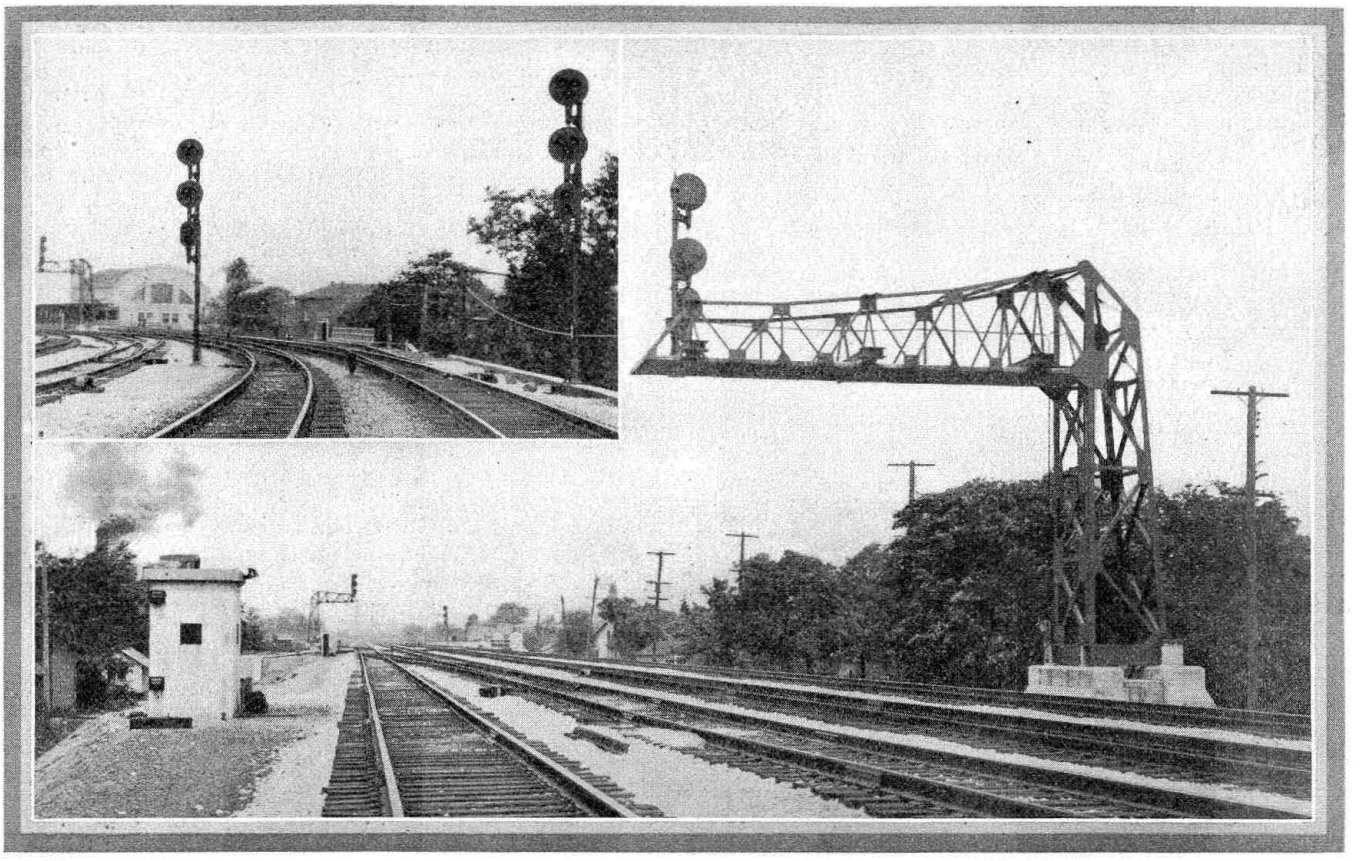


*Top—View approaching station from the east  Bottom—One of the three-track cantilever bridges*

