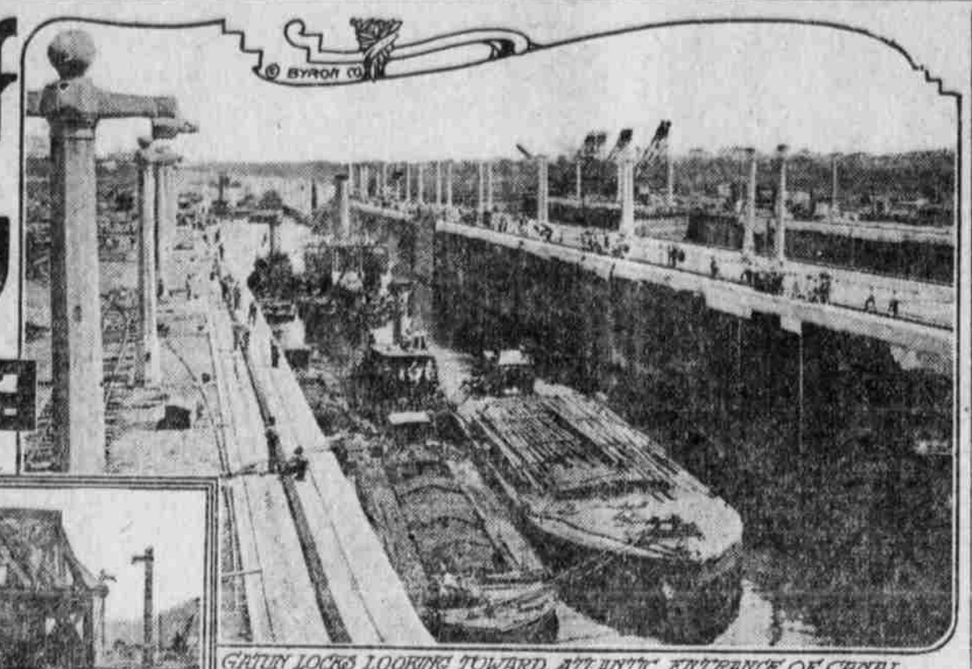
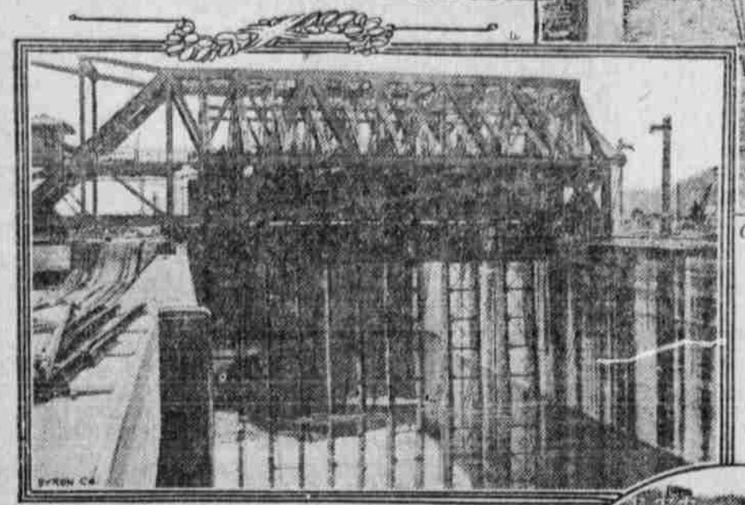
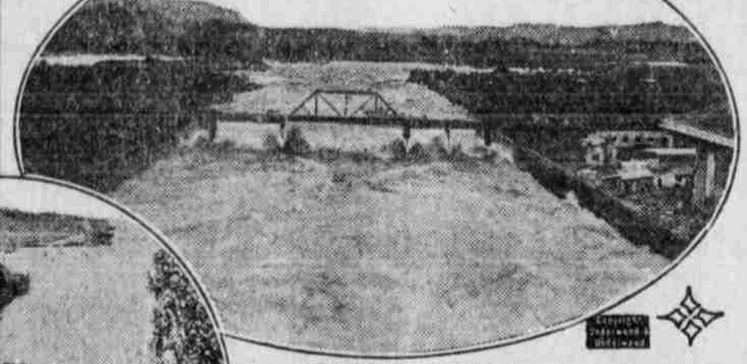
Triumph of Electricity in Panama



