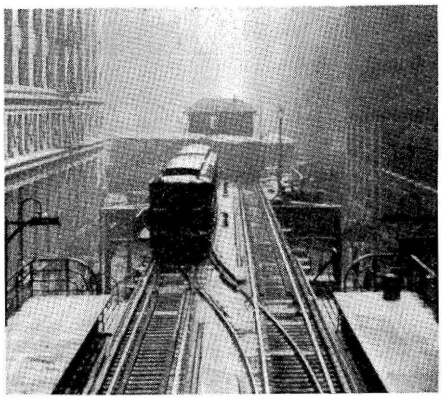
New Interlocking in the Chicago Loop

Rapid Transit Company rebuilds electro-pneumatic plant—a-c. track circuits replace detector bars



Tower 8 is shown in the background

AN INTERLOCKING plant on the elevated railway of the Chicago Rapid Transit has been completely modernized during the past few months. Besides the elimination of detector bars and the addition of a-c. track circuits, a new 19-lever Union Switch & Signal Company Model-14 interlocking machine is now in service in place of the one that was formerly used. This interlocking, situated at Wells and Van Buren streets in Chicago's central business district, is one of several of the same type that make possible the reliable and expeditious handling of a great number of local and suburban electric trains which converge upon the city. One of these plants is situated at each of three corners of the rectangular double-track "loop" from which the Chicago business district derives its name.

Heavy Traffic

At Tower 8, Wells and Van Buren streets, the traffic is entirely composed of single- or multiple-unit electric trains which are supplied with traction energy by a 600-volt third-rail system. Besides the C.R.T. trains, the suburban trains of the Chicago, North Shore & Milwaukee pass over this plant in entering or leaving the loop. Indicative of the traffic density at this point is the number of scheduled trains handled during the peakload hours, which are from 8 to 9 a.m. and 5 to 6 p.m. The approximate number of trains includes 51 from the north side, 45 trains each way from the Metropolitan line (west side), 30 Lake Street trains which move around the inner loop, and 6 C.N.S. & M. trains. These constitute a total of 177 trains passing over the plant during the rush hours, or approximately 3 trains per minute. Thus it is evident that anything short of a comprehensive interlocking scheme would make such operations impossible.

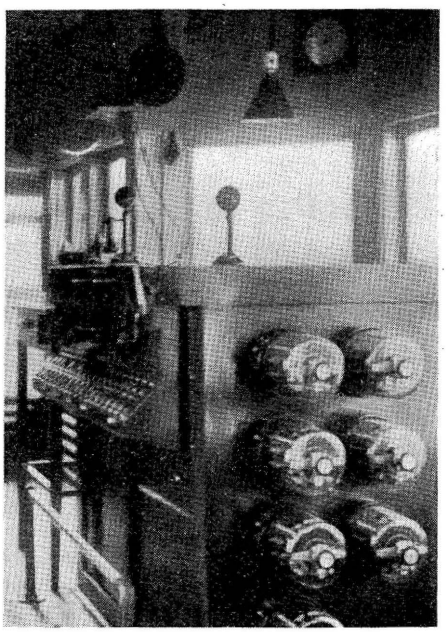
In recognition of these circumstances, the C.R.T. has undertaken a program of gradual rehabilitation of the existing interlocking facilities on the system. One of the most progressive steps in this program was the retirement of the detector-bar equipment in favor of track circuits at other plants besides Tower 8. The circumstances under which the renewal of these facilities was accomplished required that the existing interlocked switches and signals remain in service for normal traffic. This necessitated the use of temporary expedients and construction work at night when traffic was at a minimum. Obviously, serious congestion of the loop district would have resulted had not the operation of the essential signaling equipment been maintained.

Interlocking Facilities

All interlocked signals on the C.R.T. are dwarf signals, as these are adapted to the requirements of the system. At Tower 8, there are eight single arm and seven double-arm signals of the lower-quadrant two- position semaphore type. The indications given are "proceed" and "stop," with green and red lights at night. The upper arm on the two-unit signals governs the main-line moves, the loop tracks being designated as main line. The lower arm governs the diverging routes through the plant, such as those which involve the use of a crossover or a turnout switch. The Union Type-E.P. signals and the Model-14 electro-pneumatic switch-and-lock mechanisms, which were in use prior to the recent renewals, were continued in service. The switches have five-inch air cylinders with Style-C valves and adjustable lock rods.

