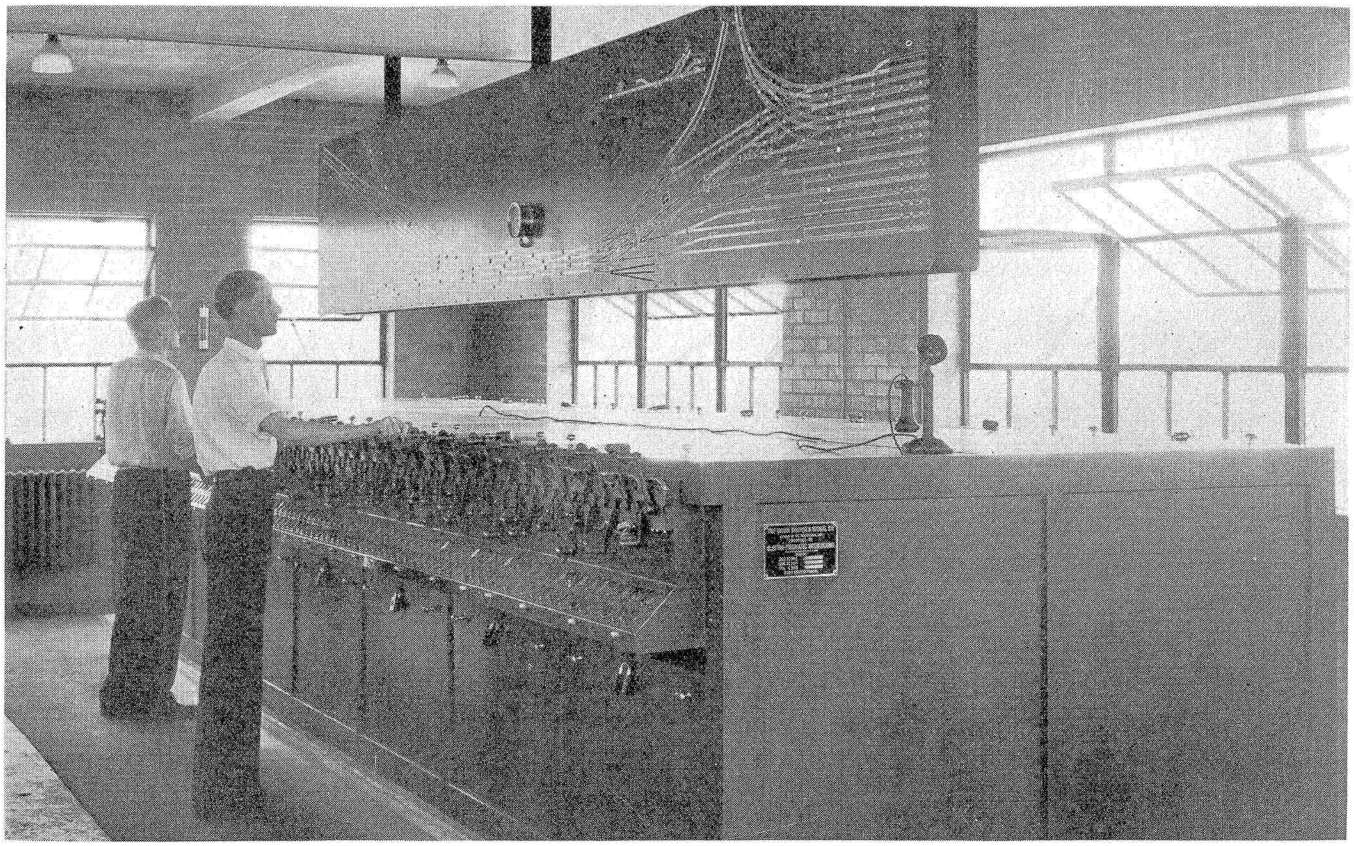
Railway Signaling

Indianapolis Union Station Installs Electro-Pneumatic Interlocking



The large spot-light type track model shows the general layout of the plant

Nearly 200 train movements each day are now made with greater safety and flexibility