GATUN LOCKS LOOKING TOWARD ATLANTIC ENTRANCE OF CANAL

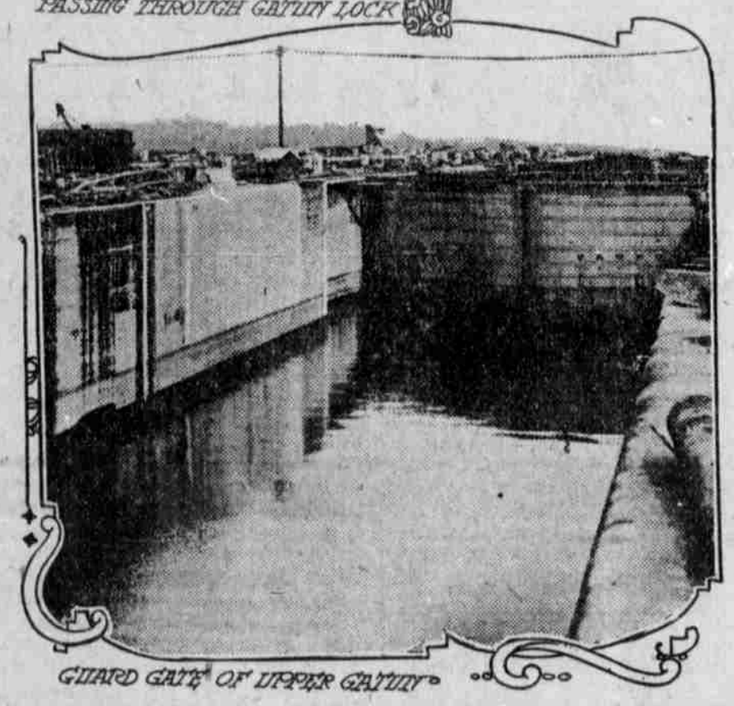


EMERGENCY DAM AT PEDRO MIGUEL



GATUN SPILLWAY

PASSING THROUGH GATUN LOCK



GUARD GATE OF UPPER GATUN

THE history of electricity, written largely in the last few years, is replete with wonderful engineering achievements. But never before has electricity been called upon to do so much, in such an entirely new and novel way, as at Panama. The hydroelectric generation of electrical energy and its distribution, the handling of the ships by electric locomotives, the novel system of centralized switchboard control for the great locks, is but another triumph for electricity, a new departure in electrical engineering and an advance in mechanics equaled only by the Panama canal itself.

It is expected that the surplus water of Gatun lake will ultimately supply the electrical energy for the entire canal zone. During the building of the canal a steam plant, located at Miraflores, furnished the electrical current necessary for the construction work at the Pacific end. This steam plant will be maintained as a reserve in case of shut down, low water or damage to the transmission line. At present it seems certain that there will be available sufficient water to generate fully 6,000 kilowatts. During the rainy seasons, which prevail in the tropics, water will be plentiful and will be allowed to run to waste over the spillway of the dam. During the dry season the storage water will be drawn upon. The maximum quantity of water diverted for hydroelectric development is about seven per cent of the minimum water supply and is the excess which is not required for lockage, evaporation and leakage.

The electricity generated at the Gatun powerhouse will be distributed for the operation of the three big locks, to the permanent machine shops, to the dry dock, to the coal handling plant and other auxiliaries. It will also be used to light the locks and the villages of the canal zone. In all probability the current will also be extensively used for electric cooking in the homes, as fuel is scarce and costly upon the isthmus. There is also under consideration the electrification of of the Panama railroad. The distribution circuits will be in duplicate throughout in order to insure a continuous service. As a further precaution, as above stated, the water-power station will be connected to the steam plant at Miraflores, which station will be held in reserve.

The power system for the operation of the locks, towing locomotives, lights for the locks and buildings, and motors not directly connected with the lock control, is composed of:

A 7,500 kv-a, 2,200-volt hydroelectric power plant at the Gatun dam.

Four thousand five hundred kv-a, 2,200-volt Curtis turbo-generator electric power plant at Miraflores for emergency, lately used to supply power for construction work.

A double 44,000-volt transmission line across the isthmus, connecting Cristobal on the Atlantic and Balboa on the Pacific with the two power plants named.

Four 44,000-2,200-volt substations, stepping down at Cristobal and Balboa, and up or down at Gatun and Miraflores, depending on which of the two plants is supplying power.

Thirty-six 2,200-240 volt transmission stations for power, traction and light at Gatun, Pedro Miguel and Miraflores locks.

Three 2,200-220-110-volt transformer stations for the control boards at the locks.

