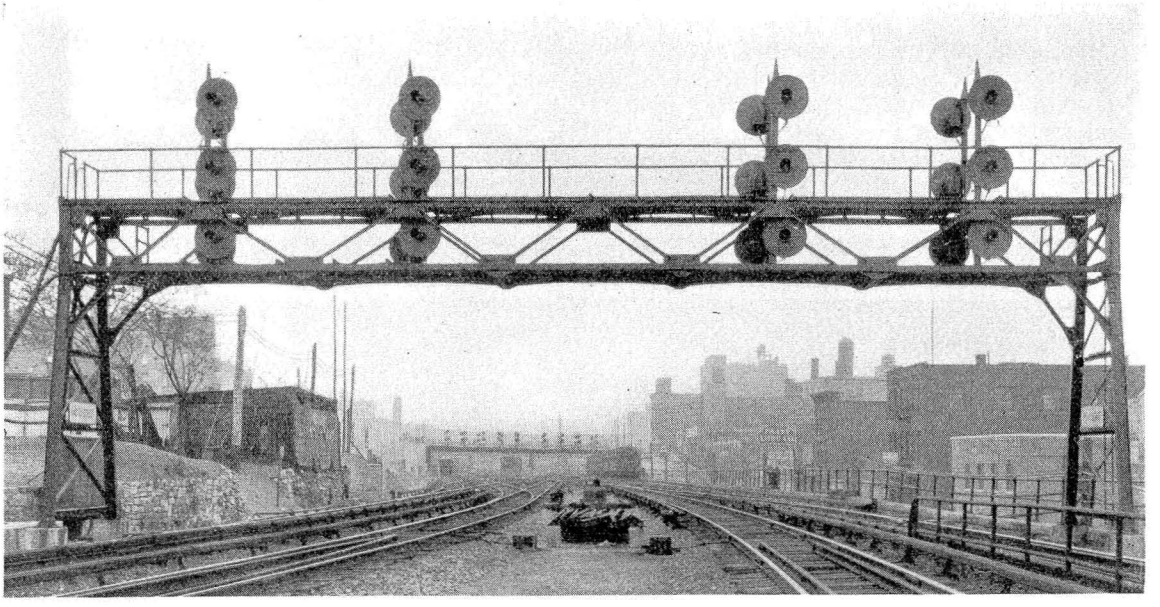
The Mott Haven Interlocking

New York Central completes new 260-lever plant on Grand Central Terminal



The signal bridges have two decks thus dispensing with ladders

THE Mott Haven interlocking recently completed at 149th street, New York, on the New York Central is of special interest not only on account of its large size, but also because of the modern equipment and methods of construction used. The construction of the new plant was included as a part of a program carried out for the purpose of facilitating train movements and increasing the track capacity between Mott Haven and the Grand Central Terminal. The automatic signaling on the five miles of four-track line between Mott Haven and the terminal, was described in detail in an article in the May issue of *Railway Signaling*.

The Mott Haven layout includes the junction of the New York Central and New York & Harlem Railroad of the New York Central, the entrance to the coach yards, and also the junction of the main line of the New York, New Haven & Hartford entering New York Central tracks at this point. One of the disadvantageous features of the previous track layout was the abrupt angle of meeting of the tracks of the Hudson and the Harlem tracks, with special No. 7½ turnouts which restricted train movements to 10 m.p.h. To overcome this, the junction tracks were moved approximately 1,600 ft. to the south toward Grand Central, by extending the three tracks of the N. Y. C. through this distance. This made possible the use of No. 16 turnouts, permitting a speed of 30 m.p.h., and also made it possible to extend the coach yard leads to Mott Haven yard, which lies in the wye between the tracks of the two divisions, a most desirable improvement.

The reconstruction of the interlocking made necessary by these extensive track changes brought about the construction of an entirely new Mott Haven plant which included also the functions of three other interlockings in this vicinity. A 35-lever electro-pneumatic plant was previously in use at MO, Mott Haven Junction this equipment having been in service since 1902. A second electro-pneumatic interlocking was located at Mott avenue, having 27 levers for 25 signals, 16 switches, 4 derails and 2 traffic levers. A third G.R.S. all-electric plant was located at 156th street, with a 44-lever frame and 34 working levers as follows: 18 levers for 18 signals, 7 levers for 7 switches, 4 traffic levers, 2 levers for 2 double-slip switches, and 1 lever for 1 movable point frog. A fourth G.R.S. all-electric plant located at Melrose, 162nd street, had a 56-lever frame and 41 working levers as follows: 22 levers for 22 signals, 14 levers for 12 switches and 5 derails, 4 levers for traffic levers and 1 lever for 1 mechanical lock. The all-electric plants were placed in service in 1907. The new 260-lever all-electric plant includes the functions formerly incorporated in all four of these layouts, plus the additional switches and signals.

