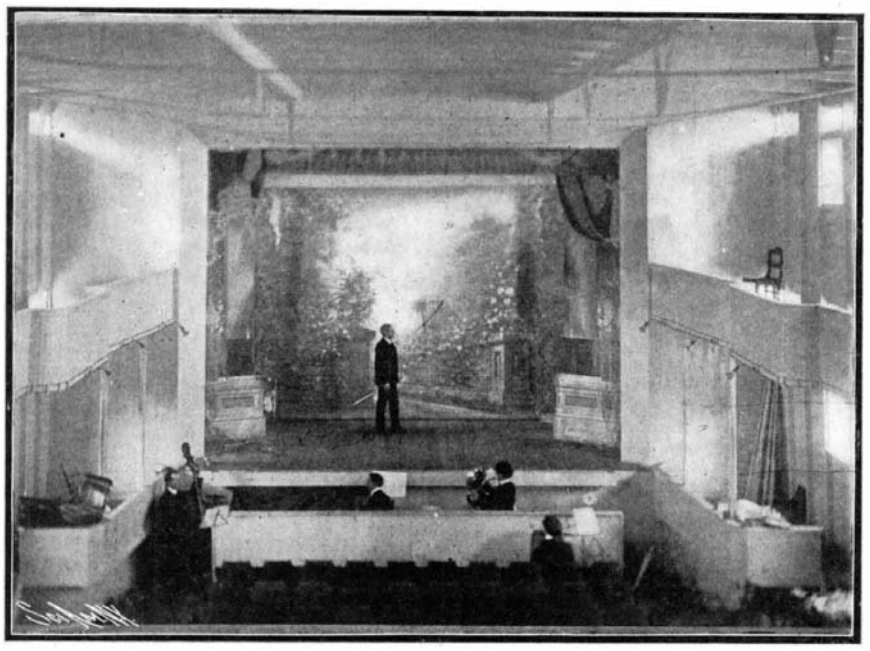
A FLOATING THEATER.

BY W. FRANK M'CLURE.

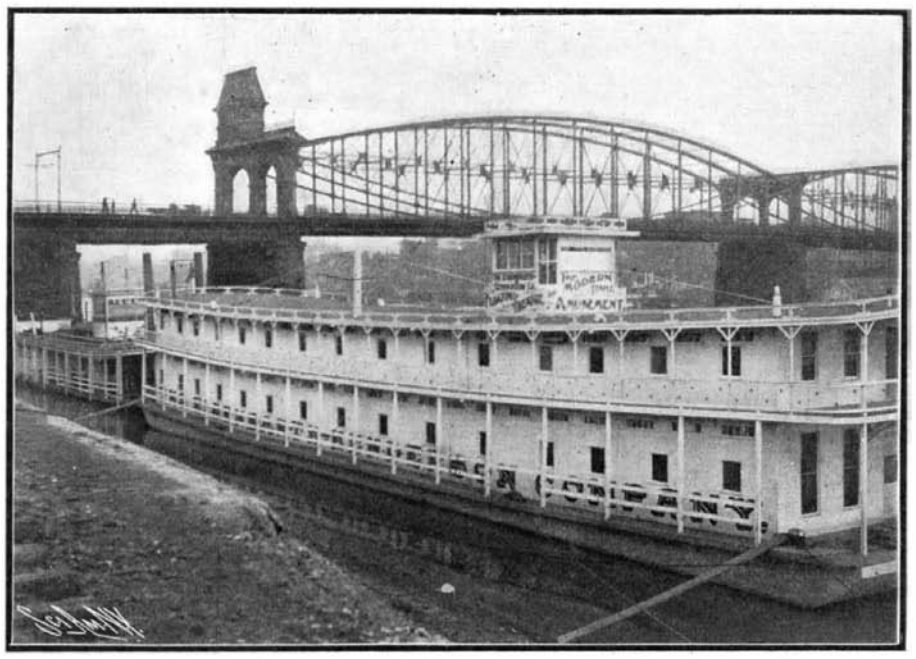
Perhaps the most interesting of new vessels plying the Ohio, Illinois, and Mississippi rivers is one built upon an extensive scale for use as a floating theater. The seating capacity is for 1,000 people, and there are boxes for the *élite* and a pit for the orchestra. In addition, the vessel is sufficiently large to admit of numerous sleeping rooms for the actors, the deckhands, and all those connected with either the show or the boat. The entire force numbers forty. On the steamer which tows the floating theater, besides the boilers and engines, there is a complete electric light plant, besides a kitchen and dining room.

