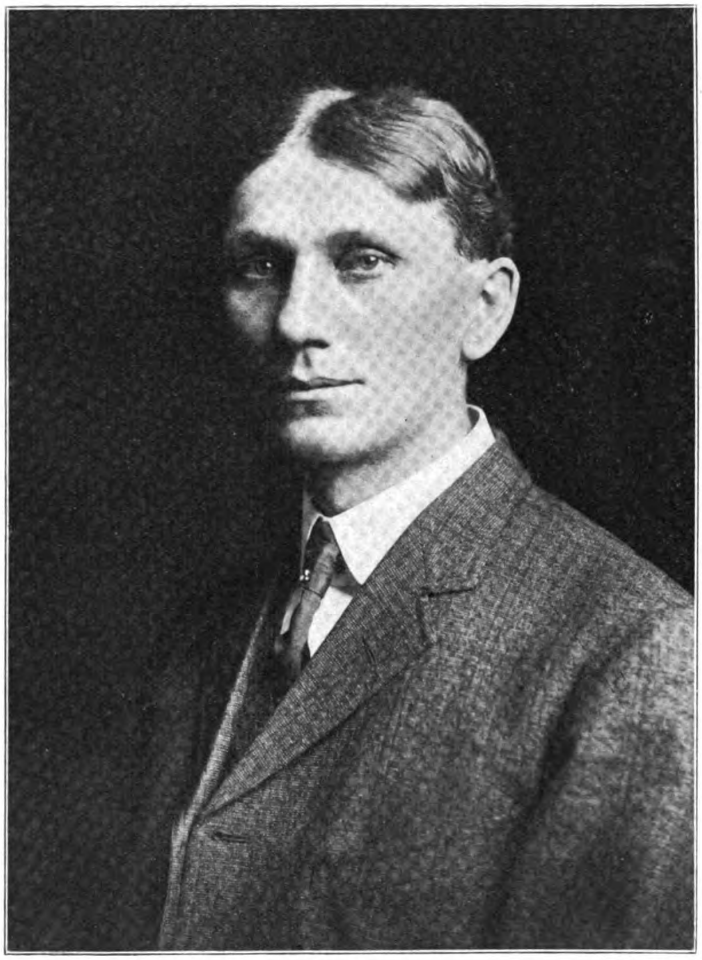
Electro-Pneumatic Interlocking Plant

On the Chicago & Western Indiana Railroad at 47th Street, Chicago

By Stanley C. Bryant

An electro-pneumatic interlocking plant is under construction at 47th street, Chicago, on the Chicago and Western Indiana Railroad. The tracks at this point are used by the Chicago and Western Indiana, the Wabash, Erie, Monon, Grand Trunk and the Chicago and Eastern Illinois Railways. An average of 900 trains every twenty-four hours is handled at this point. The tracks in this territory were recently elevated and at the time the elevation work began, two mechanical interlocking plants were thrown out of service—one being located at 47th street and one at 49th street. Since that time switches have been handled by switch tenders on the ground. The new plant will handle all switches which were formerly handled by the two mechanical plants and also a number of additional switches brought within the plant limits by change in track layout. On account of the location of the passenger depot being so close to the interlocking plant it was necessary to provide special arrangement of signals and derails.



F. E. JACOB,
Signal Engineer Chicago & Western Indiana R. R. and Belt Ry.

The signal indications are given by arms working in the lower right - hand quadrant; for the present two-position signaling is being used. The top arm of high signals is provided with a three - position mechanism and the scheme of signaling will be changed from two to three-position at some future date when automatic block signals are extended through this territory.

The tower is of fireproof construction throughout, with brick walls; the floor of ground story being concrete and floor of second story being of tile construction supported by steel I-beams. The roof is concrete supported by steel trusses. A power plant consisting of motor generators, air compressor, storage battery and switchboard is located in the lower story of the tower; interlocking machine, switchboard for electric lighting and track indicators being located in the second story. The tower is heated by steam furnished from the railroad company's power house located at 49th street.

The interlocking machine is the latest electro-pneumatic type, manufactured by the Union Switch & Signal Company, with the usual arrangement of levers locking, circuit controllers and indication devices. The size of the machine frame is 119 levers, having a total of 86 working levers and 33 spare levers. There is a total of 30 high and 28 dwarf signals controlled by 28 signal levers and a total of 81 switches, derails, slip switches and movable point frogs controlled by 58 switch levers.

The power plant consists of an Ingersoll-Rand Class B air compressor —size of cylinder 10 x 12", speed 160 R. P. M., capable of supplying 187 C. F. of free air per minute. The compressor is belt connected to a 40 H. P. Westinghouse type C. C. L. three-phase, 60-cycle, 220-volt motor. The power for operating motor is supplied from the power house at 49th street at 4,000 volts stepped down through three single phase 15 K. W. oil-cooled Wagner transformers at the tower to 220 volts.

Battery for controlling valves is supplied to interlocking machine from seven cells of 120 - ampere hour chloride storage battery in duplicate. Track circuits are fed through two No. 9 copper wires from five cells of 120-ampere hour chloride storage battery in duplicate, located in the lower story of tower. A variable resistance from zero to twenty ohms is inserted in each track section between each rail and feeder. Resistance units are housed in wood junction boxes.

