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The Folsom-Sacramento Power Transmission.

The utilization of the water-power of the American River was first conceived by the late Horatio Gates Livermore, one of the pioneers of the State, who in the early '60s was engaged in the logging industry. The famous Georgetown Divide, in which the first discovery of gold in California was made, is situated in El Dorado County, between the Middle and the South Forks of the American River. It is a district that is exceedingly mountainous, and is heavily timbered with sugar and yellow pines of unsurpassed quality, and while floating logs down the American River from this district the worked or even explored only during a few months in the year. In the fall, when the snows have about disappeared, the rainy season sets in replenishing the waning supply from melted snows, and thus, between the rains of winter and the melting snows of summer, the water supply has never been known to fail. Practically all of the catchment area is, moreover, of granite formation, surfaced with soil of varying depths, and its hundreds of deep ravines form natural sites for the building of impounding reservoirs for increasing the water supply to enormous proportions. In fact, it has been de-

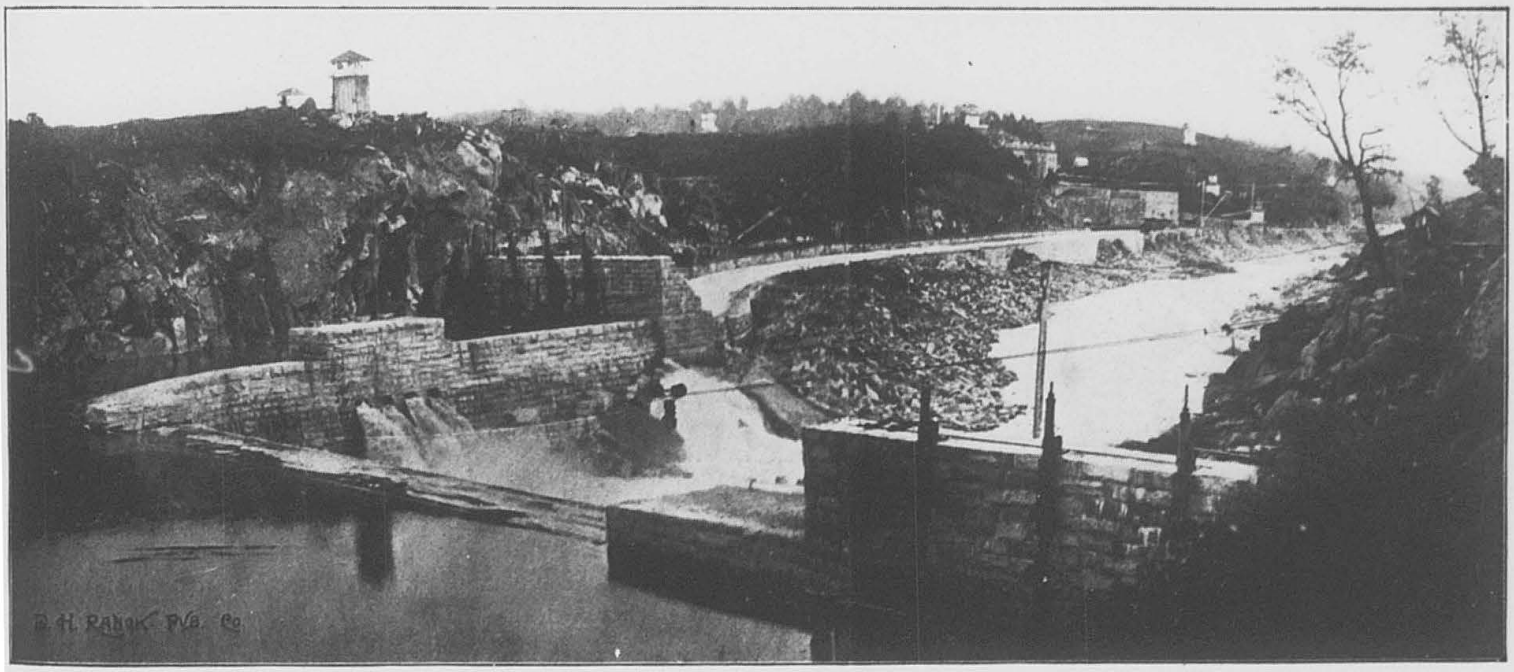

FIGURE 1.—THE DAM AND HEAD WORKS OF THE FOLSOM WATER POWER COMPANY, SHOWING SECTION 1 OF THE EAST CANAL. LOOKING DOWN THE AMERICAN RIVER.

necessity for securing a still water basin for locating log booms to receive the logs became impressed upon the mind of Mr. Livermore, who, in 1866, as President of the Natoma Water and Mining Company, laid the foundations for the present dam. The various forks of the American River rise in the Sierra Nevada Mountains within a few miles of Lake Tahoe, and the supply of the river is peculiar in that the catchment is derived from new sources at all seasons of the year. The period usual elsewhere as the "dry season" is bridged over by the melting of snows in the mountains, and so deep is the snow in some of these regions that the country can be termined from carefully made surveys that an expenditure of less than twenty-five dollars per horse-power in the construction of such impounding reservoirs will permanently increase the flow of the river at Folsom to such an extent that its minimum flow, after these improvements have been carried out, will exceed its present maximum flow. A conservative estimate of the possible power that can be developed by this means at Folsom is a minimum of 15,000 horse-power.

The Folsom Water Power Company, which consists of H. P. and C. E. Livermore, Albert Gallatin, A. J. Ralston, and others, succeeded to all the rights of the

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Natoma Water and Mining Company in 1881, up to which time the foundations of the dam had been laid in solid granite masonry, but so much capital was required to build a dam of sufficient solidity to withstand the enormous pressures, that, in the early part of 1888, a contract was entered into with the State of California, whereby the State in return for ample concessions agreed to furnish to the Folsom Water Power Company such convict labor as was necessary to enlarge and finish the company's dam, and to finish Sections 1 and 2 of the proposed canal to the termination of Section 2 at Robbers' Ravine, near the town of Folsom.

