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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

GATUN DAM FACTS PERVERTED.

It seems to be the fate of every great national enterprise undertaken by the United States to be assailed by a more or less numerous, and always vociferous, crowd of detractors and prophets of disaster. Such has been, and evidently will continue to be, the fate of the Panama Canal. The latest evidence of this was the altogether misleading statement that the settlement of a small section of the Gatun dam proved that the site for the dam was unstable, and that the structure, when completed, must inevitably cave in and let loose the waters of the great Gatun Lake.

From the newspaper point of view, this item, as cabled from Panama, was a most attractive piece of sensationalism; and one of the leading New York dailies has not hesitated to exploit the incident, with all those refinements of the art which are so well understood and remorselessly practised to-day. Interviews were sought with engineers who were known to be opposed to the present lock-and-lake plan of construction as adopted by the government, and their lurid predictions of what would happen, if the canal were completed along the present lines, were spread upon many a page of the journal in question.

Now, the Scientific American is in a position to assure its readers that this subsidence of a small portion of the dam is a matter of no significance whatever, and gives not the slightest reason to suppose that the dam when raised to its full height will not be perfectly stable.

The Gatun dam, as completed, will consist of an artificial mound of sand and clay, 135 feet in height, about 1,800 feet in width, and extending for 8,000 or 9,000 feet across the valley of the Chagres River from hillside to hillside. This huge mound is to be formed by means of suction dredges, which will pump sand and clay, mixed with water, from the bed of the Chagres River below the dam, on to the site of the dam. Here, as the water drains away, the sand and clay will settle into a mass of very close consistency, so close as to be impervious to seepage. In order to confine the deposited material within the proper width of 1,800 feet, and prevent it from flowing away with the water, two walls of loose rock are being built entirely across the valley, one at the foot of the slope on the upstream side or lake side of the dam, and the other on the downstream side. The wall along the upstream toe, as completed, will be 30 feet broad at the top and 60 feet high. As the rock fill was being built out across the valley it crossed the old French canal channel, which runs through the site of the dam. During the past twenty years this channel had become filled with silt and soft mud; and the engineers decided that, instead of excavating this material until firm bottom was reached, it would be more economical to dump the rock directly upon the mud, and allow the fill as thus formed to settle through the mud until it reached firm ground. As the fill was raised in height, its weight at length became such that the expected displacement occurred, the rock settling down and forcing the mud up into mounds on either side of the fill. So far from the settling causing any concern to the engineers, it is exactly what they expected to take place; and the greater the settlement, the more they will be pleased. There is nothing new in this, and certainly nothing to warrant the attempt to stir up public apprehension, to say nothing of Congressional anxiety, regarding the stability of the dam. Railroad embankments are being made every day by this very method of displacement; and when the rock fill at the toe of the Gatun dam has finally reached the underlying solid material, which it will do long before the dam is completed, the public need have no anxiety as to further settlement.

FASHIONS IN ELECTRIC SYSTEMS.

The views presented by an entirely disinterested and impartial critic, Mr. M. E. Uytborck of the Belgian State Railways, in the Bulletin of the International Railway Congress, describing his "Journey of Inquiry" in the United States, form a topic not a little suggestive in the light of other recent publications on the subject of electrical equipment.

Mr. Renshaw, in the December Electrical Journal, points out with admirable clearness and in a manner interesting to others besides the technically trained electrical engineer, the advantages of the monophase alternating current system. The paper of Mr. W. S. Murray, electrical engineer of the New York, New Haven & Hartford Railroad, presented before the American Institute of Electrical Engineers, however much it is to be commended for its frank discussion in the interests of science of the difficulties encountered in the electrification of that railroad, is quite as much a record of failure of the monophase system in its usual application as of the successful overcoming of unexpected difficulties.

The principal advantage of the monophase alternating system is briefly that it permits of the transmission by *two* conductors only—the trolley wire and the track—of those high voltages by which alone considerable economy in the first cost of conductors may be effected, and which are at the same time readily reduced to a safe working tension with almost no loss by means of entirely automatic and comparatively inexpensive static transformers. The design of a method of trolley line construction by means of which the high-voltage wires can be safely secured, of transformers portable on each car and of motors and control apparatus comparable in simplicity to those for direct current, has permitted the introduction of rural and interurban lines using this system, where the agricultural produce and similar freight traffic had to be created and the minimum expense was essential, and where the first cost of conductors, or rotary converter substations and feeders for an equivalent motor voltage, would have entirely prohibited a direct current system.

When the monophase alternating current comes to be applied to the congested terminus of a large railway system, however, these obvious advantages seem to be a little more than offset by practical disadvantages. There is no object in using alternating current except in the readily transformable high voltages desirable for conductor economy; high voltages cannot be safely carried in third-rail or similar conductors, and overhead wires have obvious disadvantages in stations, especially freight stations involving the use of cranes and travelers. The multiplication of switches and side-tracks involves a corresponding multiplication of conductors, which, in the case of overhead conductors, is enormously more costly in proportion, taking into consideration the desirability of making the wires from which current is taken as independent as possible and their supports as few as possible, whereas the third rail can be laid anywhere with equal ease and moved or replaced as readily as a length of running rail.