THE Indianapolis Union Railway Company placed in full operation, on June 16, the new interlocking plant for the east end of the Indianapolis Union Terminal. This Union Station, handling the passenger traffic of all six railroads serving the city, is of the through type and the large modern station building is situated midway between the extreme ends of the terminal trackage. The entire project for modernizing this terminal, preparatory to providing for an up-to-date interlocking providing perfect safety and adequate flexibility for the average 200 train-movements a day, was first considered and started just prior to the war. At that time the complete area covered by the approaches and all of the terminal area, was elevated, and a modern passenger station was built. This elevation program was necessitated since the station is situated close to the center of the city and a number of important streets crossed the tracks.

In order to complete the second half of the construction program for the complete modernization of this entire project, the re-arrangement of tracks and the laying of new 130-lb. rail in the eastern half of the terminal was started in the spring of 1930. The installation of an electro-pneumatic interlocking was then commenced at the completion of this track work.

The previous method of handling and routing the heavy traffic through the terminal was by means of mechanical signals and switches operated on the ground by approximately 13 men on each trick in the eastern half of the terminal alone. This method proved inadequate and unsatisfactory, and, in order to secure the desired safety and speed of manipulation for the numerous passenger train and switch engine movements, an intensive study of the requirements was undertaken. The result of this investigation was the recent completion of the present modern interlocking plant for the eastern half of the terminal. Although the station has two approaches, only one, the east end, has been interlocked. The west end is still being operated by switch tenders, but provision has been made for the future installation of an addition to the new plant to accommodate the west end, as well.

Color-light signals are used within interlocking limits

Interlocking Machine

The interlocking machine is the Union Switch & Signal Company's latest Model-14, having a 111-lever frame with 107 working levers controlling 100 high and dwarf color-light, position-light, and color-position-light signals, 94 Type A-1 electro-pneumatic movements for 65 switches, 7 double-slips with movable point frogs, 1 single-slip with M.P.F. and 5 M. P. F. and also handling three master releases for effecting the emergency release of the approach or time locking of the signal levers involved. Each of these three master releases is controlled by a lever in the machine and handles a third of the plant, although the circuit used is so arranged that only the particular signal lever or levers concerned are released, the others retaining their locking features. Complete indications for proper lever manipulations by means of lights under the levers, are provided, and they function as follows:

1. A green light under each switch lever, when illuminated, indicates that the particular lever is electrically unlocked since no trains are on the track circuits within which the switch or series of switches are located.
2. A red "flash" light under each switch lever is illuminated during the transit of the switch points on the ground.
3. A similar red "flash" light under each signal lever is lighted during the clearing of the desired signal.

Track Model

The spot-light type track model, suspended above the machine, is of metal construction throughout, and the complete east terminal track and signal layout is painted on the sheet-steel front plate. Various colored sections of the tracks on a black background bring out clearly the limits of all track circuits embraced in the plant and the spot lights, normally out, serve to indicate, when illuminated, the occupancy of the track circuit involved.

Train Starting System

The original train starting system, which has been in use a number of years, was retained and slightly modified to suit the new interlocking. Three lights and two push-buttons for each of the 12 platform tracks are mounted on a sheet-steel case located on the train director's desk which is in front of the interlocking machine. These three lights for each track are illuminated in their proper order; first, by the operation of the conductor's platform push button when his train is ready to leave the depot; second, by the acknowledgment of the train director in the tower; and third by the gateman in the concourse, indicating that the gates leading to that train platform have been closed. The proper route through the terminal is then set up and the proper interlocking signals displayed for the train to proceed. These three lights as well as three duplicate lights for each platform track on the track model, which were installed for the convenience of the machine operators, are then automatically extinguished by the movement of the train past its platform leaving signal, and the entire system for that track is restored to normalcy. The complete operation may be set up for test purposes and the system restored by the use of a master release button instead of the passage of a train, and such a test is periodically made for each of the twelve tracks.

Signals

Color-light, position-light and color-position-light signals were used on this project. However, the majority of the signals used in the terminal proper are of the Style N-2 three-position color-light dwarf type.

