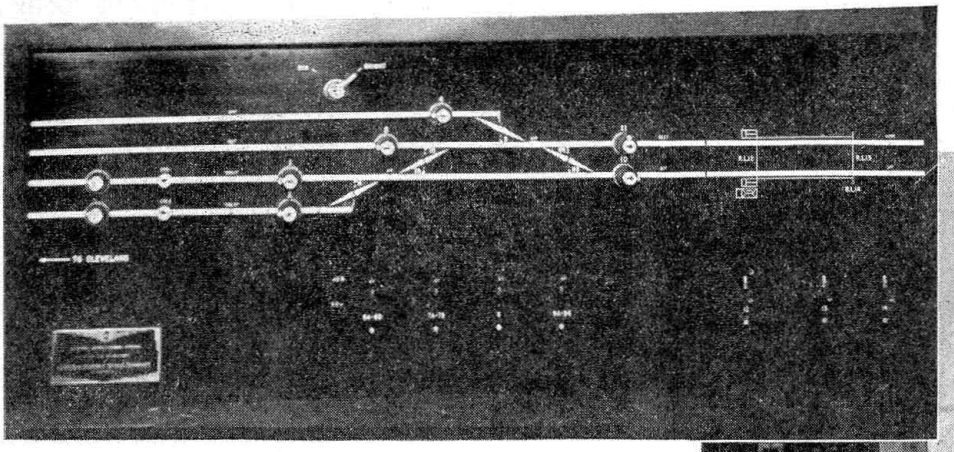
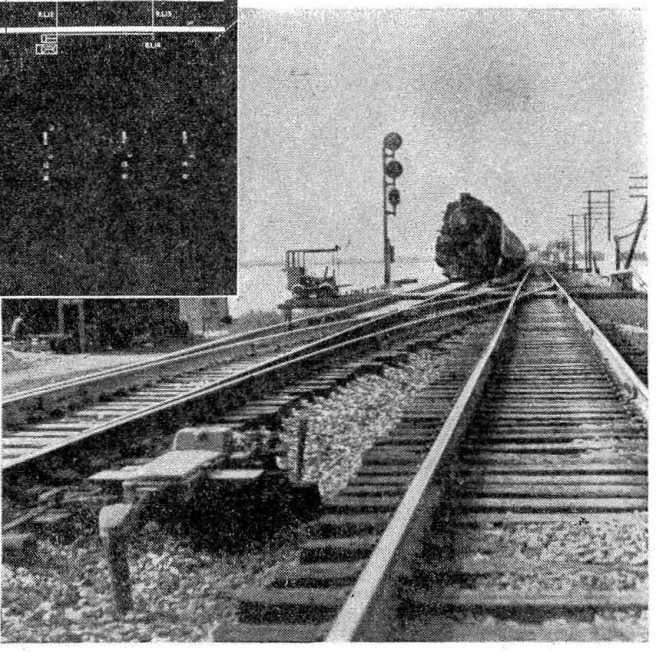




Left—Panel of the control machine of the new plant. Below—An eastbound train at signal 11 at Bay Bridge

Drawbridge Interlocking *on the New York Central*

All-relay controls and plug-in type relays are features of layout a mile long on causeway across Sandusky Bay

About 6.45 miles west of Sandusky, Ohio, the New York Central main line crosses Sandusky Bay of Lake Erie on a causeway over one mile long. During the past two years the drawbridge and the trestles have been replaced, and more of the causeway filled in as parts of a program to permit normal train speeds as compared with a limited speed on the previous structures.

As it now exists, the causeway consists of filled embankment except for about 350 ft. which includes the waterway. The lift span is 75 ft. long and the remaining 225 ft. is trestle, constructed of reinforced concrete and steel. The traffic over this causeway includes 44 scheduled passenger trains and 30 through freight trains daily, in addition to several local freight and switch-run trains. Counting these regular trains and extra trains, a total of about 80 train movements are made daily over this causeway.

