John D. Kuster and Mrs. Kuster, visited Los Gatos where Mr. Henley had important business to transact.

Camp 1 at de Sabla was the scene of a pretty festival recently when Mr. and Mrs. I. B. Adams entertained a large party of friends, most of them residents of the city of Chico near by.

Those who arrived early enough enjoyed a few hours' fishing in the de Sabla reservoir before the program of the day opened. There was an open-air picnic, luncheon being served on the lawn of the Adams home. There was a dance in the evening, the Adams barn being made beautiful for the occasion with ferns and flowers gathered from neighboring dells.

ELECTRICITY IN THE HOME.

Modern inventors have not at all ignored the woman in the home. As time goes on housework becomes less heavy to a great many, and women begin to realize more and more that to be a little less parsimonious and indulge in a few of the luxuries of work-savers results in health, economy and leads, in time, to the saving of money.

We cannot jump instantaneously from the old-fashioned methods of housekeeping, which invariably caused body fatigue; but if we would adopt some of the many electrical machines now in almost general use housework would not be such a drudgery and more husbands would return home to find clean houses and wives not tired out. And then more congeniality would prevail.

Taking the main items of homework, we find that the washroom can be made very cheery by a motor-driven washing machine, electric wringer and an electric iron. These are each immense helps and would save many steps. Then, for sweeping, an electric vacuum cleaner does the work up rapidly and immaculately and leaves a room almost entirely without dust as well as keeping one from inhaling the germ-laden dirt. After using one of these you wonder how you ever got along without it.

The kitchen of nowadays can be the pride of the house; in fact, many beautiful homes are being built with electrically equipped kitchens, so that coal stoves are entirely omitted, for there are electric ranges, smaller electric plates, toasters, percolators, chafing dishes, water heaters, and nearly everything conceivable for cooking. The use of electricity is also a great factor in the cleanliness of the kitchen, as it is void of soot, coal dust and ashes.

It is a good idea, too, to have electric massages for the sickroom, as a great many illnesses are caused by poor circulation, and the massage could be used in innumerable cases.

The time will come when electricity and electrical furnishings will be just as essential to us as gas, wood and coal are now, so to the new home-builder, or the bride, "a word to the wise is sufficient." Also, we might lighten the work of older women who have struggled through years of hard work, and they, to be sure, would appreciate the saving of their declining energy by electricity.

ORGANIZED OCT.-7-1913

James Hugh Wise Library

Here is Hon. Secretary Baloun's report for the current month:

Prof. Joseph N. LeConte of Berkeley has donated to the library eleven completely bound volumes of the Transactions of the American Institute of Electrical Engineers, covering the period from 1895 to 1904, inclusive, and excepting only the second part of the year 1902. Your gift is a most gracious one, Mr Le Conte. We appreciate the courtesy and the spirit prompting it.

Mr. F. G. Baum has given a complete set for 1913 of the Electric Traction, which the library is having bound. A bound copy of "The Engineering Valuation of Public Utilities" was also given to our shelves by our Chief Engineer. This double gift merits double appreciation.

Mr. Joseph F. Butler tendered the first volume of the Company's magazine, completely bound. Thank you, friend Joe.

Mr. Stephen P. Lavezo of the Drafting Department presented a small historical book relating to the electrical field. Many thanks.

An interesting booklet on the new Diesel engine was sent by Mr. H. S. Jones who is connected with the representatives of the Diesel Engine Company.

We are still adding shelves, and the last installment finishes the circumference of the library walls, but these will be shortly filled and then it may be necessary to find more commodious quarters. Meanwhile, the library is to have an elegant rug and a large palm shortly, to make it "comfy."

Inquiries come in from the outside for ideas as to the most acceptable form of donation to the library. A fine large framed picture of our late Mr. Wise is coming from some one; what's the name of the donor, please?

Suggestions for a suitable motto for the library are pouring in to the secretary's desk. The list is open until July 4th, when the name of the winner will be announced.

