THE CHICAGO-ST. LOUIS WATERWAY.

BY W. FRANK M'CLURE.

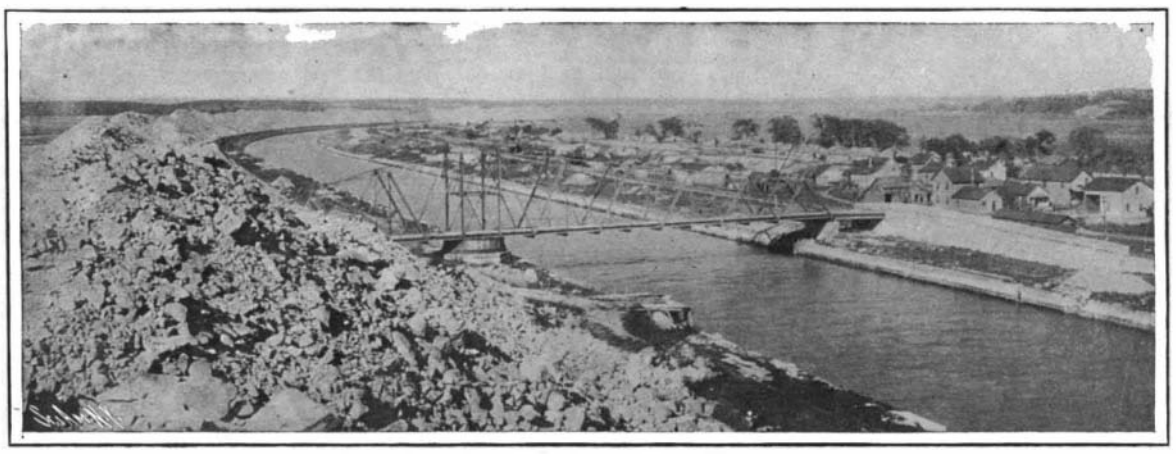
The Chicago to St. Louis waterway project *via* the Chicago drainage canal is attracting more attention to-day than at any time since its inception. Just recently it has gained a strong ally in the fact that St. Louis, for years hostile to the plan, is now urging its feasibility, and the Business Men's League of the city is taking an active interest in behalf of a navigable canal all the way from the Great Lakes to the Gulf. The recent developments with reference to this project may be summed up as follows:

About eighteen months ago the United States Supreme Court ended a long legal battle by its decision permitting Chicago to maintain its drainage canal. The present canal has a capacity of 10,000 cubic feet of water per second *via* the Chicago River, of which it is now utilizing a little less than 5,000 fect.

With a view to meeting all future needs of Chicago's sewerage and providing water for an adequate ship canal, the proposal to reverse the flow of the Calumet River, so that it will discharge into the Des Plaines River instead of into Lake Michigan, and for a part of the route follow the drainage canal already excavated, has recently been under consideration. By way of the Calumet, 4,000 additional cubic feet of water would be diverted. This proposition has been acted upon by the International Waterways Commission. The commission reported against the diverting of more than 10,000 cubic feet. In other words, its report was not favorable to reversing the waters of the Calumet. However, the commission stated its belief that 10,000 cubic feet is sufficient for all the future needs of Chicago from a sanitary standpoint, and in addition would provide a ship canal fourteen feet deep. Still more recently the government engineers and Secretary of War Taft have reported against the Calumet River project.

The whole matter came before Congress at its last session in the form of a bill to expend $31,000,000 in the completion of at least a fourteen-foot waterway to St. Louis *via* the drainage canal, and it will come up before that body again. In the meantime the Lakes-to-the-Gulf Deep Waterway Association and other organizations will actively keep the need for such an improvement in the public eye.

