Speed Control Installed on *the Long Island*

This $6,000,000 project includes new safety system on 165 track miles with 42 locomotives and 355 multiple unit cars equipped with two-speed three-indication indicator; speed control; warning whistle; speed governor; and new automatic brake equipment

At the automatic block signaling locations new relays, coded track circuit equipment and transformers were installed in sheet metal cases

A CONTINUOUS two-speed, three-indication, control signal system is now being installed by the Long Island. Main lines and branches of this railroad extend throughout Long Island which is 116 miles from Montauk Point on the east end to Brooklyn on the west. The railroad as a whole has a total of 335 route miles including 522 miles of main passenger tracks.

In New York City, the Long Island trains terminate in an underground track layout in the Pennsylvania Station. From this station, tunnels extend eastward under part of Manhattan and under the East river to Sunnyside yards, these tracks being used jointly with the Pennsylvania and the New York, New Haven & Hartford. Exclusive Long Island Rail Road operation starts at Harold Avenue interlocking which is in Long Island City about 4 miles east of Pennsylvania Station in New York.

Long Island as a whole, and especially the western half, is an enormous suburban area where more than a million people have their homes, and approximately 300,000 commuters use the Long Island to commute daily to and from their work in New York City. In the principal part of this commuter area, the railroad is equipped for direct-current electric propulsion, using multiple-unit passenger cars. During the rush hours, each train consists of a maximum of 12 cars. Steam or diesel locomotives are used on the eastern portion of the railroad.

Trains from branches feed into the main line at junctions, so that traffic is heavier on the sections of main line that approach New York City. These are the sections on which the new speed control is being installed, as indicated on the map, Fig. 1 herewith. The table lists the road miles and track miles on each section, and lists the approximate number of train movements daily.

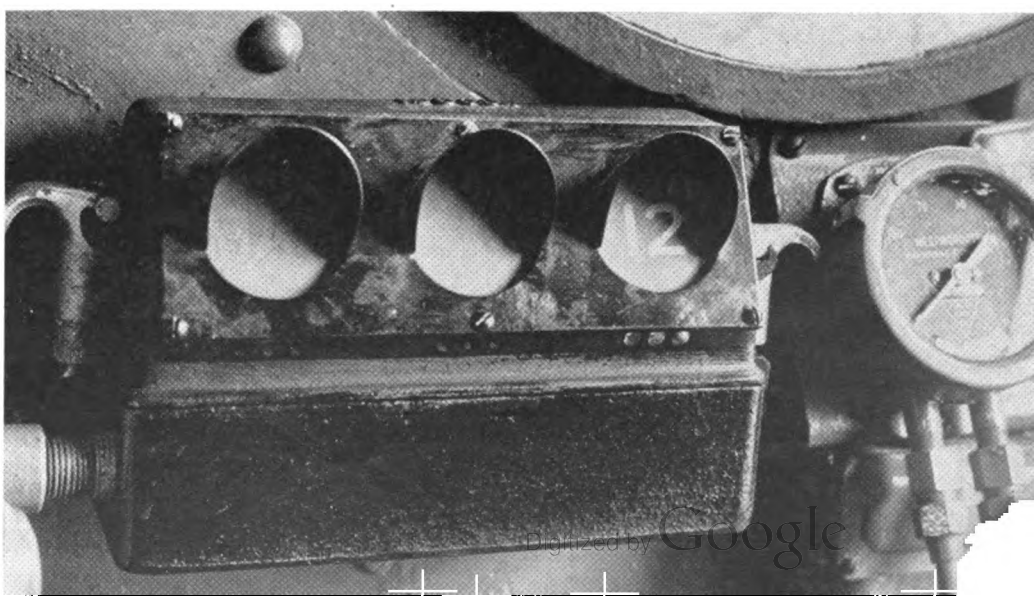
Previous Signal System

The new speed control system was superimposed on the existing wayside signal system. This wayside system includes three-aspect position-light signals, which with a few exceptions are in the same locations as previously. The propulsion current in the third rail territory is 650-volts d.c. The track circuits for controlling wayside signals are 25-cycle a.c., using conventional two-element vane type relays. In addition to wayside position-light signals, the Long Island previously had cab signaling between Harold Avenue and Port Washington 16.3 miles, and between Jamaica and Babylon 27.5 miles. This cab signaling is being modified for the new speed control system.