In view of the fact that the long water route of the floating theater carries it into the warmer portions of the South, the season for the show does not close until late in the southern winter. The entire route comprises 2,500 miles. The boat starts at Pittsburg and visits the towns of the coal miners and steel workers along the Monongahela River. Next it returns and goes down the Ohio to the Kanawha, thence to Cairo, and later up the Illinois River to La Salle. Then after going back to the Mississippi, the boat slowly makes its way in the direction of New Orleans. The idea of a floating theater is not exactly new, but the extensive scale upon which it is being carried on and the fact that it is the drama instead of the vaudeville programme that is being presented, attract unusual attention to the boat herewith pictured. "Faust" is the production which has been presented this season.

Along the route of the floating theater the towns are often but ten or fifteen miles apart. Therefore the jumps of the boat and its company are not long ones. On the upper deck of the steamer is a calliope. Long before the theater reaches the town in which it is to show, the sounds of this instrument may be heard. The idle population of the river towns at once begins to assemble on the wharf. As the steamer comes within a few hundred feet of the dock, the calliope is silenced and a brass band strikes up a familiar air. The crowd on the wharf then grows larger. Many are there awaiting the first opportunity to secure reserved seats. When the boat touches the wharf the sailors, some of whom later are transformed into actors, make the vessel fast and put the gangplank in place. The scenery is arranged and the orchestra rehearses while the cook is preparing the next meal in the kitchen. The people come aboard and select their seats instead of doing so from a diagram on shore. At night the theater is brilliantly lighted by electricity and a searchlight flashes over the surrounding territory. The entertainment lasts about three hours.



THE INTERIOR OF THE FLOATING THEATER.



THE FLOATING THEATER WHICH TRAVELS A ROUTE OF 2,500 MILES.

A NEW CHLOROFORMING APPARATUS.

BY EMILE GUARINI.

We illustrate herewith a very interesting apparatus for the administration of chloroform which was invented some time ago, and experimented with upon an extensive scale, by Dr. Roth-Draeger in collaboration with M. Guillelminetti. Chloroform, as is well known, is the best of anæsthetics, but the administration of it is a dangerous and delicate operation. So, as long as death or danger lurks in chloroformization, it is the duty of scientists to seek a means of obviating all mischances. For this purpose, inhalations of oxygen have been employed, and this method was proposed by Ducray so long ago as 1850, in a note to the Academie des Sciences. The good effects of anæsthesia obtained with chloroform mixed with oxygen have been noted by Krantzmann, of San Francisco, Northrop, Schall, Hart, Prochoconik, Championnière, and Neudorffer, who pumped this gas through a Junker apparatus. But the difficulty experienced, up to but a few years ago, in procuring chemically pure oxygen, necessarily contributed toward discouraging innovators. Even granting that oxygen were of no importance to anæsthetized persons, the value of the apparatus is not diminished. It allows a patient to respire a mixture of air, oxygen, and chloroform, the quantity of the latter being exactly proportioned per minute by the current of oxygen, regulated to 3 or 5 liters per minute. The apparatus is provided with an expander of precision, to the construction of which M. Guillelminetti has contributed by his researches upon the efficiency of the inhalations of oxygen in mountain and balloon sickness. The exact quantity of chloroform mixed with the air by the oxygenated current, that is to say, the proportioning of the mixture, is of considerable importance, and herein lies the merit of the new apparatus. With a mixture of 25 grammes of chloroform and 100 liters of air, a dog is killed in 10 minutes, but with 6 grammes of chloroform to 100 liters of air, it is kept under perfect anæsthesia for 6 or 7 hours. The labors of Paul Bert have demonstrated that the anæsthetic state depends upon a certain tension of the gas in the blood kept up by the tension of such gas in the air respired, and that it is a question not of the quantity, but of the proportion of the gas mixed with the air. The apparatus under consideration permits of administering chloroform always mixed with a certain quantity of oxygen and air, and never in too concentrated a state. In this way it completely abolishes the injurious local action of concentrated chloroform upon the mucous membrane of the respiratory tracts, so that there is no longer any danger of laryngeal spasms, of suffocation, or of glandular hypersecretion. In case of symptoms of asphyxia in the course of a long anæsthetization of a patient exhibiting a weakness of the heart, it is possible to use the current of oxygen alone and cease the administration of chloroform.