The nature of the site of the dam is clearly indicated in the accompanying illustrations. High granite bluffs confine the river on either side for many miles, and where the dam is erected they form a natural point for the building of such a structure. The dam has an elevation of 210 feet above sea level, and of 175 feet

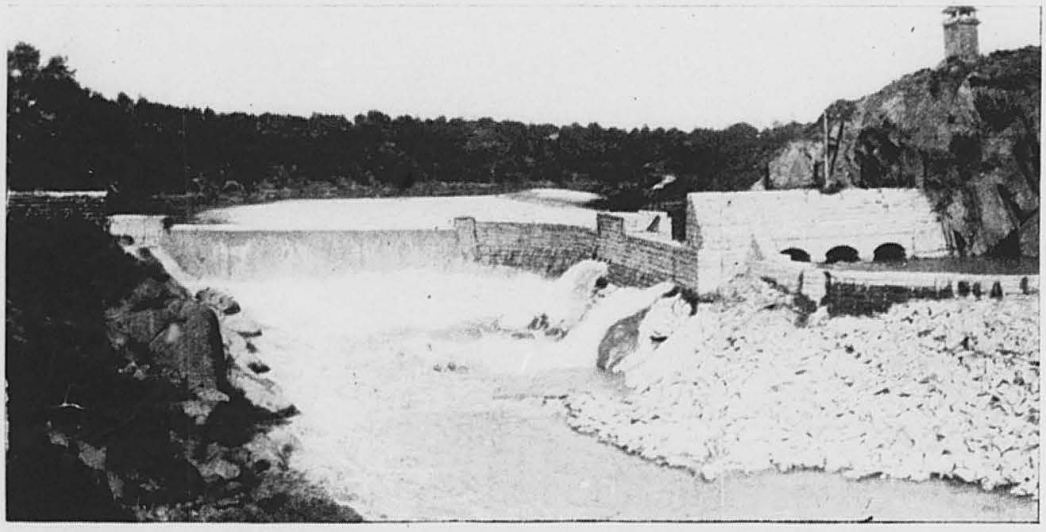

FIGURE 2.—THE DAM AND HEAD GATES OF THE FOLSOM WATER POWER COMPANY, LOOKING UP THE AMERICAN RIVER.

above Sacramento. It contains more than 37,000 cubic yards of masonry, while the contents of the head works is about 15,000 cubic yards. The general dimensions of the dam are shown in Figure 5, from which it will be seen that the crest is provided with a heavy wooden shutter, 180 feet in length, which can be raised during the low-water season in September by five hydraulic rams, so as to create a storage basin for conserving the flow during the hours of light load when the least amount of water is used. The basin formed when the shutter is raised backs up the water in the river for a distance of about four miles, causing an estimated storage of 13,007,105 cubic yards of water. The shutter is a trussed timber platform, resting in a masonry recess running longitudinally along the top of the center of the dam. When raised, the platform is made tight at the ends by wedge pieces, and at the bottom by mud apron boards. When lowered into the recess it is flat and secure from damage by trees and logs which may pass over it. Three of the five hydraulic rams operating the shutter are seven inches in diameter each, the remaining two having a diameter of five and one-half inches each, all having a stroke of five feet six inches each. The details of the larger rams will illustrate the construction of the smaller ones as well. The cylinders are seven and one-half feet in length, with an external diameter of eleven inches, and each has two trunnions on which it is free to oscillate. One of these trunnions is solid, while the other is bored with a half-inch hole to receive the pressure water by which the apparatus is operated. The bottom of the cylinder has a hemispherical cap secured to it by eight, one and one-fourth inch bolts, while at the other end there is a brass stuffing box through which the shank of the piston passes. The piston is six inches in diameter and seven feet eight and one-half inches long, and the piston head is a hemispherical brass knob with a projecting screw, by which it is fastened to the piston. When the shutters have been raised the piston is fastened in position by means of a locking pin, moved back and forth by a pinion and hand wheel.

This hydraulic method of operating the gates is a characteristic feature of the works of the company, and there are in all about thirty similar rams in different places, most of which are operated by hydraulic pressure, at a pressure of 1000 pounds per square inch, piped from the state power house on the canal. Snow and ice are practically unknown at Folsom, and on this account it is possible to use hydraulic apparatus that would prove impracticable in a severe climate. The appliances for operating the head gates on the east side canal, and which are illustrated in Figure 6, are perhaps the most noteworthy of all. The gateways they operate are sixteen feet by fourteen feet in the clear, and are provided with gates opening to a height of twelve feet six inches above the sill, and made of three by twelve inch timbers, secured together by six bolts fastened through them. Each gate is attached by link and pin to the lower end of a piston six inches in diameter, made of wrought iron

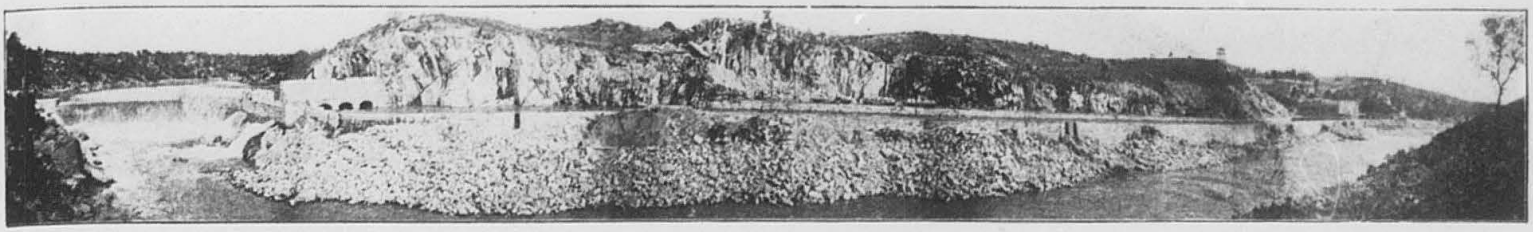

FIGURE 3.—SECTION 1 OF THE EAST CANAL OF THE FOLSOM WATER POWER COMPANY, SHOWING THE STATE POWER HOUSE IN THE DISTANCE.

and sheathed with brass. The brass piston, which is packed with cut leather, moves in a brass-lined cast iron cylinder of twelve-inch bore and thirteen-foot stroke, closed at each end with a stuffing box and gland to receive hemp packing. The pistons are operated by water under the pressure stated, which is delivered to the cylinders through a half-inch pipe. To provide against any movement of the gates by leakage of water in the cylinders, suitable checking gears are placed, there being two such gears to each gate, and these gears are keyed to a three and one-half inch shaft passing through the bracket by which the cylinder is mounted on the bulk-

State is using about 800 horse-power of the power available from this drop. Section 1 is cut much of the way into solid granite cliffs, and the rock taken therefrom was almost entirely used in the construction of the dam and headworks on the east side and in the building of the heavy masonry wall, eight feet wide on the top, from fifteen to thirty feet wide at the base, and in some places as high as thirty feet. This wall, which is built on the bed rock, forms the outer bank of the canal. The section is provided with four sand gates, and is about 2000 feet in length.