Operation of Plant

The accompanying diagram illustrates the track and signal arrangement at the plant. The operation of the three crossovers, four main-line switches and one protective turnout requires seven levers of the interlocking machine. It will be



A new interlocking machine was installed

noted that the protective turnout near signal 10 is controlled simultaneously with the main-line switch No. 11. This is made necessary by the proximity of the crossing frog involving the two conflicting routes. The stub track, with a buffer, provides sufficient braking distance to stop a train safely in case the motorman overruns signal

10. The air-trip train stop at this signal, as well as those located at signals 3, 4, 6 and 8, are operated with the movement of the signal lever affecting the lineup over the switch.

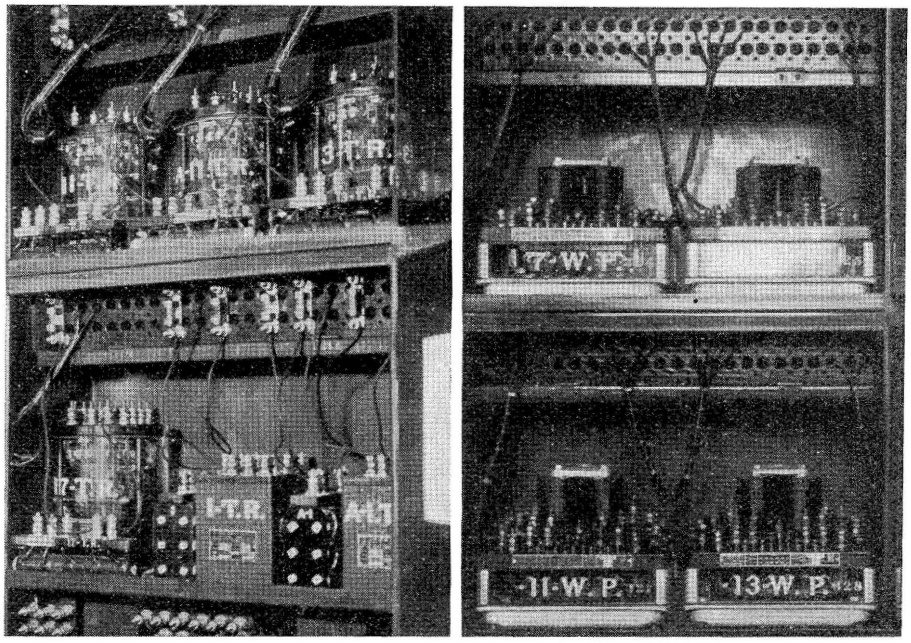
Owing to space limitations of the track layout, signal L12 is located on the left hand of the track. However, this occasions no inconvenience to the motorman as they have a clear view of the entire track. The detector track-circuit sections have been designed with special care in order that dead sections at switches might be avoided. This occasions transportation of the single-rail insulation scheme in certain cases. The diagram of a typical track circuit shown herewith illustrates the necessity for careful maintenance of the joint and rail insulation. Of course, one rail must be continuously bonded as a common return for the d-c. propulsion current and the a-c. track circuits. In addition, the common rail is bonded at frequent intervals to the steel supporting structure of the tracks, welded bonds being used throughout. Typical track-circuit equipment comprises a W-10 transformer, one adjustable series resistor at each end of the circuit, the necessary protective fuses, and an SLV-13 single-element a-c. relay.