Speed Limit Indicator and Indications

As shown in pictures herewith, the speed limit indicator on each MU car is mounted in the engineman's cab at the left of and in line with the three air gauges. Each indicator has three lenses in a line. The one at the left displays green with the letters MAS, indicating "Maximum Authorized Speed." The next one is yellow with figures 30, indicating "30 m.p.h." The third one is red with figures 12 indicating "12 m.p.h." The speed is measured by a speed governor which is mounted on the end

Cab indicator beside the air gauge in engineman's compartment of MU car



Car repair man holding cover for speed governor mounted on a journal box

of the journal box on the trailer truck of the car, the moving element being bolted to the end of the axle.

Basis of Speed Control on the Wayside

The new speed control system, including cab indicator, is controlled by coded impulses of 100-cycle a.c. current, fed on the rails in the direction toward an oncoming train. Ahead of the front wheels of the leading car or locomotive is a pair of receiver coils which inductively pick up the coded impulses from the rails. The coded energy is then fed through electronic detector and amplifier tubes on the car, which, in turn, operate relays as a function of the code received.

Referring to Fig. 2, code at the 180-rate is feeding on the rails west from signal Y, in the direction opposite to train movement. This 180-code will cause the speed limit indicator of train No. 2 to display the MAS, green aspect. (Maximum Authorized Speed). While train No. 1 occupies automatic block X, signal X displays the horizontal aspect, with one light below, indicating Stop and then Proceed. No code is on the rails between the rear of train No. 1 and Signal X. Also no code is on the rails between Signal X and the "B" point in block Y. Seventy-five code is applied to the rails westward from this "B" point to signal Y.

Two seconds after the receivers on the leading multiple-unit car of train No. 2 pass the insulated joints into a block in which 75 code is applied on the rails, the cab signal changes from "MAS," to "30" on a yellow background (30 m.p.h. speed restriction) and the warning whistle blows. The engineman has 5 seconds, after the whistle starts blowing, in which to move the brake handle to the service position if the train is moving in excess of 30 m.p.h., and depress and release the acknowledging pedal. If the train is moving at 30 m.p.h. or less at this time, then it is only necessary to operate the acknowledging pedal within the 5-second period after the whistle blows. Since the engineman would not have the brake handle in the service position at this time, failure to acknowledge would cause the brakes to apply at the service rate.