Section 2 is constructed with an outside bank of

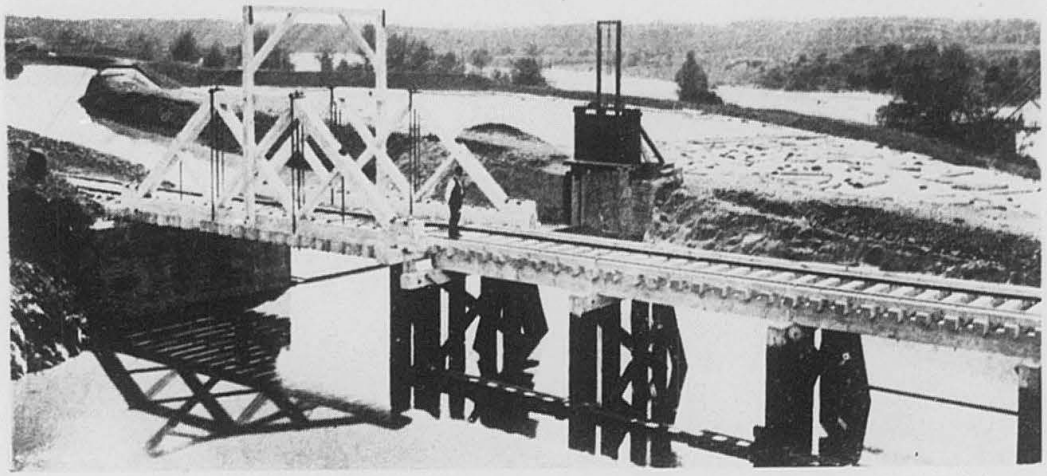

FIGURE 4.—ROBBERS' RAVINE, MARKING THE DIVISION BETWEEN SECTIONS 2 AND 3 OF THE FOLSOM WATER POWER COMPANY'S CANAL, SHOWING A LOG DAM OF THE AMERICAN LAND AND LUMBER COMPANY AND THE AMERICAN RIVER IN THE BACK GROUND.

head. A wire rope runs from the top of the gate to each of the wheels, and a spiral spring is riveted at one end to a projecting casting on the gear, and is fastened at the other to a boss on the cylinder bracket.

THE EAST SIDE CANAL.

Two canals, known as the West Side and East Side Canals, are projected to continue on down the river from the dam. As yet the West Side Canal has not been constructed, but the East Side Canal is entirely finished. It is divided into three sections, the first of which extends from the dam to a point just below the first or State fall, where a drop of 7.33 feet in level occurs, at which is located the State power-house. At present the

earth and rock filling, on which is laid a broad-gauge railroad track, and at the lower end of the section are located four deep outlet gates, raised and lowered by hydraulic rams. Section 2 is 4000 feet long, and its inner side is faced by a heavy masonry wall, and the outer side is protected against the river by heavy rip-rapping.

The third section was built by the Folsom Water Power Company. It is made by earth and rock excavations and an earth rock fill, which forms the outer bank of the canal and which, as in Section 2, carries the railroad track. The outer bank is protected by rip-rap, and some portions of the inside are faced with dry rubble

wall. Section 3 is 3599 feet long, which makes the total length of the canal to be 9,500 feet.

The East Side Canal has a width of sixty-six feet above the headgates. From the headgates to the State fall, Section 1 has a width of fifty-three feet on top and forty-five feet on the bottom. Sections 2 and 3 are each fifty feet wide on the top and forty feet wide on the bottom. They carry water eight feet deep, and with such a grade that the water in the canal has an estimated flow of 104,000 cubic feet per minute.

Four sluice or sand gates, each covering an opening five by six feet through the wing dam, are located at the end of the dam to prevent sand or gravel from passing into the canal and causing injury to the wheels. The bottom of these gates is eight feet below the level of the bottom of the canal, and a short distance further down the stream an eight-foot wall is built directly across the canal. Inasmuch as ordinary gates placed in the side of the canal would only remove the gravel within a few feet of their entrance, three of the gates have a tunnel-like arrangement built through the outer bank, the mouths of these tunnels covering the entire width of the canal. As the entrances to these tunnels are eight feet below the bottom level of the canal, the water is not impeded in its flow thereby, and any heavy substance will be drawn into one or the other of the tunnel-mouths and be discharged through the sluices into the river below.

Between Sections 1 and 2, and immediately over the canal, the State of California has erected the State power-house previously referred to. This is adjoining the yard of the State Prison and is built of heavy granite masonry. It has a floor area of 166 by sixty feet, is sixty feet high, and within it are installed six special eighty-seven-inch Leffel turbine water wheels with vertical shafts, geared through beveled pinions to a horizontal shaft overhead. From this shaft power is delivered by cables and belting to a heavy set of pumps, to a large air compresser, to ice machines and to electric lighting generators. The arrangement at the State fall is such that the flow of water may be directed either to the wheels or turned into Section 2 of the canal through side gates operated by hydraulic rams, and in addition, a log chute or by-pass is provided to facilitate the passing of logs down the canal to the saw mill which it is proposed will be erected at Folsom. No water is wasted at the State fall, but the entire flow continues passing on down the canal.