Control Machine and Circuits

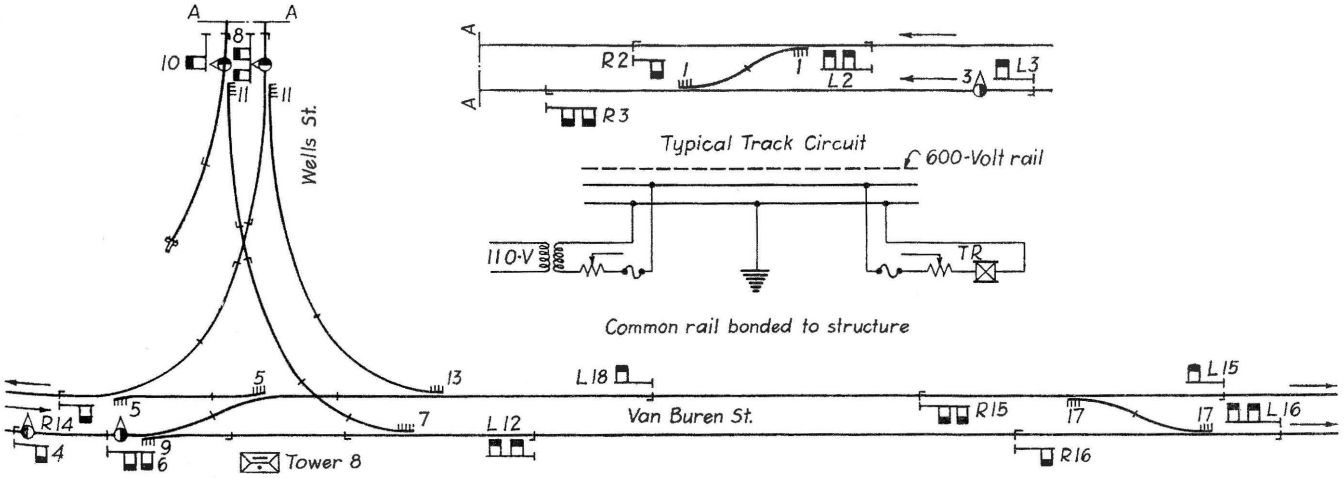
The operating equipment is situated so as to afford a full view of all three approaches to the plant; consequently, no illuminated track diagram is required. A green light at each switch lever denotes an energized lock magnet permitting use of the lever; a red indication with the word "train" thereon, informs the leverman that the detector track section including the switch, is occupied, precluding movement of the lever. The lever indication circuits are selected by 750-ohm Style L-10 repeater relays which are mounted inside the rear panel of the machine. These relays are connected in parallel with the switch-lever locking magnets, both functions being controlled by the detector locking circuits. The standard switch-indication locking is accomplished with the use of polarized WP relays which are energized from the polar indication circuit controllers at the switch machines. The switch-repeater relays are of the DP-17 type; all of the neutral relays are the DN-11 type. Route-locking circuits are of the usual character controlled by lever and track-relay contacts, with the stick circuit bridging the necessary track controls through a front contact of the stick relay.

Release of the detector locking, permitting the operation of a switch in the event of a track-circuit failure, is effected by the action of one of the seven clockwork time releases which are adjusted to close the lock-magnet circuits after an interval of 15 sec. Of course, the leverman is responsble for the safe use of this expedient, which becomes a necessity in case of an a-c. supply failure or other irregularity in the operation of the detector functions.

Telephone communication between the loop towers and the loop train superintendent is afforded, with the added convenience of amplifier receivers which relieves the levermen of the duty of answering the telephone when general information is to be conveyed. This adjunct is highly desirable owing to the necessity of the operators giving



Left—Track relays and transformers in the tower. Right—Polarized switch-repeater relays. All cables are terminated on boards below



close attention to trains during rush hours.

All of the relays in this installation are equipped with shock-absorbing springs. These are made doubly necessary by the unavoidable vibration of the tower and track structure. The integrity of the relays also requires strict attention from the maintainer. An interesting test was conducted at this interlocking to determine the number of track-relay operations that take place during the rush hours. The results of this test showed that one track relay responded a total of 1,876 times in a single day, while the track relay which registered the lowest number of operations during this same day responded in excess of 800 times.

Wiring Distribution

One of the outstanding construction features of this interlocking is the wiring distribution. All of the relays and the control-circuit battery are situated on the first floor of the tower. From the terminal boards of the eight-way steel relay cabinet, a 4-in. conduit extends upward to the machine. All of the local circuits are run on No. 16 stranded wire, each conductor being marked at each end with a fiber tag. Another 4-in. conduit extends from the tower to a central location at the signal group adjacent to cross-over No. 17 eastward on Van Buren street. A third conduit main connects with the Wells Street group in the vicinity of crossover No. 1. These conduits are fitted with cable outlets without terminals, for runs to the separate functions on the track level, the conduit being suspended underneath the ties. The outside conduit runs carry groups of five- and seven-wire Kerite cables, one for each signal and switch movement respectively. This arrangement greatly facilitates the grouping of the conductors with respect to the functions they control; that is, one separate cable serves each mechanism. One made-up cable is suspended from the steel structure. Parkway cable is utilized to connect this cable with the track functions, the connections being made at splicing boxes.

