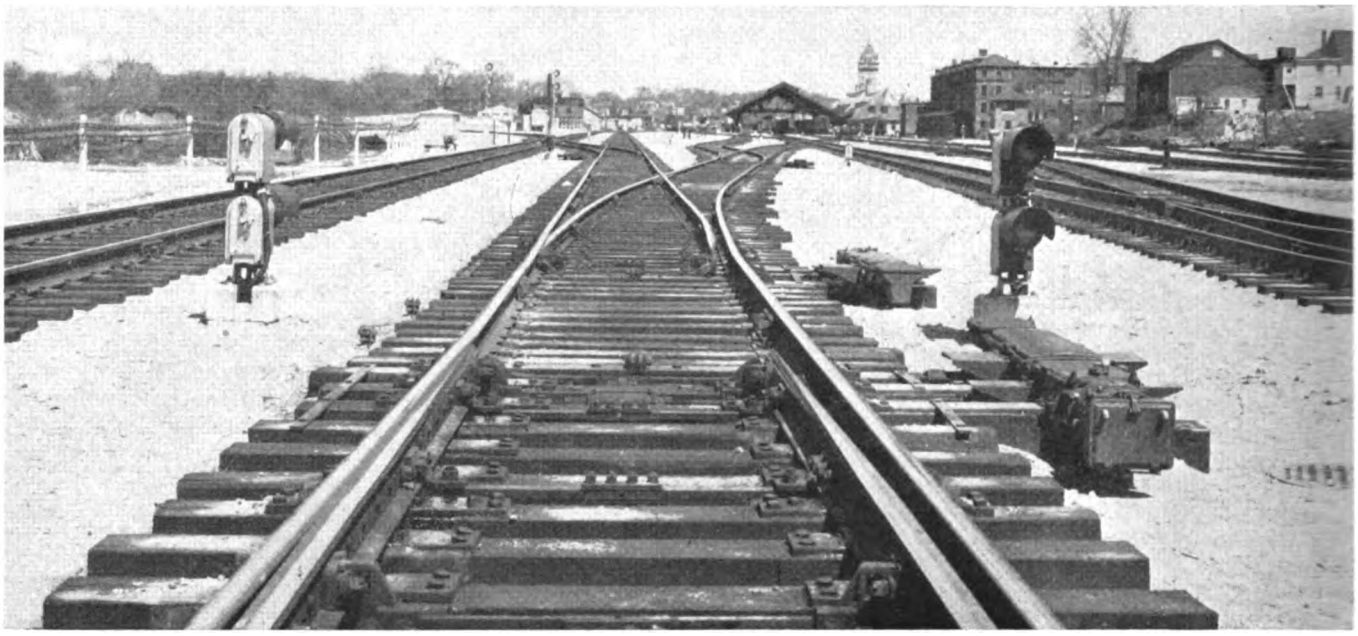


**MOUNTAIN JUNCTION to left, freight mains straight ahead, and passenger terminals to right of center**

## At Portland Terminal

# Combined Interlocking . . .

**Project extending 1 ¼ miles includes passenger station layout, junctions and river bridge. Control machine indicates track lineup before lever is thrown to clear signals**

