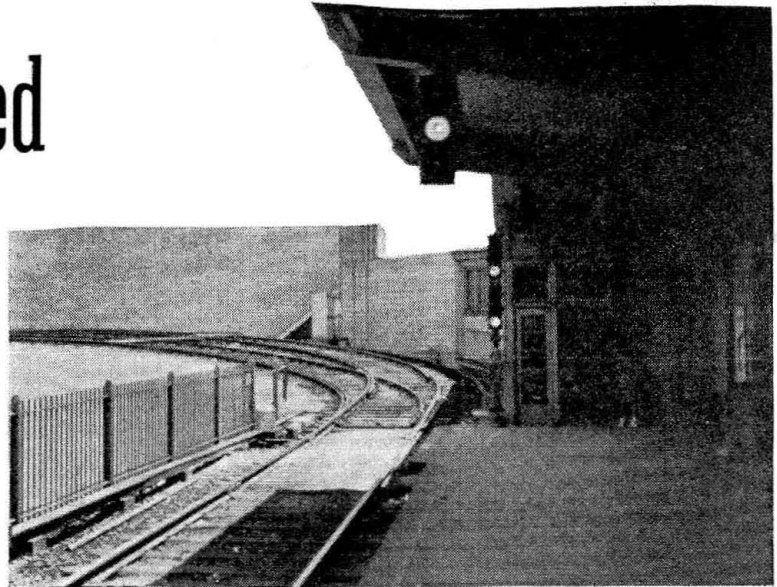


A Most Complicated Automatic Interlocking



Unloading platform, showing signal 16 suspended from overhead and signal 18 on short ground mast at far end of the platform

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Red Arrow Lines in Philadelphia has all-relay automatic plant including switches and crossovers in large layout

IN rebuilding the 69th Street Terminal Station building of the Philadelphia Suburban Transportation Company, an interurban electric passenger road, the trackage was completely revised. An eight-track stub terminal, which was operated by a

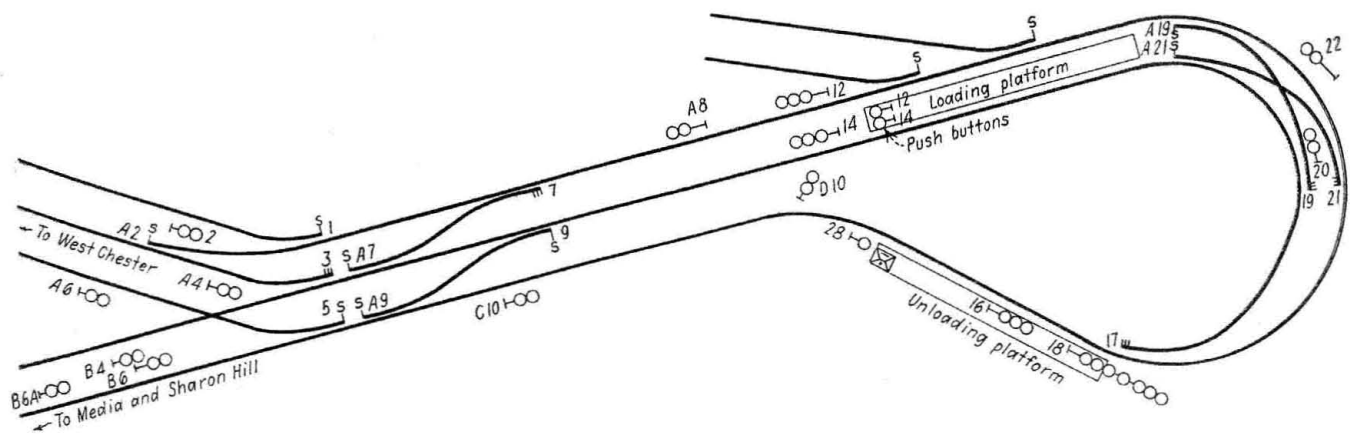
double-track divisions through a spring switch to a single-track unloading platform, to a double-track island loading platform with a scissors crossover in between to permit proper departure sequence, all operated by an all-relay automatic interlocking.