An air gauge is connected in such

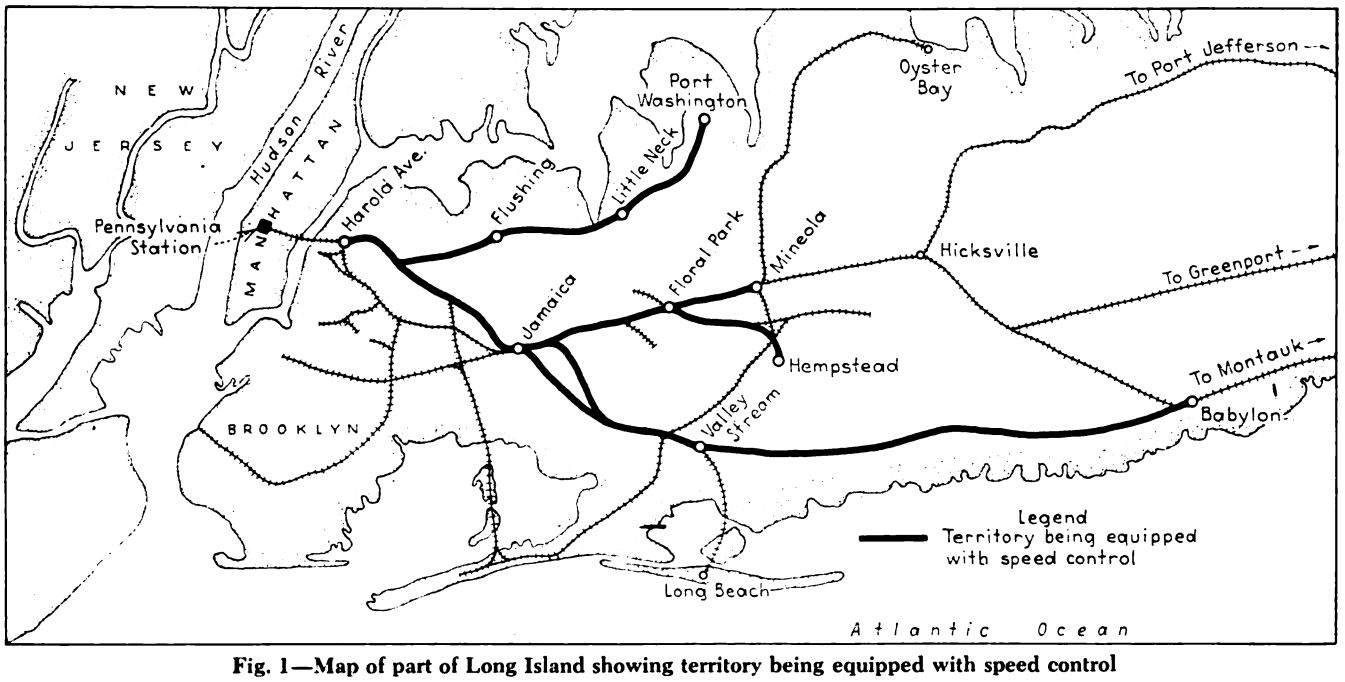


Fig. 1—Map of part of Long Island showing territory being equipped with speed control

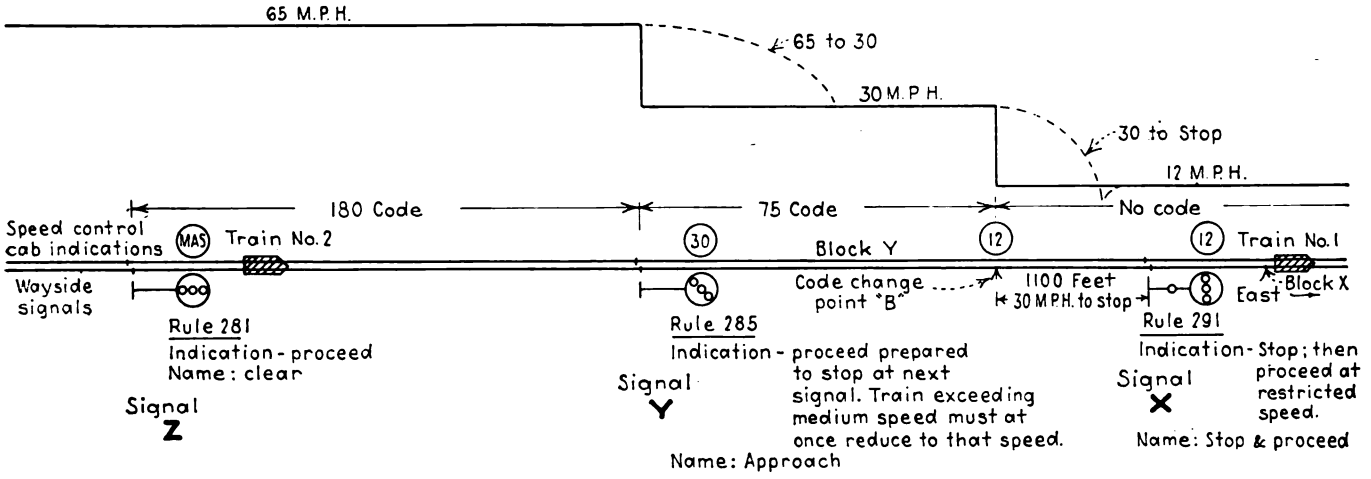


Fig. 2—Diagram showing how various signal indications require train to reduce speed progressively

a manner that it will indicate normal pressure whenever the speed of the train is under the speed being enforced by the speed governor. Approximately five seconds after the cab signal changes from MAS to 30, the air gauge hand drops to 0, and remains there until the train speed is 30 m.p.h. or below, and acknowledgement has been made by the engineman, at which time the gauge will go back to normal. When the gauge reads normal, it serves as an indication to the engineman that the brake handle can be moved to the release position.