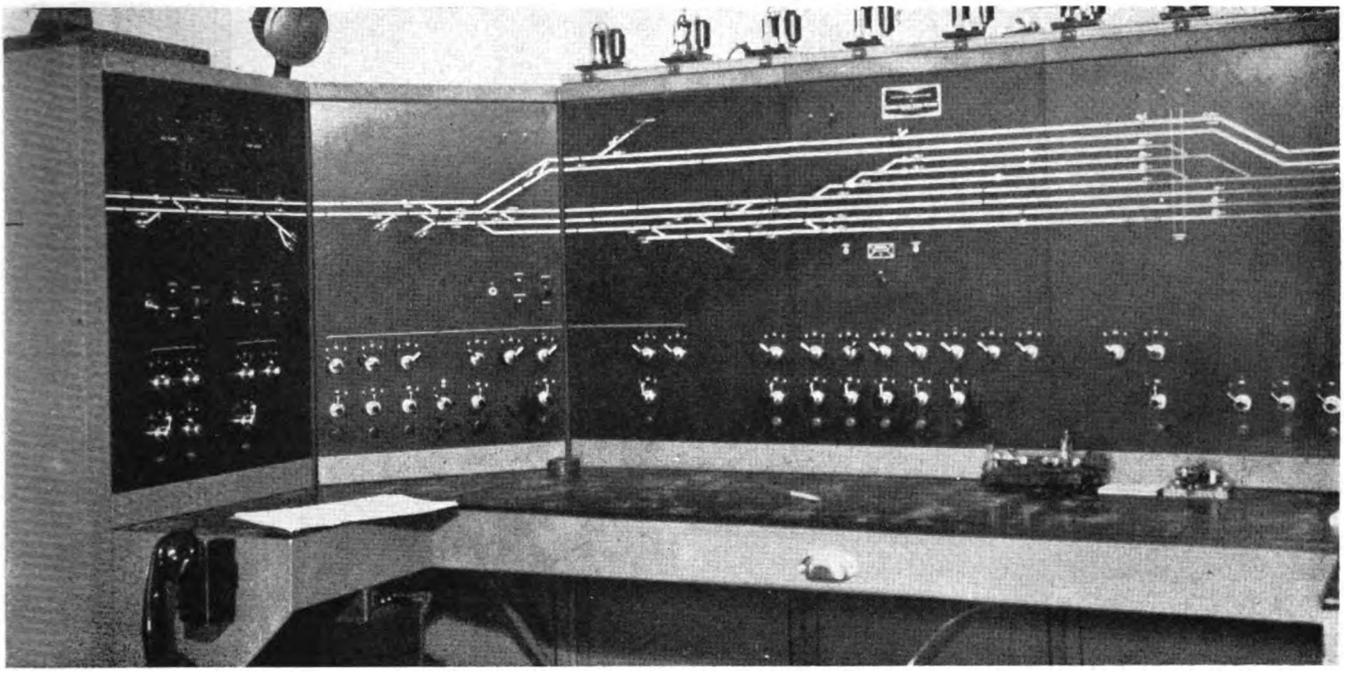
SPECIAL FEATURES of interlocking controls and indications, as well as good construction practices, are included in an extensive interlocking installed at Portland, Maine, by the Portland Terminal Company, which is owned and operated by the Maine Central, and is used by trains of the Maine Central and the Boston & Maine.

This interlocking was progressed in conjunction with the installation of a new highway and railroad bridge constructed over Fore River, which was located 100 ft. up-river from an old railroad bridge. Relocation of the bridge necessitated extensive track changes, which resulted in complete rebuilding of the yard leads west of Portland Union Station and track alignment extending approximately 1¼ miles west thereof. Included in the former layout were two electro-mechanical interlockings, one of which controlled the junction of the freight mains with the passenger mains; the other interlocking controlled a Maine Central branch line connecting to St. Johnsbury, Vt., and yard track connections with the Portland Terminal Company main line. Switches at the west end of the passenger station were hand-thrown and were under the direction of a switchtender, and trains into and out of the station were governed by ball signals. The double-track freight mains, which extend around the north side of the Portland Union Station, were straightened and tied into the new track layout approximately 600 ft. west of the station.

The single-track line from St. Johnsbury, Vt., connected to the terminal tracks on the old bridge in the area where the tracks were to be changed. Therefore, this St. Johnsbury line was relocated to connect with the terminal tracks at a new location, shown on the plan as Mountain Junction. East of Fore River two connections provide access to the extended yard and waterfront area of the Portland Terminal Company. Portland Terminal Company freight classification yards, used by both the Maine Central and the Boston and Maine, are located about 1.5 miles west of Fore River, in the City of South Portland.

The new interlocking extends for about 6,570 ft. from the eastward home signal RA4 west of Fore River Bridge to westward home signal L62 which is at the east end of the station tracks. The entire plant includes 10 single switches, 9 crossovers, 8 high home signals and 40 dwarfs. Three hand-throw switches in home signal limits are equipped with electric locks.