Storage battery is charged by a one horsepower General Electric three-phase, 60-cycle, 220-volt motor, direct connected to a shunt wound generator with a capacity of thirty amperes and a range of voltage from

ten to thirty volts. Motor generator sets are in duplicate.

A switchboard of slate 1¼ inches thick, mounted on a steel frame with voltmeter, ammeter, wattmeter and the necessary switches and fuses for controlling motor, motor generator sets and storage battery is located in the lower story of tower.

The air for operating plant is fed from compressor through a condenser which is located on the south end of the tower, to the service line which is of 2-inch galvanized iron pipe. Branch leads from service line to auxiliary pots are ¾-inch galvanized iron pipe. The connection between auxiliary pots and switch movements is ½-inch amored hose; connection between auxiliary pots and signal movements is ½-inch galvanized iron pipe. All pipe lines are provided with auxiliary and drain pots which collect all moisture due to condensation in the pipe line, thus avoiding all danger of air pipes freezing up during the winter season. Air line is 2½ feet below the surface of the ground.

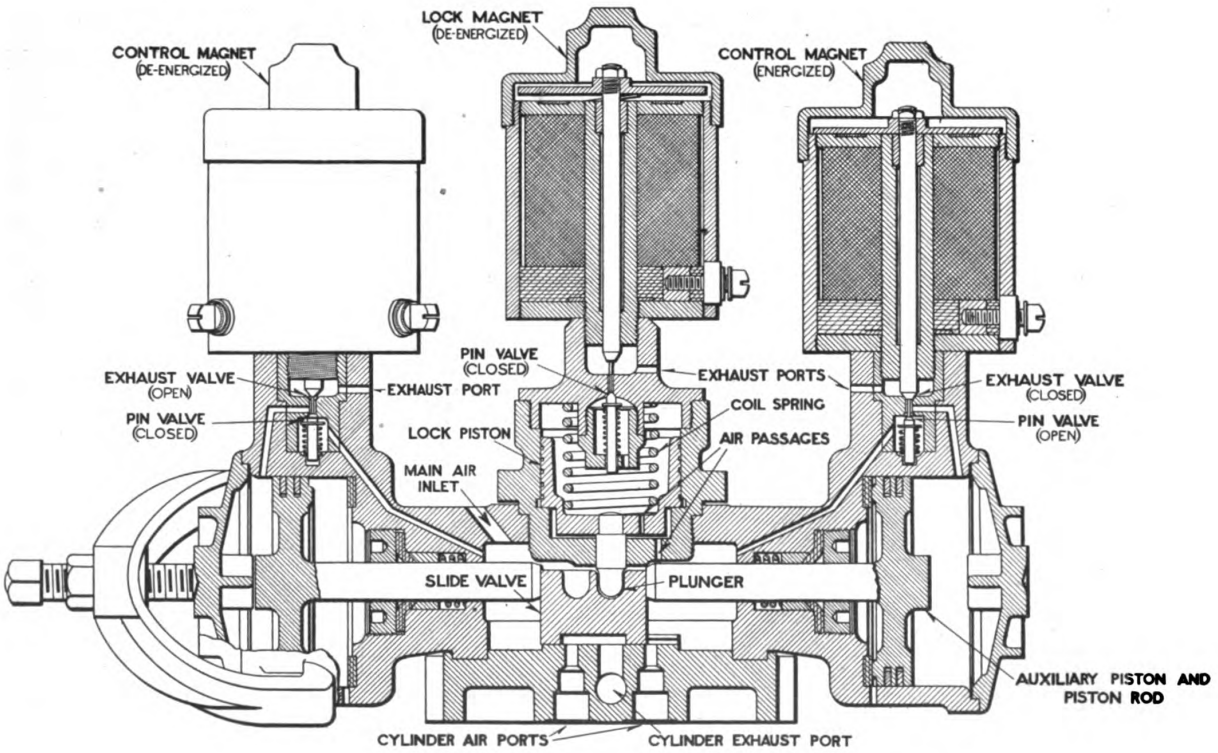
Wire between tower and movements is carried in a line of trunking which is built up of 2-inch white pine, the size of trunking varying from 6 x 16 inches to 1½ x 1½ inches inside dimensions. Main line trunking is supported on cast iron piers 2½ feet long, branch lines being supported on 3 x 4-inch x 4-foot oak stakes. Lines under track are of 3-inch white pine placed 6 inches below the bottom of ties. Junction boxes are provided at all corners and at all points where branch lines connect to main line. Single conductor is used for all signal control and selector wires, five-wire cable being used for all switch control and indication circuits. All control and indication wires are No. 14 copper, electric light wires being No. 12 copper and track circuit wires No. 9 copper; insulation on wire being 5/64-inch rubber wall in all cases. On single conductors rubber wall is protected by one tape and one braid and conductors in cable by one tape, with one tape and one braid covering outside of cable.

The approximate amount of conductors used is as follows:

Five-strand conductor, No. 14 wire, 55,000 cable feet.

Single conductor, No. 14 wire, 180,000 feet.

Electro-Pneumatic Switch and Lock Movement.



Section of Electro-Pneumatic Switch Valve Showing Air Passages.

