INTERLOCKING PLANT AT STATE LINE CROSSING NEAR CHICAGO, ILL.

The great network of railway terminal tracks in and about the city of Chicago is probably the most extensive and complicated system of terminal tracks at any railway center in the world. With the growth of both the city and the railway systems, with the consequent increase in both street and railway traffic, two very important engineering improvements have become necessary on this great network of lines. They are, first, the elevation of the tracks through the city; second, the protection of all junctions and grade crossings by means of signal and interlocking plants. The first of these has been undertaken mainly for the safety and convenience of street traffic, although it is of great benefit to the railway traffic as well. The second is now a well recognized necessity for the safe and convenient handling of the railway traffic. Several of the important works of both classes have been described and illustrated in our columns, and in the present article we deal with the datest and largest of the interlocking plants, which is also one of the largest in the country.

This plant is at the State Line crossing, just south of the Chicago city limits, and near Hammond, Ind., where several railways cross and connect with each other. During the past year, the Chicago, Hammond & Western R. R., which is one of the important terminal roads of Chicago, built an extension of its line which intersected this crossing, and under the laws of the State of Illinois it developed upon this road to put in an interlocking plant for the protection of the entire crossing as a whole. The plan, Fig. 1, will give an idea of the complicated system of crossings and junctions to be protected. The tracks are used by eleven railway companies, eight of which own tracks, while three use the tracks as tenants. The eight owning companies are as follows: (1) Chicago, Hammond & Western R. R.; (2) Chicago & Western Indiana R. R.; (3) Chicago Terminal Transfer R. R.; (4) Chicago & Erie R. R.; (5) New York, Chicago & St. Louis R. R.; (6) Michigan Central R. R.; (7) Chicago, Indianapolis & Louisville Ry.; (8) Chicago & Indiana State Line R. R. (a terminal line of the Pennsylvania Lines West of Pittsburg). The three tenant companies are as follows: (9) Wabash R. R.; (10) Elgin, Joliet & Eastern R. R.; (11) Chicago, Lake Shore & Eastern R. R.

Each company arranged its own tracks, and the interlocking was planned under the direction of Mr. J. B. Cox, Signal Engineer of the Chicago, Hammond & Western R R., after conference with the representatives of the other companies interested. The contract for the execution of the work was awarded to the National Switch & Signal Co., of Easton, Pa., and the details of the plan and the interlocking plant were worked out by Mr. Charles Hansel, M. Am. Soc. C. E., Vice-President and General Manager, and Mr. Henry M. Sperry, the Signal Engineer and Western agent of that company. The construction was done under the direct supervision of Mr. Cox and Mr. Sperry.

The signal tower is of unusual size, being 100 ft. 8 ins. long and 16 ft. 0½ in. wide. The operating floor is 15 ft. above the level of the rail heads. The walls are of pressed brick, laid in cement, and the roof is of Bangor slate. The second story or operating floor, has windows on all sides, affording an unobstructed view of the entire crossing. It is heated by two Beckwith hot-air furnaces. The locking frame is below the operating floor, and is of the vertical type, occupying no floor space. It is very compactly arranged, though it includes 2,500 ft. of locking bars and 900 locking dogs. A special feature of this frame is the substantial manner in which it is supported. A steel plate girder, 20 ins. deep, is carried by five steel columns on concrete foundations, and on the girder stand cast-iron columns supporting the lever frame. This construction, shown in the view of the locking frame, Fig. 2, guards against any distortion which might occur with such a length of locking frame if carried on wooden supports.

The levers are all arranged in one row, as shown by the interior view, Fig. 3, and the telegraph instruments, etc., are placed behind them. A novel feature in the arrangement of the levers is that instead of all the switch levers, all the signal levers and all the lock levers, etc., being grouped together, as in ordinary practice, the levers are arranged in three principal groups, for the three principal sets of train movements. This greatly facilitates the work of the signalmen, as for any one train movement, the switch, signal and lock levers are all close together. The lever frame or machine frame is about 94 ft. long, with spaces for 224 levers, of which 157 are now in place. The interlocking plant at the 75th St. crossing has 132 levers (Eng. News, Sept. 20, 1894), and that at Dolton, Ill., built in 1897, has 172 levers. The distribution of the levers at the State Line plant is as follows:

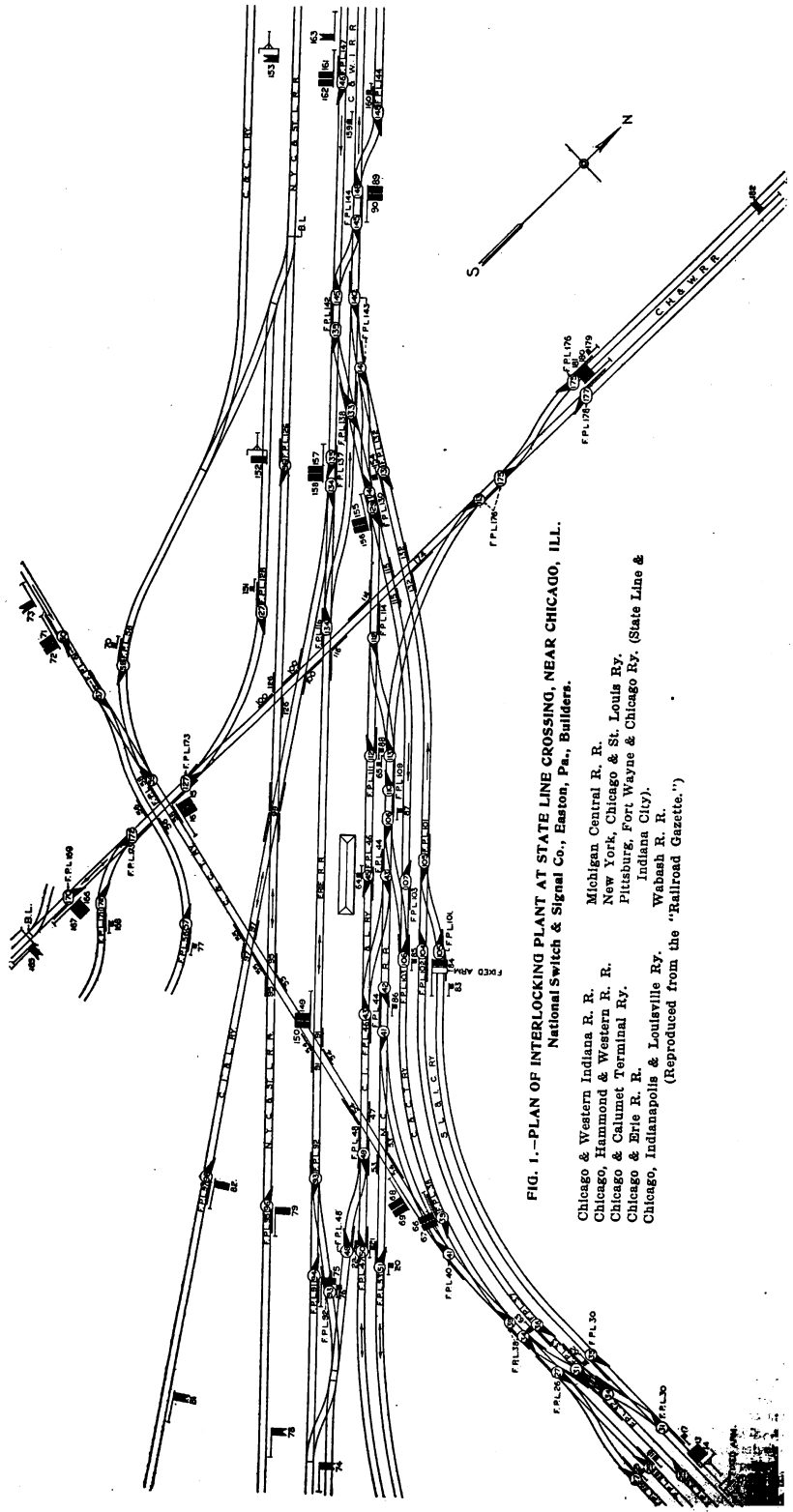

FIG. 1.—PLAN OF INTERLOCKING PLANT AT STATE LINE CROSSING, NEAR CHICAGO, ILL.
National Switch & Signal Co., Easton, Pa., Builders.

Chicago & Western Indiana R. R. — Michigan Central R. R.
Chicago, Hammond & Western R. R. — New York, Chicago & St. Louis Ry.
Chicago & Calumet Terminal Ry. — Pittsburg, Fort Wayne & Chicago Ry. (State Line & Indiana City).
Chicago & Erie R. R. — Wabash R. R.
Chicago, Indianapolis & Louisville Ry. — (Reproduced from the "Railroad Gazette.")

Levers for 68 switches and 1 movable point frog	45
Levers for 70 facing-point locks and 20 crossing or detector bars	43
Levers for 19 crossing bars	6
Levers for 63 signals	63
Working levers	157
Blank spaces	67
Total number of levers (when completed)	224

The switches and locks are operated by levers of 1-in. pipe laid on double anti-friction carriers. These are placed 7 ft. apart c. to c. of rollers. Each signal is operated by two lines of No. 9 wire, carried on pulleys 21 ft. apart c. to c. The connections for operating the plant comprise 62,000 ft. of pipe line (about 47 tons) and 109,000 ft. of wire. The most distant signal is 2,492 ft. from the tower, and the most distant switch is 1,242 ft. from the tower. At three places where the connections pass under the tracks, the rails are supported by special forms of steel ties resting on longitudinal timbers. The foundations for the interlocking are of the improved design for timber foundations, shown in our issue of Jan. 13, the bell-crank and compensator foundations being set in concrete.