The Pennsylvania uses position-light high and dwarf signals, and the B. & O. uses color-position-light high and dwarf signals on their various approach sections, while the other roads involved use color-light signals. All dwarf signals and the call-on units of the high signals were given 30-sec. time-locking while the high signals are approach locked and have a 2-min. emergency releasing time.

Field Apparatus and Circuits

The signal control relays, d-c. track relays, track batteries and their chargers, and all normal and reserve signal lighting apparatus are housed in steel relay cases located advantageously throughout the plant. Each track circuit is fed by an Exide cell on a-c. floating charge by a Type RT-10 copper-oxide rectifier. The track relays, as well as all field and tower neutral relays, are of the DN-11 Type while the polar switch-indication relays, providing SS control of the signals, are Model-12.

The signal control and track repeating circuits outside the tower are of the double-wire type while all circuits within the tower are single-wire. The main circuits from the tower to each of the field relay cases are carried in lead cables, the largest of which are 37-conductor. These cables are run through buried ducts which were installed at the time the entire elevation program was being carried out. The necessary wires from these cases to the track circuits and interlocked switches and signals are carried in trenchlay cable, being buried approximately 2 ft. in the ground. As a means of preventing damage from track tools, a creosoted plank, 1½ in. by 4 in., was placed on top of and cleated to the trenchlay cable where it passed under a track.

Power Supply

Power at 220 volts 60 cycles single-phase is carried in lead cable from the tower to each of the field relay cases for supplying the normal lighting of the signals by means of lighting transformers, for charging, by means of RT-11 rectifiers, the various field sets of 5-cell Exide storage batteries required for the signal circuits, for the reserve lighting of the signals, and for charging the track cells. This power is used also in the tower for the normal lighting of the track model and machine lever lights and also for charging the Exide 7-cell 160 a.h. tower battery which handles the main circuits and feeds the d-c. mains extending throughout the field. Although the normal discharge of this battery is approximately 5 amp., duplicate RP-41 copper-oxide rectifiers, each capable of charging this battery at the a-c. floating rate of 10 amp., are provided. One of these rectifiers is held in reserve but either or both can be cut in for charging by means of transfer switches on the tower power board. This battery also automatically acts as a reserve supply for the track model and machine lever lights in case of an a-c. outage.

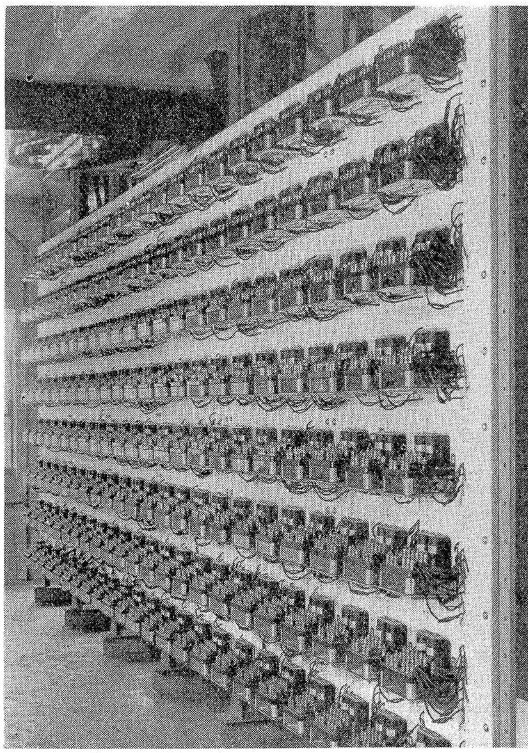
Air Supply

Compressed air is supplied to the plant for the operation of the electro-pneumatic switches with their CP valves by means of a duplicate set of 100-cu. ft. single-stage Westinghouse compressors delivering air at 120 lb. pressure. These compressors, one of which alone is of ample capacity to handle the plant under maximum operating conditions, are located in the power room in the basement of the station and the compressed air is carried by a 2-in. line through a pipe and wire tunnel to a large 565-cu. ft. storage tank located above the ground in the vicinity of the tower. The air, upon leaving this tank in 2-in. main feeder lines, is reduced to 70 lb. pressure by the use of reduction valves and by this method a maximum storage tank capacity is attained. These 2-in. feeder lines are carried above or below the ground as conditions warranted, while all ¾-in. branch lines leading to the switch movements are buried. Copper bearing steel pipe was used throughout and when buried in the ground was encased in concrete.