When the train is moving in a block having 75 code on the rails, the proper action is assumed to have been taken in bringing the speed to 30 m.p.h. when the block was entered. If the train accelerates to exceed the speed limit of 30 m.p.h. being enforced by the governor, the whistle sounds, and, after a 5-second delay time, the automatic brake application will occur as was the case when the train passed from an "MAS" to a "30" block. This automatic brake application may also be suppressed, provided the engineman initiates a full service brake application before the expiration of the 5-second delay time.

Referring to Fig. 2, when train No. 2 passes the "B" point, it is thus moving from a section having 75-code to a section having no code. This causes the whistle to blow, and the cab indicator to change from "yellow 30" to "red 12." The engineman has 5 seconds, after the whistle starts blowing, in which to move the brake handle to the service position, and to depress and release the acknowledging pedal. When the service brake application reduces the speed to 12 m.p.h. or less, the engineman can release the brakes, and proceed not to exceed 12 m.p.h.

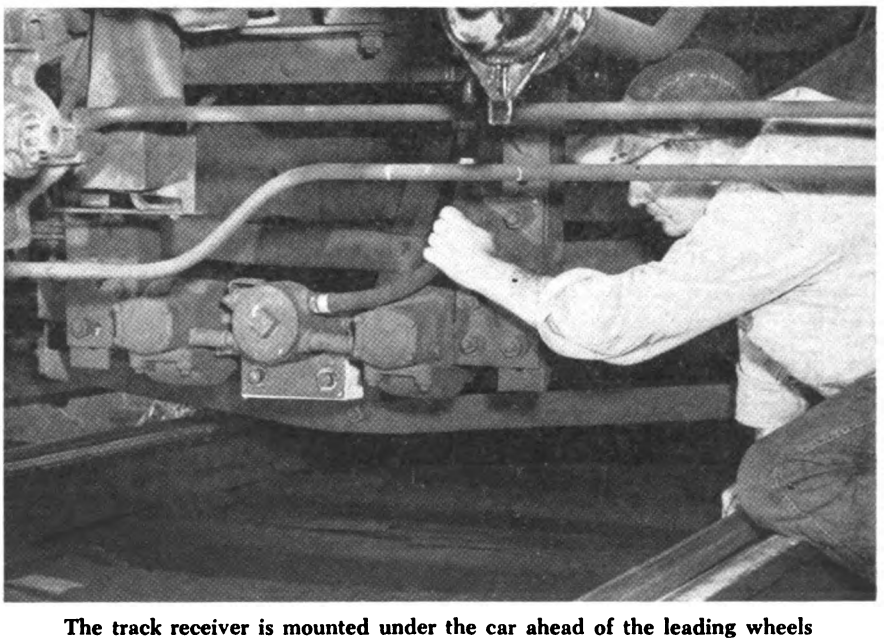
In either example, (180-code to 75-code) or (75-code to no code) if the engineman takes no action within five seconds, an automatic service application of the brakes will occur, regardless of the speed, and will bring the train to a stop.

Assuming now that the engineman did take action during the 5-seconds delay time, then, when the train speed has been reduced to that permitted by the cab indicator, air pressures are restored in the timing reservoir and application valve. On multiple-unit cars, pressure of 62 lb. on both the red and white hands of the duplex gauge are required before the engineman restores his brake valve handle to the release or running position. The "B" points are installed in order to automatically and continuously enforce a speed restriction for trains *before entering,* as well as while proceeding through an occupied block.