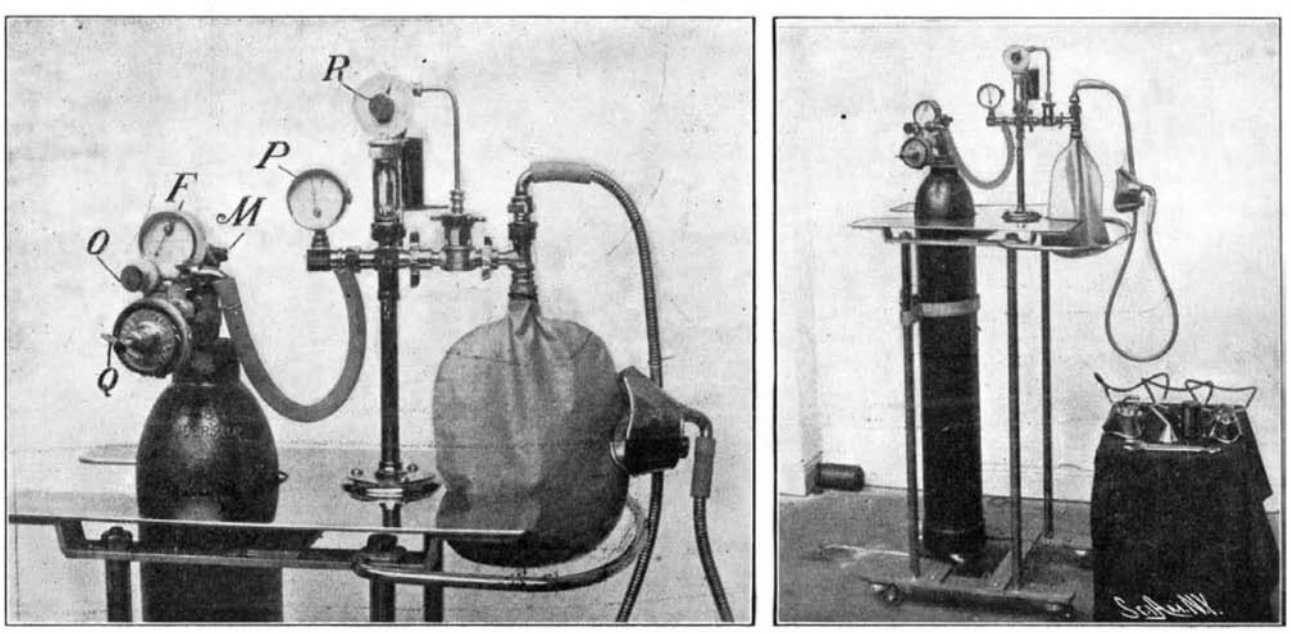
Anæsthesia has already been produced thousands of times with this apparatus in the Hospital of Hamburg-Eppendorf and in that of Lübeck, etc., and all the administrations have proved more effective and easy than with the compress or mask. The interesting point is the small quantity of chloroform employed, from 20 to 40 grammes sufficing for an anæsthetization of from 1¼ to 1½ hours. From an economic standpoint, the expense involved by the use of oxygen is compensated for by a saving in chloroform.