Approaching from the east and the west there are four main tracks up to

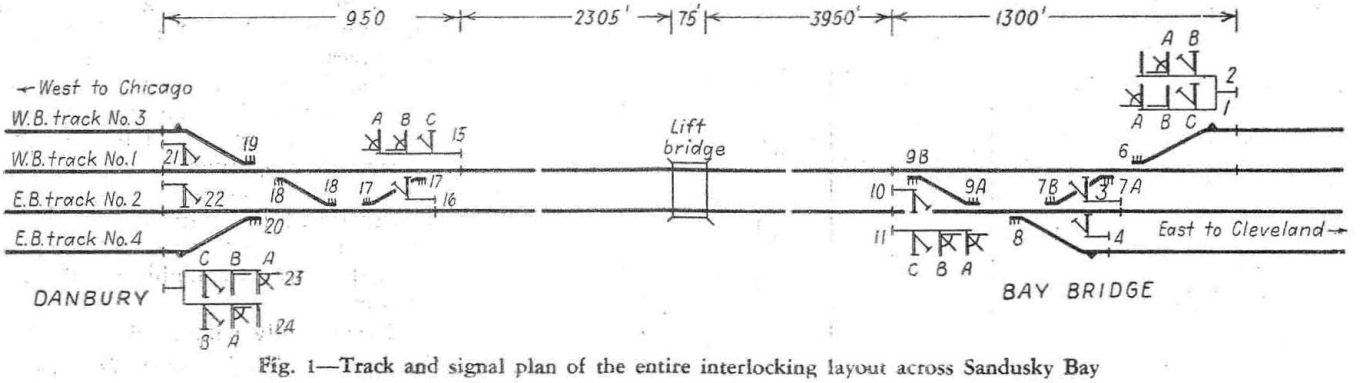


Fig. 1—Track and signal plan of the entire interlocking layout across Sandusky Bay

the shore of the bay, with only two tracks for the mile on the causeway across the bay. As shown in the accompanying plan, at Bay Bridge on the east shore there is a four-track-two-track junction including two single switches and two crossovers which are so arranged that trains can be routed to or from either of the two tracks on the causeway to or from any of the four tracks on the shore. At Danbury, on the west shore of the bay there is a track layout which is correspondingly the same as the one at Bay Bridge. Under ordinary circumstances, track No. 1 is used by westbound passenger trains as well as westbound through freight trains being operated at high speeds. Westbound freight trains are diverted to the westward track No. 3 when necessary to clear westward high-speed track No. 1 for fast passenger trains. Eastward high-speed track No. 2 and eastward track No. 4 are used in the same manner for eastward passenger and freight trains.

All One Home Signal Limit

The switches and crossovers in the layouts at Bay Bridge and at Danbury are operated by 5D dual-control low-voltage direct current switch machines, and the interlocking signals are the color-light type. All these switch machines and home signals are controlled by a new panel type control machine in the tower at the lift bridge in the center of the causeway, and this same interlocking machine also controls the operation of the rail locks and circuit controllers on the lift bridge.