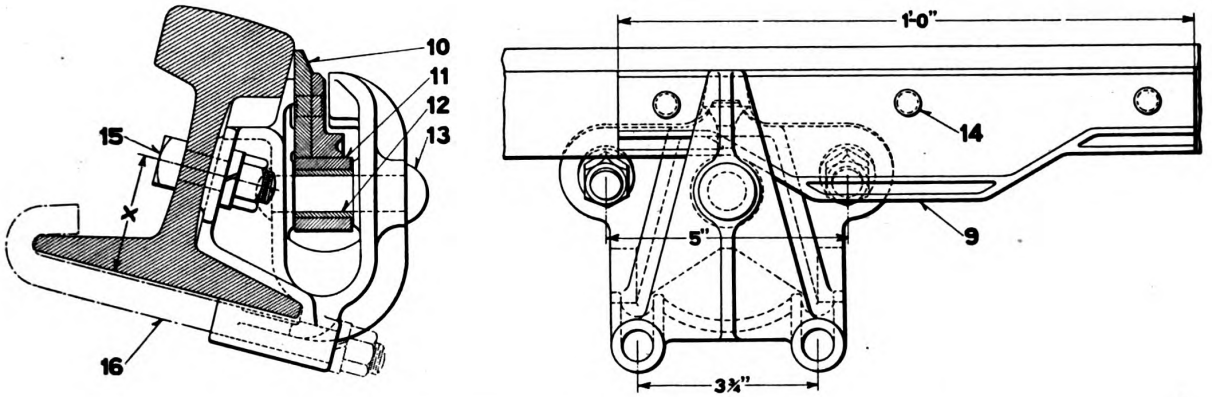
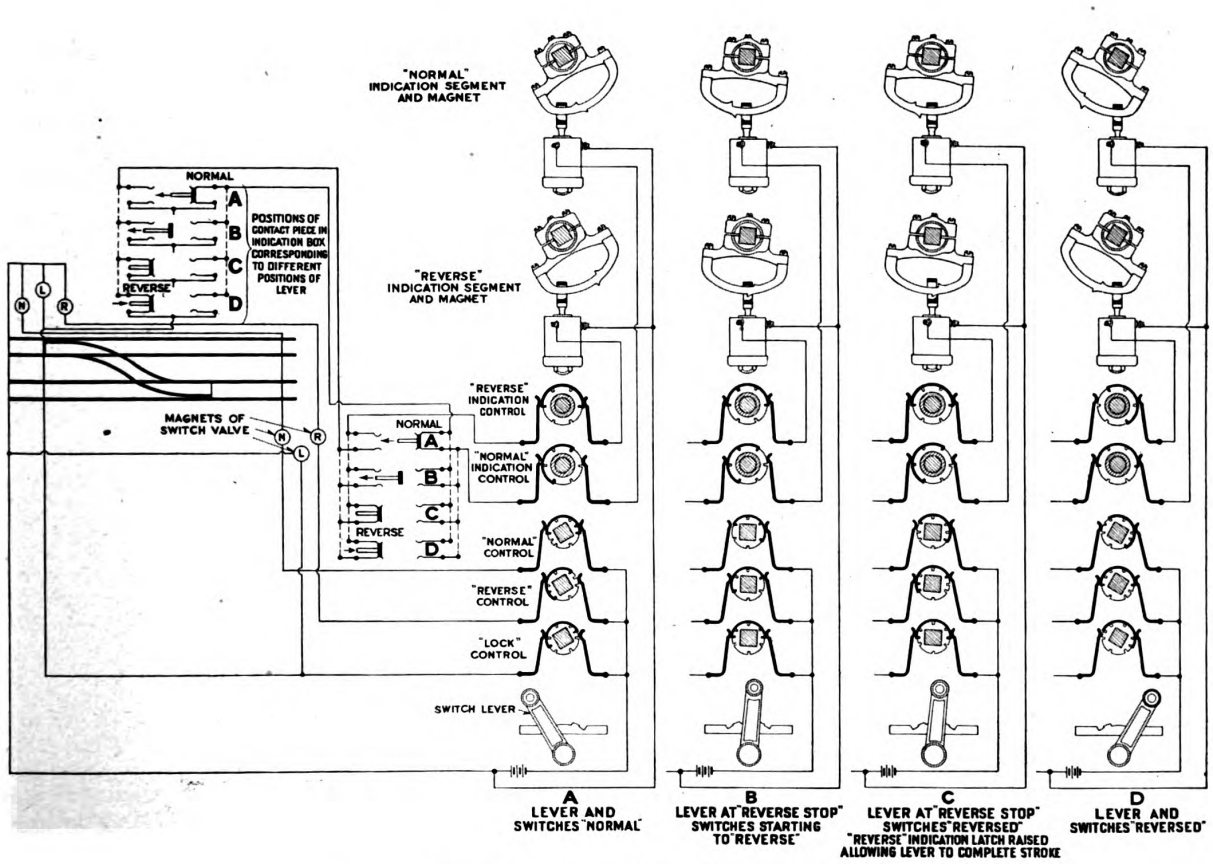
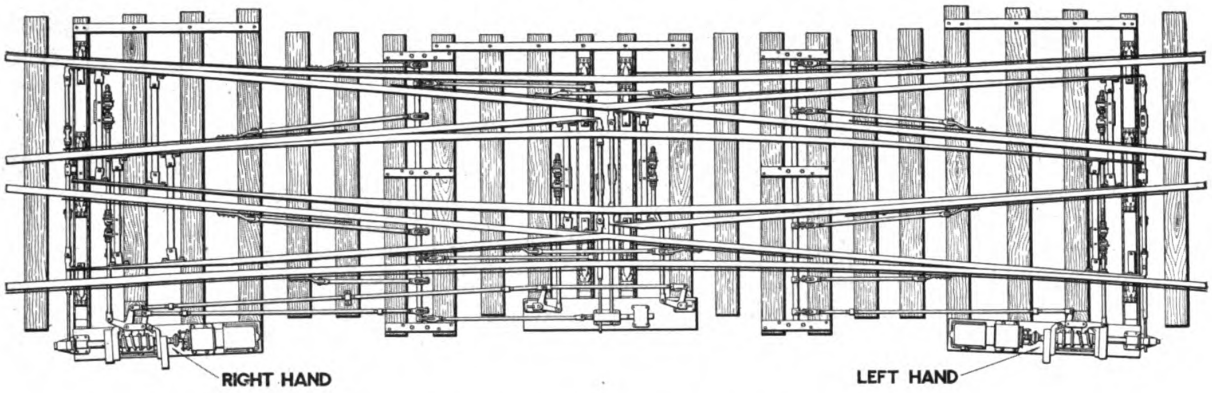