*New York Central's Reconstruction Program at South Bend Involves*

# New Electric Interlocking

## *with Design Which Minimizes Maintenance Costs*

By G. E. Beck

Assistant to Signal Engineer, New York Central, Lines West, Cleveland, Ohio

THE New York Central's recent reconstruction program at South Bend, Ind., motivated by the desirability of separating the grade at important heavy-traffic street crossings, involved the construction of an extensive electric interlocking plant. The track layout within this territory includes: The ends of double track, at each end of the plant, leading to the center, or yard, tracks, two double-track junctions of the Grand Trunk; a double-track junction with its own Illinois division line; and a single-track crossing of the latter over its four-track main line. The distance between the east and west home signals is approximately 3.68 miles.

Where, formerly, 18 city street crossings presented a serious crossing-protection problem, there is now an elevated earthwork track structure nearly three miles long with 14 street bridges. A new passenger station was built, which also accommodates the Grand Trunk as a tenant line. The traffic through this plant each 24 hours consists of 40 Grand Trunk trains, 70 New York Central trains, and about 6 yard movements.

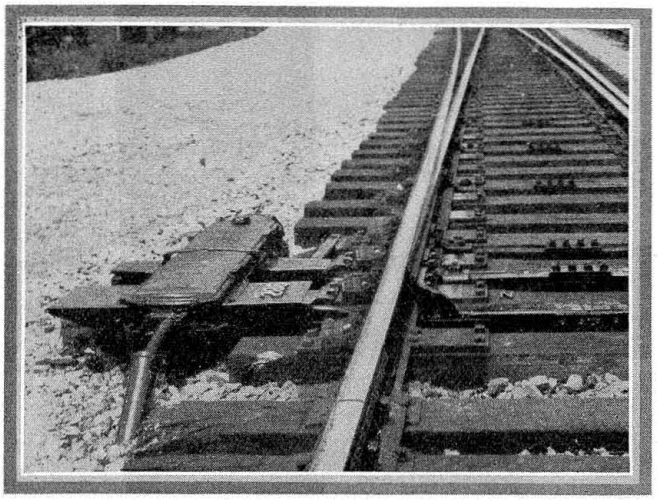
The interlocking installation is based on the principles of the General Railway Signal Company's all-electric system, the Model-5B interlocking machine, with latch locking, being used. This machine has 259 working levers, 9 spare levers, and 36 lever spaces in a 304-lever frame, which is enclosed in a steel cabinet, finished in olive green. Electric locking is effected by the use of 102 forced-drop electric locks, which are applied to the lever latches. Ninety-two time releases, adjustable from 0 to 90 sec. operation time are applied to various levers, as required. In addition, the machine is equipped with 662 six-way banks of low-voltage relay-type controller contacts, 2 ammeters, 1 voltmeter, and G. R. S. standard ground-detector switches. It is proposed to install, at a later date, transit lights over the switch levers to indicate that the switch is full normal or full reverse. Switchboard lamps will be used, and will be mounted in a hole drilled in the case of the machine. The indication will be effected by inserting a 100-ohm relay in series with the *SS* relay, the transit light to be controlled through a back contact of this series relay.

An illuminated track diagram, 3 ft. wide by 24 ft. long, mounted on the wall back of the machine, consists of 111 track sections, outlined in color, each

section being equipped with an indicating lamp of the switchboard type. Mounted also on the wall are two panels, bearing 32 clockwork hand releases, arranged so that they can be swung from the wall to facilitate inspection of the wiring on the back thereof.

### Tower a Modern Structure

At about the center of the track layout there was built a three-story brick tower 17 ft. wide by 70 ft.



**Note method of protecting cable at switch**

long. The three floors are designed to accommodate the interlocking apparatus, heating plant, and maintenance headquarters in an efficient manner. The basement floor contains a battery room, repair room, cable terminal compartment, coal bunker, and furnace room. The second floor is divided into two rooms, one for the relays and charging equipment, the other an office for the maintainer. The third floor, containing the control apparatus, is designed as the operating room. Under the interlocking machine in this room is a repair pit, 2 ft. deep by 3 ft. wide which provides ample room for wiremen or maintainer; the indication apparatus is easily reached from this pit.