From the outside loop track on the loading platform movements are normally for the Ardmore and West Chester divisions that branch at Llanerch Junction. From the inside loop track on the loading platform, the movements are normally for the Media and Sharon Hill divisions that branch at Drexel Hill Junction. For movements from the opposite sides of the loading platform, there are crossovers in the West Yard.

The facing switches are equipped with A1 electro-pneumatic switch-and-lock machines and Style-C valves.

The main running signals are mounted on 4-ft. posts, while the reverse signals are mounted as dwarf signals. At the electro-pneumatic switch locations, there are three-position levers to control each switch manually. Operation of the manual levers, normal or reverse, besides causing the switch to operate normal or reverse, open the normal signal circuits, and also cause the reverse signal to display a proceed indication through contacts of the switch indicating relay, thus preventing reverse movements through opposing switches and protecting normal movements while operating manually.

The inbound signals, A6 and B6 are approach cleared. Due to highway crossing conditions, overhead contactors were installed on B6 signal and a distant signal, B6A, was placed

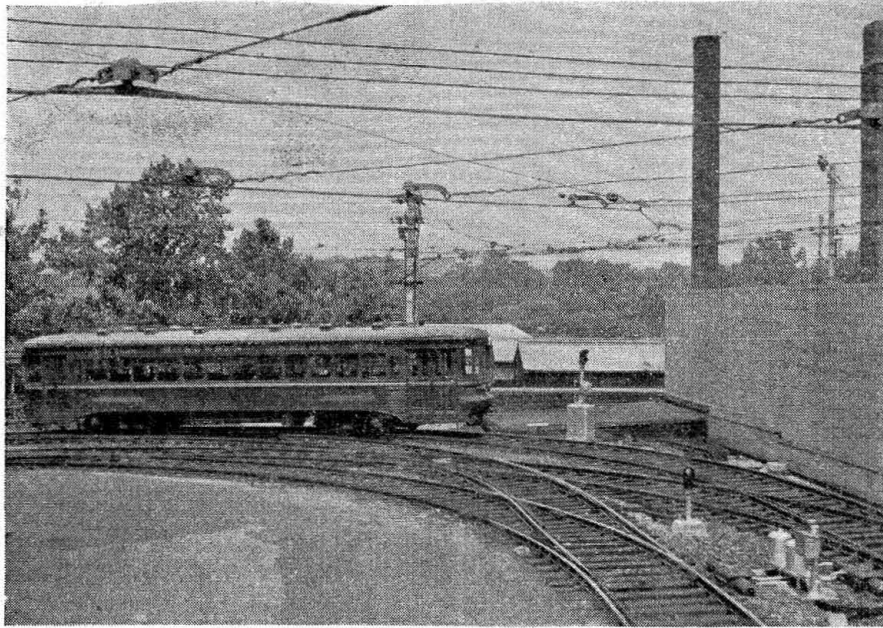


Track and signal diagram of interlocking plant

79-lever electro-pneumatic interlocking machine, was replaced by a loop of single-track entry from two

The crossovers have spring switches on the trailing ends. The signals are Style-N, two and three-position sig-

about 500 ft. south of B6, so that only one train could be between the setting and release contactor at a



View on the loop showing scissor crossovers 19 and 21 as well as the signals 20 and 22

time. Signal A6 is operated by A6TR, and the entire interlocking is protected by track circuits and advance locking.

For route selection from the single-track unloading platform, the color *green* has been adopted for a final

acceptance of the color *yellow* at 16 signal will set up a route for the outside loop track over 17 switch reverse and 21 switch normal, with 17TR and 21TR unoccupied, and display a yellow-over-red aspect on 18 signal.

This is accomplished by the use of

tacts of opposing route stick relays. Once a route is set up, it is advance locked over a back contact of a track repeater stick relay, 16TPSR, which is picked up by a front contact of 16TR and stuck up over a back contact of 18HR, which is picked up when a route stick relay picks up and the track circuits are unoccupied and the switch indicating relays are poled normal or reverse. Then after a route is set up, advance locked and then accepted, the normal locking is taken over by the track relay contacts.