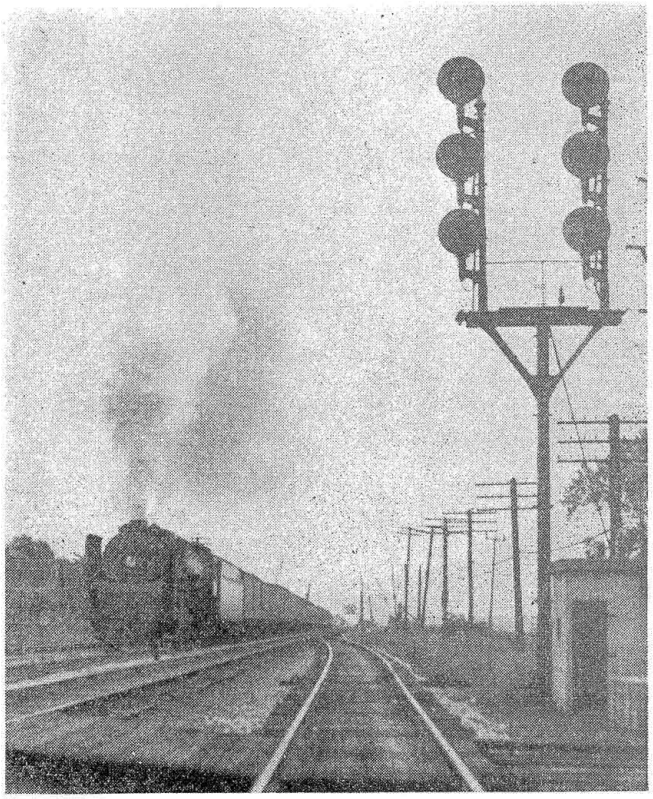
Prior to the 1945 program, the switches and signals were included in two separate interlocking limits, one at Bay Bridge and one at Danbury, and these interlockings were controlled by desk levers in the tower on the old lift bridge which was just west of the new one. Also in the old arrangement, there were separate home signals and home signal limits at the immediate location of the old bridge. In view of the fact that the entire improvement was planned to permit normal train speeds, the blocks between Danbury and the bridge, or between Bay Bridge and the bridge, would be too short for practical use, and would be so short that multiple-aspect signaling would have been required. For these reasons, in the new arrangement no home signals were installed at the bridge, but rather the overall interlocking limits extend between the westward home signals at Bay Bridge and the eastward home signals at Danbury. As all of this territory is within interlocking limits, trains may be operated against current of traffic by signal indication. No train orders are required.

At Bay Bridge the track layout was improved by adding crossover No. 7 and moving switch No. 6 to get it east of the east end of crossover No. 7. Similarly crossover No. 17 was added at Danbury. Also new rail was laid throughout the layouts at Bay Bridge and Danbury to include No. 18 turnouts and frogs with 30-ft. switch points which permit diverging train movements to be made at speeds up to 30 m.p.h.

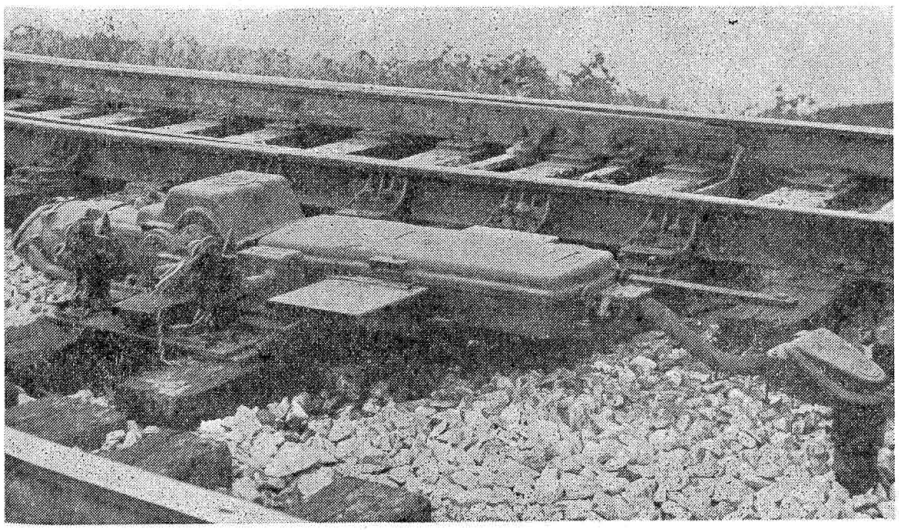
Aspects and Indications

The signal aspects and indications are in accordance with A.A.R. standards. For a diverging move over a high-speed turnout the Medium-Clear, red-over-green-over-red is used, in which instance the signal in approach would display the Approach-Medium, yellow-over-green. The call-on aspect to authorize a train to proceed when the home signal limits ahead are occupied is Restricting, red-over-red-over-yellow. The back-up dwarf signals normally display the Stop aspect, red, and are controlled to display the Restricting aspect, a single yellow, to authorize a train movement. The electric lamps in the home signals are normally extinguished, being lighted by approach control circuits.