In one important respect the conferences between the representatives of the railway companies did not result as satisfactorily as might have been wished, and that is in the matter of uniformity. Some of the railways insisted that certain special arrangements and equipment employed on their lines should be fitted for the tracks to be used by them, and the result is that the standards of three railway companies had to be followed in putting up the work. The Chicago & Western Indiana R. R. uses the ordinary form of semaphore, while the State Line & Indiana City R. R. uses a design that is standard on the Pennsylvania Lines, in which the arm of the semaphore drops to a vertical position, parallel with the post. The semaphore arms for the tracks of these two roads have the running face painted yellow, with a black stripe, while all the other semaphores have the running face painted red or green (for home and distant signals respectively), with a white stripe. There are also different forms of fittings required for switch connections, plunger locks and other details. This involves a needless and unfortunate complication, to which we have briefly referred in our editorial columns. The responsibility for this, of course, rests entirely with the railways and not with the signal company, as the company made strong efforts to bring about the adoption of some uniform system throughout.

The traffic includes nearly 200 trains per 24 hours, with 50 train orders and 50 telegraph messages in addition. Mr. J. M. Warner, Superintendent of the Chicago & Western Indiana R. R., informs us that the records for Dec. 3, 4 and 5, show a maximum of 184 trains in 24 hours, while the busiest hour during that period was from 10 to 11 a. m., on Dec. 4, during which time 26 trains used the interlocking plant. All this work is attended to by six lever men, working two at a time on shifts 8 hours long. There is also one lamp man and one repair man in charge of the maintenance of the plant. The following are the instructions governing the operation and maintenance of the interlocking plant, as furnished us by Mr. Warner:

1.—Levermen will report to and receive instructions from the Signal Engineer concerning the operation and maintenance of the plant, and will receive instructions from the Superintendent or Pilots as to special movements of trains.

2.—Signals must be kept at danger, except when in use for train movements, and must be returned to danger position as soon as train has passed.

3.—Clear signal must not be given until it is known that the route governed by it is clear.

4.—Do not attempt to move a switch or detector bar when a train covers it or is closely approaching it.

5.—When interlocking is not in use, all levers (excepting those for locks) should be kept in normal position.

6.—Should it be necessary to change a route, after clear signal has been displayed to an approaching train, the signal may be returned to danger, but the switches must not be changed nor signal given for a conflicting route until the first train signalled has come to a full stop. Signal must not be given for a route when cars or engines are standing between the derails of a conflicting route.

7.—In case of accident the Superintendent, Signal Engineer and Repairman must be notified at once, and no trains allowed to pass until parts liable to damage have been examined and found in safe condition.

8.—A failure of any part of apparatus to work properly must be reported at once to Signal Engineer and Repairman.

9.—No part of the signal or track appliances, nor any part of the machine, should be disconnected except in case of accident.

10.—When, from any cause, signal is out of order and cannot be set to clear, leverman, after ascertaining that the route is safe, must personally notify the engineman that signal cannot be given but route is all right for him to proceed.

11.—When, from any cause, signals, locks or switches are disconnected from the machine, all movements must be made under direction of leverman.

12.—Levers should be handled by a steady movement.

13.—During freezing weather levers must be handled frequently to keep connections free.

14.—Allow no one to handle levers except duly authorized employees of signal department.

15.—Levers and all machinery above working floor must be kept bright and clean.

16.—Keep all lights in tower so they cannot be seen from approaching trains.

17.—Allow no one in tower except employees in the discharge of their duties.

18.—Report to Signal Engineer all enginemen running their trains past danger signal or using sand on switches or detector bars.

19.—Bell signals for communication with other points are to be used in accordance with established codes. All bell signals must be plainly given and promptly answered.

20.—Report daily to Signal Engineer, on blank prepared for the purpose, all delay to trains, also condition of plant.

21.—Lampmen will report to and receive instructions from Signal Engineer.

22.—Their regular duties are to inspect all signals, switches, derails, detector bars, locks and other moving parts daily, and report promptly to leverman any defects discovered; keep the switch points free from obstructions; clean and oil the interlocking machinery and moving parts so they shall present a neat appearance and work smoothly at all times; take care of the lamps and assist levermen in scrubbing floors and cleaning windows.

23.—Lamps must be lighted and put up before sunset and remain in place until after sunrise, proper allowance being made in foggy or stormy weather, to insure their being in position during such hours as may be necessary to display night signals; lamps should be cleaned and filled as soon as taken down.