The hydroelectric station is located adjacent to the north wall of Gatun spillway. The building is of concrete and steel, designed specially for a power station in a tropical country. The building is capable of being enlarged to house six 2,000 kilowatt units, of which three have been installed. The building has but one main operating floor, with a turbine pit and two galleries for electrical equipment. Each unit of the mechanical equipment consists of an individual headgate, penstock, governor, generator, exciter, oil-switch, and control panel. Water is taken from Gatun lake through a forebay, which is constructed as an integral part of the curved portion of the north spillway approach wall. From the forebay the water is carried to the turbines through steel plate penstocks 350 feet long and 10 feet 6 inches in diameter. The entrances to the penstocks are protected by bar iron trash racks to prevent sunken debris from damaging the turbines. The headgates are raised and lowered by individual electric motors. These motors and the gate machinery, are housed in a small concrete gate-house erected in the forebay.

The turbo-generating units are of the vertical type, rotating parts of the generator and the turbine being mounted on the same shaft. Superimposed upon each turbine casing is a generator rated at 2,000 kilowatts, which will deliver three-phase, 25-cycle current at 2,200 volts. The main control switchboard for the control of the current is located on the second gallery floor, where the operator possesses a good view of the entire station. The operator at the switchboard completely controls all switching operations and, in addition, controls the headgates, the governors, the rheostats and the field circuit-breakers. Besides the control switches the main switchboard contains all indicating and recording instruments which are essential for an intelligent operation of the station. A storage battery, located on the first gallery, will be used to supply lighting current, etc., when the plant is not running. When the plant is in operation this direct current will be supplied by two motor-driven exciter sets which are operated directly from the 2,200-volt circuit.

The centralized control system for the Panama locks marks a wonderful advance in electrical engineering. The locks are operated by electricity and the controlling switchboards reproduce in miniature on the board, by synchronous indicators, every detail of operation so the man in charge sees the complete movement of all gates, valves, fender chains, etc., reproduced before his eyes, eliminating any errors which might otherwise occur.

The specifications for the entire generating, lock controlling and distribution system for operating the Panama canal were prepared under the supervision of Mr. Edward Schildhauer, electrical and mechanical engineer, Isthmian canal commission, assisted by a staff of able electrical engineers, including Mr. C. B. Larzelere, who was closely identified with the lock control problems; Mr. W. R. McCann, with the generation and distribution of power.

Speaking of this great engineering feat, Mr. Schildhauer said:

"The electrical control system has decided advantages over hydraulic or air systems. This will be readily granted when it is known that the flight of locks at Gatun, for instance, extends over a distance of 6,152 feet and the principal operating machines are distributed over a distance of 4,115 feet. To control the machines locally meant a large operating force distributed practically along the full length of the locks, which has invariably been the practice heretofore. Such a force would be difficult to co-ordinate into an efficient operating system. The matter therefore resolved itself into centralized control, which reduces the number of operators, operating expenses and liability to accident. Moreover, it fixes responsibility.

"Another argument for centralized control is the fact that by having all control switches centralized on one switchboard it permits the various control switches to be mechanically interlocked in a manner to minimize, if not entirely prevent, certain errors of human manipulations."

Heavy fender chains are stretched across the locks in front of all mitred gates which can be exposed to the upper level and also in front of the guard gates at the lower end. These are maintained in a taut position at all times when the gates behind them are closed, and are lowered when the gates are opened for the passage of a ship. These chains are raised and lowered by a hydraulic cylinder, in a method similar to that followed in hydraulic elevators, with the additional feature that if a ship approaches the gates at a dangerous speed and rams into the chain, the chain is paid out from each end with a maximum resistance for gradually stopping a ship before it reaches the gates. Lowering the chain for the legitimate passage of a vessel and raising it again after the vessel has passed are also under the control of the operator at the control house, and each operation of raising or lowering involves the control of two motors; viz, the starting of a large motor driving the main pump supplying water under pressure, and the control of a motor-operated valve which in turn controls the direction of movement of the chain, rising or falling.

At Gatun the control house is located at the lower end of the upper lock. At Miraflores the location is the same, that is, at the lower end of the upper pair of locks; but there are only one pair of duplicated locks downstream from the control house, the same as upstream. At Pedro Miguel the control house is at the lower end of the one pair of locks.

The motors are started and controlled by contactor panel located near them, the contactors of which handle the main motor currents. These contactors are controlled from the control house.