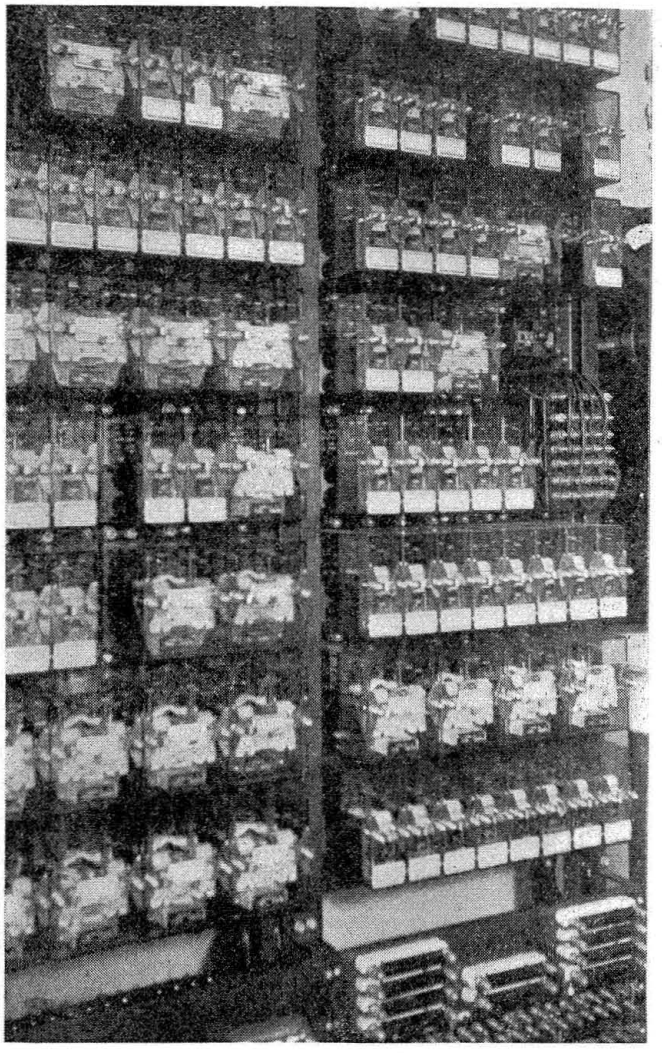
The new interlocking control machine is of the panel type, as shown in one of the accompanying pictures, the