TABLE							
CLIP COMPLETE FIG.	BRACKET COMPLETE FIG.	RAIL SECTION	X	CLIP COMPLETE FIG.	BRACKET COMPLETE FIG.	RAIL SECTION	X
A	1	100 LB. A	2½"	E	5	85 LB. P.R.R.	2 1/16"
B	2	100 LB. P.R.R.	2 5/32"	F	6	80 LB. A	2 3/16"
C	3	90 LB. A	2 11/32"	G	7	75 LB. A	2⅛"
D	4	85 LB. A	2¼"	H	8	60 LB. A	1 29/32"

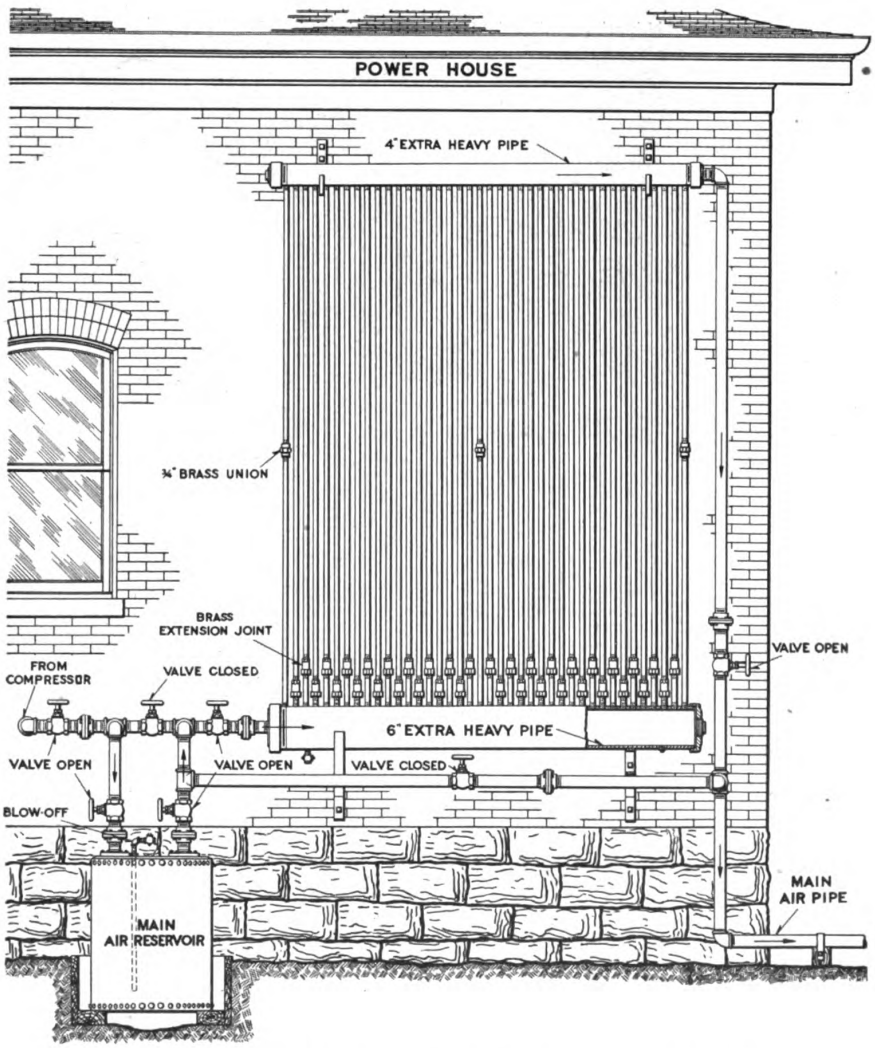
Combination Rail Clip for All Types of Interlocking.



Electro Pneumatic Interlocking-Wiring for Single Switch.



Layout for a Double Slip Crossing With Detection Bar.



Main Air Reservoir and Condenser, Electro-Pneumatic Interlocking Plant.