Departure Sequence

Within the loop, there are two signals, 20 and 22, that are used to check one movement for another to run around it, thus gaining proper departure sequence. This is accom-

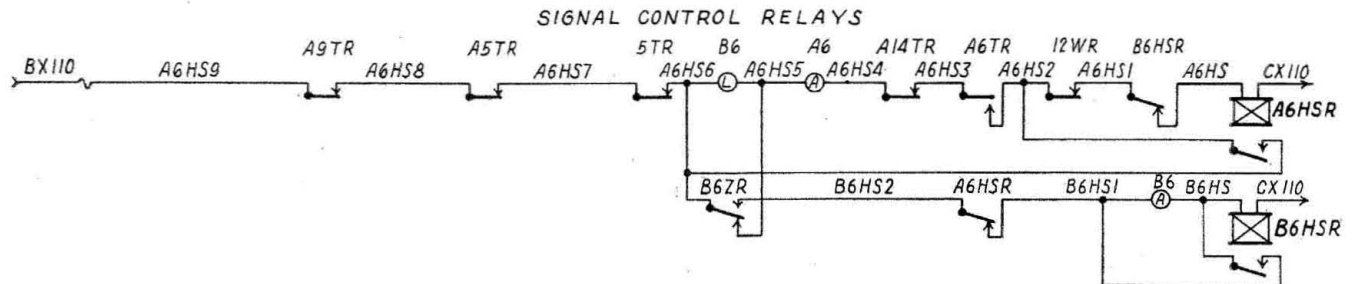


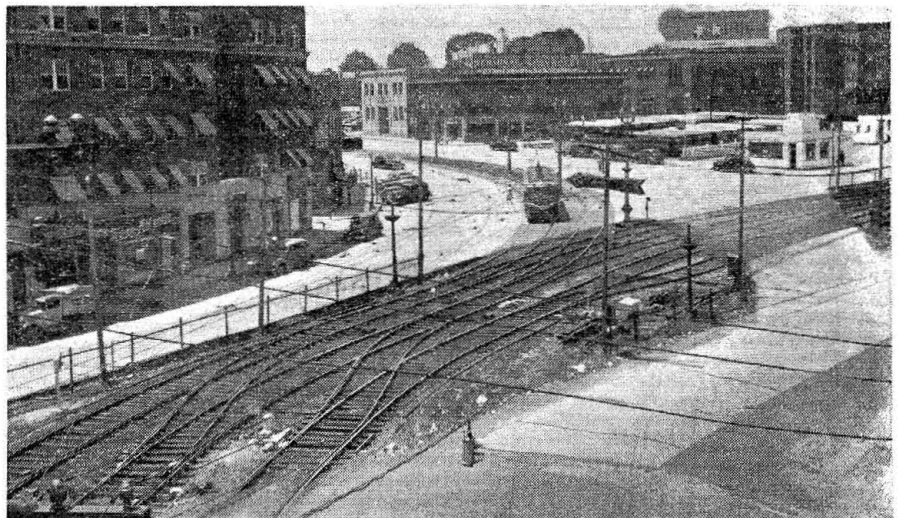
Diagram of circuits for signal control relays

destination to the Media and Sharon Hill divisions. The color *yellow* has likewise been adopted for a final destination to the Ardmore and West Chester divisions. Therefore, a selector signal, 16, has been set up to operate from a timer relay, 16TER, which starts over a back contact of A16TR and stops over a front contact of 16TR. Then acceptance of a specific color on 16 signal, green for example, will set up a route for the inside loop track over 17 switch normal and 19 switch normal, providing 17TR and 19TR are unoccupied, and display a red-over-green aspect on the two-arm home signal, 18. Similarly,