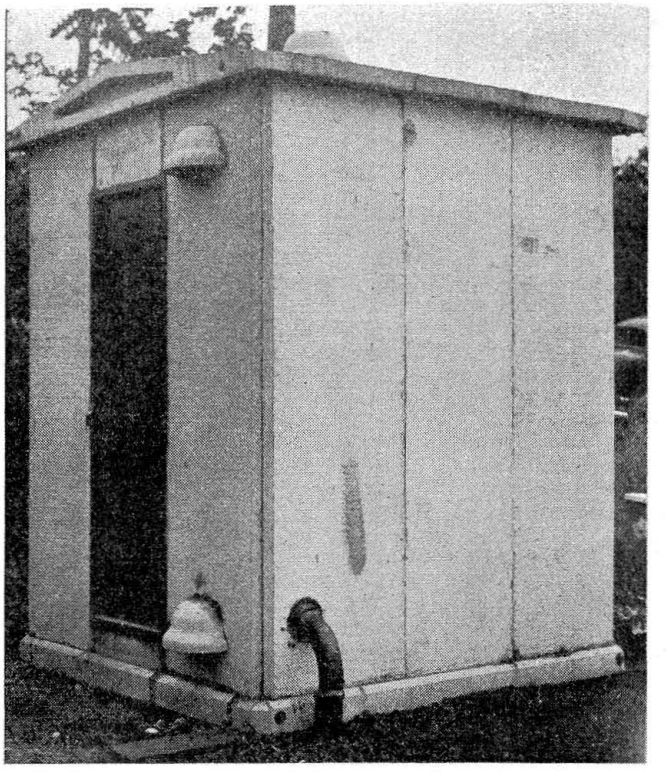


Right—Westbound train at signal 1



Below—One of the switch machines





Above—Sectional concrete housing

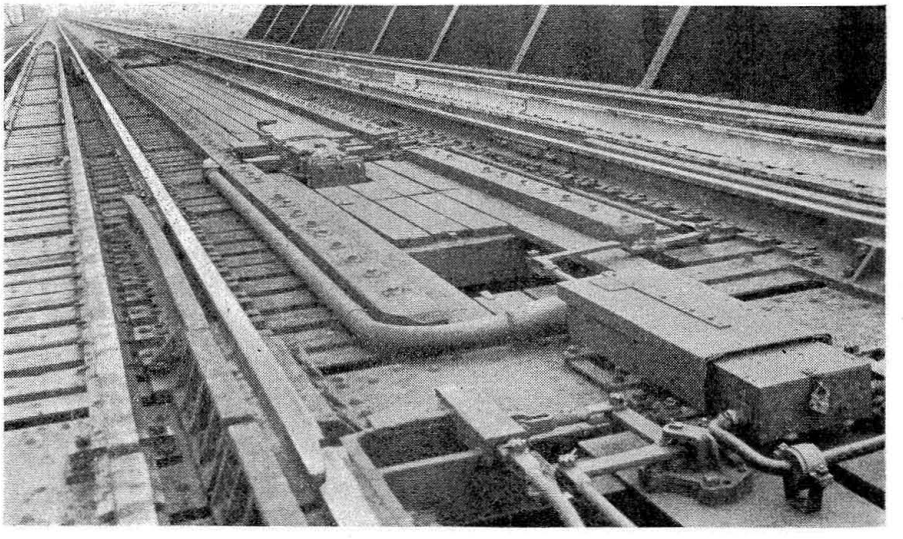
Left—Plug relay rack in the tower

panel being 15½ in. high and 63 in. long. The illuminated track diagram includes lamps which are lighted to repeat occupancy of corresponding sections of track. Also on the lines representing tracks and at locations corresponding to signals on the ground, there are knobs each of which control a corresponding interlocking signal. A lens in the barrel of each knob has a fixed arrow which always points in the direction in which the signal controls. This arrow is lighted to repeat a proceed aspect on the signal. The outer rim of each knob can be turned. The normal position is marked by a white dot opposite the base of the arrow in the fixed lens. The knob is rotated 90 deg. up to control the two upper arms of high signals, or it is rotated 90 deg. downward to control a dwarf signal or a call-on aspect on a high signal.

Each switch and each crossover is controlled by a toggle type lever, these levers being in a row below the track diagram. The levers are normally in the upper position, being moved to the lower position to reverse the corresponding switch or crossover. A small amber lamp below each lever is lighted when the corresponding switch is not over and locked in the position corresponding to that of the lever. Also when a switch is over and locked, small sections of metal in the track diagram are moved to display a continuous full-width white line to indicate the track line up in the field. Below each amber lamp there is a red light which is lighted when electric locking is in effect to prevent operation of the switch even if the lever were thrown.

In the same row with the switch levers there are three similar levers which control the switch machines that operate the rail and bridge locks. On the west end of the deck of the movable span there is one switch machine which operates the bridge lock at that end and also the Stiles bridge circuit controller which has 8 plunger contacts to carry the track circuits across the movable span. No bridge circuit controller is required at the east end of the span as the circuits are carried to the bridge by wires arranged in a large loop.

On the shore at each end there is a



Bridge circuit controller and switch machine on bridge deck

switch machine which operates the rail locks at that end. When the bridge is in the closed position and the main bridge lock, a 3-in. by 6-in. lock driven by a special motor, is in place, the bridge lock lever on the panel is operated causing a switch machine to drive a plunger through this bridge lock, locking it in place. The rail lock levers are then operated to lock the rails in place. These rail locks will not complete their stroke if the rails are not in place. All these bridge and rail locks must be reverse in order to clear a signal for a train movement over the bridge. Conversely, the signals must be at Stop and the home signal limits unoccupied in order to release the bridge and rail locks in order to raise the bridge. In such instance, approach locking applies to occupancy of approach sections.