New Tower House at 47th Street—Front View.

Single conductor, No. 12 wire, 18,000 feet.
Single conductor, No. 9 wire, 15,000 feet.

Signals are equipped with convertible lamps and under normal conditions will be lighted with two-candle power 110-volt lights. In case of emergency the electric light may be removed and oil fount substituted. Light feeders are controlled and fused at the switchboard in the tower. As far as practicable, lights are arranged in groups, varying in number from four to eight and each individual group is fused at junction point with main feeder. These fuses are located in trunking junction boxes. Electric light wires between trunking and signal lamp are run in iron pipe on the outside of signal mast. The lower story of the tower is provided with four and the upper story with six 16-candlepower, 110-volt lights. Connections to secondary of transformers are such that either 110 volts or 220 volts may be obtained in tower. All tower wiring will be in accordance with underwriters' rules.

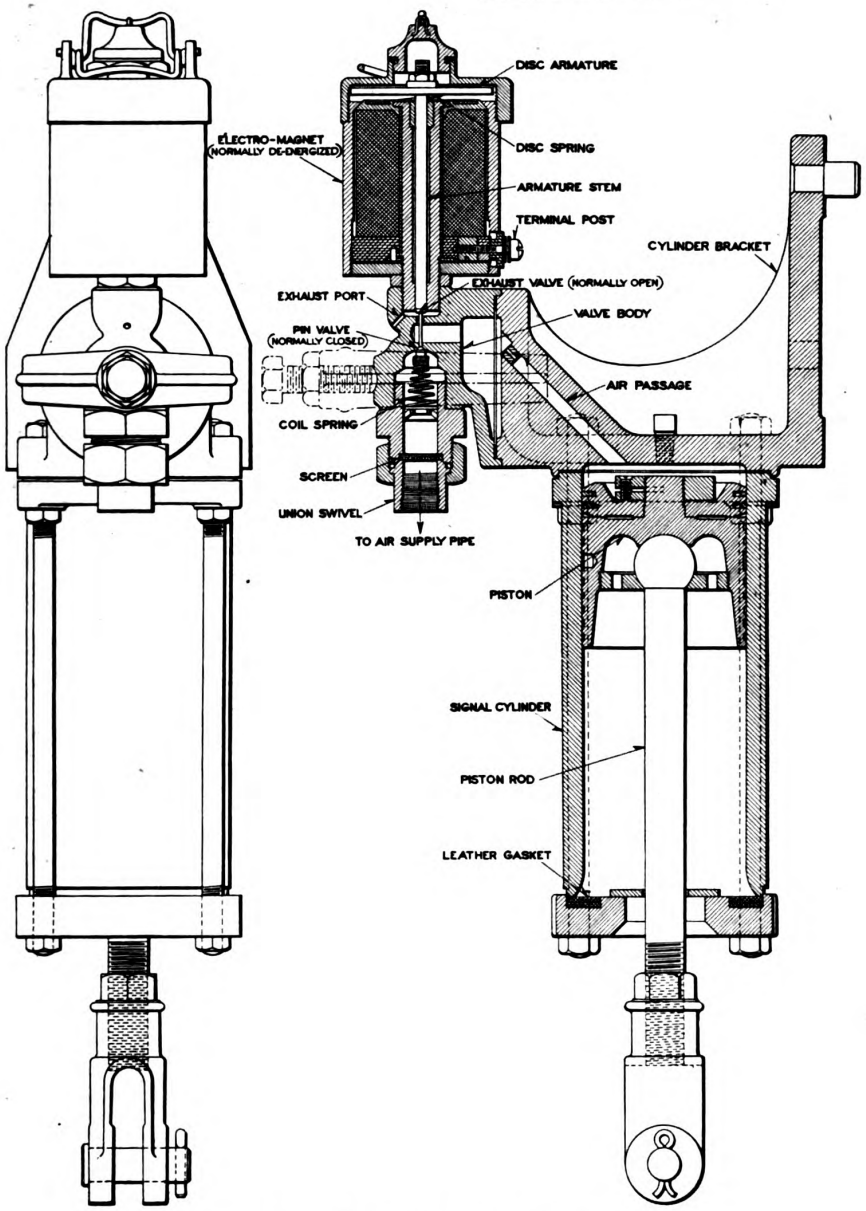
There are thirteen track circuit sections inside of home signal limits, each being provided with a four-ohm glass enclosed standard track relay housed in iron relay boxes. Track circuits are fed by central battery located in the tower as described above. All metal connections between rails such as tie plates, front rods and Nos. 1 and 2 rods are insulated on switches located inside of track circuit limits. Each track circuit is repeated in the tower by a 1,000-ohm indicator of the semaphore type. The battery for operating indicators is obtained from the same source as that for track circuit. Indicators are controlled by a front contact on track relay and in addition by a normally closed contact on home signal lever. When home signal lever is normal and track circuit unoccupied, indicator stands in the clear position and front contact of indicator is closed. When home signal lever is reverse, indicator continues to remain in the clear position taking battery through its own front contact until the track circuit which it repeats is occupied and front contact of track relay opens. Home signal clearing circuit is arranged to loop through the front contact of the indicator which repeats the condition of track over which signal governs. Under this arrangement, it is necessary to make a complete and separate signal lever operation for each train movement. Details of the above circuits may be seen by referring to wiring diagram which we reproduce on another page. The common wire for all high-speed signals loop through switch boxes on all facing point switches, derails and movable point frogs. The common wire for dwarf signals and

Rear View of Tower, Showing Steel Stairway.

lower arms for diverting routes loop through switch boxes on facing point derails.