At the lower end of Section 2 four other sand gates have been placed, but they are more for the purpose of

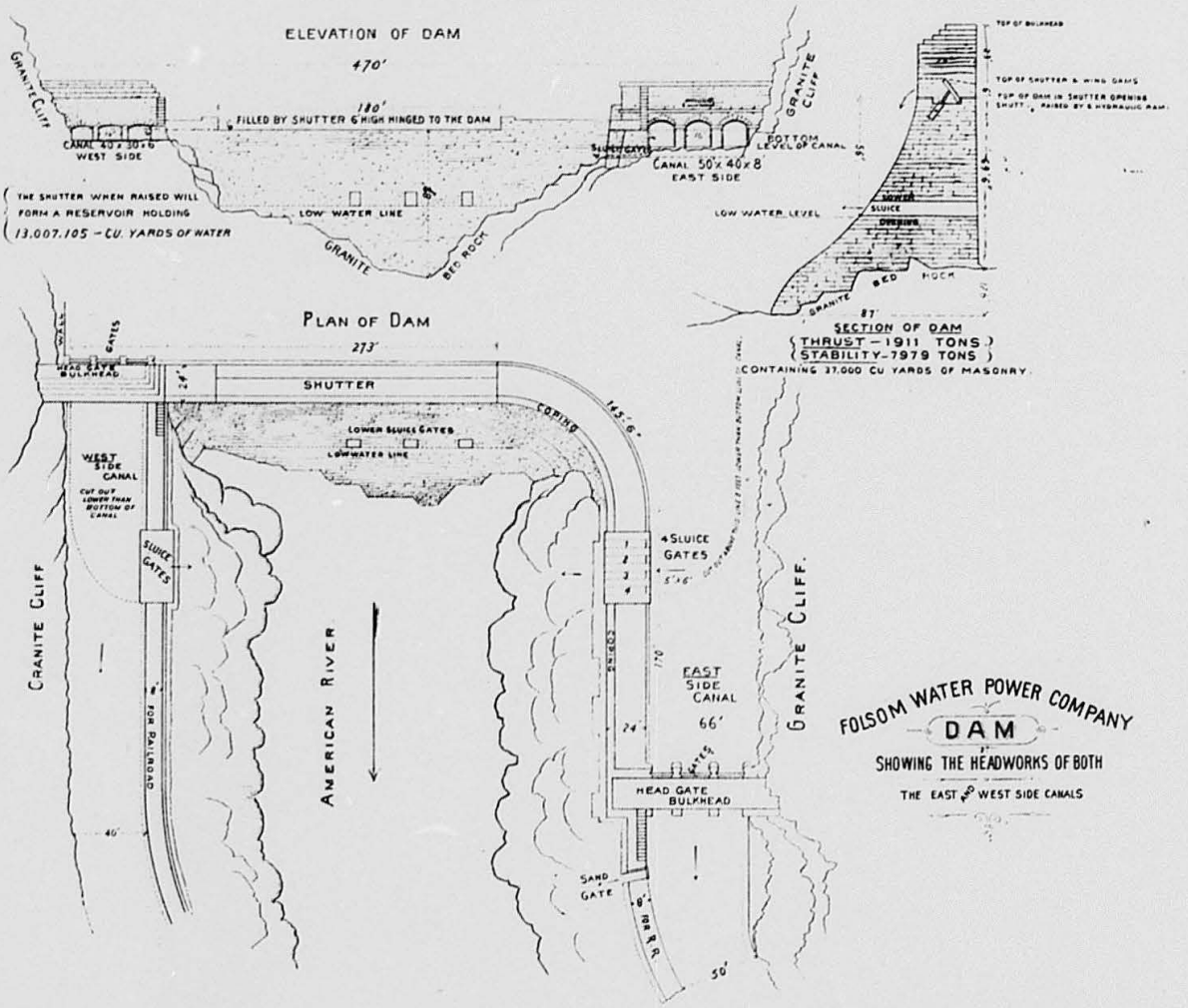

FIGURE 5.—AN OUTLINE PLAN OF THE DAM AND HEAD WORKS OF THE FOLSOM WATER POWER COMPANY.

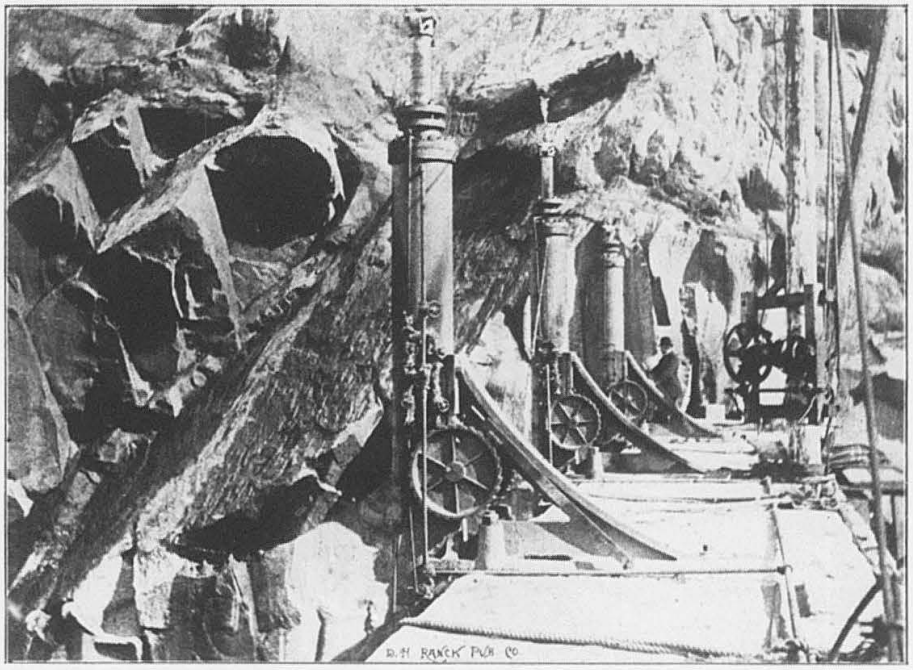

FIGURE 6.—HYDRAULIC RAMS OPERATING HEAD GATES OF THE FOLSOM WATER POWER COMPANY.

relieving the canal during storms than for clearing it of sand deposits. They are not, therefore, fitted with tunnels across the canal. The company's railroad crosses from the outer to the inner bank of the canal on a substantial truss bridge, supported by heavy masonry buttresses at the upper end of Section 3. Just below this bridge a timber boom is extended across the canal to deflect the logs into a large log basin covering several acres.

THE HYDRAULIC PLANT.