The apparatus comprises: (1) a metal cylinder containing oxygen under a pressure of from 120 to 150 atmospheres; (2) a cock that permits of turning on the current of oxygen, and another that permits of proportioning the quantity of chloroform per minute; (3) a glass flask containing the chloroform; (4) a bag of goldbeater's skin serving as a temporary reservoir for the oxygen; and (5) a metal mask. This latter is provided with a small aperture for the entrance of pure air, so that the patient shall not inhale pure oxygen. The patient inhales about 8 liters of air per minute. If 3 liters of oxygen are given, he will inhale from the exterior through the aperture 5 liters of air. As such air contains 1 liter of oxygen and 4 liters of nitrogen, the patient will inhale a 50 per cent mixture of air and oxygen. The mask is provided likewise with a wide aperture furnished with a valve for expiration.

The expander causes a lowering of the pressure of the oxygen, which passes into a tube and, acting after the manner of the Bunsen burner, sucks up the chloroform contained in the flask. A cock permits of regulating the suction and, consequently, of administering the chloroform in varying quantities. After the mixture is formed, it passes into the bag, where it accumulates during the expiration, and whence it escapes during the aspiration.

In order to make use of the apparatus, the main valve, *M*, of the oxygen cylinder is opened, and then the supply valve, *O*, of the same. The pressure, being too strong, is reduced by actuating the thumb-screw, *Q*. The quantity of oxygen per minute is then regulated according to the indications of the gage, *P*. The proper quantity of chloroform is given by means of the valve, *R*. By shutting off the oxygen at *O*, the inhalation of the chloroform is arrested. If it be desired to administer oxygen only, all that has to be done is to close the chloroform valve, *R*. The gage, *F*, indicates the quantity of oxygen remaining in the cylinder.

In order to begin the anæsthetization, the oxygen alone is allowed to flow into the mask for from one to two minutes, and the patient is requested to take a deep inspiration. Then the indicator of the chloroform valve, *R*, is put upon the figure 10 or



A NEW APPARATUS FOR THE ADMINISTRATION OF CHLOROFORM.

15 (indicating the drops) in order to accustom the patient to the anæsthetic. After a few seconds, the operator raises the figure to 25 or 30 drops if the patient is a woman, and to 40 to 50 if a man. This quantity is maintained for four or five minutes. After the patient falls asleep, the quantity is diminished to 20 to 15 drops in order to keep up the anæsthetization, which is always excellent and calm.

ELECTRICITY ON THE MIAMI AND ERIE CANAL.

The general interest which has been aroused by the appropriation on the part of the New York legislature of $101,000,000 for the improvement of the State canals, and also by the various attempts which have been made within recent years to use electric power in drawing the barges of the Erie Canal, lead us to suppose that an account of the Miami and Erie Canal, the only waterway in this country which is successfully operated by electricity, and the only example in this country of three-phase traction, will not be without interest to our readers. The work of electrifying the Miami and Erie Canal is due largely to the energy of Thomas N. Foredyce, who, in 1900, conducted a series of experiments with an electric towing locomotive which ran along the banks of the canal on a specially built track. Through the courtesy of Charles W. Ricker, an engineer, who rendered valuable assistance in the electrification of the canal, we are enabled to present illustrations of the waterway, and likewise to present a full account of the installation.

Active work was begun on the Cincinnati-Dayton section, 68 miles long, in July, 1901. The section is nearly completed, and the stretch from Cincinnati to Middletown, some 42 miles in length, is now in operation. The table in the footnote gives the length and depth of the canal.*

Along the line of the canal are 95 locks, each 90 feet long and 15 feet wide. The gates are of the wood, swinging-miter type, and are operated by hand. There is but one summit level, which is 395 feet above Lake Erie and 512 feet above the Ohio River. Its length is 23 miles, beginning 100 miles north of Cincinnati. The high levels are supplied by three artificial lakes and by rivers.