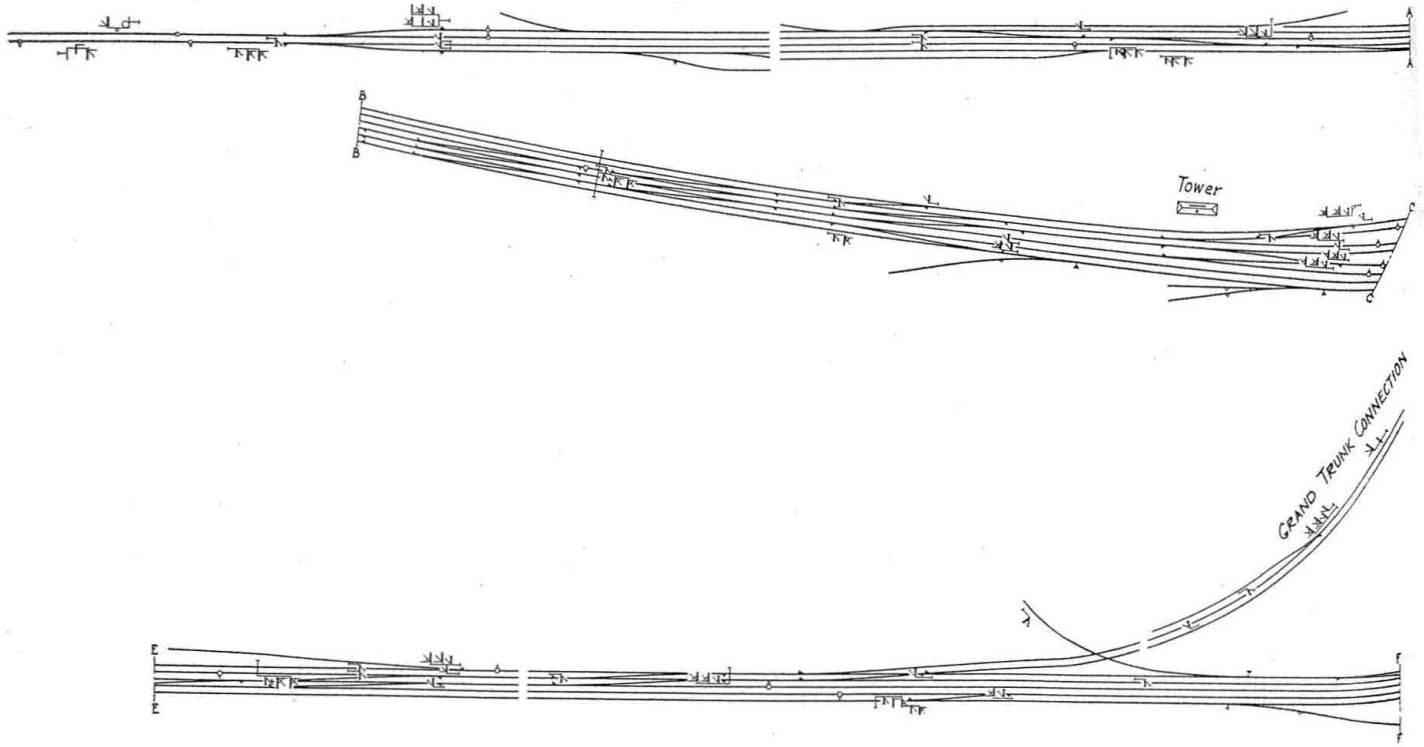
Aside from these practical conveniences, the interior of the tower is well appointed in a color scheme of olive green. The entire floor is laid with olive green battleship linoleum; desks, railings, cabinets, lockers and toilet partitions are of steel, finished in the same color; the windows are equipped with Venetian blinds to match. All floors are connected by inside stairways, while an outside stairway connects the first floor level with the basement level.