The interlocking control machine is on the second-floor of a new 24-ft. by 20-ft. brick tower, on the south side of the tracks, just west of the passenger station. The machine panels are 25 in. high. The main panel is 54 in. long, and at the left and right, set at angles, are two small panels, each of which is 18 in. wide, as shown in the picture. On these panels each track is represented by a white line 3/16 in. wide. In these lines are red and opal lamps which are lighted to indicate occupancy of corresponding sections of track. Red lights are used for track circuits containing power switches, opal lights for approach and other track circuits. Also on these lines representing tracks, there is a white lamp at each of the locations which represents an exit, that is, a location where a route through the plant passes beyond the opposing home signal or leaves the home signal limits of the plant. These white lights are equipped with black arrows and are known as "Exit" indicators. On the track diagram each home signal is represented by a



**THE EXIT LAMP** or the route being set up, is lighted when the signal lever is thrown

symbol including a lamp which is normally dark, but is lighted green when the corresponding signal is cleared to display any proceed aspect.

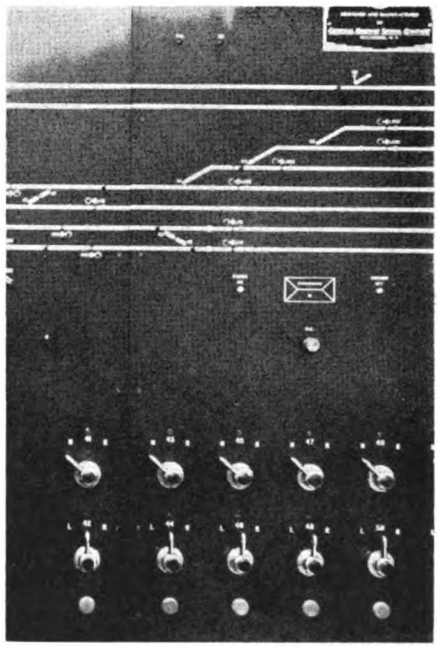
Under the track diagram the first horizontal row of levers is for the control of switches. Such a lever is thrown to the left to control its switch to the normal position, or to the right for the reverse position. In the panel just above each switch lever there is a small opal lens, which is lighted from the time lever is thrown until the switch operates to the position corresponding with that of the lever.

In the face of the barrel of each switch lever there is a small red lens which is lighted when electric locking is in effect to prevent operation of the switch, even if the lever is thrown inadvertently. In such an instance the switch would not operate even when the locking is released. The lever would have to be restored to its previous position and thrown again.

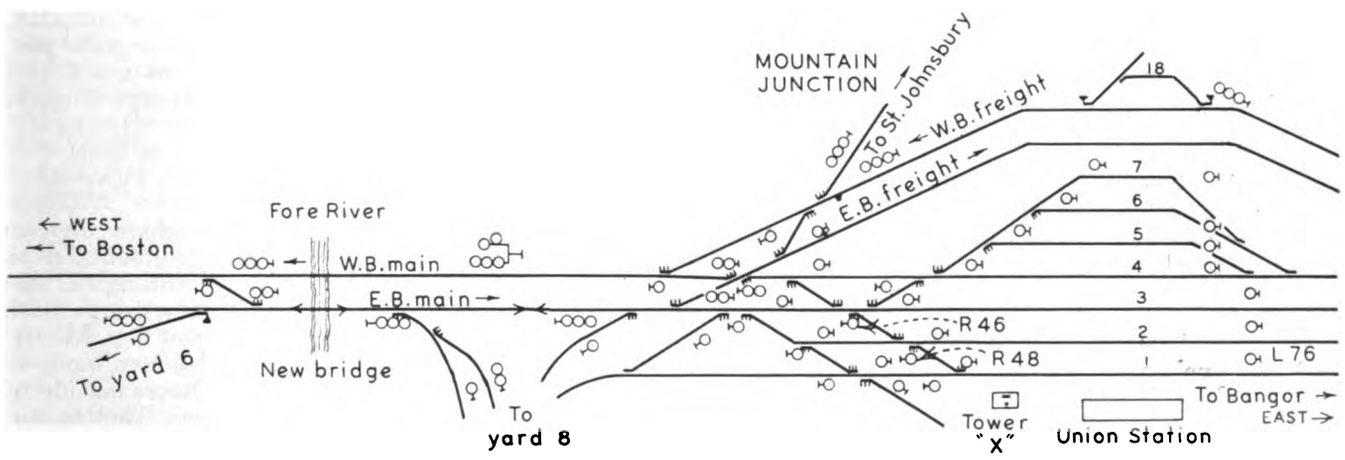
The signal levers are in a row below the switch levers. These signal levers normally stand vertical and are thrown to the left to clear westward signals, or to the right to clear eastward signals. In the face of the barrel of each signal lever there is a black pushbutton and below each signal lever there is a red "start" button. "Start" pushbuttons are provided on both syncrostep and direct wire control sections for uniformity in lever manipulation.