The canal and locks will accommodate the largest vessels. The fact that the control board is a working miniature of the lock which it operates shows the operator the actual condition of gates, height of water, etc., and, consequently, having the whole condition in miniature under his eye he knows what to do next and when to do it, the operator receiving his information as to the movement of the vessel from a towing master. The engineers on the locomotives which take the vessels through the locks, as well as the towing master, can see the position of the gates, but the position of the fender chains is indicated by semaphore arms on the lock walls.

Let us take a vessel through a set of locks.

It proceeds into the lock forebay either under its own power or that of a tug, and comes to a full stop. It will then proceed under the power and control of four electric locomotives—two forward to take it along, one on each side, and two others astern, one on each side, to keep the vessel in the middle of the waterway and to stop it when it has reached the proper point.

After the vessel comes to a full stop in the forebay its position is given by the towing master to the switchboard attendant, who, by moving a control switch lever, causes the lowering of the fender chain and the miniature fender chain on the control board after lock gate is in proper position. The fender chain is stretched across the canal to prevent the vessel from striking the gates if for some reason it should get beyond control. In such an event the fender chain brings the vessel to a full stop.

Now the vessel advances into the lock by means of the electric locomotives. The fender chain is raised and then the massive gates are shut behind, the miniature control board gates in the meantime indicating this movement. When the water on opposite sides of the gates in front of the vessel has been raised or lowered, as the case may be, until the water on both sides is at the same level, as shown on the water level indicators on the control board, these gates are opened and the boat is pulled into the next compartment, and so on.

NEWS FROM STATE HOUSE

Because of the mild weather of the winter just past, the state has been able to save thousands of dollars on the coal used at the various state institutions.

Ten tubercular cows belonging to a herd that had been condemned by State Veterinarian Kigin were killed at the plant of the Lincoln Packing company.

The injunction sought for against the submission of the $20,000 appropriation for an armory at Nebraska City was denied by Judge Stewart in district court at Lincoln.

All but two counties have reported to the state assessment board the valuations, total tax collections, and total levies for all purposes in the various taxing districts. This is a requirement of a 1913 amendment to the tax statutes.

Chief Game Warden Gus Rutenbeck declined to issue licenses to seine in public water of Nebraska last year and adheres to that policy this year. During the year 1912 between 200 and 500 licenses to seine were issued by the state game warden.

State Veterinarian Kigin will go to Scotts Bluff to investigate several cases of horse disease, reported by the owners to be glanders. When animals having this malady are killed by the state veterinarian's order, the horses must have been in the state for one year.

All commissioned officers of the Nebraska national guard are being examined at the present time in 1913 army regulations, 1911 infantry drill regulations and small arms firing manual for 1913. Circulars are being sent out to all branches of the service containing instructions on mobilization.

Adjutant General Hall has been elected brigadier general of the national guard troops in Nebraska. He received 105 of the 107 votes cast by commissioned officers. He now holds the appointive office of adjutant general and the elective office of brigadier general, and is the youngest person up to this time in the history of the state to hold such offices.

One of the most successful short courses of the boys' and girls' clubs ever held at the Nebraska college of agriculture closed Friday, May 1. Young people from a large number of counties came to make their first visit and to receive elementary instruction concerning seeds, soils, dairying, animal husbandry, farm machinery, and home economics.

Co-operative pruning and spraying demonstrations are being made by the horticultural department of the Nebraska College of Agriculture with many of the farmers of the state. Skilled men are being sent out from the University Farm who are at present treating 3,500 trees. In the counties having farm demonstrators the work is being done in co-operation with the farm management associations.

Five hundred people leave Lincoln every year for Europe or some other foreign country, according to the estimates of railroad and steamship agents. Agents in the city sell more than one ticket a day to some traveler going back to the "old country," or off on a sight-seeing tour of the world. All year round people leave for the seaports to embark for some land across seas.

Farmers and townsmen are showing more than ordinary alacrity this year in their purchase of automobiles. Records at the office of the secretary of state show that the total number of registrations in Nebraska, including several thousand motorcycles, has reached 51,355. April 24 a total of 120 automobiles were registered and on April 30 and May 1 a total of 153 cars were licensed.

Educational trust funds of Nebraska have accumulated almost to the $10,000,000 point, according to the monthly report of State Treasurer George at the close of business for April. The total amount in these funds is $1,661,904, and more than four-fifths of this belongs to the permanent school fund. There are four other funds in the class designated, known respectively as permanent university, agricultural college, university building and normal endowment funds.