### Operation and Maintenance

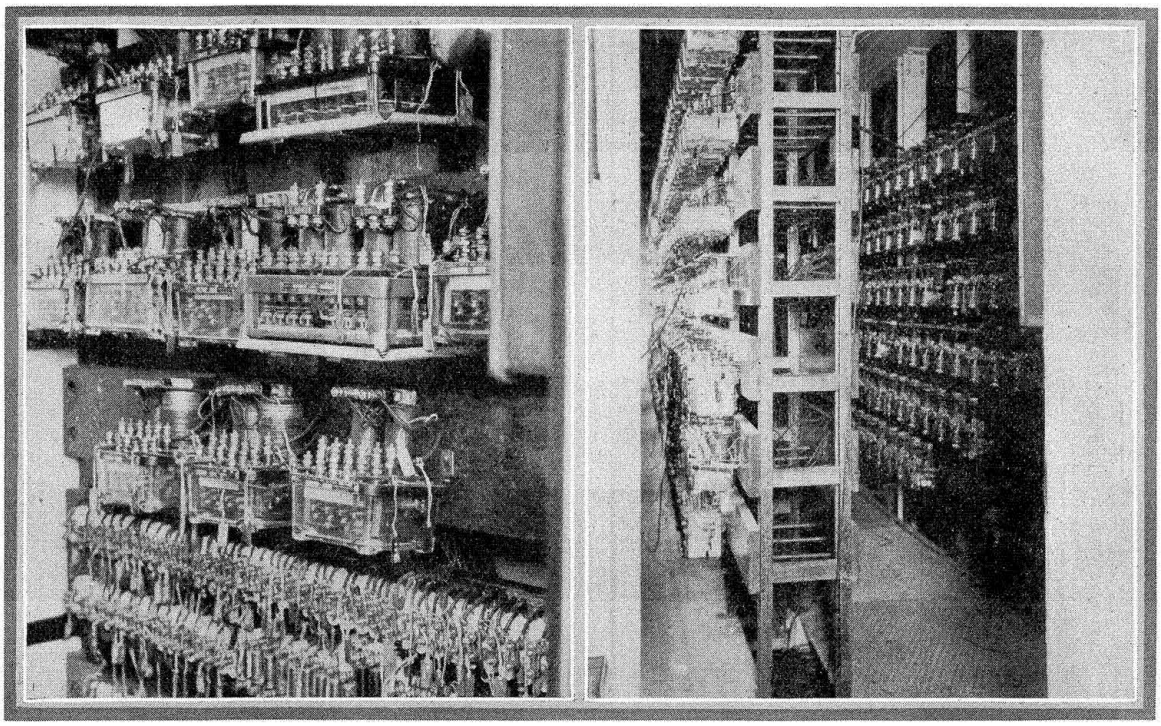
The maintenance schedule consists of three tricks of eight hours each, with the operating personnel consisting of a director and a leverman. Full advantage was taken of modern developments to give the director every available facility in his work of directing the traffic. A train describer, the Union Switch & Signal Company's latest button-type transmitter, is installed in the tower and serves to inform the station master and his attendants regarding train movements.

In addition to the regular dispatcher telephone equipment with loud speaker, the operating room has a loud-speaker telephone which can be connected through 22 telephone jacks to as many points suitably located throughout the plant, transmission being effected through No. 12 twisted pair in the power cable. Seven Klaxon horns, properly distributed, enable the leverman to call the maintainer to the nearest phone in case of trouble. Likewise, the maintainer may, at any one of the 22 telephone locations, call the leverman if his testing requires the co-operation of the latter.