In Memoriam

ETHEL MAE BUTLER

It is with deep regret that we have to record the untimely death of Ethel Mae Butler, wife of Mr. Joseph F. Butler, Superintendent of the Gas and Electric Records Department of the San Francisco District.

Mrs. Butler, who was Miss Ethel Crocker, will be affectionately remembered by her friends and associates in the company, having been a member of "Pacific Service" for about four years prior to her marriage, leaving the company May 22, 1910. In those years of daily association she endeared herself to all who came to know her, and while these friends now mourn her loss they will cherish her memory.

Mrs. Butler died in San Francisco April 20, 1914, after a short illness. Besides her husband she leaves two children.

"Pacific Service" extends sincere sympathy to her husband and family in their bereavement.

Exchange of Courtesies Between Departments in Line With the Spirit of "Pacific Service"

By J. W. VARNEY, Superintendent of San Francisco Substations


J. W. Varney

IN all large organizations, either civil or military, there are necessarily various departments and subdivisions with subheads in control of the rank and file. These subheads report to heads of departments who, in turn, report to their superiors, and eventually the entire organization comes under the commander or general manager.

This brief outline of organization is not new to any of us, as it is characteristic of all civilized or semi-civilized society, but it may serve as a preface to this article.

Where an organization reaches the proportions of the Pacific Gas and Electric Company and the various departments are so widely scattered, it devolves upon the heads to bring these departments into contact with each other, so as to make a homogeneous whole working in harmony and relieving the general officers of the detail work of directing parallel operation. To accomplish this result an exchange of courtesies between department heads and men in general seems to be the best solution.

For some time past the Company has held periodical meetings of division superintendents and district managers; besides, there has been organized a "Pacific Service" section of the National Electric Light Association, where heads as well as workmen meet on an equal footing and become acquainted. More recently still the plan of taking a small number of men from one department to visit the scene of activities of another, has been tried with considerable success and little expense.

As instances of the latter plan the visits of Mr. F. C. George and Mr. Gentis of Oakland to the San Francisco stations, the trips of the Contracting Department of San Francisco to the gas and electric station in that city, and the visiting of some of the San Francisco station men to the Oakland stations, are noteworthy, and have proven of considerable value both to the Company and employees.

When it becomes necessary for an operator in San Francisco to talk to the Load Dispatcher in Oakland, it makes a great deal of difference whether the two men are personally acquainted or total strangers, both as to the conversation and the extent of co-operation between the two departments; or, when one of the Contracting Department is trying to convince a prospective customer of the superiority of "Pacific Service" over that of our competitors, it is of advantage to him to have visited a station and learned something about that station, rather than be as much a stranger there as the man whom he is showing around.

Again with regard to that same "Pacific Service," on each visit we learn something from the station visited and from the other men with whom we came in contact, and all go back to their respective jobs with a better feeling and a renewed ambition to surpass or at least emulate the other fellow.

These exchanges of courtesies we all hope to continue and possibly extend into visits between the more distant stations and men. It is in line with the spirit of "Pacific Service" as we understand the meaning of the company slogan.

"Pacific Service" Boys Play Ball

Redwood City Wins From San Mateo in a Fast-Scoring Game. Oakland Goes Abroad to Defeat.

A baseball game was played in San Mateo on April 19th between "Pacific Service" employees living in Redwood City and those of San Mateo. The San Mateo News of April 20th says:

"Some of the rivalry which usually exists between neighboring towns, and in the past San Mateo and Redwood were no exception, was displayed, but it was not like the old days. Near the end of the game the umpire sent back four runs on a so-called foul and the decision was accepted and the game resumed with the same umpire.

"The Redwood bleachers were well represented by the stenographer and the bill clerk. The gas men were very talkative, one remarking that he could lay a pipe between certain bases in the same time occupied by the office force in covering the same distance. Several three-phase connections were made by the linemen playing with San Mateo. Those batters struck by the ball were referred to the complaint department.