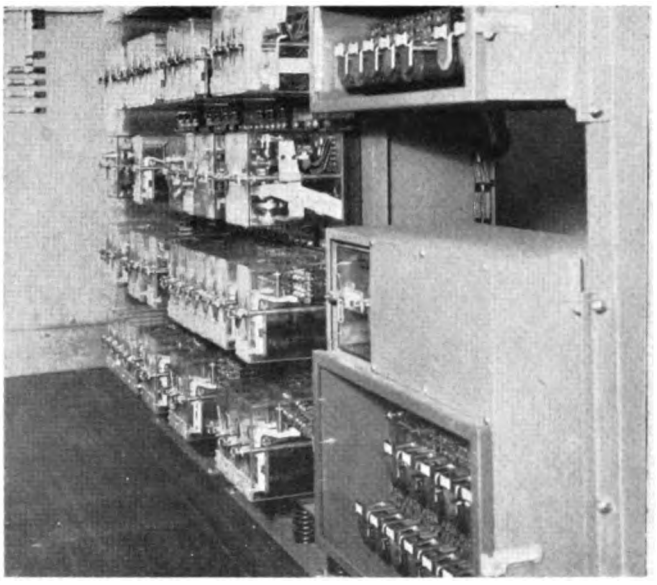
## Exit Lamp is a Help

Having used the switch levers to operate the switch as required for a desired route, the leverman throws the signal lever, and then he looks on the track diagram at the location which represents the "exit" for the proposed route. If the "exit" lamp at that place on the track diagram is

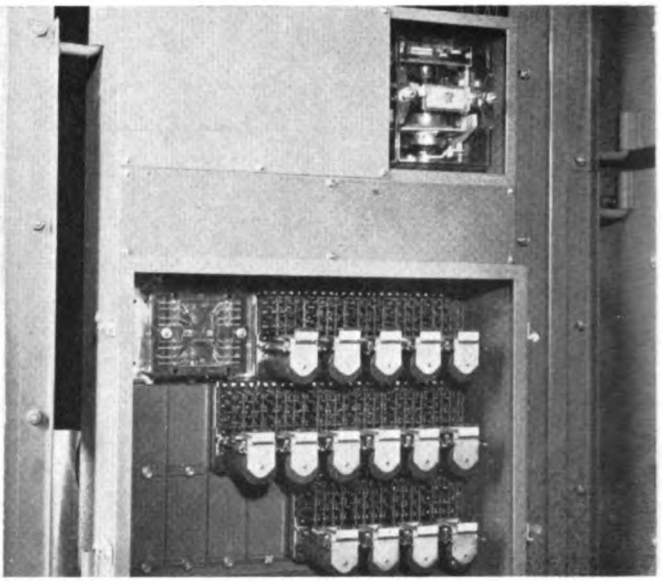


**SWITCH LEVERS,** signal levers and buttons





RELAYS ARE PLUG-IN type which are easily replaced



CODING EQUIPMENT saves wire for remote layouts


STORAGE BATTERIES for d.c. supply

lighted, this indicates that he has the switches lined properly for the exit point desired. However, the control to clear the signal has not gone out, and does not go out until he pushes the "start" button below the signal lever.

This affords the leverman a quick check that the line-up intended is ready for the signal, without making an individual switch check, and prevents him from finding himself "locked up" by having inadvertently cleared the signal for a route other than the one intended. This feature is accomplished by using a route check network which checks the correspondence of transmission of the controls from the office and receipt of indications from the field, and also enables the signal control to open field locking relays whose back contacts are placed into the controls of the signal insuring that locking is effective before signal will clear. Approach locking is in service applying to some of the signals, and time locking applies to the re-remainder.