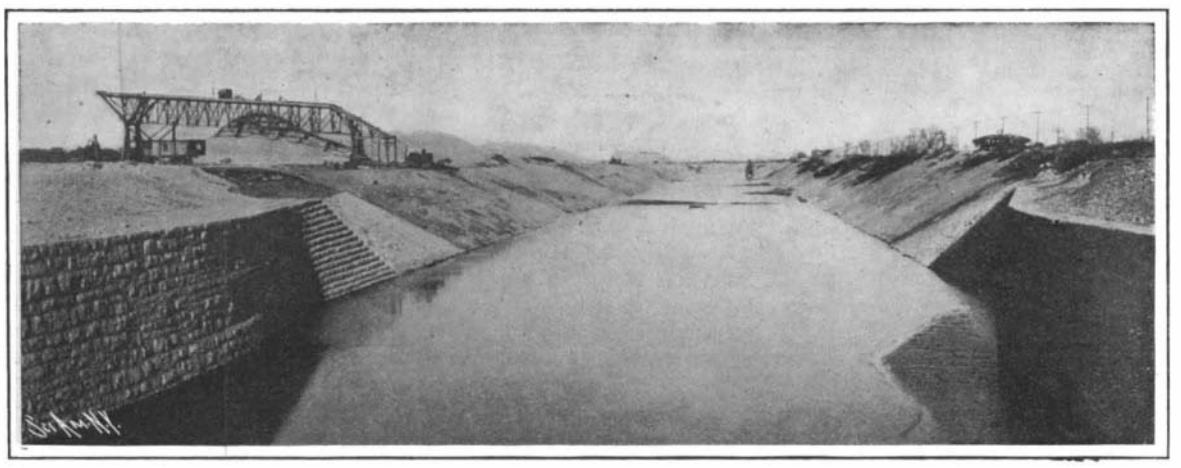
Active work on the Chicago drainage canal was begun in the year 1892. In 1899 it was completed sufficiently to be opened for use. The need for such a canal lay in the fact that the volume of Chicago's sewerage, as it emptied into Lake Michigan, was such as to pollute the city's water supply. The route of the drainage canal follows for six miles the Chicago River to its headwaters, where it pierces the watershed. Beyond this the digging was continued through both earth and rock for twenty-eight miles to the Des Plaines River. The Sanitary District also includes eight miles of this river.



Two Mile Curve in Channel at Rome, Ill.

Work on Earth and Rock Sections at Willow Springs.

The piercing of the divide between the Chicago and Des Plaines rivers was the most expensive and difficult work. In fact, the construction of the drainage canal is said to represent nearly two-thirds of the entire cost of the building of a fourteen-foot waterway between Chicago and St. Louis. The amount spent by Chicago on her drainage canal is close to $50,000,000; and, with a view to making it eventually a part of the deep waterway, the people of Chicago expended $18,000,000 more in its construction than would have been necessary for sanitary purposes only.



Junction of Earth and Rock Sections at Willow Springs.

Such a connecting link between Chicago and St. Louis had long been talked of. In 1808 it was mentioned in Congress. In 1817 a resolution was presented to that body instructing the Committee on Canals and Roads to inquire into the feasibility of building a navigable waterway from Lake Michigan to the Mississippi. By treaty with the Indians some ninety years ago a strip of land between Chicago and Ottawa was secured, with a view to the establishment of a canal between the two points. Many years afterward, at intervals, portions of this route were improved at government and State expense.

When the rest of the waterway is completed to St. Louis, the government is to be given control over the drainage canal, for navigation purposes. In assuming this control the government will find that every precaution has already been taken against any obstruction to navigation in the drainage canal. Bridges which, as far as sanitary requirements are concerned, could have remained stationary, are all movable for the passage of boats.

The entire length of the proposed waterway from Chicago to St. Louis is 362 miles. From Chicago to the controlling works of the drainage canal at Lockport is thirty-four miles. Next comes the eight-mile section from Lockport to Lake Joliet. On this short distance, rock cutting enters into the construction to no small extent. In fact, the cost per mile is more than on any other portion of the route. Of the cost of $8,000,000 which it is estimated that this will reach, the city of Chicago expects to pay $3,000,000.

Next comes the section between Lake Joliet and Utica, fifty-four miles in length and deeply cut the greater part of the way. The level of Lake Joliet is seventy-six feet below Lake Michigan, and there is a fall of sixty-six feet from here to the Utica level. On this length three levels or pools and three dams or locks will be necessary. A fourteen-foot waterway can easily be maintained here with a width of 300 feet.

From Utica to the mouth of the Illinois, 227 miles, is an alluvial stream of small declivity. The stream bed is from 600 to 900 feet wide. On the route are several locks and dams already built by the government. To obtain a fourteen-foot depth here, cheap hydraulic dredging will serve to increase the present depth by seven feet. This will necessitate the removal of 100,000,000 cubic yards, at a cost of $7,000,000.