The canal boats are towed in a string by a locomotive running on the tow path. Before electric locomotives were used, each boat required, for twenty-four hours' operation, a crew of two steersmen, two drivers, and one cook—in all five persons—besides five mules. The average speed was about two miles an hour. With the new system, each boat needs only two men and the locomotive four men for the same period of time. The speed has been increased to three miles per hour. The numerous curves and irregularities of the channel render it impossible to string together more than ten boats, each 80 feet long. About 200 feet of line are used between the motor and the first boat, and 50 feet between boats, so that an electric mule drags a tail some 1,500 feet in length.

Since the whole length of the canal is to be supplied from a moderate number of generating stations, the principal transmission is naturally by alternating current at high tension, with reducing sub-stations at intervals along the line. Owing to the small number of large units forming the load, and their ability to bunch, the sub-stations must be placed far apart, or some of them will be idle much of the time, thereby involving a low all-day efficiency. The average demand per unit is high, involving a high average line loss. These conditions rendered it necessary to select a high trolley voltage. The running conditions are such that induction motors can be used to advantage. Stops are infrequent. A string of boats must be set in motion slowly in order to prevent breaking of the towing lines. Hence the slow starting torque, as compared with series motors, is not a serious objection. The higher trolley voltage possible assures good regulation and a good starting torque without excessive expense for copper.

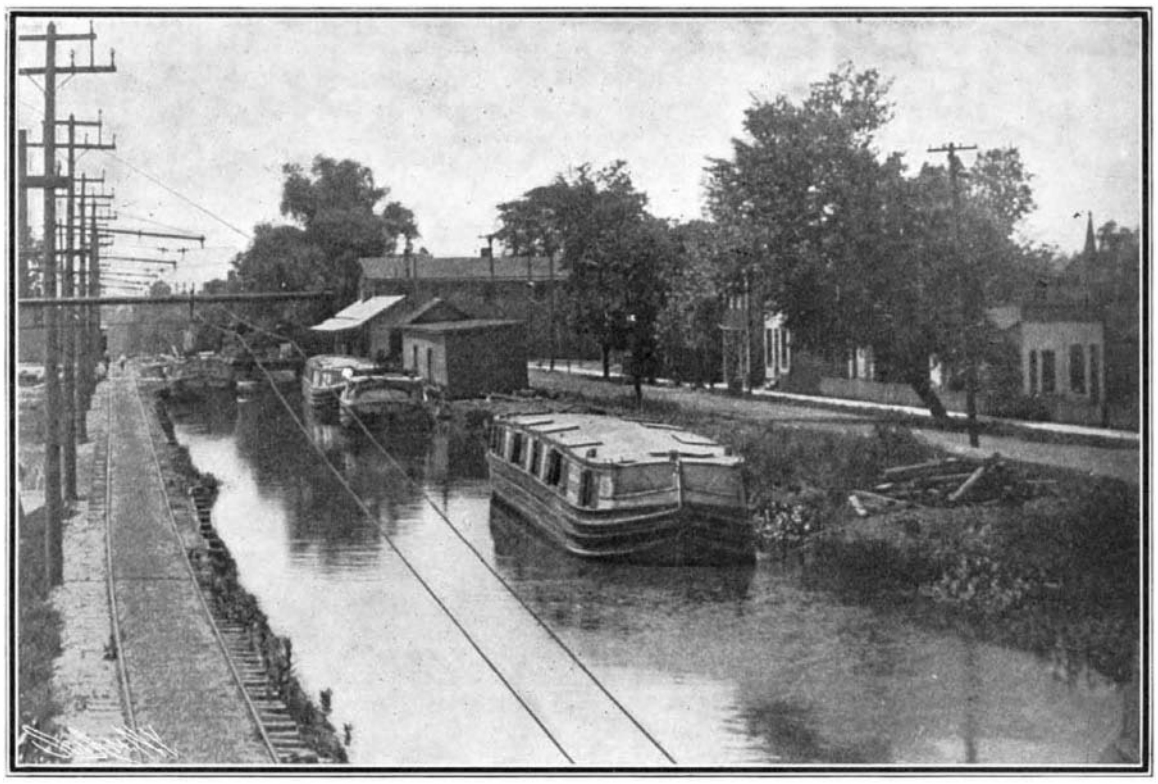
The Cleveland Construction Company, who designed the electrical equipment, installed an alternating-current system throughout, with locomotives equipped with three-phase induction motors to which energy is supplied from a three-conductor line, consisting of two overhead trolley wires and the track.