The maintainer has his headquarters in the office room on the second floor of the tower structure, where he is conveniently located in case of trouble. Five tool houses are located at advantageous points




**Track and signal plan of extensive interlocking**



Interior of concrete relay house

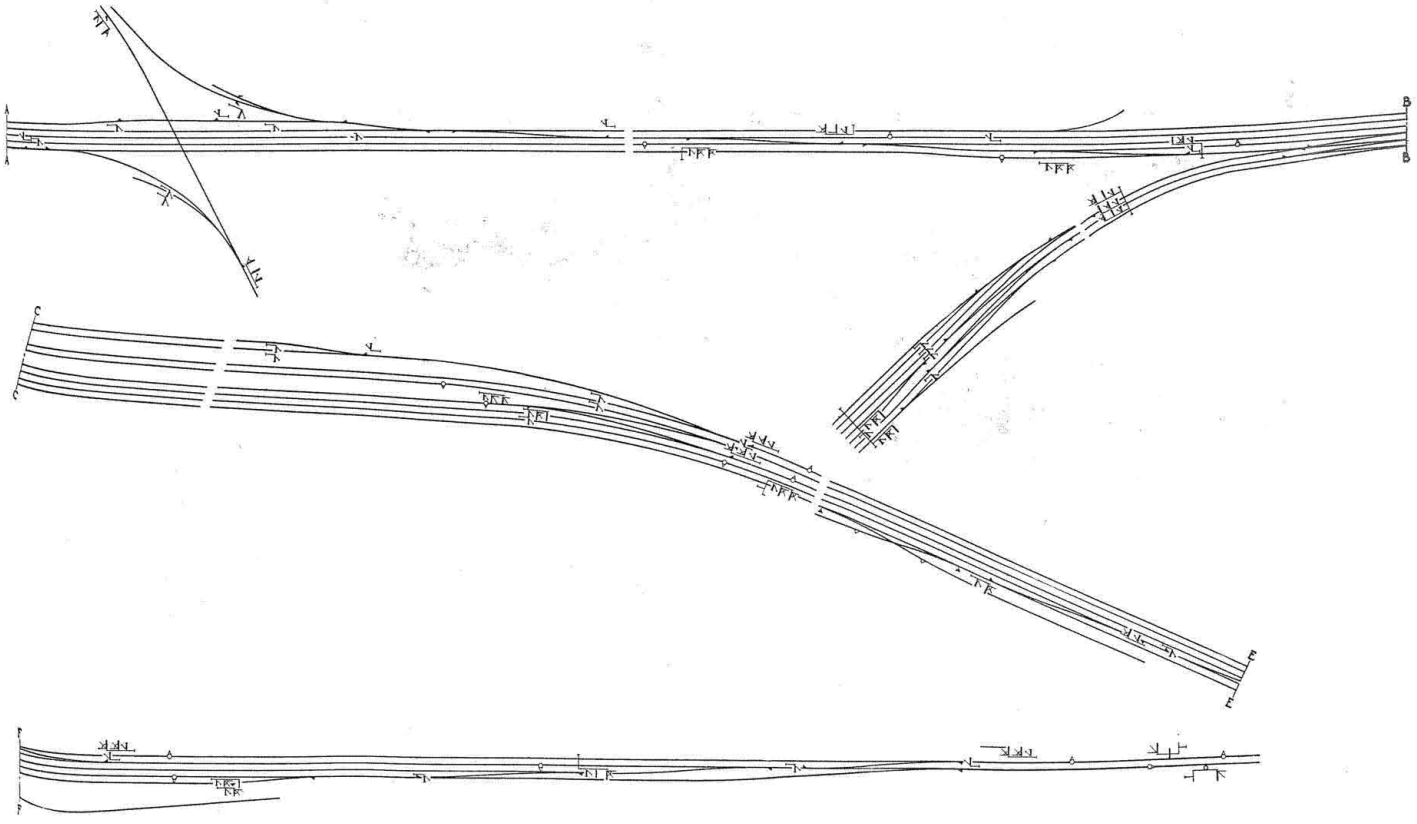
In relay room at tower

throughout the plant. Each of these tool houses is equipped with a work bench, desk, electric lights, telephone and space for motor car and light materials.