"By prearrangement, trouble was reported in a remote part of the district just as the game was called. The superintendent and his linemen returned, however, in time to play in the ninth inning. The overhead service in the field was not up to standard, and many times the linemen were up in the air.

"The accountant took the score to the main office to make a detailed report of the runs, etc., with the aid of the adding machine. However, the visitors from Redwood made enough to entitle them to the victory and a dinner at the expense of the natives."

Mr. E. W. Florence, the district manager, umpired the game, the score of which was:

	R.	H.	E.
San Mateo	13	14	10
Redwood	19	20	5

SUMMARY.

SAN MATEO.

	POS.	A. B.	R.	B. H.	A.	P. O.	E.
Snell, T. W.....	L.F......	5	2	2	1	1	3
Johnstone, C...	1 B. and 2	6	0	2	2	2	4
Kellogg, W. T..	R. F.....	3	0	0	0	0	0
Rigby, R. W...	R. F.....	1	0	0	0	0	0
Owen, L. G.....	R. F.....	2	1	1	0	0	0
Holm..........	C........	5	0	2	2	7	0
Goncalves, P. F.	S. S......	5	1	1	2	0	0
Johnstone, W...	C. F.....	2	3	0	0	0	1
Wille, A. L.....	1 B. and P	5	1	2	3	6	1
Knopf, H......	P. and 1B.	5	3	3	5	8	1
Woolley, J.....	3 B......	5	2	1	1	0	0
	Total..	44	13	14	16	24	10

REDWOOD.

	POS.	A. B.	R.	B. H.	A.	P. O.	E.
Long, P........	S. S......	6	5	3	1	0	1
McCarthy, J. H.	C........	6	3	3	5	13	0
McCracken, C..	1 B......	6	3	3	0	9	1
Crockett, A. E..	3 B......	6	4	3	3	2	0
Dashiell, H. H..	C. F.....	5	0	1	0	0	1
Roberts, B.....	C. F.....	1	1	0	0	0	1
Sahlberg, A. P..	L. F.....	4	1	4	0	0	1
Hocken, A. J...	2 B......	5	2	1	1	1	0
Parkinson, B. C.	R. F.....	3	0	1	0	0	0
Bailey, R. B....	R. F.....	2	1	1	0	0	0
Dunshee, R....	P........	5	1	0	4	2	0
	Total..	49	19	20	14	27	5

RUNS AND HITS BY INNINGS.

SAN MATEO.

	1	2	3	4	5	6	7	8	9
Runs.........	0	0	2	3	0	1	1	1	5—13
Hits..........	0	2	2	2	0	1	1	2	4—14

REDWOOD.

	1	2	3	4	5	6	7	8	9
Runs.........	3	0	4	3	1	7	0	1	x—19
Hits..........	2	0	3	4	3	3	2	2	x—20

Three-base Hits....C. Johnstone; C. McCracken.
Two-base Hits.....Woolley, Knopf, Owen, Holm, Sahlberg, Long.
Base on Balls—Off. Dunshee 6; Knopf 0; Wille 0.
Struck Out by.....Knopf 5; Dunshee 13.
1st Base on Errors. San Mateo 4; Redwood 9.
Hit by Pitcher.....Rigby, Sahlberg, Goncalves.
Time of Game.....2 hours, 30 minutes.
Umpire...........E. W. Florence.
Scorer............L. H. Patty.

The P. G. & E. Co's team from Oakland office journeyed over to the Island and met defeat at the hands of the sailors, 5 to 0. Both teams played good ball, but the sailors bunching their hits won.

The playing of Wilkinson, Davis, Anderson, Dixon and Britton were the features. Manager Brooks would like to hear from the San Francisco office regarding a dinner on them.