Heavy Traffic

The traffic through this plant includes all the New York Central and New Haven passenger and express trains into and out of Grand Central Terminal. As the coach yards of both roads are located north of Mott Haven, this results in the number of movements through the plant being practically double the number of scheduled trains. Under normal conditions, approximately 680 train movements are made through the plant every 24 hours, while during holiday seasons as high as 850 moves have been made daily. The heavy traffic periods

of the day are from 7 a. m. to 10 a. m. and from 3 p. m. to 6 p. m., during which time a train moves through the plant on the average of one each minute.

The New Mott Haven Plant

A new brick signal station was constructed facing south toward the junction. The main portion of the building is 26 ft. wide and 100 ft. long inside, with a large bay on the front. Metal sash windows, with ventilators at the bottom, extend almost all the way around the top floor, thus affording an excellent view of the tracks. Adequate toilet and locker room facilities are provided at the west end of the operating room. The ceiling and upper section of the walls are covered with perforated Celotex as a means of reducing sounds, thus decreasing interference due to noise.

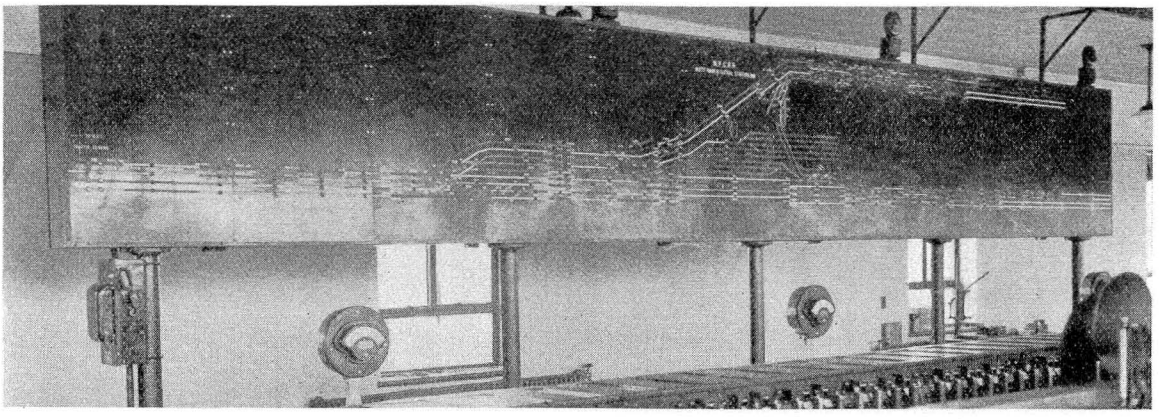
The interlocking machine is of the latest Model-5 Form-A all-electric type equipped with latch-lever locking and forced-drop electric lever-locks. Of the 217 working levers, 112 are for 225 signals, 80 for 80 switches, 10 for 11 derails, 6 for 6 movable-point frogs, 2 for 2 double-slip switches, 2 for 2 single-slip switches, 4 are traffic levers and 1 is a check-lock lever. Fifty-five spare lever spaces are provided in the machine for future growth and the signal station building is long enough to add another 64-lever section to the machine if required, it being anticipated that the limits of the plant will be extended even farther in the future.

A small lamp is mounted behind the frosted glass number plate on each lever. On a switch lever this lamp is illuminated whenever the lever is unlocked electrically, thus informing the levermen that it can be used, providing the proper route is being set up. For the signal levers, this number plate lamp is illuminated when the signal is cleared and remains lighted until the signal assumes the Stop indication. Immediately above each switch and derail lever there is another lamp, equipped with a red lens. If this lamp is lighted, it is an indication that the corresponding polarized relay is open, which means that there may be a cross or ground on the circuit. The polar relays are glass enclosed but the leverman can get at them to reset them. Likewise, he can replace a fuse, but he cannot get at any other apparatus in the machine. A special fuse tester with a light as an indicator is provided.

Above each traffic lock lever there is a green lamp which is lighted to show when an unlock is being given from the other signal station involved, and the direction in which the line-up is established as indicated by lighted direction arrows on the illuminated track diagram.