### Engineering Features of Tower Equipment

Included in the tower equipment in the relay room are 995 relays, placed on three N. Y. C. standard channel-iron and wood relay racks, having a total capacity of 1,058 relays.

The charging equipment consists of an a-c. -d-c. motor-generator set and five Union Switch & Signal Company's copper-oxide rectifiers, with a control panel to operate same. The tower battery room contains racks which support the Exide storage cells. Batteries, consisting of seven 41-plate 680-a.h. cells



at South Bend, Ind., on the New York Central

each, are used for the low-voltage circuits; 65 cells, Type-EMGO, 15-plate, 280-a.h. are used for switch operation.

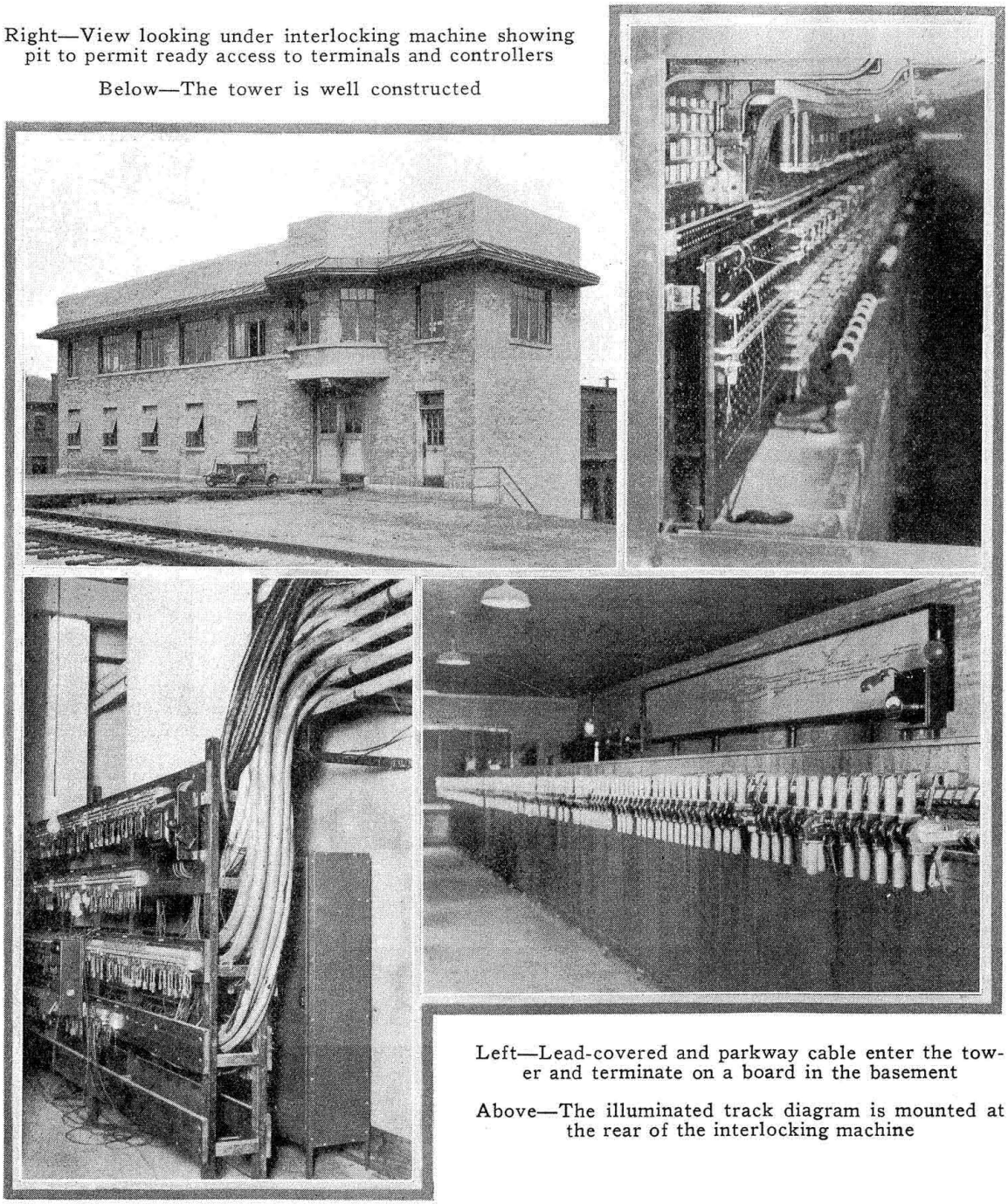
The basement of the tower contains a terminal compartment in which all cables from the conduit system terminate. These cables are carried into the base-