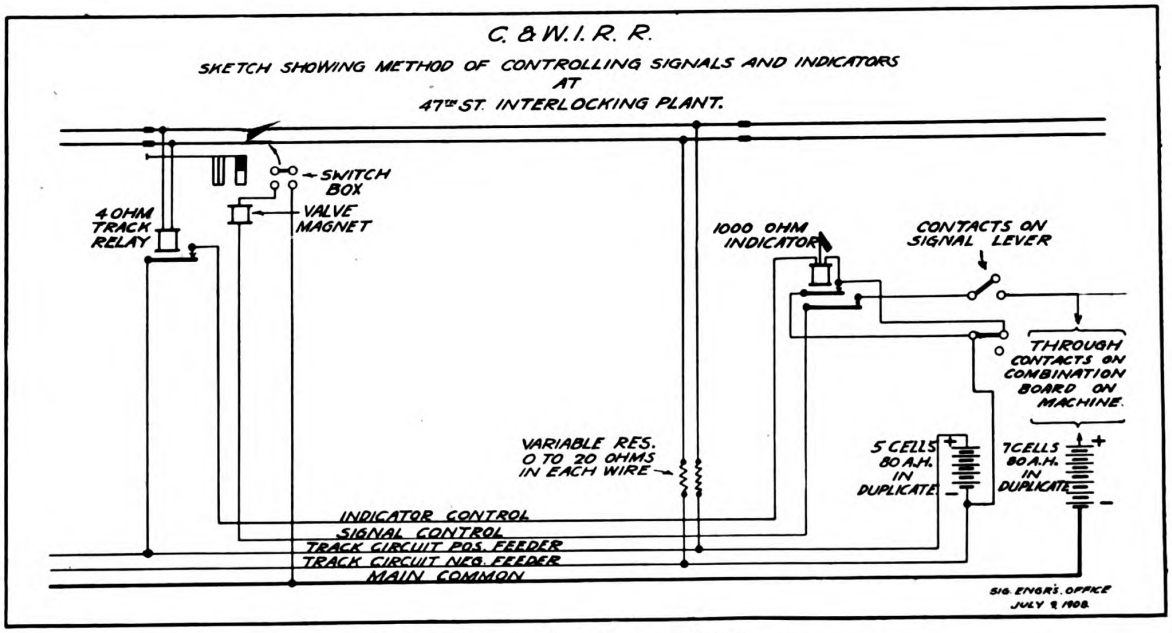
Single switches and derails are equipped with No. 12 switch and lock movement, operated by a 5-inch cylinder. Slip switches and movable point frogs when operated independently, are equipped with No. 12 switch and lock movement and 6½-inch cylinder. Slip switches and movable point frogs, when operated jointly, are equipped with No. 12 switch and lock movements and one 7½-inch cylinder. Each switch, derail and movable point frog is protected with fifty feet of continuous detector bar. Detector bar is of mild steel, ½ x 2¼ inches, and in two sections of twenty-five feet each, bolted together. In the normal position, top of bar is ¼-inch below top of rail and with bar on center, top is one inch above top of rail. Driving rod of detector bar is solid iron with screw jaw adjustment. Connection between driving rod and switch and lock movement is by a two-inch square rocker-shaft. Each 50-foot bar is mounted on fifteen clips of the motion plate type, each clip being fastened to the rail by one ⅝ x 2-inch bolt. Experience has demonstrated that the motion plate type of clip is by far superior to all other types for power interlocking work. The clip used on this plant allows for a 10-inch stroke and is so designed that plunger cannot be withdrawn from lock rod provided an engine or car is standing on detector bar. The design of clip is very simple and substantial with few wearing parts, which makes the clip very durable and cost of maintenance extremely light. Actual demonstration has proved that bars equipped with this type of clip can be operated with much less power than clips of the link type. (This feature also makes this clip especially desirable for manually operated interlocking plants.)

At the present time the plant is 85 per cent com-



Electro-Pneumatic Signal Movement.