The theoretically automatic monophase transformer is found to provide a flexibility and safety commensurate with that of the direct-current system only with an attendant at every transformer substation; on the New York, New Haven & Hartford system no transformer stations are used, the generating station voltage being carried directly to the trolley, but, whereas on the New York Central electrification only one man to each 6.2 miles is required continuously to attend the rotary converters, on the New York, New Haven & Hartford system there is an attendant in charge of the sectional cut-out corresponding to each switch-bridge *every two miles*. In either case the duties of the employee permit him to attend to other matters so that the only difference in cost favoring the monophase system is that of the buildings required and the moving machinery of the direct-current converter stations, which rather effectually disposes of the theory that on monophase railways no staff is required for the distribution of traction current.

The number of employees of course decreases with the track congestion, and many miles of monophase trunk line would require only one sectional cut-out attendant, whereas a direct-current trunk-line would still require the converter station and attendant every six miles or so; to offset this, however, there is the immediate probability of the development for large power work of static transformers from alternating to direct current, and their introduction would at once put the direct current upon the same plane as the alternating as regards automatic transmission.

To come to the economy of operation, a New York Central train weighing, say 175 tons with an engine weighing 95, requires in starting from stations and in shunting operations only 400 to 500 amperes at 600 volts; a corresponding New Haven train in getting up speed requires 2,000 amperes and upward at the same voltage, or approximately five times the power, making no allowance for phase displacement, and the motors have the additional disadvantage that running at low speed can only be effected by repeated cutting off and on of the current.

In view of the above considerations, the difficulties of adequately insulating high tension overhead wires in smoky tunnels, of stray magnetic fields, lack of inductive element to counteract surging currents, and not least the electrical possibilities of a serious accident within the electrified zone, which are far more appalling for high-voltage overhead conductors than for any third-rail system under lower voltage, Mr. Uytborck concludes that traffic conditions should be the principal determining factor in deciding upon the system to be used. Electrical engineers, he suggests, have the tendency to follow the latest fashion and to adopt that which is new and has been successful in some instances in preference to older and better-known methods that could sometimes be more economically used.

MANHATTAN SUSPENSION BRIDGE TO BE INVESTIGATED

The last thing that the Scientific American desires is to pose as an alarmist regarding the safety of public structures; but we must confess to a feeling of relief on learning that the Mayor has directed that the Manhattan suspension bridge be submitted to an expert investigation. Had the recent expert inquiry into the cantilever structure at Blackwell's Island revealed only some minor and easily remedied defects, our confidence in the suspension bridge would not be so rudely assailed; but when we remember that the stresses in some of the members of the cantilever bridge are as high as from 25 to 47 per cent above the limit which has been set by conservative engineering practice, we may be pardoned for feeling no little anxiety as to the actual conditions of things in the Manhattan Bridge. When the present administration came into office, they found on file complete sets of plans for both of these bridges; and one of the first acts of the Bridge Department was to make some very radical changes in these plans. In the case of the cantilever bridge, the live load and the weight of the bridge itself were increased about 25 per cent; although the general outline and plan of the bridge were retained. In the case of the Manhattan Bridge, however, the plans which the Bridge Department found on file were ignored altogether, and others for an entirely different type of structure were drawn up. If, then, a mere change in the loading of the one bridge has sufficed to produce some deplorable results, what may we expect to find in the case of the other structure, in which not even the broad outlines of the original plan were preserved?

In view of these considerations we are gratified to learn that the Mayor has acceded to the request of the City Club for the appointment of "one or more competent bridge engineers to inspect the plans and stress sheets of the Manhattan Bridge." Ralph Modjeski, one of the engineers who will design the new Quebec bridge, having been selected. Anxiety regarding the newer structure is increased by the fact that, although the Bridge Department has from time to time made public the general plans of the Manhattan Bridge, it has never made public the strain sheet. In the course of the investigation of the Blackwell's Island Bridge, the extraordinary fact was developed that no complete strain sheet, showing the stresses in the various members under the heavier loading, was available; and it is natural that a doubt should be raised in the minds of the members of the City Club as to whether any complete strain sheet of the Manhattan Bridge has been drawn up. If approximate methods were adopted in determining the increase of size of the members of the Blackwell's Island Bridge, they may have been used also in proportioning the Manhattan Bridge. It is certain that the only possible way to restore confidence in a suspension bridge, which is not only the largest but the most heavily loaded that has yet been designed or built, was to subject the plans to a searching examination by an independent bridge engineer of national reputation, such as will now take place.

Chinese wood oil is obtained from the nut of the wood oil tree by pressing or extracting. The color of the oil varies with the method of extraction. In China it is usually heated strongly and is consequently very thick and black. Wood oil forms a very durable lacquer for wood, far surpassing boiled linseed oil in hardness and permanence. The oil possesses the peculiarity of drying more quickly in damp than in dry weather. The residue of the nuts left after the removal of the oil is a good fertilizer, which possesses the valuable property of destroying insects which feed on the roots of plants.