5-position dwarf signals, the top unit being three-position and the lower unit two-position. In addition to these there are 49 Type-F, two position dwarf signals and 34 Type-G, three-arm, two- and three-position high signals, arranged for four-block indications.

The approach-lighting circuits are so arranged that

Right—View looking under interlocking machine showing pit to permit ready access to terminals and controllers

Below—The tower is well constructed



Left—Lead-covered and parkway cable enter the tower and terminate on a board in the basement

Above—The illuminated track diagram is mounted at the rear of the interlocking machine

ment through wood-log conduits and terminate in banks on two terminal racks.

### Color-Light Signals

All signals are the General Railway Signal Company's color-light type, approach lighted, and are mounted on ground masts, bracket masts or signal bridges, as required, to be to the right of the track governed. The railroad company's bridge department designed the cantilevers and bridges needed for the long spans across the three to seven tracks. Track 5, which is signaled in both directions, required 7 Type-SA

only those signals will be lighted that are on the route over which the prevailing train movement is to be made, as established by the prevailing lever positions and electric-locking conditions.

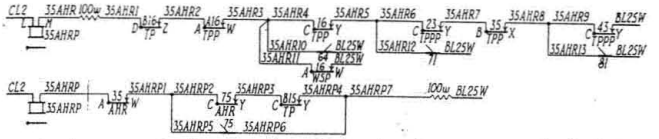
### Switch Equipment

Switch machines are the General Railway Signal Company's Model-5A, designed for operation on 110 volts direct current. Twenty-eight are of the low-speed type, requiring from 8 to 15 sec. for operation; these are used at the ends of the plant to permit the use of smaller control wires than would otherwise be needed.

All other switch machines are the 3 to 3.5-sec. type. Under a recently adopted departmental policy, the work of applying rail braces and tie plates to power-operated switches and derails is done by the track department; the signal department simply ties the switch movement to the track with a short plate.

### Cable and Conduit System

All circuits from the tower to outside points are carried in cables, 70 per cent of which are lead-covered and placed in conduit, for lateral runs, while the remaining 30 per cent, for transverse runs, are parkway or trenchlay cable buried underground. The cables vary in size from 1- to 75-conductor and in gage from No. 14 to No. 4. In addition to the control, operation and indication circuits, the lead-covered cables carry the 440-volt, 60-cycle, 3-phase power used throughout the plant for lighting and trickle-charging. It is interesting to note that 190,000 ft. or 36 mi., of cable was




Typical control circuits for the selective approach lighting

used. The total length of conductors was 6,200,000 ft., or about 1,173 miles. Of this figure 335,000 ft. or 63.4 miles, was flexible single-conductor wire.

A conduit system, devised jointly by the New York Central and the Western Union, makes use of Bermico duct in the open and wood log over bridges. Fifty manholes are located at convenient points. A locomotive crane, with a 50-ft. boom, gave excellent service pulling in the cable. The heavy reels were easily handled and placed to best advantage, and the empty reels were quickly loaded.