The dam and canal is the property of the Folsom Water Power Company, but the plant about to be described is the property of the Sacramento Electric Power and Light Company, which has acquired all the power rights for the water from the Folsom Water Power Company. At the terminal of the canal a forebay, 150 feet long, 100 feet wide and twelve feet deep has been constructed in a northwesterly direction at right angles to the canal. It is divided lengthwise by a continuous stone wall, reaching above the top of the water and extending from the canal to the power-house, so as to make virtually two forebays. Each of these is again divided longitudinally by planking which does not reach to the surface of the water, and gates are placed at each end of each forebay.

This construction was carried out because at certain seasons of the year much silt is held in suspension in the water of the American River, owing to the hydraulic mining constantly going on in its upper branches. The velocity of flow in the river and canal is sufficient to carry this silt along, and unless it were interrupted it would cause considerable trouble in the turbines. Advantage has therefore been taken of the fact that when a channel is widened out so as to cause slack water silt will be deposited, hence wide forebays were constructed. It will now be clear that in order to clean out the silt it will only be necessary to check the flow in one of the divisions of the forebay by closing the wheel gates and opening the waste gates, thus allowing a small flow to take place in the forebay, dropping out all silt with it. Then the water is again let in, and the wheels may be started and the other part of the forebay may be cleaned out.

But one forebay was completed up to the time of the Electric Carnival, hence the plant was operating to only half its capacity, but by October 1st the remaining forebay will be entirely finished, when the entire plant will be practically completed. The hydraulic part of the equipment was furnished by the S. Morgan-Smith Iron Works, of York, Pa., under contract with the Pelton Water Wheel Company, of San Francisco, and consists of four pairs of 30-inch McCormick turbines, having a capacity of 1260 horse-power each, and two of which, together with an exciter turbine, are illustrated in Figure 7.

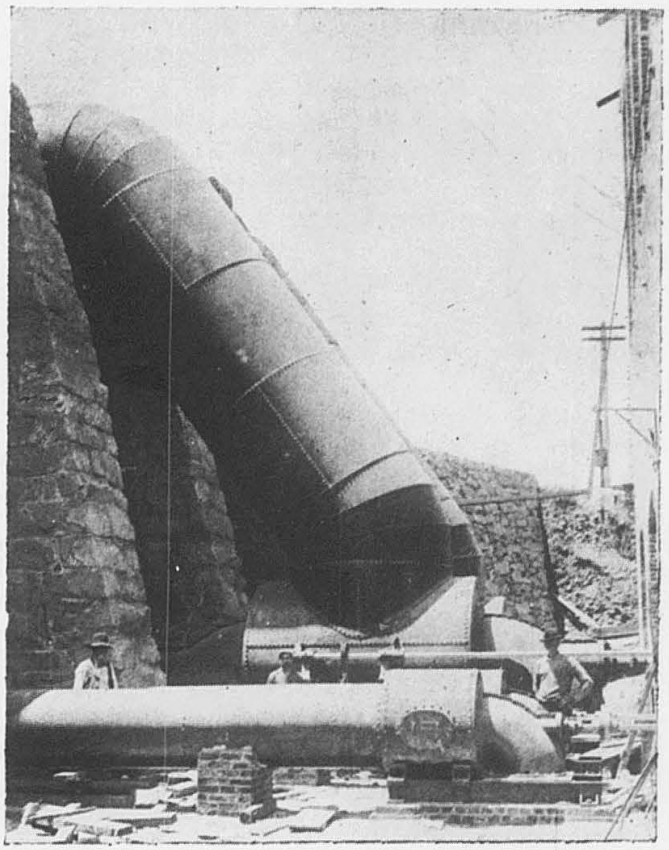

FIGURE 7.—PENSTOCKS AND TURBINES FOR TWO UNITS IN THE POWER HOUSE OF THE SACRAMENTO ELECTRIC POWER AND LIGHT COMPANY.

The wheels run under a head of fifty-five feet at 300 revolutions per minute, and are directly connected to the armature shafts of the generators by insulated couplings. The inlet pipes are eight feet in diameter, and made of five-eighths-inch steel, with double draft tubes.

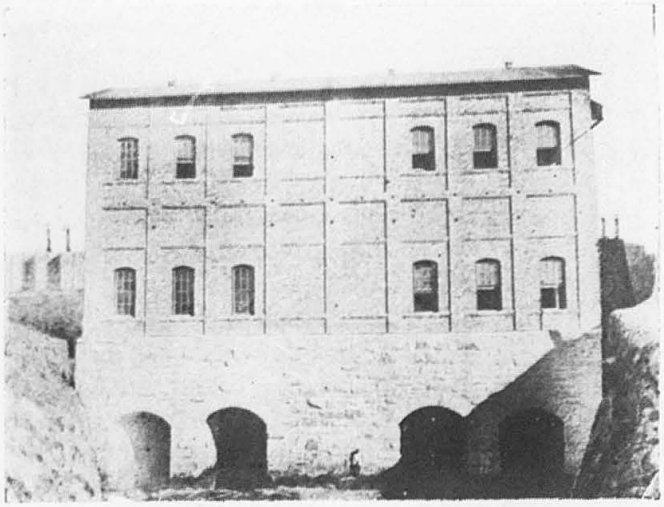

FIGURE 8.—THE POWER HOUSE OF THE SACRAMENTO ELECTRIC POWER AND LIGHT COMPANY AT FOLSOM.

Each pair of wheels is furnished with a steel flywheel ten feet in diameter, weighing 10,000 pounds, and which has a peripheral speed of 9425 feet per minute. To provide for the centrifugal strain that such a high velocity gives, heavy steel tires are shrunk on to the rims. The exciters are run by two special wheels of a size to give them the proper speed, which are also direct connected as in the case of the larger wheels. The governors are of the Feasch-Picard type, the same as are used on the Niagara wheels, and, being located in the generator room, are convenient for observation and control. Under the present temporary conditions it is necessary for an attendant to watch the tachometer and control the water manually.

The wheels are made of phosphor-bronze and the work throughout embraces the latest and most improved practice in hydraulics. The hydraulic equipment weighs upward of 400,000 pounds, and the plant, as a whole, is believed to be the most massive and powerful in the world, with the single exception of that at Niagara.

THE POWER HOUSE.