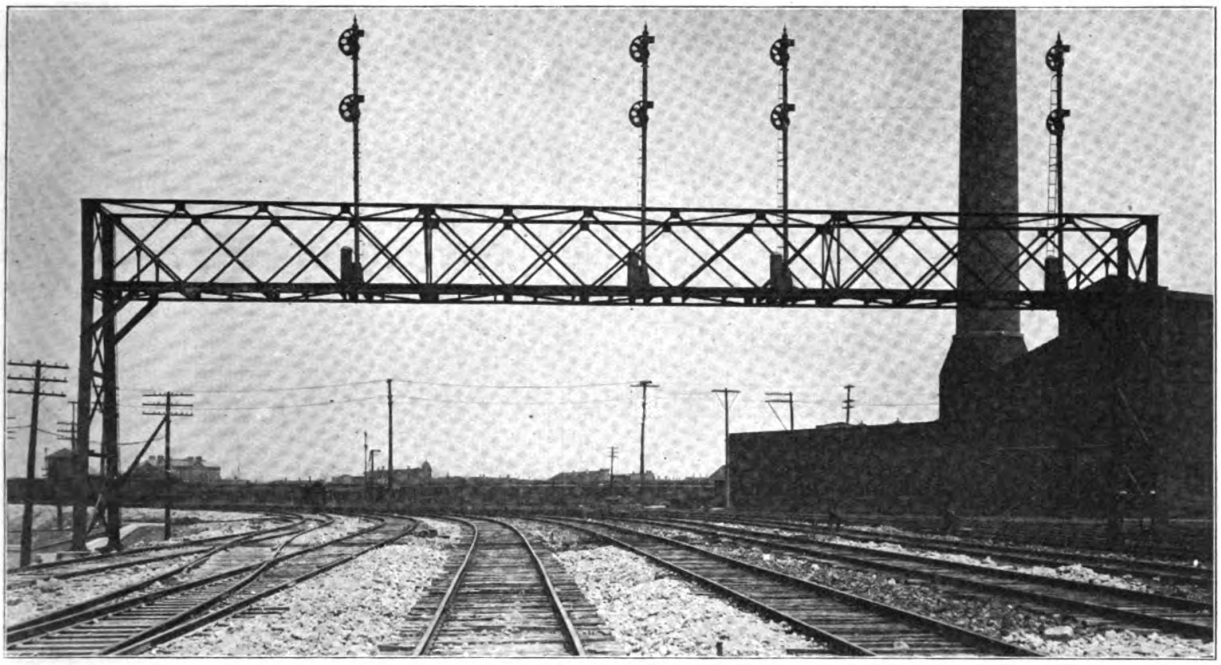
Second Floor of Tower—Showing Steel Construction.



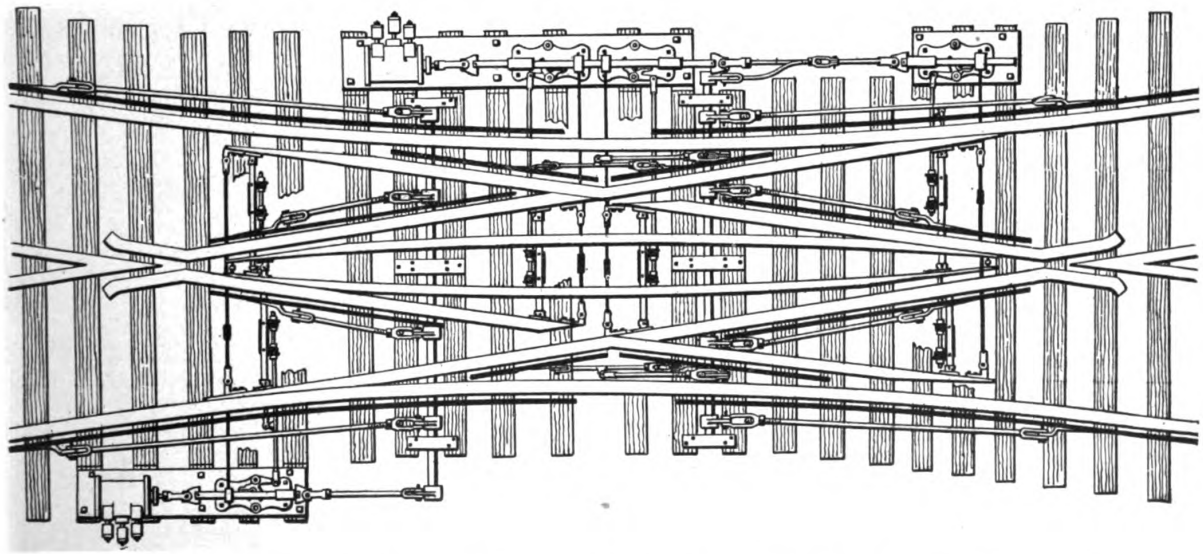
Method of Controlling Signals and Indicators.

plete and will be ready for service about September 1st. Material is being furnished and installed by the Union Switch & Signal Company of Swissvale, Pa., and is in direct charge of Foreman George Dane. Plans and specifications for the work were prepared in the office of Mr. F. E. Jacob, signal engineer of the Chicago and Western Indiana Railroad Company and the Belt Railway Company of Chicago.