Track circuit connections are carried to the rail in single conductor trenchlay cables, No. 6 being used at the relay ends and No. 10 at the battery ends of track circuits. Cable outlets, of the double-plug type, were furnished by the O. S. Flath Company. To house the relays at outlying points, concrete relay houses, built by the O. S. Flath Company, were installed wherever the amount of equipment would warrant. Twenty-one relay houses shelter 1,054 relays (including 59 power-off relays), 165 copper-oxide rectifiers, and accessory equipment. Concrete battery boxes were used to house 103 Exide Type-EMGO, 7-plate, 120 a.h. track cells and 354 Type-EMGO, 11-plate, 200-a.h. cells for signal lighting standby service. These boxes are similar to the A. R. A. type and were manufactured by the Signal Accessories Corporation. The rail bonds are of the ⅜-in. plug type, double-strand, purchased from the American Steel & Wire Company.

All of the circuit and detail wiring plans were prepared in the signal engineer's office at Cleveland.

The installation was made by the railroad company's regular signal construction forces under the supervision of T. G. Inwood, signal supervisor, Western signal district.

## Accident in Signaled Territory

ON October 29, 1929, there was a derailment of a passenger train on the Alabama Great Southern, Southern System, at New England, Ga., resulting in the death of one employee, and the injury of four passengers and one mail clerk.

In the vicinity of the point of accident this is a single-track line over which trains are operated by time-table, train orders and an automatic block signal and train stop signal; the signal system, however, was temporarily out of service. An abstract of the report of this accident as issued by the Bureau of Safety, I. C. C., follows:

The accident occurred at a switch located about 60 ft. south of the station at New England; this switch is a facing-point switch for southbound trains and leads off the main track to the west to an industrial spur track.

Southbound passenger train No. 43 stopped at absolute signal 12.3 in the stop position, and the conductor received and copied train order No. 210, Form 19, from the dispatcher over the emergency telephone, reading as follows:

> "Block signals between Morganville and Trenton not working. May be passed without stopping, looking out for obstructions, broken rail or switches not properly set. This order void after 6:50 six fifty a.m."

Morganville and Trenton are 5.8 miles apart, and include the territory within which this accident occurred. Train No. 43 departed from Morganville at about 6:02 or 6:03 a.m., about 15 min. late, and when in the vicinity of signal 13.1, which signal was displaying a stop-and-proceed indication and is located 7,392 ft. north of signal 14.5, speed was reduced in order to permit their own flagman, who had been sent ahead to flag through the block while the conductor was obtaining the train order, to get aboard the train; the engineman also operated the forestalling feature of the automatic train control apparatus and the train passed signal 13.1 without stopping. Approaching signal 14.5, which was also displaying a stop-and-proceed indication, the engineman again forestalled and the train passed that signal at a speed estimated to have been between 15 and 20 miles per hour and was then derailed at the switch leading to the spur track. The employee killed was the fireman.

Engineman Daniels stated that when approaching New England, he was leaning out of the side window and looking ahead; the headlight was not burning. The switch at which the accident occurred was the only facing-point switch within the territory covered by the train order, and on seeing the switch points, which were plainly discernible when the engine was about 350 or 400 ft. north of them, and after satisfying himself that they were properly lined for the main track, at which time he estimated the speed of his train to have been about 15 miles per hour, he released the air brakes and opened the throttle a little, and then a little more, and the speed was increasing on the descending grade at the time the switch was encountered.

This accident was caused by the defective condition of a switch.

The investigation developed that the automatic block-signal and train-control system functioned as intended, that the No. 1 bridle rod of the switch had broken in some unknown manner, and that this condition permitted the switch points to open, causing the automatic signals to assume the stop position. Engineman Daniels did not see the open switch points from his position in the engine cab, it appearing to him that they were properly lined for the main track. Engineman Daniels, however, should have known that there was a break somewhere in the track circuit by reason of the signals displaying stop indications, since he knew there was no train in the block; this was the only facing-point switch between the points named in the train order.