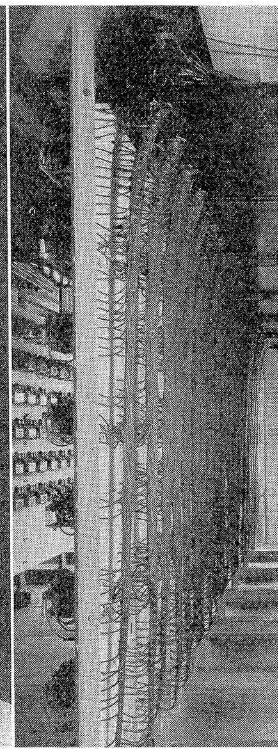
Well Constructed Tower

The three-story 25 by 60 ft. brick tower, in addition to housing all the tower apparatus for the east interlocking, provides ample room for the probable future addition of an interlocking machine and tower relays for the west end of the terminal. This tower is located in the east end of the yards approximately 600 ft. from the ends of the platforms.

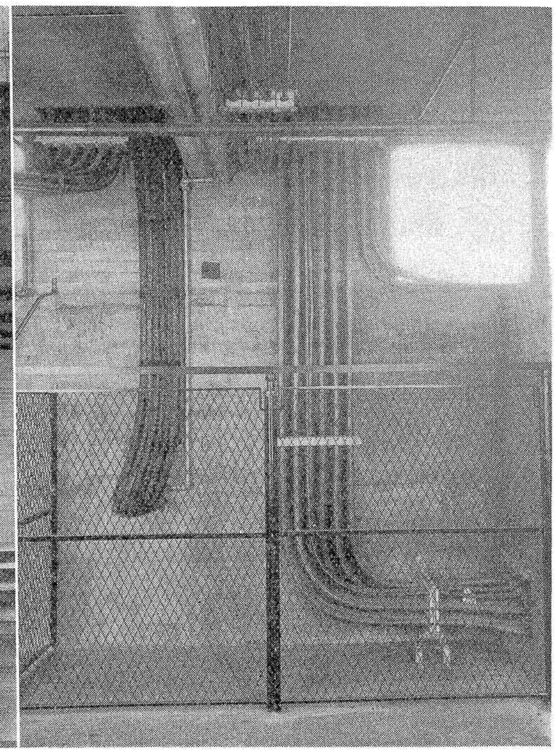
The basement floor contains the maintainer's headquarters and work shop. All the lead cables enter the tower through this floor and are then carried by means of racks to the ground floor where they are terminated in enclosed sheet-steel wall cases. The tower relays are housed on this floor, the relay racks being built of angle-iron vertically faced with sheets of Johns-Manville 1-in. "Transite" board on which the rows of wall-mounted relays are supported. All tower wiring is of the direct type and overhead steel chases are used to carry the wires from the cable terminal cases to the relay rack. A row of holes was drilled on each side of each relay mounted on the rack and the wires were run from the back of the boards through these holes to the relay terminals, thus avoiding the use of separate terminals and flexible leads. Vertical steel cases house the wires extending from the relay racks to the machine located on



Transite board is used for the relay racks



The wires run directly to the relays



Cable entrance in basement of tower

the floor above. An unusually neat appearance results from this type of relay rack construction and relay wiring since all relays are entirely open to view and inspection, while the wiring is concealed, although it is easily accessible for maintenance purposes.

The 24-ft. 111-lever interlocking machine is placed at the eastern end of the upper floor in order to allow floor space for the future addition of a machine of similar size for handling the west end of the terminal. The track model is located above the machine while the train director's desk is placed on a raised platform in front of the machine, for the purpose of more easily directing the two levermen. The director has on his desk, in addition to the train starting indicator cabinet, telautograph and telephone connections over which advance train information is received. Audible warning or call signaling devices, located at various strategic positions throughout the plant, are operated by pushbuttons located on the machine. By means of telephone connections in each of the field relay cases, a maintainer using his portable telephone set can converse with the train director, his own headquarters or work shop, the power house, or any other part of the plant.