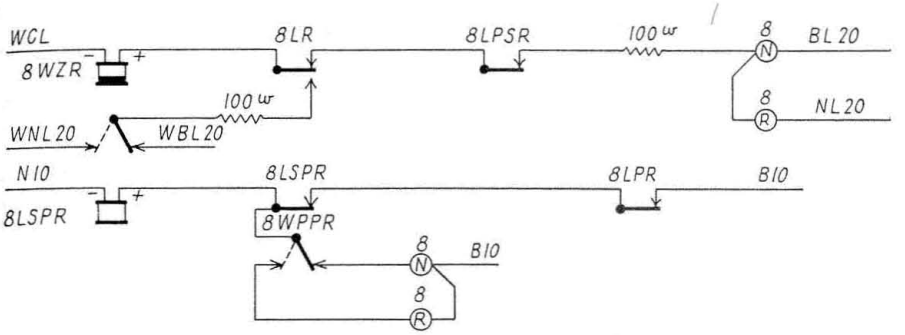


Fig. 2—Typical circuits for a single switch

The control and indication circuits on this entire interlocking are the direct-wire type using two-wire separate circuits with no common. Typical control circuits for a single switch are shown in Fig. 2. The circuits are so arranged that switch controls cannot be stored, in other words, if a lever is thrown while electric locking is in effect, the switch will not operate even after the locking is released. In such an instance the lever must be returned to the position corresponding to that of the switch in order to again gain control of the switch.

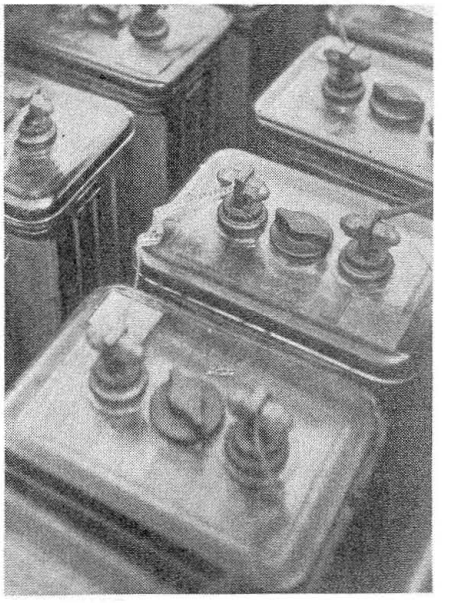
The relays on the bridge are the plug-in type and are located in a room of the tower at track level. As shown in the picture, these plug-in relays are mounted in three racks each 24 in. wide with channel-iron frames which are mounted on coil springs to absorb vibration.

The relays at the shore locations, at Bay Bridge and Danbury, are the conventional wall-mounted type, and are equipped with plug-couplers. The incoming wires are attached to terminals on a base which includes receptacle contacts, which fit over plugs in a second base that fits over the conventional terminal posts on the relays. When replacing a relay, the upper section of the coupler, with the wires attached, is lifted off and placed on the relay being installed, thus no changes in wire connections are required.

At Bay Bridge and Danbury the relays are in concrete houses which are built up of standard pre-cast reinforced slab sections, a view of a completed house being shown in one of the accompanying views. The circuits from these houses to the rail to the switches and to the signals are in underground cables. The track wires are No. 10 solid single-conductor to bootleg outlets. The 24-volt d-c. battery feeds to the switch machines are No. 6 for short runs, or No. 4 for long ones. The control circuits are No. 14.

The tower is on the east side of the channel, and a 75 conductor submarine cable extends across this channel. From the shore end of this cable, aerial cables extend west to the layout at Danbury, and also aerial cables extend east from the tower to Bay Bridge.

A commercial supply of 110-volt a-c. power is available for feeding through rectifiers to charge storage batteries. On the bridge, for example, there is a set of 12 cells of 120-a.h. storage battery to feed the three switch machines which operate the rail locks. A set of 6 cells of 200-a.h. battery feeds the locking circuits.



Battery in concrete box

At Danbury and at Bay Bridge two sets of 12 cells each in multiple, rated at 120-a.h., feed the switch machines. Other sets of battery feed line circuits and act as stand-by for signal lamps. Each track circuit is fed by one cell of 120-a.h. lead type storage battery. This interlocking was planned and installed by New York Central signal forces.

Close views of plug-in type relays