Coupled direct to each of these four turbines, as stated, through a 6 7-16 inch shaft fitted with insulating flanges, is a 750 kilowatt three-phase General Electric generator. At the time of the Electric Carnival only two of these generators, as shown in Fig. 10, were in operation, and these are without doubt the largest three-phase dynamos yet constructed. Their height is 8 feet 8½ inches, they cover a floor area of 11 feet by 8 feet 8 inches, and their weight is 57,877 pounds each. They are provided with twenty-four poles, and deliver a three phase current at a periodicity of sixty cycles per second and at a potential of 800 volts. The station is provided with two four-pole 500-volt exciters, having a capacity of 30 kilowatts each, and the entire four generators may be excited from either exciter.

From the generators the current is led through the simple switching-board, Fig. 10, to the bank of the step-up transformers placed in the transformer chamber on the upper floor of the building. These are of the large air-blast type manufactured by the General Electric Company, and each have a capacity of 265 kilowatts. Each generator feeds a group of three such transformers, making a total rated transformer capacity of 3180 kilowatts in the power house.

Only the dynamo potentials are handled at the station switchboard, which is, as stated, essentially a switching board. The two outside panels control the four generators, and as the board is provided with double sets of bus bars, the generators may be coupled to the circuits of the pole lines as desired. The center panel contains the synchronizing indicator lamps, the exciter instruments and the main line switches, while the generator panels, in addition to the switches, are provided with a voltmeter, current indicator, and the usual pressure regulator in each set. The switchboard is of Tennessee marble, and presents a very handsome appearance.

Both the primary and secondary coils of all step-up transformers are worked in parallel, taking current at 800 volts from the generators and delivering to the lines at a potential of 11,000 volts. Each generator is provided with a separate and distinct circuit from the power house to Sacramento, and they may be worked singly or in parallel, in the latter instance a synchronism being effected through the use of suitable indicators. As yet the transformers are run without the air blast, but as soon as the load increases sufficiently to cause material heating, both the power house at Folsom and the sub-station at Sacramento will be equipped with Sturtevant blowers, each operated by a 2-kilowatt inductor motor.

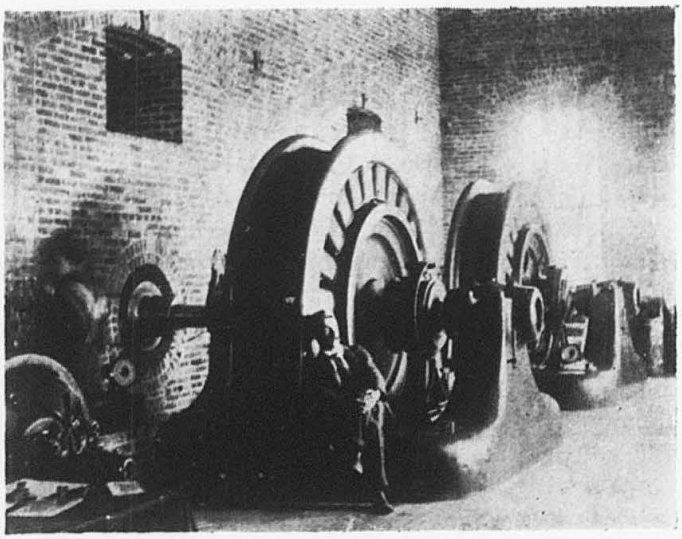

FIGURE 9.—TWO OF THE FOUR 750-KILOWATT THREE-PHASE GENERATORS IN THE FOLSOM POWER HOUSE.

The power house, which is shown at Fig. 8. is divided into practically four parts. The photograph from which the accompanying illustration was made was taken before water was run into the tail-race, and at present the water comes up within a few inches of the

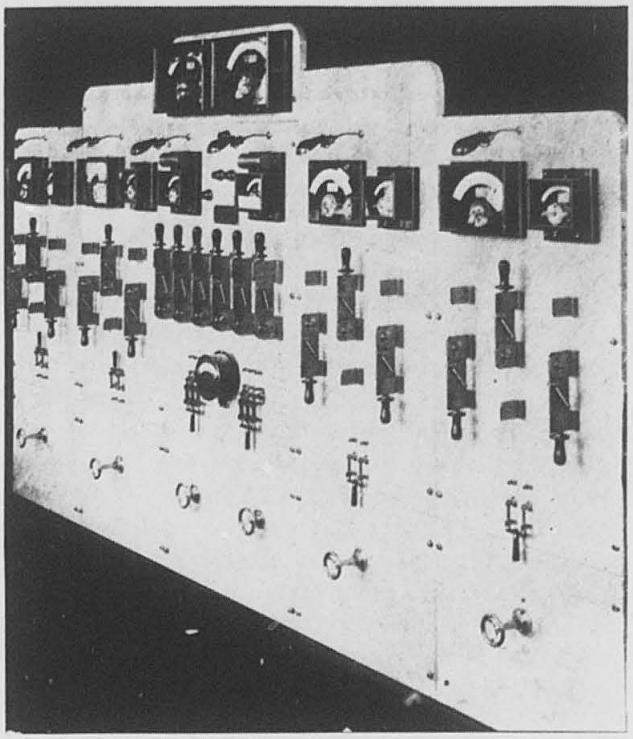

FIGURE 10.—GENERATOR SWITCHBOARD AT THE FOLSOM POWER HOUSE.

arches. The tail-race forms the first section of the power house and the first story is divided into two portions, one for the turbines and the other for the electrical apparatus. The transformers occupy the upper story, forming the fourth portion of the station. The secondaries are led from the transformers to the pole lines out through twelve porcelain-lined holes in the end of the station, protected by a substantial hood.

THE POLE LINE.

The pole line fittingly exhibits the care that has been exercised in the construction of the entire installation. It is a double line throughout, and following, as it does, along the sides of the country road and the Sacramento Valley railroad, it forms an avenue of poles 20.4 miles in length and of uniform construction. Forty-foot peeled Washington cedar poles of diameters averaging twelve inches at the top to sixteen inches at the butt, are used throughout the country division, but in the city sixty-foot poles have been placed at points of intersection with other pole lines. The transmission circuits proper, or those carried on the country pole lines, are supported on large special double-petticoat porcelain insulators that have been tested to withstand a potential of 25,000 volts A. C. The pole lines each support six No. 1 B. & S. bare copper wires, effecting transmission with an estimated line loss of ten per cent. Four such wires are carried by the upper cross arm and the two remaining wires by the remaining cross arms, as clearly shown in Figure 11. The illustration also shows that the poles are gained for two extra cross arms, with the intention of doubling the capacity when necessary. The cross arms, which are braced with angle irons, are seven feet in length, having a section of 4 x 4 inches, and the poles are set fifty to the mile, being placed six feet in the ground.