PACIFIC GAS AND ELECTRIC COMPANY

DIRECTORS

F. B. Anderson	F. G. Drum	Samuel Insull
Henry E. Bothin	John S. Drum	John Martin
John A. Britton	D. H. Foote	C. O. G. Miller
W. H. Crocker	Wm. G. Henshaw	Louis Sloss
E. J. De Sabla, Jr.	A. F. Hockenbeamer	George K. Weeks

OFFICERS

F. G. Drum ....President
John A. Britton.........Vice-Pres. and Gen. Mgr.
A. F. Hockenbeamer ....2d Vice-President, Treasurer and Comptroller
D. H. Foote.........Secretary and Asst. Treasurer
J. C. Love.........................Asst. Treasurer
Charles L. Barrett ....Asst. Secretary

HEADS OF DEPARTMENTS

M. H. Bridges............................Auditor
W. H. Kline......................General Agent
R. J. Cantrell....................Property Agent
George C. Robb.................Supt. of Supplies
J. H. Hunt.....................Purchasing Agent
E. B. Henley...............Manager Land Dept.
J. P. Coghlan.............Manager Claims Dept.
H. Bostwick..............Secretary to President
F. S. Myrtle............Manager Publicity Dept.
L. H. Newbert..........Manager Appliance Dept.
G. C. Holberton..Chief Eng'r Stockton Water Dist.
W. B. Bosley ....Attorney
H. C. Vensano.....................Civil Engineer
E. C. Jones.......................Engr. Gas Dept.
H. P. Pitts ....Industrial Engineer
S. V. Walton..........Manager Commercial Dept.
S. J. Lisberger.........Engr. Electric Distribution
Sherwood Grover.....Asst. Engr. Gas Department
J. P. Jollyman......Engr. of Electric Construction
P. M. Downing......Engr. O. & M. Hyd.-Elec. Sect.
C. J. Wilson.....Asst. Engr. Electric Distribution
F. H. Varney.........Engr. O. & M. Steam Section
F. G. Baum....Chief Engineer Hydro-Electric Dept.

DISTRICT MANAGERS

District	Headquarters	Manager
Alameda Co.	Oakland	F. A. Leach, Jr.
Berkeley	Oakland	F. A. Leach, Jr.
Oakland	Oakland	F. A. Leach, Jr.
Chico	Chico	H. B. Heryford
Colusa	Colusa	L. H. Hartsock
Contra Costa	Martinez	Don C. Ray
Fresno	Fresno	M. L. Neely
Grass Valley	Grass Valley	John Werry
Marysville	Marysville	J. E. Poingdestre
Marin	San Rafael	W. H. Foster
Napa	Napa	O. E. Clark
Nevada City	Nevada City	John Werry
Petaluma	Petaluma	H. Weber
Placer	East Auburn	H. M. Cooper
Redwood	Redwood City	E. W. Florence
Sacramento	Sacramento	C. W. McKillip
San Francisco	San Francisco	G. C. Holberton
San Jose	San Jose	J. D. Kuster
Santa Rosa	Santa Rosa	M. G. Hall
Solano	Dixon	C. E. Sedgwick
Stanislaus	Newman	W. A. Widenmann
Vallejo	Vallejo	A. J. Stephens
Woodland	Woodland	W. E. Osborn

MANAGERS OF WATER DISTRICTS

Nevada (Nevada City).........George Scarfe
Placer (East Auburn).........H. M. Cooper
Standard (Electra)............W. E. Eskew
Stockton (Stockton)..........J. W. Hall

SUPERINTENDENTS OF POWER DIVISIONS

Colgate ....Miles Werry
De Sabla......................I. B. Adams
Drum ....James Martin
Electra ....W. E. Eskew
Marysville ....E. C. Johnson
Nevada ....George Scarfe
North Tower ....C. D. Clark
Oakland ....William Hughes
Sacramento ....J. O. Tobey
San Jose......................F. G. Maynard
South Tower ....A. H. Burnett
Stockton ....E. C. Monahan
Solano ....J. W. Coons

SUPERINTENDENTS OF STEAM ELECTRIC STATIONS

H. N. Mosher....Chief Engr. Station "C," Oakland
C. A. Eastwood...Supt. Station "A," San Francisco
J. W. Varney..................Supt. of Substations, San Francisco