From the mouth of the Illinois to St. Louis harbor represents a distance of thirty-nine miles with a total fall of twenty-one feet.

Ultimately, it is planned to extend this waterway to the Gulf. Already there are projects under consideration for the improvement of the Mississippi from St. Louis to Cairo, and Cairo to New Orleans. These projects, however, provide only for eight or nine feet depth as yet. On this account one of the

The Bear Trap Dam of the Chicago Drainage Canal.

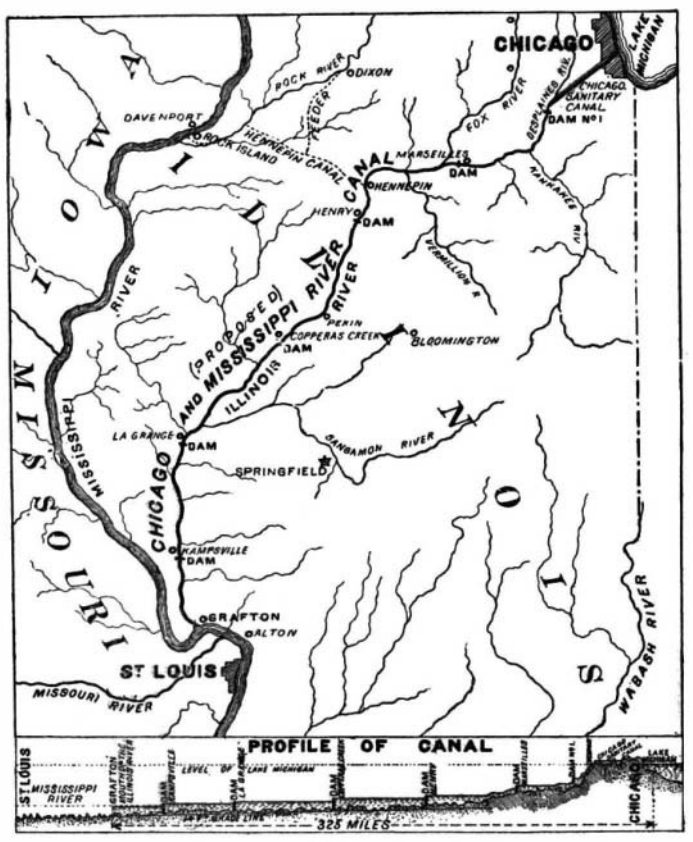
THE CHICAGO-ST. LOUIS WATERWAY.

boards of engineers recently sent to review the Chicago to St. Louis waterway situation recommends but an eight-foot channel between these two cities. The contention, however, has been made that the traffic between St. Louis and Chicago alone will warrant a fourteen foot depth, even though there is no plan at present to deepen the route from St. Louis to the Gulf.

With a waterway complete from the Great Lakes to New Orleans, and with the completion of the Panama Canal, it is contended that the States of the Middle West, with all their great industries and multiplicity of products, would be in communication with the Orient all the way by water. Freight rates would also be reduced, and much transferring of freight from cars to vessels would be avoided. Lake vessels running light could make their way *via* this canal to the ocean, and even light-draft war vessels, in case of necessity, could be brought to the lakes.

The international question in connection with this waterway arises over the diverting of water from the lakes. By a treaty of long ago, the Canadian government also has something to say about the regulation of these levels. The Lake Carriers' Association is also opposed to any lowering of lake levels, for the largest lake ships now draw twenty feet of water, and some of the big harbors offer none too great a depth for them. However, it is estimated that when Chicago utilizes the full 10,000 cubic feet for her drainage canal, or twice what now empties into it per second, the lake level cannot be affected beyond five or six inches. Remedial works of an international character are suggested to cope with any noticeable lowering of levels on the lakes.

As to Chicago's sewerage affecting the drinking water of St. Louis, time has obviated the objection at first raised; for in the intervening years St. Louis has suffered from no epidemic which is traceable to the water. The volume of water is so great, that it is found to be clear and odorless.



MAP AND PROFILE OF THE CHICAGO-ST. LOUIS WATERWAY.

THE "TURN-DOWN" ELECTRIC LAMP.

BY A. FREDERICK COLLINS.

An incandescent light has the advantage over the usual gas flame in that it cannot be blown out, but must be turned off; on the other hand, gas furnishes a much more flexible light than electricity, since its luminous values may be varied anywhere from minimal to maximal brilliancy, whereas the other usually has a fixed candle-power.