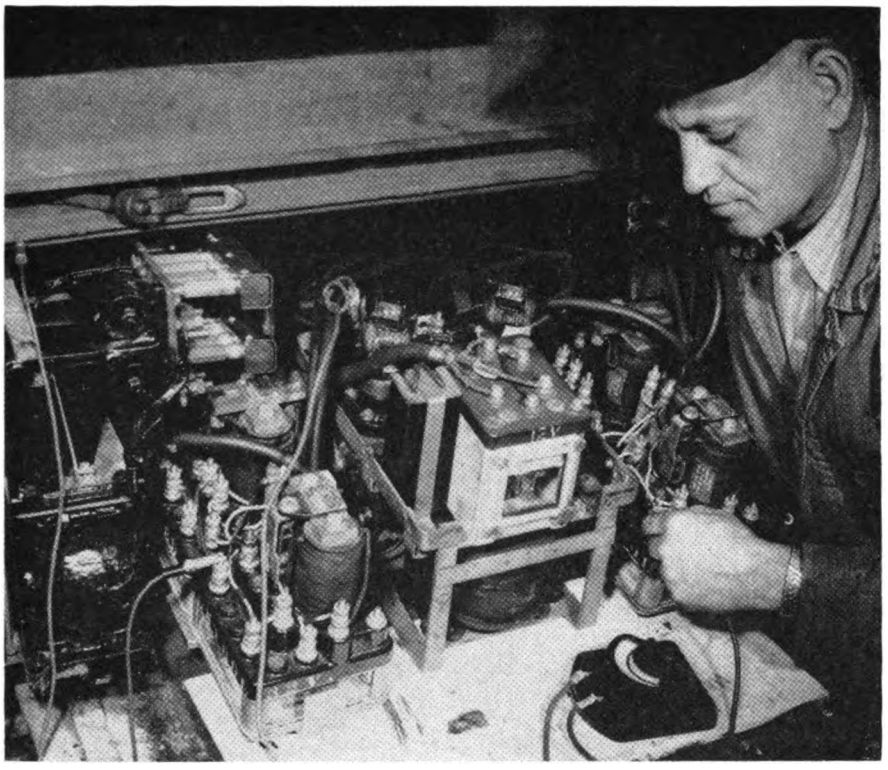
The automatic speed control will be cut-in automatically by a loop circuit or track circuit immediately in advance of the speed control track circuits when the train enters speed control territory. These cut-in loops or track circuits are of a length equivalent to six seconds at 65 m.p.h. As the receivers pass over the cut-in circuit, code is received on the multiple-unit cars or locomotives, and the equipment is automatically cut in.

Cut-Out Loops

Cut-out loops are provided at the exits to the speed control territory. A sign carrying the letters "CO" is located immediately at the approach to the cut-out loop. This sign has black letters with reflector buttons on a yellow background. Each letter is approximately 1 ft. high. As the sign is reached by the train, the engineman operates the acknowledging switch in the cab. The acknowledging switch is released when all of the lights go dark on the cab indicator. This dark indicator serves



The track receiver is mounted under the car ahead of the leading wheels



Relays, amplifiers and other electronic equipment in case under the car

as an indication that the speed control is cut-out. The cut-out is accomplished by a high-current, 180-code. The loop is energized at approximately 35 amperes. The cutout loops are equal in length to 10 seconds at 65 m.p.h.

On the Cars

As trains cannot be turned in the Pennsylvania Station in New York, direction must be reversed to depart. Therefore, on every multiple-unit train, there must be a car on each end that is equipped for speed control. The program calls for the installation of speed-control apparatus on 355 multiple-unit cars, and also on 42 locomotives used on branch lines but which enter on speed control territory for portions of their runs. An old roundhouse at Jamaica is being used as a shop in which to equip these cars. With a force of approximately 146 men, working on about 12 cars, the job is being completed at the average rate of one car each working day. The new equipment for each car costs about $6,000, and other materials and labor about $4,000, thus totaling about $10,000 per car or locomotive.

The first work is to remove the old air piping and conduit. One set of wheels is removed to drill a hole in the end of the axle for mounting the revolving drive for the speed governor. The car is then moved into the shop.

The car apparatus includes:

(1 A speed governor

(2) Case including electronic equipment and relays which are controlled by (a) code at 75; (b) code at 180; and (c) absence of code.

(3) Case with two d.c. control relays, the purpose of which is to automatically cut in the cab signals and speed control for the direction in which the car is being operated.