If a signal which has been cleared is to be taken away, the leverman restores the signal lever to the center position, and pushes the red button below it to send out a stop control. If time locking is in effect, or if the train is occupying its approach locking section, the red lamp over the lever flashes until the time period expires and the locking is released. This indication of the duration and termination of the locking period is an aid to the leverman so that he will know at once when he can start to throw switches for another route.

Any attempt by the leverman to move a switch in the route during the flashing of the light, will not be effective, and the switch lever so moved must be restored to its former position and again thrown after the flashing ceases, that is, after the locking is released.

When a train accepts and passes a home signal, the signal is controlled to display its stop aspect automatically, at which time the green lamp in the corresponding signal symbol on the board goes dark and the red lamp over the signal lever is lighted. When the leverman restores the lever to normal, the red lamp goes dark. With the entire plant normal, the machine indication lamps are all dark, except the power on and ground off lamps.

## Control of Call-on

To display a call-on aspect on a signal, the leverman lines up the switches, throws the signal lever, pushes the "start" button and then pushes the black button in the face of the barrel of the lever, and then again pushes the "start" button. The first track circuit beyond a signal must be unoccupied in order to clear the call-on aspect.

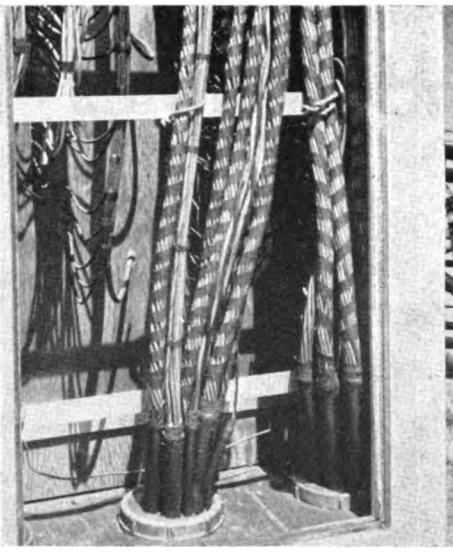
## Station—Protection

While some trains are stopped at the station, head-end switching moves are made to pick up mail or express cars. For example, a westward train having head-end switching: in order for the locomotive with or without cars to make an eastward move back onto its train on Track 3, the eastward dwarf signal R46 would be involved. When the lever is thrown, the signal does not clear for a time period, for example 60 seconds, and in the meantime the track-occupancy lamp for the station track, occupied by the standing cars of the train, will be flashing. This is an extra warning to the leverman that the proposed move is onto an occupied track. The duration of the time delay period, for example 60 seconds mentioned above, is varied according to the length of track. At the expiration of the time interval, signal R46 will display an aspect to proceed at restricted speed and the track-occupancy lamp will again become steady.

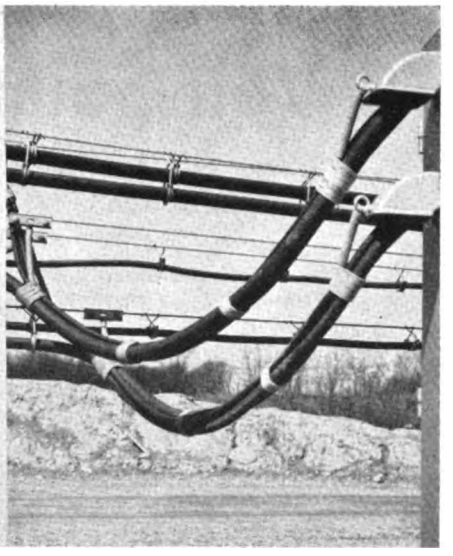
## Telephone Line

On the control machine are two loudspeakers. One is connected to a line which extends throughout the entire Portland Terminal area with loudspeakers connected to it, located in towers and yard offices, and, in addition, telephone boxes outside of the interlocking area. The second loudspeaker is connected to a local

line extending throughout the interlocking area, on which are connected approximately 20 telephones located in outside telephone boxes, and locked with switch locks, for the use of train crews operating in the interlocking. In addition a telephone line is provided having telephones in bungalows and jack boxes, in relay cases and switch machines, for use of signal maintenance forces. This line is equipped with a voice-actuated calling device, which will sound a buzzer on the control machine whenever the maintainer talks on this line. The operator, by pushing a special button, can tie this line together with the local line extending throughout the interlocking area, and thus with the second loudspeaker.