An illuminated track diagram supported on 3½-in. pipes is located in the rear of the machine. The face of this diagram is made of sheet bakelite in sections two feet wide. The drawing of the respective section of the track layout is a groove 5/16 in. wide and 1/16 in. deep, milled into the bakelite, thus making a permanent diagram. If any change is required, one of the two-foot sections can be replaced without disturbing the remainder of the diagram. The track occupancy lights, mounted directly on the milled groove representing the track, are normally extinguished, being lighted only when the corresponding section of track is occupied. Small triangular sections of metal, located at points corresponding to the switches, are moved to repeat the position of the track switches, the operating device being controlled to repeat the respective SS relay.

Inspection of the interlocking machine is facilitated by a long pit under the machine, which is 52 in. wide and about 43 in. deep below the floor line. The platform or cat-walk at the bottom is 3 ft. 10 in. wide. Enough space was allowed at each side of the pit to bring the wires up straight, and the wires are supported by ties secured to round iron supports located at the floor line. A special feature is that the pit is lined with sheet metal, thereby reducing the fire hazard and preventing dust from coming up from the relay room into the machine.



The face of the illuminated diagram is made of bakelite

Relay Room

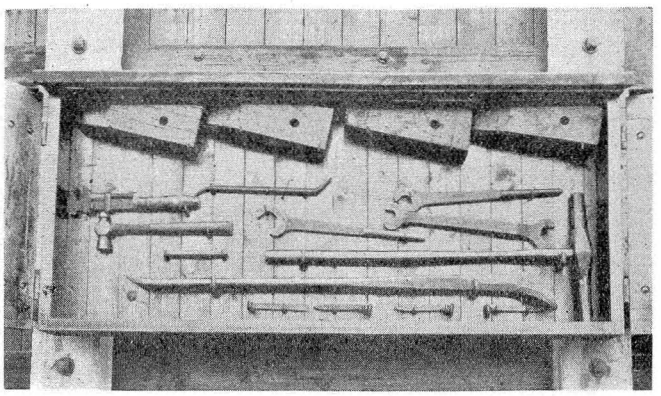
The ground floor of the tower is used exclusively for relays, and attendant apparatus, all of which is of the wall-type mounted on racks made of sheet steel bolted to an angle-iron framework. Small bakelite templates are set in the holes in the steel racks through which the wires pass. Four of these racks 91 ft. long are required for the 2,500 relays. Each rack has five panels for relay mounting, and two at the top and another at the bottom for terminals. A floor made of steel tread plates is supported 3 ft. 6 in. above the actual concrete floor of the room, the intervening space being used to run cables and wire. All wires between relays and the machine above are No. 12 solid insulated copper and are continuous from terminal to terminal without joints.

Control Circuits

As the entire track layout is in electrified territory where 650-volt d-c. propulsion is used, the track circuits are all operated on alternating current. Type-D a-c. relays are used for the 71 two-rail track circuits and

Type-K d-c. relays fed from rectifiers are used for the 45 single-rail track circuits which are located in certain sections of the complicated switch layouts where double rail circuits were not practicable. All relays, excepting the relays for the track circuits, are located in the signal station.

The switch machines are the Model-4A, operating



Emergency tools are located in boxes at remote points on the plant

on 110 volts direct current. Two control wires and a separate common wire extend from each switch lever to the corresponding switch machine. The switch indication is on the dynamic principle. The 122 switch-repeater relays, located in the tower, are Type-K, 150-ohm d-c. and are fed through rectifiers from 55-volt a-c. circuits. The 58 SS relays are Type-D vane three-position a-c. Every SS circuit is fed from an individual 1-1 transformer located in a cast-iron housing bolted to the end of the switch machine.

The Signal Circuits

The signals are of the a-c. SA type, there being 187 high signals and 38 dwarfs included in the plant, 10 of the dwarfs being equipped with double lights and 28 with single units. The signal lamps are lighted on a

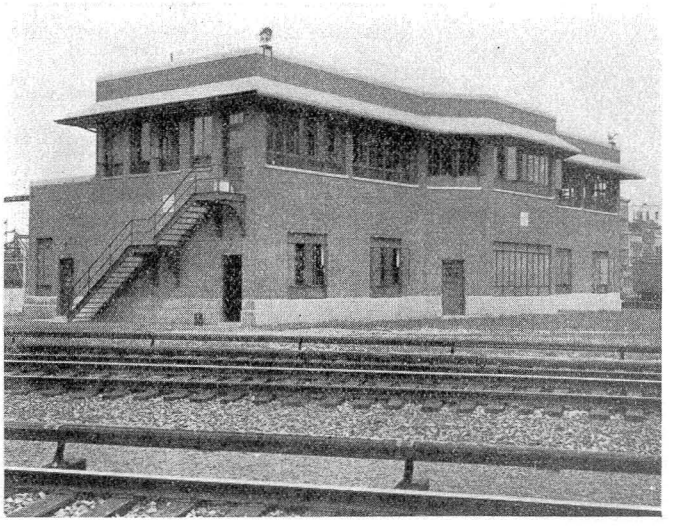
The interlocking machine includes 260 levers