(4) A dynamotor, driven on 32-volt battery to put out 300 volts d.c. to feed the plate voltage on the electronic tubes. This machine operates at approximately 3,400 r.p.m. at all times when the cab signaling and speed control is in service on the car.

Associated with engineman's compartment, at each end of the car, is the following equipment:

(1) Cab indicator

(2) Acknowledging foot switch

(3) New engineman's brake valve with application valve

(4) Three air gauges,

(a) Main reservoir and brake

(b) Timing reservoir and application pressure

(c) Suppression pressure

(5) Automatic air-operated switch in control circuit of power feed to traction motors. This cut off is effective for forward motion but not for a back-up move.

(6) Mounted under the car at each end is an assembly including an automatic electro-pneumatic control valve with timing reservoir and timing valve with necessary reservoirs.

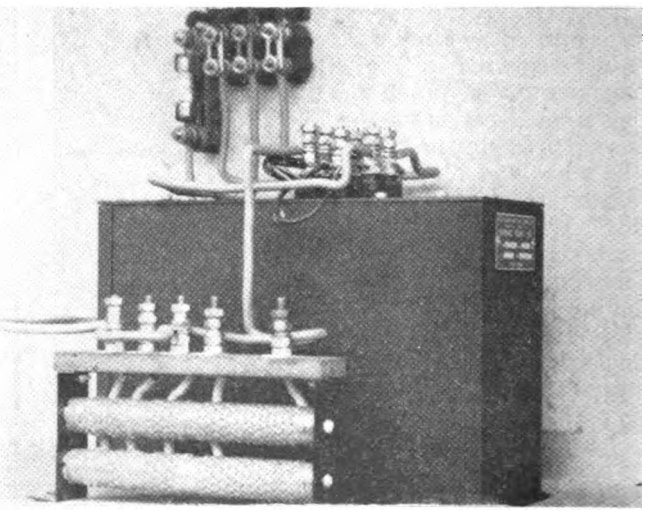
(7) New air piping and conduit.

(8) Approximately 5,000 ft. of No. 14 stranded insulated wire on each car.

The new air brake equipment is

Sections Where Speed Control Is Being Installed

	Road Miles	Miles Track	Approximate No. of Trains Daily
Harold-Port Washington	16.3	28.4	92
Harold-Jamaica	7.2	28.8	344
Jamaica-Floral Park	5.5	22.0	220
Floral Park-Mineola	3.6	7.2	132
Floral Park-Hemstead	4.9	8.7	92
Jamaica-Babylon	27.5	55.0	108
Jamaica-Valley Stream	6.4	12.8	142
Total	71.4	162.9	1,130