INCOMING CABLES at sheet-metal house



AERIAL CABLES are well supported

### Syncrostep Controls

The switches and signals near the tower are controlled by direct-wire circuits, but those more remote are controlled in groups by the GRS syncrostep system which transmits controls and returns indications over two wires to each group. The remote sections are controlled by three syncrostep units, one of which controls the west end of the interlocking in the vicinity of "Mountain Junction," a second controls the switches and signals at "Fore River," and a third controls the switches and signals at "Oil Plant."

The relays on this project are GRS Company's plug-in type. Control and indication relays are Type "A" plug-in relays housed in cabinets and mounted on racks in the relay room on the first floor of the tower. The control relays are GRS Company's Type "B" plug-in relays mounted on racks in welded steel bungalows and adjustable cases.

### Power Supply

The switch machines are the GRS Company Type 5C and Type 5D with 110-volt d.c. motors. The switch machines are operated from separate batteries, one in each zone. One 110-volt battery feeds the switch machines in the main area from the station west as far as switch 15. This battery consists of 55 cells of Exide DME9A, 80 a.h. The other two switch machine batteries are the new Exide Type 3CME5 rated 16 a.h. Three of these cells are mounted in each jar, and 19 such jars make up the 110-volt battery. The locations where the 3CME5 cells are used for switch operating battery are syncrostep controlled. In view of this feature, a 0.6 second time interval between starting of switch machines is inherently introduced, thus reducing the maximum current demand to that required to simultaneously start the two switch machines of a crossover.

In the tower, 28-volt d.c. control circuits are fed from a set of 240-a.h. Exide Manchex type storage batteries. Each track circuit is fed by one cell of 100 a.h. Exide storage battery.

Commercial a.c. power is fed to each of the 11 instrument houses, and to the tower. If this a.c. power fails at any of these locations, a power-off indication goes to the control machine, so that the leverman can call the maintainer. The towerman can send out a maintainer's call to any of the 7 major instrument houses, which blows a siren for 3 seconds and lights a lamp in a fresnel lens on the track side of the house. Having heard the call, the maintainer goes to the nearest telephone to answer.

At each of the 7 major instrument houses there is an arrangement of relays which automatically makes a constant check for grounds on both the battery which feeds the control circuits and switch operating battery. If such a ground is detected, an indication is sent automatically to the control machine panel.

### Cable Construction

From the tower, which is on the south side of the tracks, buried cables extend under the tracks to the north side, and then aerial cables extend both directions. These aerial cables are in rings on stranded Copperweld messenger, attached about 8 ft. above ground level to posts, most of which are reinforced concrete, and a few at the houses are 6-in. steel pipe poles on concrete foundations. Buried cables come up through sections of 6-in. pipe through the floor of the steel houses. At the tops of these conduits the cables are sealed with compound.

In the cables, the 110-volt d.c. switch motor feeds are No. 6 wire, and controls or other circuits are No. 14. Telephone and syncrostep controls are carried on a four-wire quad, spiral ½ turn to one foot, and located either in separate cable or in the center of a larger cable. These cables and the other insulated wires on this interlocking are the anhydrex type made by the Simplex Wire & Cable Company.

To prevent frost and condensation of moisture in the switch machines, small ventilators were installed and small electrical heater units were added. The heater in the control compartment is rated at 25 watts, and the ones in the brake and motor housing are rated at 15 watts. These units operate on 110 volts a.c. and are fed constantly during cold weather.

The preliminary planning and early stages of construction of this interlocking were under the jurisdiction of E. N. Fox. Effective October 1, 1953, the Maine Central established engineering personnel separate from the Boston and Maine, J. W. Wiggins being appointed chief engineer, and J. F. Stanford, signal engineer of the Maine Central and Portland Terminal; therefore, the construction of the interlocking was completed, and placed in service, under the direction of Mr. Stanford. The engineering and major items of equipment for this interlocking were furnished by General Railway Signal Company.