Revenues collected by the state of Nebraska from the occupation tax levied upon corporations doing business for profit will be doubled this year, as compared with 1913, on account of the Potts law, enacted by the legislature a year ago, which creates a new sliding scale multiplying the tax upon the largest companies. A year ago the state derived $60,000, including penalties, from this source; this year the income from corporation tax is estimated at not less than $125,000.

Acting under a decision of the attorney general's department Dr. P. L. Hall, Rev. A. L. Weatherly and Rev. H. H. Harmon, members of the board for the care of dependent children, have turned over their burdens to the state board of control, comprising ex-Governor Silas R. Holcomb, Judge Howard Kennedy and Henry Gerdes.

The State Insurance company of Omaha has arranged with the state insurance commission for leave to reinsure its business with the National Fire company of Hartford, Conn.

STATE BOARD ISSUES WARNING

FARMERS URGED TO ENFORCE EFFECTIVE QUARANTINE ON CHOLERA.

GOSSIP FROM STATE CAPITAL

Items of Interest Gathered from Reliable Sources and Presented in Condensed Form to Our Readers.

Western Newspaper Union News Service.

Serum, the prevention of hog cholera and the precautions to be taken by farmers is the subject of warnings being emphasized by the state board of directors. Farmers are urged to enforce an effective quarantine when cholera breaks out on a farm. It is a mistake, it is claimed, to neglect sanitary precautions and to rely wholly on serum. The serum is useful, not so much to cure sick hogs, as to prevent other animals from taking the disease.

The following precautionary measures are necessary:

"Do not locate hog lots near a public highway, a stream or a railroad.

"Do not allow neighbors or strangers to enter your hog lots and do not go into your neighbors' lots. If you are compelled to pass from one hog lot to another, clean your shoes and wash them with a 3 per cent solution of the compound solution of cresol.

"Do not put new stock, either hogs or cattle, in lots with herd already on the farm.

"If hog cholera breaks out, separate the sick from the apparently healthy animals and burn the carcasses of all dead hogs on the day of death.

"If hog cholera appears on the farm notify the state veterinarian at once.

"Serum is furnished from the state agricultural college. The department of agriculture does not distribute serum direct to farmers."

Officials Deeply Puzzled.

State officials are deeply puzzled over the manner in which the university location proposition should be submitted to voters this fall. The form meeting with the greatest approval thus far, but which is not altogether satisfactory, puts it up in this form:

"(A). For removal of the university to the state farm campus." At the end of this line will be a square over which are printed the words, "For removal to the state farm."

"(B). For extension of the university on the present campus." At the end of this line will be a square over which are printed the words, "Against removal to the state farm."

The aim is toward simplicity. The officials want to avoid the least confusion in the matter. The question has been raised with regard to the above form, that if the largest vote is cast "against removal to the state farm," that the proposition B, providing "for extension of the present campus," might not be held to have carried.

On the other hand, if the squares for the crosses of the voters are labeled "for removal" and "for extension," respectively, the officials believe the proposition will not be as simply stated as it should.

Aboriginal Implements.

Nebraska university museum has been further enriched by another consignment of aboriginal implements from eastern Nebraska's underground house ruins from R. F. Gilder of Omaha, which have arrived at the state mueseum. The objects contained in the shipment comprise an exceptionally fine lot of decorated pot rims, bone and stone implements, shell spoons, digging tools manufactured from the shoulder blades of buffalo, bone needles and punches, arrow heads, a large assortment of stone knives and blades, grooved and ungrooved stone axes, peculiar in design to the builders of the underground houses, sandstone implements for smoothing the shaft of arrows and spears. The shipment of specimens just received at the state museum is the last of the material secured by Mr. Gilder last year while acting as archeologist in the field for the university and is considered a splendid addition to the anthropological collections which have made the institution famous.

Duncan McEwan of Chicago, a representative of the company now operating a chair and furniture factory at the state penitentiary, has offered the plant for sale to the state upon the expiration of the contract under which it is now operating. The contract will not expire for about one year. At the present time fifty men are employed in the factory. A law passed by the last legislature does away with the working of the inmates on contract labor following the expiration of the present contract.

Food Commissioner Harman is sending out a bulletin to ice cream manufacturers, calling their attention to the legal requirement that ordinary ice cream must contain not less than 14 per cent of butter fat, and fruit ice cream at least 12 per cent. Artificial flavors must be labeled on the containers of ice cream whenever they are used. The containers must also show the net contents. This does not apply to packages sold by a retailer. The bulletin also directs the notice of manufacturers to the sanitary requirements of the law.