For many years the Sunset Telephone and Telegraph Company operated a long-distance telephone line between Sacramento and Folsom. It was of ordinary galvanized iron construction and grounded at each end, but as soon as the power transmission lines were put in operation the telephone circuit became useless from the induction. The new Capital Telephone and Telegraph Company, however, which has just been established in Sacramento, secured the privilege of placing a third cross arm on one of the pole lines a distance of thirty-six inches below the lowest power line. Number 14 bare copper wire is supported on porcelain knobs four feet apart, and the wires are transposed at every fifth pole. Columbia receivers and carbon transmitters are used, and the service is not only satisfactory between Sacramento and Folsom, but conversation may be carried on from Sacramento to Placerville, which is thirty-eight miles beyond Folsom, or a total distance of fifty miles.

The actual length of the power transmission circuits as measured by the pole line is as follows:

	Feet.
From the power house to the railroad depot at Folsom	1,056
From the Folsom depot to the limits of Sacramento	102,432
From the city limits to the sub-station	10,000
Total length of pole line	113,488

Or, practically, 21½ miles.

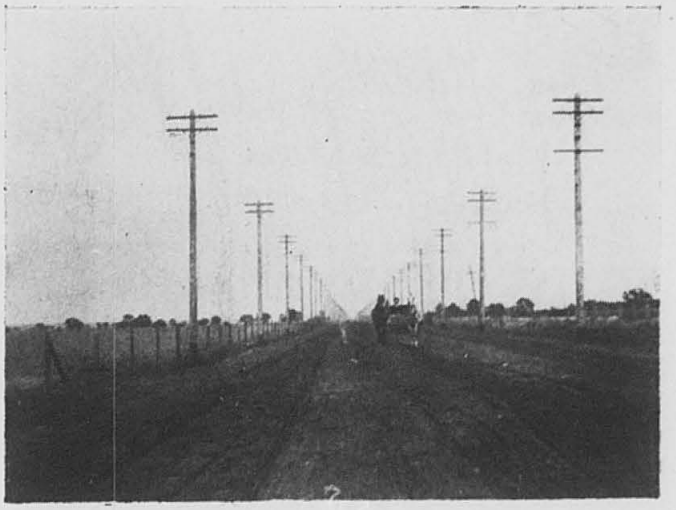

FIGURE 11.—DOUBLE POLE LINE TRANSMISSION CIRCUITS OF THE SACRAMENTO ELECTRIC POWER AND LIGHT COMPANY.

THE SUB-STATION.

The distributing station, as the step-down or sub-station of the Sacramento Electric Power and Light Company is called, is located on the northwest corner of Sixth and H streets, Sacramento, quite close

to the business portion of town. It is a substantial fire-proof structure, two stories in height, with an airy basement, and in addition to the general offices of the company, which, when completed, will occupy the front

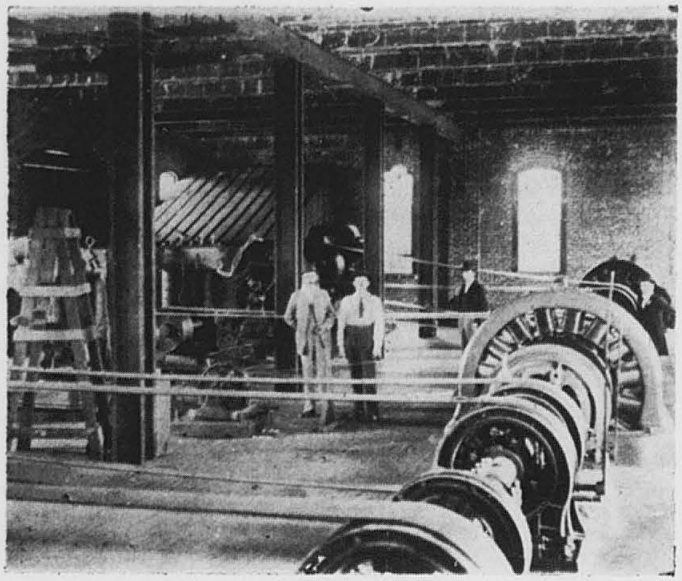

FIGURE 12.—THE MOTOR-GENERATOR ROOM IN THE SUB-STATION OF THE SACRAMENTO ELECTRIC POWER AND LIGHT COMPANY AT SACRAMENTO.

corner portion, it contains the motor and generator room (Fig. 12) on the ground floor. This room has an area of 50 by 100 feet in the clear, and here are located the three 3-phase synchronous motors and the various electric railway generators, and arc lighting dynamos comprising the plant.

From the pole line the transmission circuits are led direct to the step-down transformer chamber in the sub-station. Only a temporary wooden apartment, which appears in the corner of the dynamo room (Fig. 12) is used at present, as the permanent chamber has not yet been completed. Here are located nine 125-kilowatt type "A B" or air blast transformers, taking energy at 10,000 volts, and transforming down to the various potentials required for the different forms of distribution.

The large 250-kilowatt synchronous motors are supplied with energy from six of the nine 125-kilowatt transformers, delivering current at 500 volts. The remaining transformers step down to 125 volts, the current being distributed over the city on a four-wire system consisting of three wires for the three-phase current, and of a fourth or neutral wire. The incandescent lighting service is rendered from extensions made between either of the three wires and the neutral, due care of course being maintained to keep the circuits balanced within reasonable limits, but the power service is rendered from the three-phase wiring without reference to the neutral in any way. Motors of large capacity will undoubtedly be operated from 500-volt three-phase wiring, while the 125 and 250-volt four-wire system will be used for incandescent lighting and small motor work.