Tracks adjacent to the interlocking tower

Resulting Economies

The total cost of this installation was approximately $360,000 and a saving over and above the interest, depreciation and operating charges will result from this investment. The greatest tangible saving effected was caused by the elimination of the large number of switch tenders formerly required. Other appreciable savings, however, are evident by the elimination of the many heretofore necessary train stops, and the resulting increase in the speed and ease of train operation and movements. With all traffic under the direction of one man, safety has been raised to a high degree of satisfaction and is being so recognized by the traveling public.

All of the signal materials and the necessary plans were furnished by and the labor performed by, the Union Switch & Signal Company under the supervision of T. R. Ratcliff, engineer maintenance of way for the Terminal Company.

Accident in A. T. C. Territory

ON May 15, there was a side collision between a Chicago, Burlington & Quincy passenger train and a Chicago & North Western passenger train, at Clinton, Iowa, which resulted in the injury of 11 passengers, 1 Pullman porter and 1 dining-car waiter. An abstract of the report of this accident, issued by the Bureau of Safety, I.C.C., follows.

This accident occurred at a crossover which connects the C. & N. W. with the D. R. I. & N. W.; trains of the C. B. & Q. operate over the D. R. I. & N. W. In the vicinity of the accident the D. R. I. & N. W. is a single-track line over which trains are operated by time-table and train orders, no block-signal system being in use, while the C. & N. W. is a double-track line, left-hand running, over which trains are operated by time-table, train orders, and an automatic train-control system of the two-speed continuous type, with two-indication visual cab signals; no wayside signals were involved in the movement of the C. & N. W. train. A dead section in the track circuits of the C. & N. W. automatic train-control system extends from the depot westwardly to signal bridge 2; an engine on this dead section receives a slow-speed cab signal indication, restricting speed to 17 m.p.h. With the west switch of the crossover on the D. R. I. & N. W. track open, but with the east switch on the C. & N. W. westbound track closed, such as was the case in this instance, the slow-speed indication does not change as the engine enters upon the track circuits of the automatic train-control system at signal bridge 2, but continues to be displayed until a point is reached on the westbound track of the C. & N. W. about 1,300 ft. west of the crossover; the engineman would not necessarily know just what caused the slow-speed indication to be displayed, but in the event the speed was increased to 20 m.p.h. the air brakes would automatically apply and bring the train to a stop.

Westbound C. & N. W. passenger train No. 1 left the depot at 1:52 p. m., passed over the dead section in the automatic train-control track circuits under a slow-speed cab signal indication, entered train-control territory at signal bridge 2, at which point the slow-speed indication remained unchanged, due to the west switch of the crossover being open, and was passing the crossover at a speed between 12 and 18 m.p.h. when the seventh and eighth cars were struck by the C. B. & Q. train.

Chicago, Burlington & Quincy passenger train No. 53, entered the west switch of the crossover and cornered the rear portion of C. & N. W. train while traveling at a speed estimated to have been reduced from 15 or 20 m.p.h. to about 3 to 5 m.p.h.

The direct cause of this accident was an open crossover switch. The west switch to the crossover between the D. R. I. & N. W. and the C. & N. W. is connected to the automatic train-control system of the C. & N. W. As a result of this switch being open, westbound C. & N. W. train No. 1, which was making a through movement, continued to receive a slow-speed cab signal indication, and the engineman was operating his train in obedience to this indication when the accident occurred. The engine crew of C. B. & Q. train were on the alert and saw the open facing-point crossover switch practically as soon as it was possible to have done so, with the result that the speed of their train was considerably reduced prior to entering the crossover and colliding with the rear portion of C. & N. W. train. After the accident, the switch was found to be lined for the crossover and locked, but exactly when or by whom the switch was opened could not be ascertained.