Resonate unit in case at a "B" point

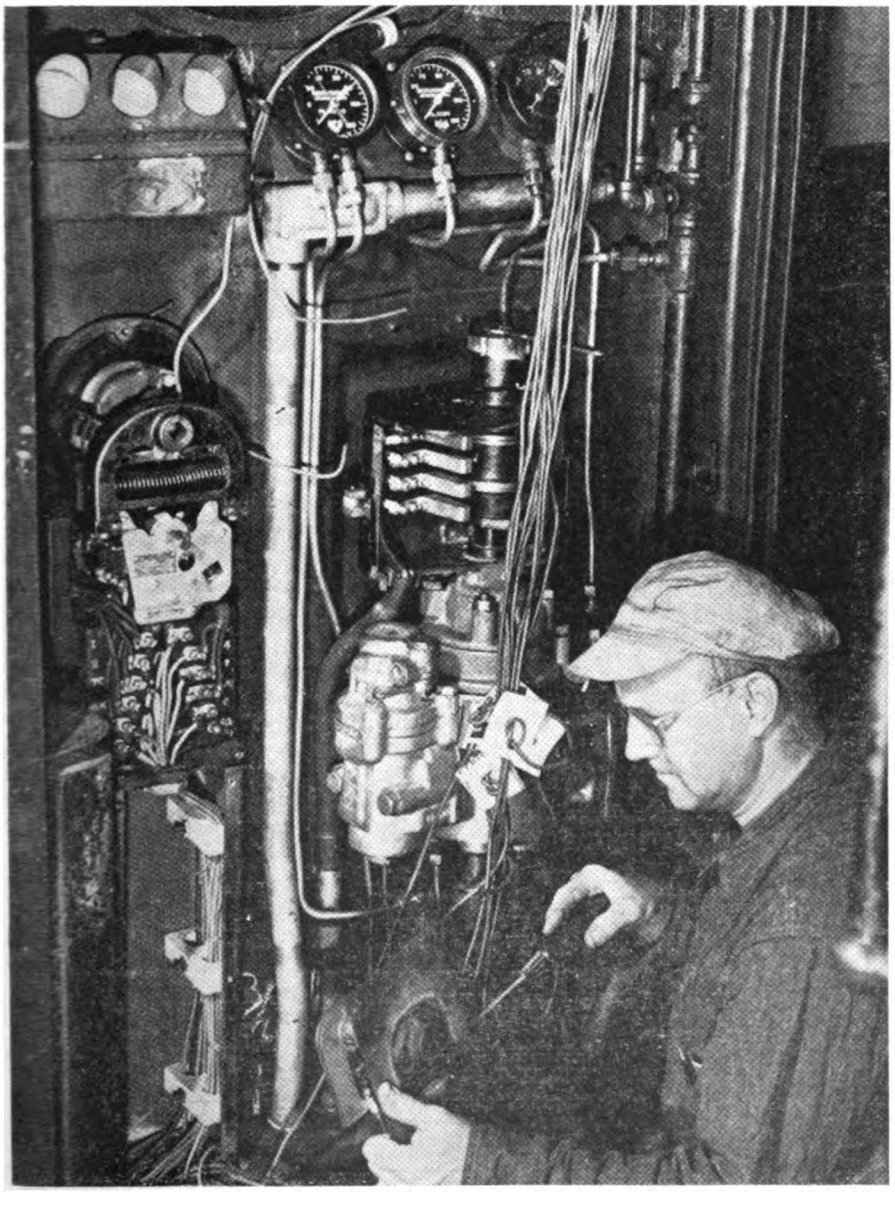
furnished by the Westinghouse Air Brake Company; the speed control devices by the Union Switch & Signal Division of the Westinghouse Air Brake Company; the wire by various wire companies; and the solderless wire terminals by the Aircraft-Marine Products Company.

Wayside Signal Construction

With a few exceptions, the wayside position-light automatic signals remained in their previous locations. In order to superimpose the new track circuit code on the existing system it was necessary to replace the present instrument cases, and install modern sheet-metal cases to house the combined arrangement of relays, transformers, code transmitters and decoding relays. Therefore complete new cases and wiring were installed at every signal. Most of the old low-voltage track transformers and vane-type track relays were reused. Otherwise, all the apparatus in the cases is new. At the "B" points all the equipment, cases and wiring is new.

Above—Relays and track coded equipment at signal location

Below—New equipment and wiring is being installed in engineman's compartments of 355 of the MU cars



The connection from instrument cases to rail are No. 6 solid single-conductor cable. The wiring in the instrument cases is No. 14, and was furnished by The Kerite Company. The solderless terminals were made by the Aircraft Marine Products Company.

In certain sections, new power lines were installed for the distribution of the 100-cycle power. This circuit is on two No. 00 conductors. The new power lines extend for 8 miles from Harold Avenue to Jamaica; Jamaica to Mineola 9 miles; Jamaica to Valley Stream (Atlantic branch), 7 miles and Floral Park to Hempstead, 5 miles.

All the wayside signal construction is being done by railroad forces, using several crews totaling from 75 to 90 men. About a third of the territory has been finished, and the entire project is scheduled for completion about November 1, 1952. The wayside signaling engineering is under the direction of S. B. Higginbottom, assistant chief engineer, signals and speed control. The construction of the wayside equipment is under the supervision of C. Meyers, engineer of construction and speed control. The installation of the cab signal and speed control apparatus on the multiple-unit cars and locomotives is under the direction of P. S. Mock, superintendent of motive power.