24.—Keep fire buckets filled and ready for use in case of fire, and use them for no other purpose.

25.—Make monthly report to Signal Engineer of oil and other supplies used.

J. M. Warner, Superintendent.
Geo. Espy, Signal Engineer.

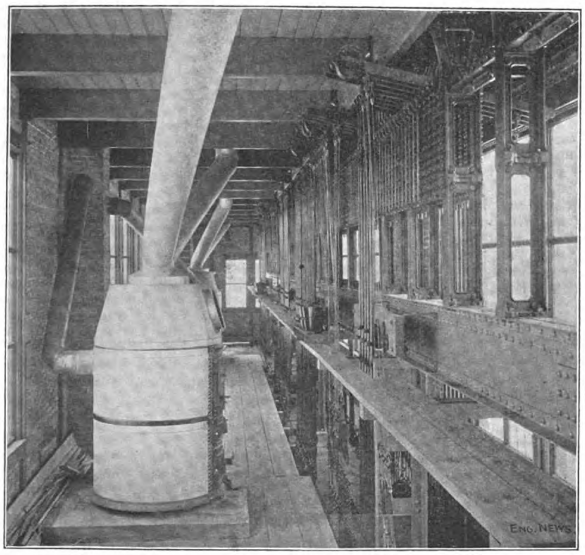

FIG. 2.—INTERIOR VIEW OF SIGNAL TOWER, SHOWING LOCKING FRAME.

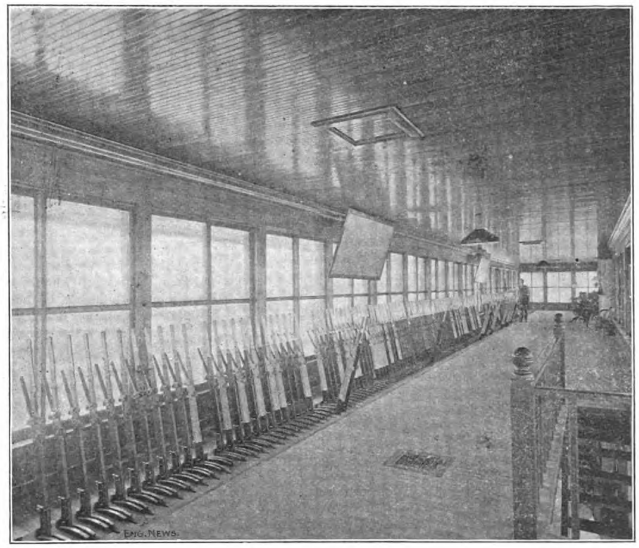

FIG. 3.—INTERIOR VIEW OF OPERATING ROOM OF TOWER.

THE RELATIONS BETWEEN THE CUSTOMER, CONSULTING ENGINEER AND ELECTRICAL MANUFACTURER.*

By S. Dana Greene, M. Am. Inst. Elec. E.†

The manufacturers of apparatus and the manufacturers of current are dependent upon each other to a large extent, and their relations should be close and friendly. The consulting engineer, as in other engineering trades, is a necessary and proper connecting link between the two, and I can say frankly that I believe he has a proper and permanent field of usefulness. Broadly speaking, his function is to see that his client who buys apparatus and installs it, selects first that system best suited to his particular local conditions, and then, in purchasing, secures the best (not necessarily the most) for his money. It is equally the duty of the consulting engineer to learn what the manufacturer can reasonably be called upon to make, to consult with him freely and to obtain the benefit of his experience; to give him credit for work well done, and to insist that bad work shall be promptly corrected.

Many consulting engineers, especially those who have recently commenced practice, seem to think that it is improper for them to consult with the manufacturer, or to examine his plant, or to ask him for information or advice. Their idea seems to be that by so doing, they may be accused of partiality or undue bias, or with lack of proper care for the interests of the purchaser; or they may feel that it is derogatory to their own dignity as independent engineers. The inevitable result is that specifications often contain provisions which are a source of annoyance and expense to the manufacturer and purchaser alike, and which have no compensating advantages, from either the engineering or commercial standpoint. In fact, some of these provisions are impossible or impracticable of fulfillment; and in such cases the honest manufacturer who wishes to meet the specifications and guarantees required, finds himself forced to ask the engineer or the purchaser (sometimes both) to modify them. This is a proceeding which is always difficult and delicate to undertake, and often results in friction and trouble for all concerned.

I am satisfied that if every consulting engineer would take advantage of opportunities as they occur, to visit manufacturing establishments, see the work there in progress and confer with the engineers, he would find himself well repaid for the visit, and his own work and practice benefited thereby. I am equally satisfied that no reputable manufacturing establishment would refuse admittance, but on the contrary would welcome such visits

*From a paper read before the New York Electrical Society, at the College of the City of New York, Jan. 12, 1898.

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