special 55-volt a-c. circuit, the voltage being controlled automatically by a clock-work switch to give 6.5 volts at the lamp during the hours of darkness and 10.5 volts during daylight. Each signal is controlled over a two-wire 55-volt a-c. circuit with a rectifier to feed a Type-K d-c. neutral relay, which in turn controls the SA signal unit. The signal circuits are checked through the SS relays for the respective route. A time contactor is connected with each signal lever so that 15 sec. must elapse before the lever can be moved full normal, regardless of whether the approach track circuit is occupied. Approach locking is effective on normal and medium speed signals, a clock-work time release set at 1.5 min. being used when necessary to release the approach locking feature.

The traffic locking circuit for each track between Mott Haven and the next interlocking south, is accomplished by a two-wire circuit which breaks through the track relays of all the intervening track circuits. The lock lever in turn controls a three-wire circuit arrangement which in turn energizes relays to establish the direction of train operation for the automatic block signals. This is a 55-volt a-c. circuit but the relays are d-c. and are fed through rectifiers. Approximately 13 relays are controlled on each of these circuits.

Wiring Distribution

The main runs of the wiring distribution are in lead-covered cable, run in duct lines, using 3½-in. fibre conduit laid in concrete. The concrete bed is 3 in. thick and the conduit is spaced 2 in. apart by using concrete blocks. The main run south from the tower has 32 ducts, and the runs on the Harlem and Hudson divisions have 20 ducts each. The conductors in these cables for signal controls are No. 12 and the wires for switch control vary in size depending on the length of the run,



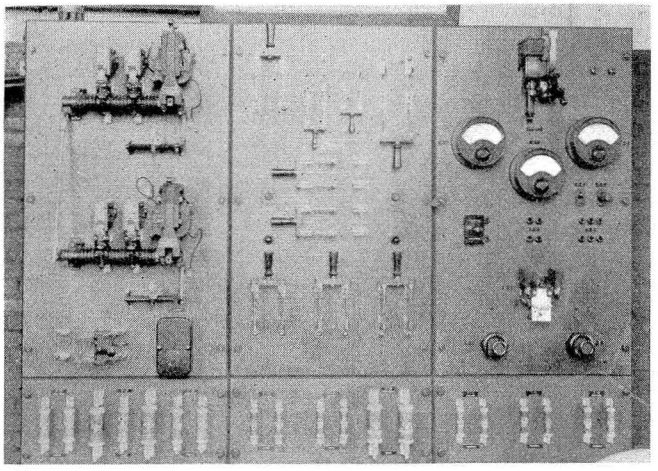
The tower is 100 ft. long

No. 6 being the largest for a run that is nearly a mile long.

A parkway cable of 10 or 12 conductors extends from the main junction box to each switch. This cable is terminated in an outlet box about 3 ft. from the switch machine, from which point single wires extend through a flexible conduit to the machine. Two of these wires are used for a telephone circuit, being located in the terminal box of each machine, into which the maintainer can plug his portable phone set. Plugs are also located in the main junction boxes and relay cases. This circuit extends to a loud speaker outfit on the train director's desk in the signal station so that a maintainer can talk to the director at any time. The director can call the maintainer to a phone by operating a push button to sound the Klaxon horns located at each signal bridge.

For the signals on bridges a 12-conductor cable with

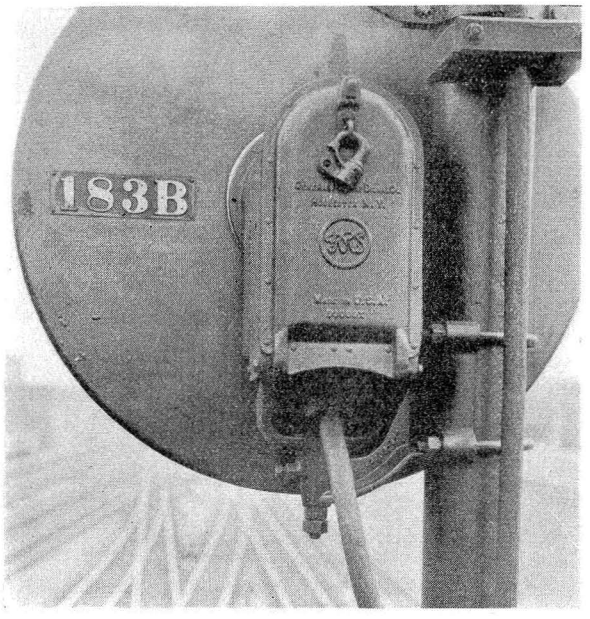
a braided-loom covering extends from the main junction box to each signal. The cable is carried across the bridge on a support of wood blocks or messenger wire, and is run up the signal mast through wood blocks bolted to the mast. One of the accompanying illustrations shows how this cable is brought into the bottom of the