To overcome this untoward feature, which frequently, especially in the home, assumes the proportions of a real objection, an electric lamp has been invented that is adjustable, and gives, when turned on full, the usual 16 candle-power, or when turned down, 1 candle-power, as desired. The above statement is not intended to convey the impression that the turn-down electric lamp is a recent production, for the first one of this type was invented as early as 1892, but it was only recently that the lamp has been brought to what we may term a perfected state; and thus it will be observed that the turn-down electric lamp of to-day is an evolved product, rather than a new invention.

A good many years in the receding past, or to be more precise, shortly after Edison showed those of little faith that the electric current could be subdivided, the art of making filaments was in a very crude condition, and in consequence they were not only short-lived, but the making of the lamps was expensive. It was then that the Wizard of Menlo Park conceived the idea of inserting two or more filaments in a single bulb, and by a simple arrangement of contacts, when one of the filaments burned out another was brought into action, and so on until all were consumed.

This multiple arrangement of filaments in a single lamp may have been, and probably was, the cause that furnished George F. Melick with the inspiration of a double-filament turn-down electric lamp, which he devised in 1892. However this may be, he produced a lamp having both filaments connected in series, the free ends being permanently attached to the lamp terminals.

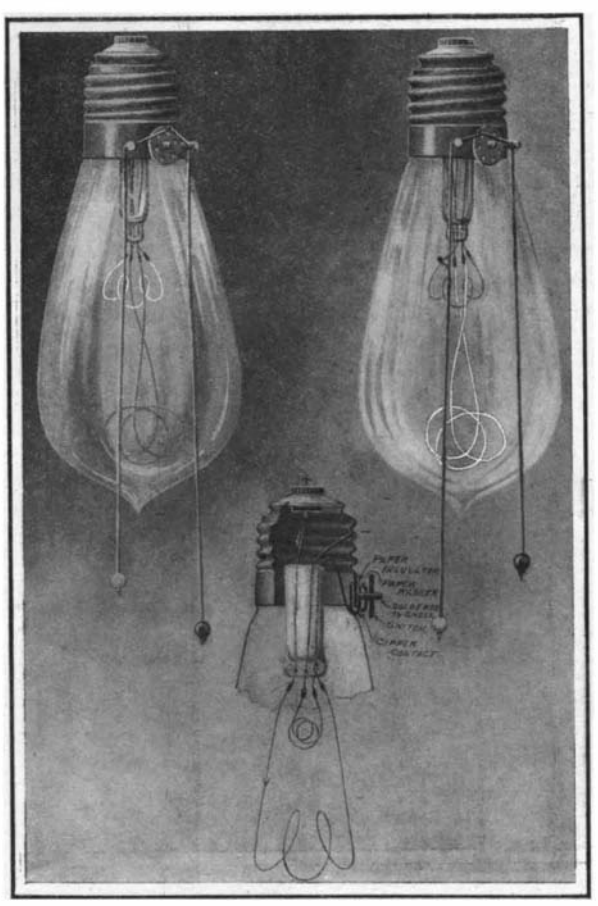
By means of a small switch in the base of the lamp, either one or the other of the filaments could be short-circuited without breaking the current, and in this way the danger of injury by sparking was eliminated. The best types of turn-down lamps manufactured at the present time still adhere to this plan of connecting the filaments together.

By this arrangement in Melick's lamp of the filaments (both of which were originally of the same size), the light given was reduced from its full candle-power to approximately one-half its candle-power. The switching mechanism was of course placed in the socket, and either a sliding switch or one having a screw was used to effect the desired changes.

After this invention other schemes were forthcoming to secure a wider range of adjustment in the light-emitting properties of the lamp, at least one of which depended upon a small resistance inserted in the base of the lamp socket; another had a similar rheostat on the wall, "conveniently located"; a third was provided with several filaments of different candle-power, mounted in the bulb and furnished with a multiple switch, so that the current would flow through one filament or two or more at once, depending upon the amount of light required; and finally two filaments have been mounted in a single lamp. These were under the control of a commutating switch arranged to burn either filament alone, both in parallel, or both in series, and in this way three different intensities of illumination were secured.