The track is built along the towpath with the finished surface 2 feet above the water level. Between Cincinnati and Hamilton, the canal lies mostly along hillsides, with the towpath on the higher bank, which is about 16 feet thick at the water line, with slopes of 1¾ to 1. The sub-grade is 12 feet wide. The central line of the track is about 6 feet from the water's edge.

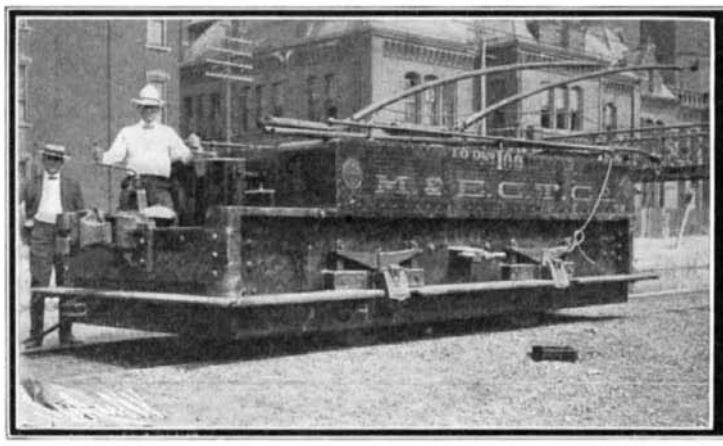
Along the main line, the maximum curvature is 25 degrees. In Cincinnati, however, there are sharp curves which require a very short wheel base for the locomotives. The only grades are at locks and depressions under low bridges. The steepest slope is 2 per cent. Within the city limits, railroad bridges and street bridges could not be raised, so that the tracks under them had to be depressed to allow the locomotives to pass. At three places the towing track crosses the canal. Where a drawbridge has been installed it must be opened immediately after the motor has passed to allow the boats to float through. Quickness of movement is important.

A three-phase, 60-cycle current at 4,200 volts is delivered at the switchboard and transmitted over the transportation company's lines, 5 miles distance to the first station—just within the northerly limit of Cincinnati. This is a motor-driven generating station which supplies the first trolley section, extending from the Cincinnati terminal northerly 7½ miles, at 390 volts, 3-phase, 25 cycles. Static transformers raise the pressure for transmission along the canal to the other stations, where it is reduced to 1,170 volts for the three-phase trolley circuit. In all, there will be four reducing stations about 12 miles apart, the most northerly about 6 miles south of Dayton. A typical station is that which is known as No. 2, at Rialto—typical because all the other reducing substations are to be exactly like it. The equipment consists of three 150-kilowatt, 25-cycle, 33,000-volt to 1,170-volt self-cooling oil transformers connected in delta in both primary and secondary. Each substation is placed at the middle of the station which it is to supply.

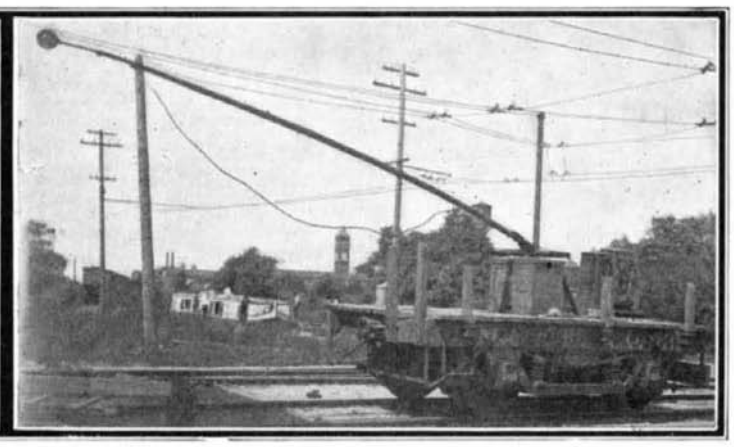
The 33,000-volt transmission line from the transportation company's station No. 1 consists of three aluminium cables made up of seven strands of wire. These are arranged in the form of a triangle at the top