The switch board includes automatic switching

signal and held by a screw clamp waterproof condulet with a lead sleeve. Four of the wires in this cable are used for the signal control, two are for the lamp, and two or more are for circuits breaking through contacts on the signal.

The signals on a mast are spaced 4 ft. 6 in. center



Cable is run directly to the SA signal

to center. It will be noted in the view of the signal bridge at 140th street that there is an upper and a lower platform in the bridge, thus eliminating the need for ladders. The platforms are constructed of subway iron grating.

Power Supply

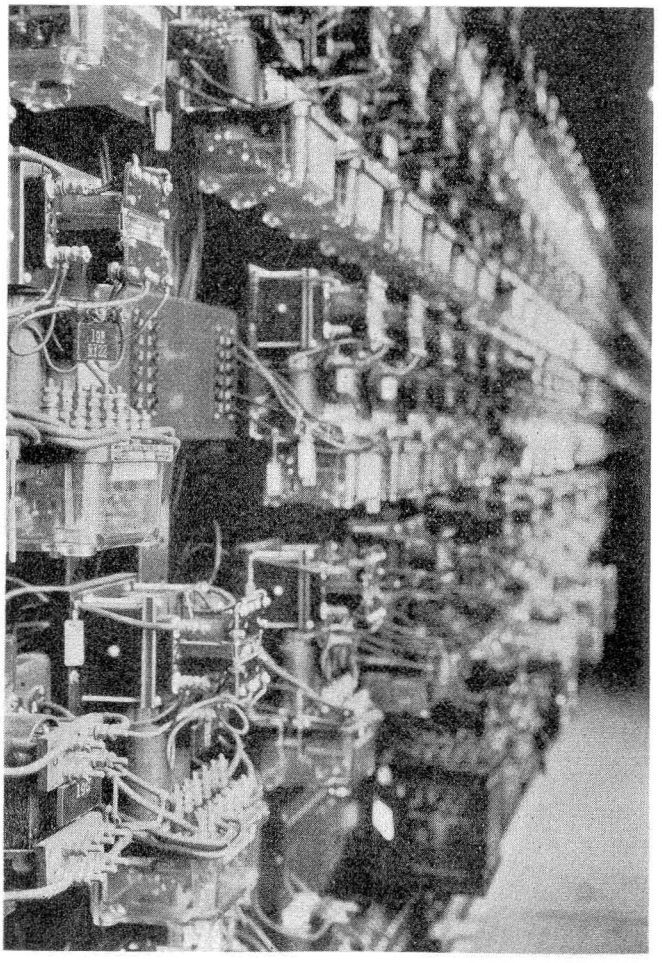
Two supply lines of 55-volt single-phase 25-cycle current are brought into the power room of the Mott Haven interlocking. If power is cut off from one of these sources the feed for the plant is automatically cut over to the other supply line. This switching apparatus is mounted on the left panel as shown in the illustration of the switchboard.

An outdoor transformer station includes three transformers. Two of these are rated at 10 kv.a, 2,200-55 volts, 25 cycles, and each is on a separate source of supply, one or the other being used to supply the electric locks, control circuits, track circuits, etc. The third transformer for the motor-generator set, is rated at 25 kv.a, 2,200-110 volts, with a 55-volt neutral tap as an emergency feed for the locks control circuits, etc.

It is a very remote possibility that these sources of a-c. supply will be cut off simultaneously, and, if such an occurrence should happen, the source of energy for the electric traction would be cut off so that no trains could be run. Therefore, there would be no need for operating the interlocking.

The Battery

The switch machines are operated on 110 volts d-c. A set of 55 cells of lead-type storage batteries is provided for a source of direct current. This battery is on floating charge from a motor-generator set, the d-c. side being rated at 122 volts 6 amp., 1,460 r.p.m. and



The relay racks are of steel construction

constructed on the diverterpole principle, the output being constant at 122 volts. The input to the battery may range from 0.5 to 6 amp., depending on the number of switch machines being operated. The motor side is rated at 110 volts 25 cycle. A motor-generator set was installed for cycle charging and has sufficient capacity to be used as a standby for the storage battery in any emergency.