The synchronous motors used are of the General Electric "A F" type, form A, and each have a capacity of 250 kilowatts. These motors are identical in all details. Each has sixteen poles, and develops 300 horse-power at a speed of 450 revolutions per minute. They are operated at an E. M. F. of 500 volts, the current alternating at a periodicity of 60 cycles. A peculiarity of the plant is the fact that the motors are connected directly in line with the main shafting through friction clutches, and all pulleys on the shafting are friction pulleys. The main shafting, including the motor shafts, is 91 feet 6 inches in length over all, and has a uniform diameter of seven inches. Its speed is, of course, identical with that of the motors, or 450 revolutions per minute, and from the shaft are belted direct: One General Electric, 4-pole, 200-kilowatt, 500-volt railway generator; two Edison bi-polar, 500-volt railway generators rated at 100 kilowatts each, and one Thomson-Houston M. P. 90,

FIGURE 13.—THE CAR BARN OF THE CENTRAL ELECTRIC RAILWAY COMPANY, SACRAMENTO.

500-volt generator; also three Brush arc lighting Class Y dynamos, each having a capacity of 100, 2000 candle-power arc lamps, and each of which, therefore, has a rated output of 9.6 amperes at 5000 volts. The approxi-

mate energy required to operate these dynamos at full load is 1000 horse-power.

No novel features are presented in the switchboards, which are of the usual fire-proof form. The sub-station will eventually contain four distinct boards, the first of which handles the incandescent lighting circuits of the city. From the second switchboard, which is fed with 3-phase current at a potential of 500 volts from the transformer room, the circuits run through the usual devices to the three 250-kilowatt motors described. The third switchboard will control the various railway generators and circuits, while the fourth switchboard is the standard form of arc lighting board designed and manufactured by the General Electric Company.

POWER CONSUMPTION.

An observation that should be emphasized in a description of the Sacramento Electric Power and Light Company's plant is the fact that a market for a considerable portion of its output is already contracted for. The transmission scheme itself is, therefore, a reality and not a venture, and of its consumers at the present time, the Central Electric Railway Company, comprising the entire street railway system of the city, is the largest patron. This road embraces 24.5 miles of a single track and 17 miles of double track, a standard gauge of 4 feet 8½ inches being used. The rails are of combination type, weighing from 35 pounds to 56 pounds per yard, according to whether they are used on the main thoroughfares or on branch lines. The cars are largely of the combination type, and the practice of equipping each car with a 15 horse-power single reduction motor has been adopted because Sacramento is an absolutely level city, and the simple single equipment has been found to be satisfactory in every way. Brill trucks are used exclusively, and in all the system comprises thirty-two motor cars and three trailers. The maximum power required to operate the system is 650 horse-power, but in laying out the station a surplus of 250 horse-power has been provided for extensions of the road, and the capacity available by the railway company from the transmission circuits, is, therefore, 900 horse-power.

The Company owns about three-quarters of the block bounded by Twenty-eighth, Twenty-ninth, N and M streets, upon the south-east corner of which is located the large brick car-barn illustrated in Fig. 14. This structure has a capacity of housing forty-eight cars, and in addition contains in the rear a well-fitted repair shop operated by electric power. Other buildings adjacent contain a blacksmith, carpenter and paint shop, while the offices of the general manager of the road occupy the front corner portion of the main building.

The system is well provided with features for attracting the patronage of the amusement-loving public. At East Park, on Thirty-first street, the company has erected the largest toboggan slide in the State, which is operated by a 10 horse-power electric motor run from the railroad circuit. Here a hotel has been erected, and the park itself is a very attractive recreation and picnic ground. Oak Park, which is owned by the company, is situated on the south-east corner of the city limits, and here are found lawns, gardens and other attractions, among which is an excellent dancing pavilion. The branch of the railroad reaching Oak Park also extends to the baseball ground, while on the M street line is located the well-known Sutter's Fort with its surrounding grounds, and which daily attracts hundreds of visitors.

New demands for power seem to be arising daily and negotiations are now in progress with the Southern Pacific Company for the placing of 900 horse power in motors in the railroad shops, which at present are operated by steam. These shops employ about 4000 men, and it is possible that the amount of power required for their operation may materially exceed the figure named.

Sacramento is located on a low, level country that is protected from inundations from the Sacramento river by means of levees built along its bank, as a result of which there is a considerable seepage of water beneath its soil, and at present this seepage is collected by means of percolation, and pumped back into the river, the power for running the pump being obtained from the city water-works. During the recent State Fair, however, the members of the City Board of Trustees were so impressed with the efficacy of operating centrifugal pumps from induction motors that they have now passed a resolution inviting proposals for the operating of the city pumping station by electricity, and as a result of which, it is believed that the Sacramento Electric Power and Light Company will receive the contract for delivering several hundred horse-power for the purposes named.

Referring to the question which has been raised from time to time as to the water-power available for use at Folsom, Mr. H. T. Knight, consulting hydraulic engineer for the Folsom Water Power Company and who has perhaps made more careful measurement of the water supply of the American River than any other person, reports that the available fall below the power-house from the tail race of the plant to the American River is twenty-six feet, while the head utilized by the present plant is 55 feet. This twenty-six-foot fall can be readily utilized, Mr. Knight states, by constructing about 100 feet of canal from the present tail race, fifty-five or sixty feet in length, to carry the water from the proposed supplementary power-house to the river. The present arrangements of the Sacramento Electric Power and Light Company contemplate the use of only about one-third of the capacity of the canal, and its remaining capacity may be made available for additional installations by a comparatively small outlay.

The electrical equipment of the system of the Sacramento Electric Power and Light Company was installed by the General Electric Company through its regular engineering corps, the work being placed under the general supervision of Mr. J. A. Lighthipe, Chief Engineer of the Pacific Coast office, who was assisted by Mr. A. C. Jewett, Superintendent of Construction at the power house, by Mr. B. O. Boswell, Superintendent of Pole Line Construction, and by Mr. C. O. Schaeffer, Superintendent of Construction at the sub-station.

The principal stockholders of the Sacramento Electric Power and Light Company, as well as of the Central Electric Railway Company, are Messrs. Albert Gallatin, Horatio C. Livermore, Charles E. Livermore and others. The officers of the first-named corporation are Albert Gallatin, President; Horatio P. Livermore, General Manager, and Joshua Barker, Secretary, and it is to the energy and enterprise of these gentlemen and Mr. Charles E. Livermore, that the installation of this remarkable power transmission is due.