Compressed air at 85 to 95 lb. per sq. in. pressure, furnished by either of two adjacent towers which include air compressors.

This interlocking was installed by the signal forces of the Chicago Rapid Transit under the supervision of J. W. Stephenson, signal engineer, and M. Van Lennep, signal supervisor, under the jurisdiction of R. N. Wade, engineer maintenance of way.

Mechanical Color-Light Signals In England

By A. E. Tattersall
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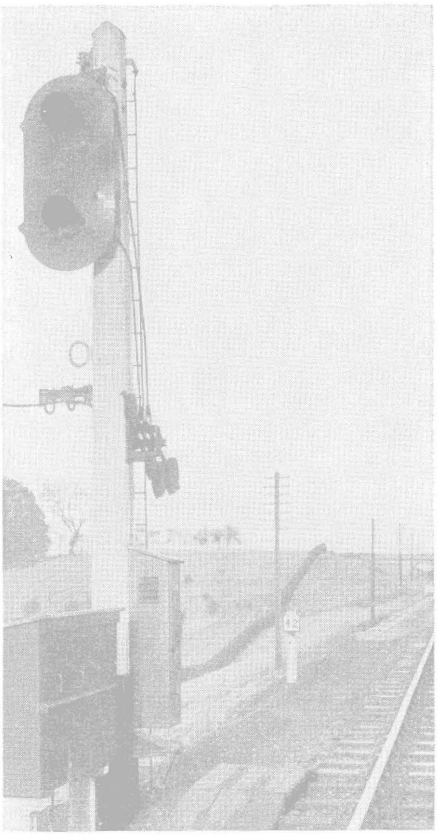
In view of the increasing use of color-light signals, the signal department of the London & North Eastern has conducted experiments to determine whether certain of the advantages of these signals could be obtained in mechanical signal installations. The chief advantages sought were the abolition of the necessity for fog signalmen during inclement weather, and the ability to convey additional information to enginemen. An adaptation of existing mechanical signals to simulate color-light signals has resulted from the experiments.



One of the converted mechanical signals

The general method of adapting the mechanical signals involved the installation of a more powerful electric lamp behind the usual spectacle and an oblong background with hoods to resemble the usual type of light signal. The background covers the spectacles excepting the round area coincident with the lamp. The spectacle, from which the arm has been removed, is operated in exactly the same manner as it was previously.

As most of these signals are in country districts, remote from any suitable power supply, approach lighting from batteries has been adopted. A track circuit of suitable length, usually 2,400 to 3,000 ft., has been provided in the approach to each signal.

The trouble often experienced with multi-lens color-light signals as a result of phantom indications does not occur with these mechanically-worked signals, for any extraneous light falling on the lamp serves only to increase the aspect displayed at the time, and all other roundels are hidden by the oblong background.

Double-filament lamps are used, the main filament being rated at 6 watts and the auxiliary at 4 watts, both at 6 volts. No auxiliary lamp is considered necessary and none is provided. Should the main filament burn out, the secondary one will give an adequate but slightly inferior signal indication.

The spectacle and light are repeated in the signal tower on a five-position, needle-type indicator, in some cases utilizing the wire formerly used in repeating the indication of the semaphore arm.

The aspects are arranged so that a yellow indication invariably precedes a red, thus preventing a green light leading up to a red one, a situation which would result in a very misleading indication being given.

This type of signal incorporates several of the advantages of the modern color-light signal and is much less costly to install. About a hundred of such signals have recently been converted on the North Eastern Area, main line, between Northallerton and Alnmouth, a distance of 85 miles. Previous to their installation, most distant signals and certain home signals were fitted with mechanical cab-signaling apparatus, but owing to the increasing use of the inter-area engines, it was decided that it would be more economical to install new lights and to withdraw the cab-signal apparatus. Fog signalmen are not employed where the new power lights are provided.

The work was carried out under the instructions of John Miller, B.E., L.L.D. Engineer, to the designs and under the supervision of the author.