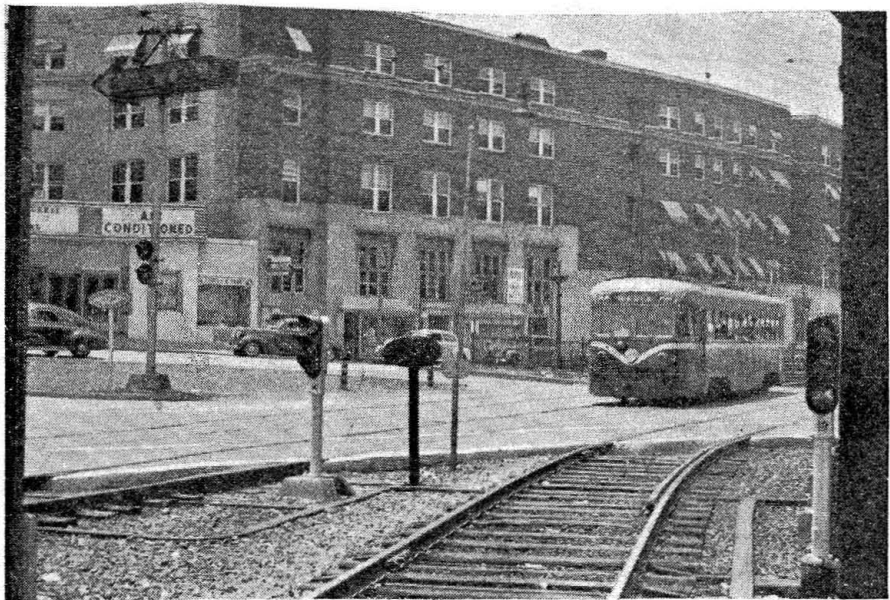
route stick relays, 17N19NSR and 17R21NSR, which are controlled by front contacts of a color stick relay on 16 signal, 16GSR or 16YSR, 17TR, 19TR or 21TR, and back con-

plished by a time-element relay that operates over a back contact of the track relay preceding each signal and a front contact of the color-repeater stick relay. The back contacts of the

Junction in West Yard of Ardmore-West Chester div. and also Media-Sharon Hill div.



View showing the leaving end of the loading platform with the signal 12 at right and the signal 14 at left



time-element relay open the normal obstructed route circuit and close the by-pass route circuits. If for any reason a movement is unintentionally delayed in passing either 20 or 22 signal, a push button has been provided at 18 signal to knock down the by-pass route and clear up the normal route, so that one movement may follow another. To make this safe, however, another time-element relay was used to drop 18 signal to Stop immediately, but delay 17 switch five seconds and then clear 18 signal.

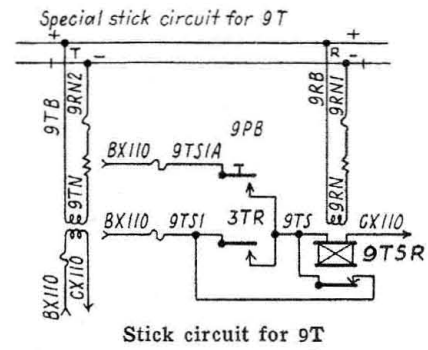
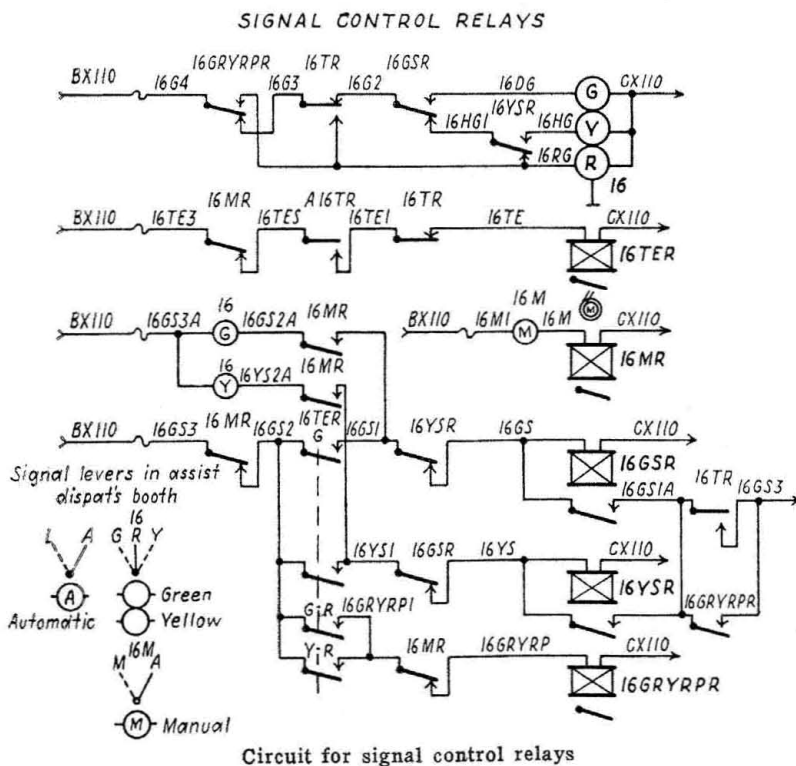
Outbound Operation