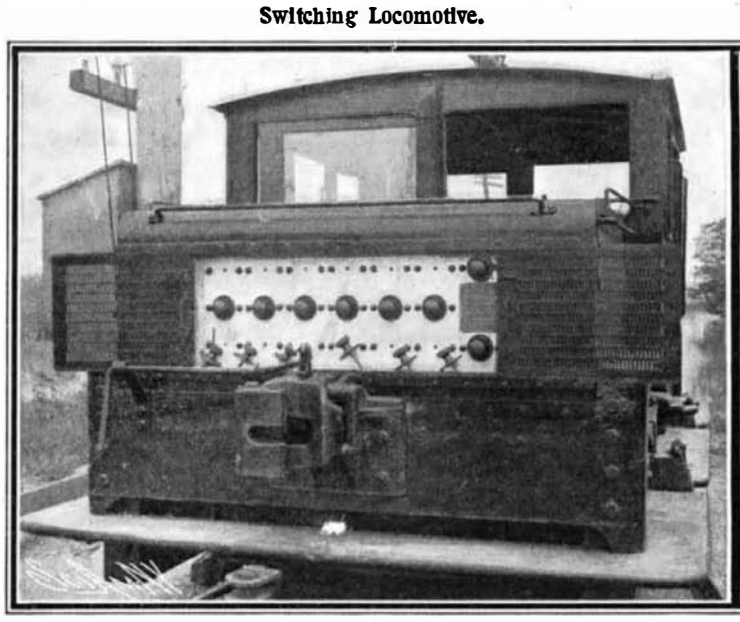
A Scene Along the Canal, Showing Overhead Lines and Track.



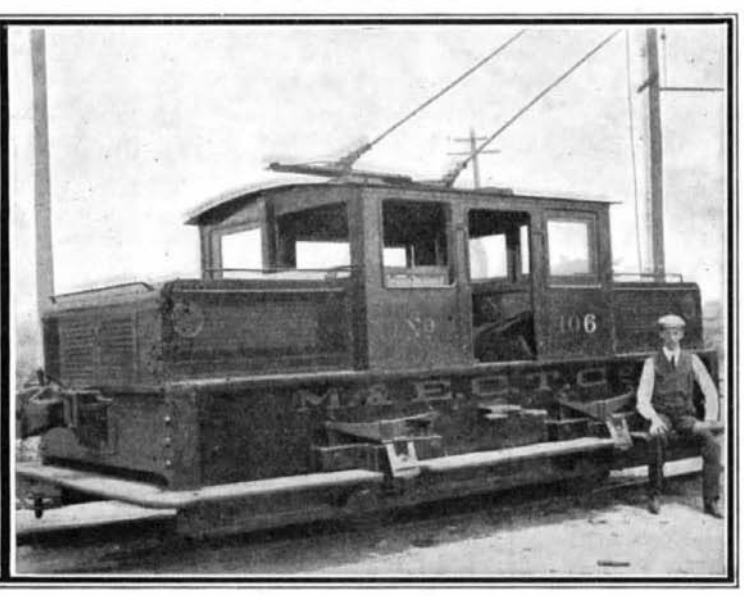
Switching Locomotive.



The Construction Motor.



End of Locomotive Showing the Primary Switchboard.



One of the Standard Electric Towing Locomotives Used on the Miami and Erie Canal.

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From	To	Distance Miles	Width in Feet—Water line	Width in Feet—Bottom	Depth Feet
Cincinnati	Dayton	66	40	26	4
Dayton Junction	Junction	114	50	36	5
Junction	Toledo	64	60	46	6
Cincinnati	Toledo	244	..	..	..