SUPERINTENDENTS OF ELECTRIC DISTRIBUTION

Berkeley....................J. H. Pape
Oakland (Underground).......R. C. Powell
Oakland and Alameda (Ovrhd).A. U. Brandt
Sacramento...................C. R. Gill
San Francisco ....A. R. Thompson
San Jose.....................A. C. Ramstad
Marin ....Chas. Dallerup

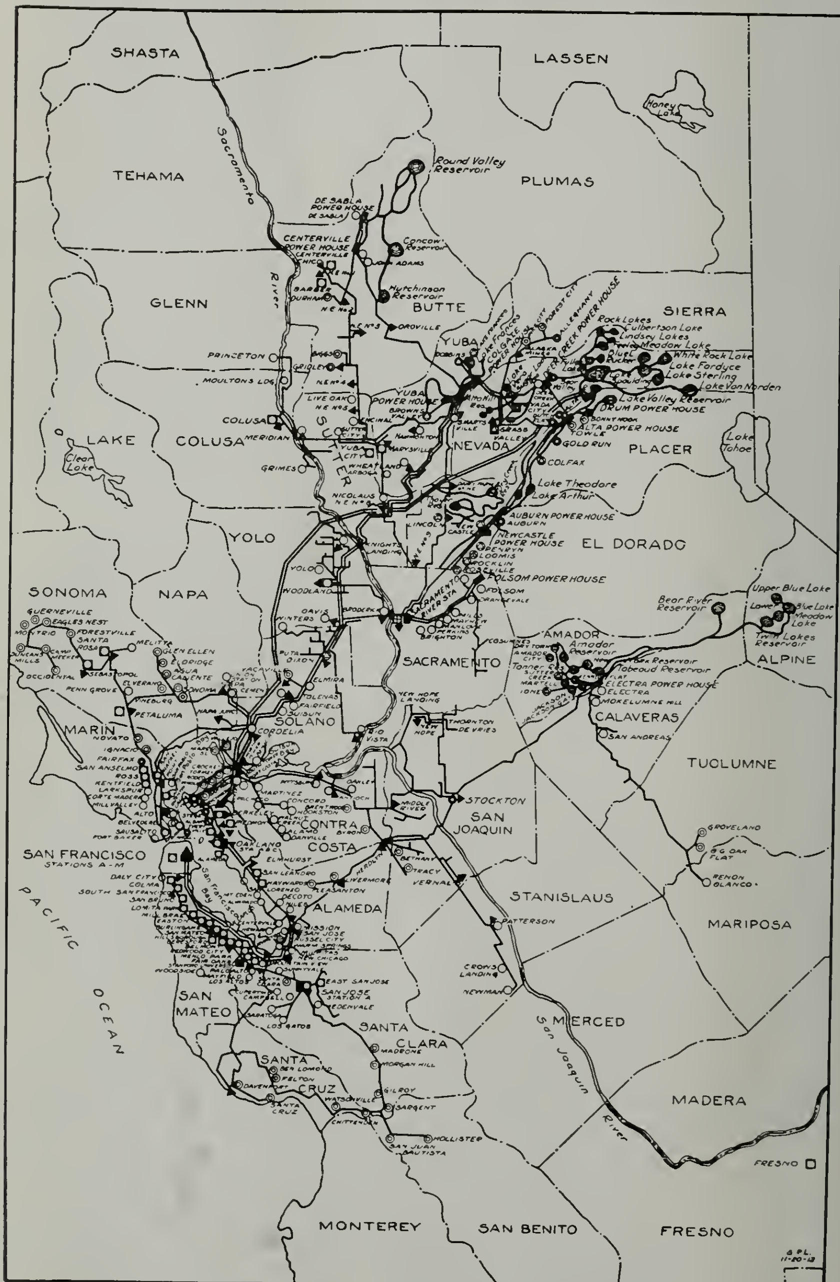
SUPERINTENDENTS OF GAS WORKS

Oakland ....A. C. Beck
Sacramento..................Edward S. Jones
San Francisco ....Dennis J. Lucey
San Jose.....................R. H. Hargreaves
Fresno......................Paul C. Funk