At the leaving end of the loading platform, each track is protected by a three-position signal that provides routes through a 200-ft. highway crossing to the Media and Sharon Hill divisions and to the Ardmore and West Chester divisions. In the highway crossing, girder rail was used with non-insulated tie rods, which

contacts of each succeeding track relay. Because of the highway crossing, the vehicular traffic is protected by highway crossing signals that operate immediately on entry of the approach circuits for 12 and 14 signals. But even though a proceed aspect is available, on 12 and 14 signals, it will not be displayed until a three-second time delay has elapsed to give the vehicular traffic a chance to stop. This

other movement on another track may enter the crossing without waiting for the time delay.

For movements from the opposite sides of the loading platform, push-buttons were placed at the end of the



loading platform on each side to pick up push-button stick relays whose contacts operate the switch control relays.

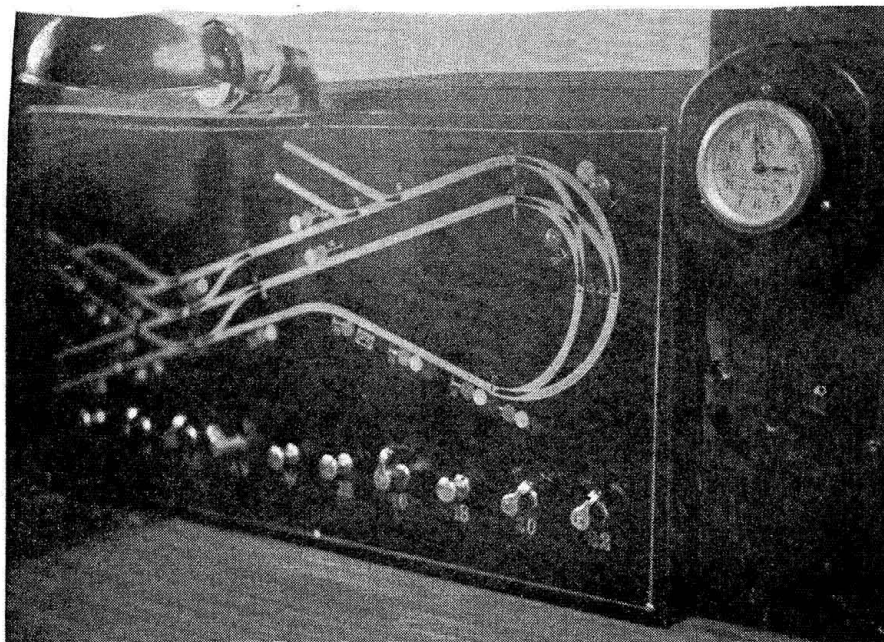
The switch operating circuit is rather unique in that energy is taken over a front contact of the normal stick relay to the normal valve. Then tapped off the normal valve wire, a circuit is taken to a reverse contact of the switch indicating relay through a hinge to pick up the lock valve. The circuit for reverse operation is the opposite. The energy comes through a front contact of the reverse stick relay to the reverse valve and tapped off is a circuit to the normal contact of the switch indicating relay, thence to the lock valve as before.

Facilities for Manual Operation

As the new terminal was built during the latter part of the depression, it was intended that the automatic interlocking was to be unattended. But

created complications in the signal circuits. So, track stick circuits were created to cover the traps in the highway crossing, which are de-energized by rail shunt and restored by back

does not require a full stop for each movement, however. A stick relay was used to keep the time-element relay energized until the movement was clear of the crossing so that an-



The tower machine with illuminated diagram and levers

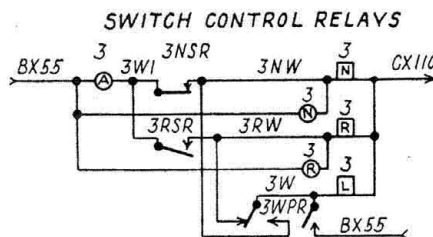
as the passenger load began to increase, the volume of traffic increased to an average of 35 departures an hour during the morning and evening peak loads. Therefore, it became necessary to put an operator in control of the movements within the interlocking during the peaks. To facilitate operation of the tower, a control panel with a model board that was equipped with miniature levers, push-buttons, and indication lights was installed.