Now it so happens that the qualities of the incandescent filament are such that white light coincident with reasonable durability is only obtained through an exceedingly small range of electromotive force, which is the critical voltage for which the filament is designed. If a higher voltage is employed, the filament will give off particles that blacken the bulb, and if its use is continued for any length of time, the lamp will burn out; oppositely, if less than the critical voltage is used, the filament will emit a yellow light, then a red light, when the actinic properties will gradually decrease until there will be no effective light at all.

These disadvantages led William J. Phelps to use an auxiliary filament having a smaller cross-section than the main filament, so that the amount of current necessary to bring the auxiliary or smaller filament up to white incandescence is insufficient to make the main filament luminous. The idea is that the cold resistance of the main or 16-candle-power filament when added to the hot resistance of the 1-candle-power or auxiliary filament is just sufficient to pass the normal current required by the latter when both filaments in series are subjected to the electromotive force for which the lamp is intended.



"TURN-DOWN" ELECTRIC LAMPS.

In 1901 John McCullough designed a lamp in which either of the double filaments could be thrown into circuit by turning the bulb through a short arc. Hence this device of his relates more particularly to the switching mechanism than to the lamp proper, the arrangement of filaments used in connection with it having previously been patented by Levi Lohenthal in 1900, and which consisted of connecting one of the two like terminals of both of the filaments to one leading-in wire, while the opposite terminal of the 16-candle-power filament is connected to a plate making contact with the other leading-in wire when the bulb is turned to the right, and with the opposite terminal of the 1-candle-power filament when the bulb is turned to the left.

The above inventors, namely, Lohenthal and McCullough, then joined hands, and together they evolved, in 1903, a clever little switching device, so that there was no longer need to turn the bulb of the lamp, which experience had shown might very often be too hot to conveniently handle; and what was equally to the point, it permitted the lamp to be placed on the wall or ceiling at a height not readily reached, as well as the inclosing of it in a spherical shade. The lamps could nevertheless be turned down at will. This was accomplished by an improved switch which could be operated by cords attached to a small lever and passing through guides attached to the base of the lamp above or below the shade, to permit of its ready movement.

The latest type of turn-down incandescent lamp is due to the efforts of John J. Rooney, E.E., son of John Rooney, who was one of the founders of the Sawyer-Mann Lamp Company. In it the designer has taken advantage of all the improvements made in the incandescent lamp business up to this time, with several additional features included. In the "sun-star" lamp, as it is termed, the construction of the base with its switching device, called a turn-down base, is a permanent fixture, and will outlast a large number of bulbs.

The bulbs of all the standard candle-powers and voltages are made to fit these detachable bases. With the one base, for example, an 8-candle-power, 104-volt, or a 16-candle-power, 120-volt turn-down lamp can be made up, according as one or the other bulb is used. In all turn-down lamps prior to the advent of this one, it has been the practice to make the switch a permanent part of the structure of the lamp, the switch being mounted on the base of the lamp, and it has therefore been necessary to provide each lamp with an individual switch. In the present lamp the switch may be readily removed or attached as desired, so that the switch, which is really the expensive part of the lamp, may be transferred from one lamp to another. All that is necessary is to detach the base from the old bulb by loosening a milled screw, place the red pieces opposite each, and push the new bulb into the base with a twisting motion, when it is bolted together again with the milled screw. The bases are furnished with strings, and a pull on one or the other turns the light high, low, or out, to suit the exigencies of the case.

Anthracite Coal Production in 1906.

An advance chapter from "Mineral Resources of the United States, Calendar Year 1906," on the production of anthracite coal in 1906, prepared for the United States Geological Survey, by William W. Ruley, coal expert, is now ready for distribution, and copies may be obtained on application to the Director of the Survey at Washington, D. C. Mr. Ruley states that the production and consumption of anthracite in 1906, amounting to 63,645,010 long tons, shows a material decrease when compared with the tonnage of 1905 (69,339,152 long tons), which was the largest on record; but in view of the reported condition of the industry at the close of December, 1905, the results for 1906 should be regarded as better than had been anticipated.

The Boston Society of Civil Engineers has appointed a committee to consider the subject of rainwater run-off in populous districts, where the sewerage systems have to take care of rainfall. The secretary of the committee is Mr. Harrison P. Eddy, 14 Beacon Street, Boston, and he asks that engineers and others will send him any data they may possess bearing on the subject.

The battleship "Kansas" is being fitted with a wireless telegraph outfit. The sending radius is said to be about 500 miles.