SUPERINTENDENTS OF GAS DISTRIBUTION

Oakland ....George Kirk
San Francisco ....D. E. Keppelmann

Superintendent of Railway Department.............N. J. Hullin


SHASTA
LASSEN
Honey Lake
TEHAMA
PLUMAS
Sacramento River
Round Valley Reservoir
DE SABLA POWER HOUSE
CENTERVILLE POWER HOUSE
Concow Reservoir
Hutchinson Reservoir
GLENN
BUTTE
SIERRA
OROVILLE
YUBA
PRINCETON
MOULTONS LDG
COLUSA
LAKE
Clear Lake
MERIDIAN
GRIMES
YUBA POWER HOUSE
NEVADA
PLACER
Lake Tahoe
Rock Lakes
Culbertson Lake
Lindsey Lakes
Meadow Lake
White Rock Lake
Lake Fordyce
Lake Sterling
Lake Van Norden
Lake Valley Reservoir
DRUM POWER HOUSE
ALTA POWER HOUSE
GOLD RUN
COLFAX
Lake Theodore
Lake Arthur
AUBURN POWER HOUSE
AUBURN
NEWCASTLE POWER HOUSE
EL DORADO
YOLO
FOLSOM POWER HOUSE
FOLSOM
SONOMA
NAPA
SACRAMENTO
Bear River Reservoir
Upper Blue Lake
Twin Lakes Reservoir
ALPINE
AMADOR
Amador Reservoir
Tabeaud Reservoir
ELECTRA POWER HOUSE
ELECTRA
CALAVERAS
SAN ANDREAS
MARIN
SOLANO
TUOLUMNE
STOCKTON
SAN JOAQUIN
CONTRA COSTA
SAN FRANCISCO STATIONS A-M
PACIFIC OCEAN
ALAMEDA
STANISLAUS
MARIPOSA
PATTERSON
SAN MATEO
SAN JOSE
SANTA CLARA
MERCED
San Joaquin River
SANTA CRUZ
WATSONVILLE
GILROY
HOLLISTER
MADERA
FRESNO
MONTEREY
SAN BENITO

PACIFIC GAS AND ELECTRIC COMPANY

CITIES AND TOWNS SUPPLIED WITH GAS, ELECTRICITY, WATER AND RAILWAY

Service Furnished	Number of Towns	Total Population
Electricity	211	1,095,117
Gas	51	989,167
Water	26	55,115
Railway	1	71,000