In order to check the movements before they enter the terminal, two-position levers for A6 and B6 signals were provided. To expedite movements through 16 signal on the unloading platform, a three-position lever was provided to manually change the aspect displayed on 16, the control circuit was completely revised to allow the operator control of all three indications. An additional snap switch was provided to choose manual or automatic operation of 16 signal. Then the left or right position of the lever picks up either the green or yellow color stick relay, 16GSR or 16YSR, which are interlocked over back contacts of each other and stuck up over back contacts of 16TR and 16GRYRPR, so once a color is accepted, that color stick relay cannot be de-energized and the other color stick relay cannot be picked up regardless of the movement of 16 lever.

The push-button that is located in the manual control box at 18 signal is paralleled by a push-button on the control panel for the purpose of closing one movement behind another. The operation of 18 push-button drops 18 signal to stop, as described before, but since the tower operator may operate 18 push-button, it has become necessary to provide a blue

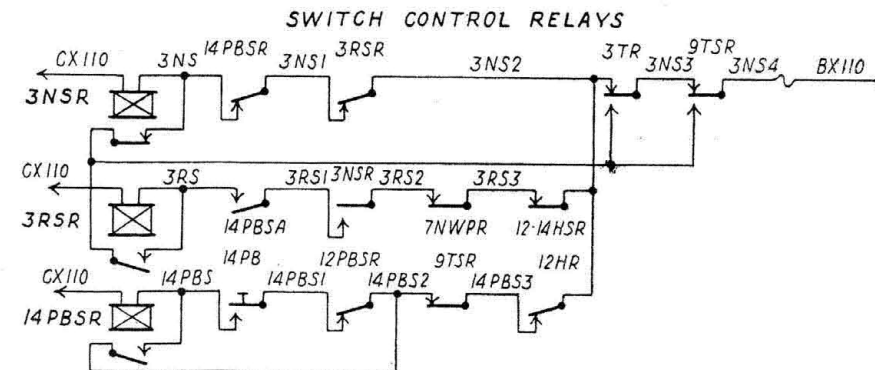
marker, or "call on" indication to be displayed, which is not to be accepted as a proceed indication until the time delay has run out and a regular route indications displayed in addition to the blue marker.

In order to eliminate the necessity



Switch control relays

of verbal conversation as to what to do in the loop, two-position levers were provided on 20 and 22 signals. If conversation should be necessary,



Switch control relays

a yellow train order signal was placed outside the tower to check inbound movements. Since B6 signal is contactor operated, with a setting and release contactor, it is possible for a

following movement to get a proceed indication on B6A signal when a preceding movement of more than one car strikes the release contactor. However, since the succeeding trolley poles of the first movement will release the route set up by the succeeding movement, the succeeding movement will be left stranded at B6 signal. To overcome this situation, a push-button was placed on the control panel to pick up a relay whose contacts will energize the contactor relay.

The indication lights on the model board are placed to show green approach lights at A6 and B6 in addition to a two-gong chime. A6 and B6 signals are demonstrated by yellow and red lights to show when the levers are in a Stop position or when a Proceed indication is displayed. If the operator should place A6 or B6 levers back to the Stop position after the train has pulled up, it will have no effect on the signals as there is a stick circuit in effect around the lever contacts. Green lights were also provided for 19 and 21 track circuits in the loop. Red lights were also placed on 20 and 22 signals to repeat the signal indication.

When the tower is unattended, the signal levers are placed in the proceed position and the snap switch for 16 signal lever is placed in the automatic position for full automatic operation.

The original circuits for the entire automatic interlocking were designed by the Union Switch & Signal Company, but were redesigned by the P.S.T.Co. when the necessity for

these changes arose. The work of the installation was done by P.S.T.Co. forces and the equipment was mostly that which was salvaged from the old stub terminal and reconditioned.