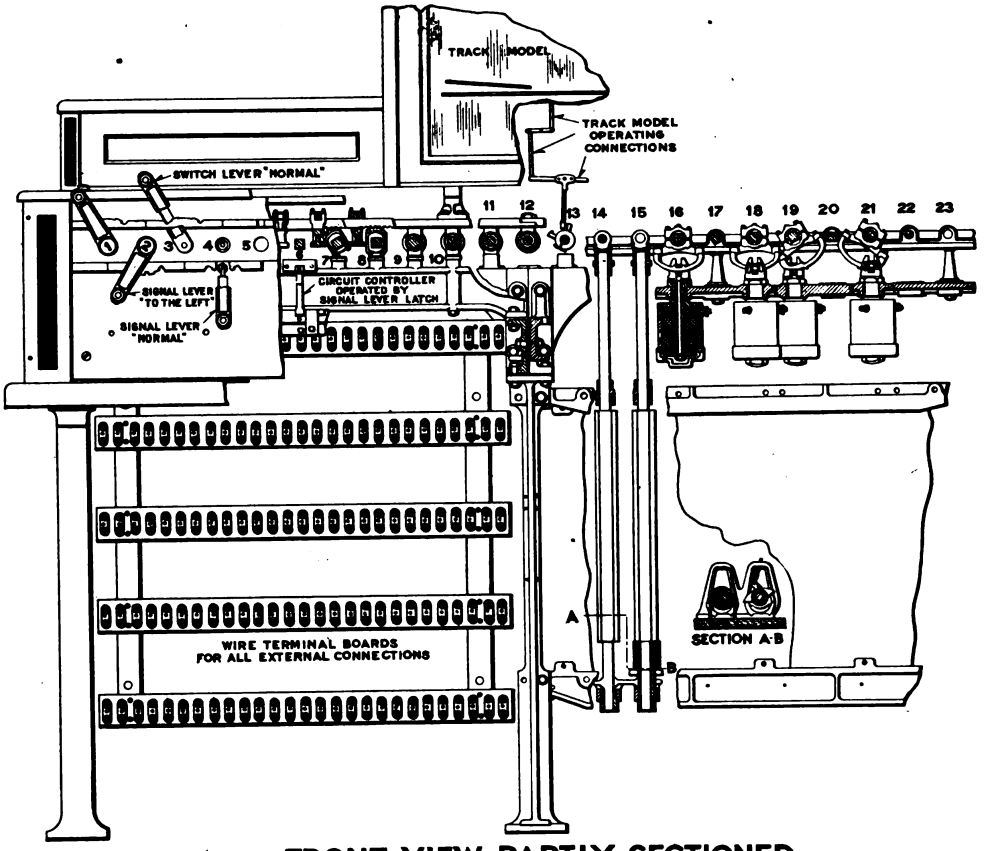
Mr. Jacob entered upon his signal career in 1894 in the employ of the Signal Department of the Pennsylvania Railroad, on the Chicago Terimnal. He served continuously with the Pennsylvania until 1899, when he was appointed signal supervisor of the Vandalia. In 1904 he was appointed signal supervisor of the Chicago and Western Indiana Railroad. Mr. George Espy, signal engineer, formerly in charge of the Signal Department of the Chicago and Western Indiana, practically retired two years ago, since which time Mr. Jacob has been in charge of the Signal Department. About three months ago he was formally appointed signal engineer. He reports to the chief engineer on engineering matters and to the general superintendent on operation. (See pages 48 and 49.)



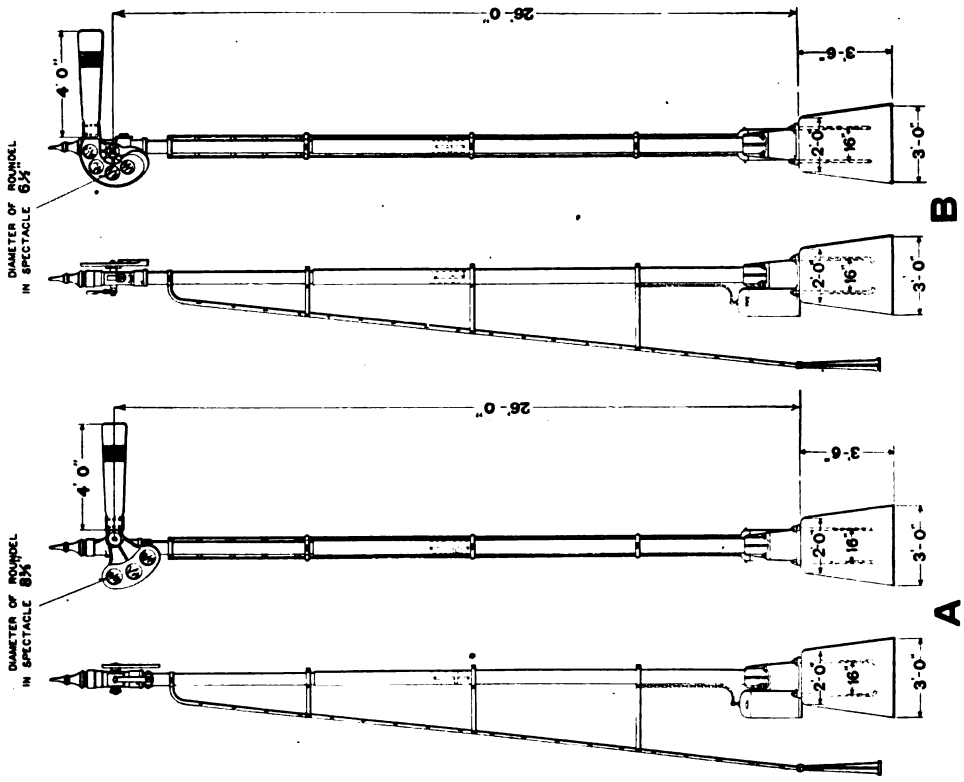
West Bound Home Signal Bridge.



Electro-Pneumatic Switch and Lock Movement Layouts for One End of a Double Slip Crossing, and for Movable Point Frogs and the Other End of a Double Slip Crossing.



FRONT VIEW, PARTLY SECTIONED



One Arm Electro-Pneumatic Ground Signals.