Place	Population
Alta	20
[1]Alameda	25,000
Alamo	50
[2]Albany	800
[5]Amador City	200
Adams John	25
Alleghany	200
Alto	25
Alviso	200
Angel Island	280
[5]Auburn	2,375
Agua Caliente	100
Alvarado	900
Antioch	3,000
Arboga	100
[2]Barber	500
[2]Belmont	350
Ben Lomond	800
Belvedere	1,000
Benicia	3,360
[2]Beresford	25
[2]Berkeley	40,000
Bethany	200
Biggs	750
Big Oak Flat	20
Brentwood	200
Brighton	100
Broderick	200
[5]Brown's Valley	50
Byron	200
[2]Burlingame	4,300
California City	25
Camp Meeker	200
Campbell	600
Centerville	1,000
Centerville	20
[2]Chico	13,000
[2]Colma	3,500
[2]Colusa	1,500
Concord	1,500
Cement	1,500
[5]Colfax	500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing	375
Cupertino	50
Daly City	250
Danville	250
Davis	750
Decoto	350
de Sabla	25
[5]Dixon	1,000
[5]Dobbins	50
Davenport	1,000
[5]Drytown	20
Durham	500
[5]Dutch Flat	500
Duncan's Mills	150
Eagle's Nest	50
Edenvale	500
Eldridge	500
Elmira	150
El Verano	400
Electra	50
[2]Emeryville	5,000
Encinal	100
Fairfax	500
Fairfield	834
Forestville	100
Felton	300
[1]Fresno	30,000
[2]Fair Oaks	250
Folsom	1,800
Gilroy	2,000
Glen Ellen	500
[5]Gold Run	100
[2]Grass Valley	4,500
Gridley	1,800
Grimes	250
Groveland	125
Guerneville	500
Hammonton	500
[2]Hayward	4,000
[2]Hillsborough	1,000
Hollister	3,000
Hookston	75
Ignacio	100
[5]Ione	900
Irvington	1,000
[5]Jackson Gate	100
[5]Jackson	2,035
[5]Kennedy Flat	20
[2]Kentfield	250
Knight's Landing	350
[5]Lake Francis	5
Live Oak	200
[5]Livermore	2,250
Los Gatos	3,000
[2]Larkspur	600
[5]Lincoln	1,400
[2]Lomita Park	100
Los Altos	500
[5]Loomis	400
Madrone	125
Maletta	30
Manlove	50
Martinez	5,000
[5]Martell	150
[2]Marysville	7,000
Mayfield	1,500
Mayhew	50
[2]Menlo Park	1,500
Meridian	300
[2]Millbrae	300
Mills	50
Milpitas	300
Mill Valley	2,500
Mission San Jose	500
Mokelumne Hill	150
Monte Rio	50
Morgan Hill	500
Moulton's Landing	30
Mountain View	2,500
Mt. Eden	200
Mare Island	500
[2]Napa	7,000
[2]Nevada City	2,700
[5]New Chicago	10
Newark	700
[5]Newcastle	750
Newman	1,000
Niles	800
Nicolaus	75
Novato	250
[2]Oakland	230,000
Oakley	80
Occidental	400
Orange Vale	100
[2]Palo Alto	6,300
Pacheco	200
Penryn	250
Patterson	300
Penn Grove	300
Perkins	50
[2]Petaluma	5,500
[2]Piedmont	1,720
Pike City	200
Pinole	1,500
Pittsburg	2,372
Pleasanton	2,000
Point San Pedro	20
Port Costa	600
[2]Redwood City	3,200
[2]Richmond	10,000
Rio Vista	884
[5]Rocklin	1,000
[5]Roseville	2,600
Rodeo	500
[2]Ross	500
Russel City	250
[4]Sacramento	71,000
San Andreas	200
[2]San Anselmo	1,500
[2]San Bruno	1,500
[2]San Carlos	100
[2]**San Francisco**	416,912
[2]San Jose	31,660
[2]San Leandro	4,000
San Lorenzo	100
[2]San Mateo	6,500
[2]San Quentin	2,500
[2]San Rafael	6,000
San Pablo	1,000
Santa Clara	6,000
Santa Cruz	16,000
Saratoga	50
[2]Santa Rosa	12,000
[2]Sebastopol	1,200
Sausalito	2,500
Smartsville	500
[2]South San Francisco	2,500
[2]Stanford University	2,600
Sonoma	1,200
Stege	1,000
[3]Stockton	30,000
Suisun	1,200
Sutter City	150
Sutter Creek	1,500
Sunnyvale	1,500
Tiburon	400
Tormey	20
Towle	100
Tracy	1,200
Union Station	40
Vacaville	1,200
[2]Vallejo	15,000
Vineburg	200
Walnut Creek	350
Warm Springs	200
Watsonville	4,500
Wheatland	1,400
Winters	1,200
[2]Woodland	3,200
Woodside	200
Yolo	400
[2]Yuba City	1,200
Total	1,150,117

Unmarked—Electricity only.
1—Gas only.
2—Gas and Electricity.
3—Gas, Electricity and Water.
4—Gas, Electricity and Street Railways.
5—Electricity and Water.

EMPLOYS 4,800 people.

OPERATES 10 hydro-electric plants in the mountains.
4 steam-driven electric plants in big cities.
17 gas works.

SERVES ⅔ of California's population.
30 of California's 58 counties.
An area of 37,775 square miles.
⅗ the size of New York State.
½ the size of all the New England States combined.