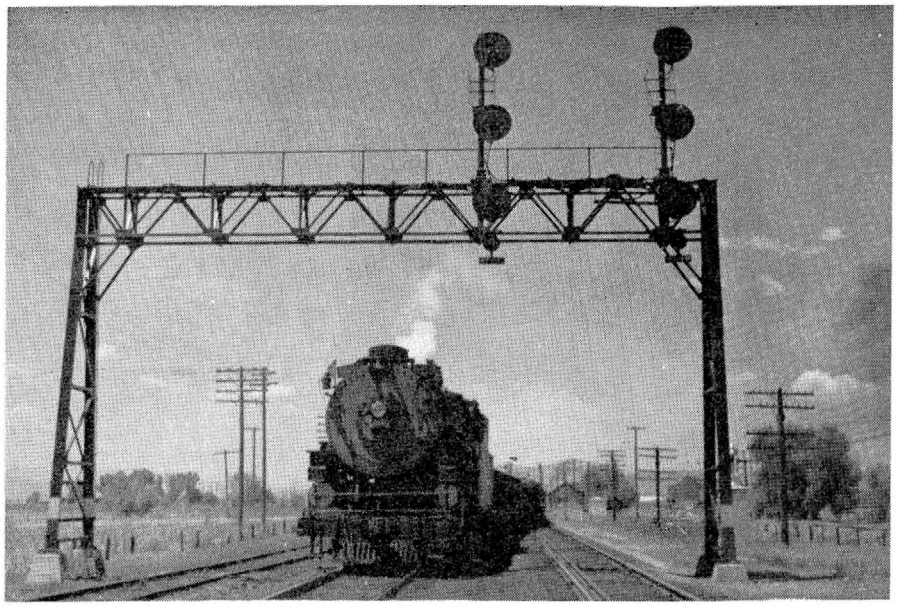
# An Unusual



Eastbound Rio Grande freight train crossing over at Geneva, Utah

IN October, 1929, the Denver & Rio Grande Western placed 32 mi. of C. T. C. in service between Provo, Utah, and Midvale (See **Railway Signaling,** February, 1930). This was a unit-wire scheme controlled from Lehi, Utah, which was located centrally in this territory. In 1937, the C. T. C. was extended westward to include 7 mi. of double track to Roper (Salt Lake City), and was controlled from Salt Lake City by code (**Railway Signaling,** October, 1937). In 1945, due to construction of steel plant at Geneva, Utah, the original track layout on the east end of the earlier 1929 installation was revised to include 8 mi. of double track, and it was signaled for normal and reverse operation and, due to the saving in line wire, the revised portion was operated with a coded system controlled from Lehi. This set up resulted in three control machines within an area of approximately 40 mi., two machines controlled by operators at Lehi, and one machine controlled by the dispatcher at Salt Lake City. In 1948, the entire project was consolidated and controlled by the dispatchers at the division superintendent's office at Salt Lake City, being changed to a coded system, which resulted in a payroll saving of three operators.

In the original 1929 project, there was one unprotected railroad grade crossing at Lakota, Utah, 39 mi. east of Salt Lake City, which required all trains to stop. In August, 1931, this was protected with an automatic interlocking (**Railway Signaling,** February, 1932). A speed of only 25 m.p.h. was permitted, even though operable distance signals were in use on account of the sharp angle of the rigid frog—8 deg. 20 min., which, for the center diamond, there was a 39-in. open throat that could not be protected in any manner with guard rails.

In March, 1943, the rigid frog was replaced with a power-operated movable point frog. In 1945, when the double track was installed, an additional power-operated M.P.F. was also placed in service. Both M.P.F.'s are 131-lb. rail section. While these crossings are located in continuous C.T.C territory, the operation of the power switches for the M.P.F.'s and the signals are entirely automatic. The speed of trains is now unlimited, and the installation has special timing and release features.

### Frogs and Signals

As shown in the accompanying diagram of the track and signal layout at Lakota, Fig. 1, the Rio Grande is crossed by a single-track line of the Union Pacific. The frogs at this crossing are operated by G. R. S. Model-5D dual-control power switch machines, designed for operation on 30 volts, d.c. The home signals are the Type-SA searchlight, equipped with compound lens assemblies, 250-ohm, 8-volt d.c. operating coils and 8-volt, 13+3.5-watt double-filament lamps, which are approach lighted. These include eastward and westward high signals 7058E and 7058W, and 7057W and 7057E, respectively, on the Rio Grande, all of which are three-

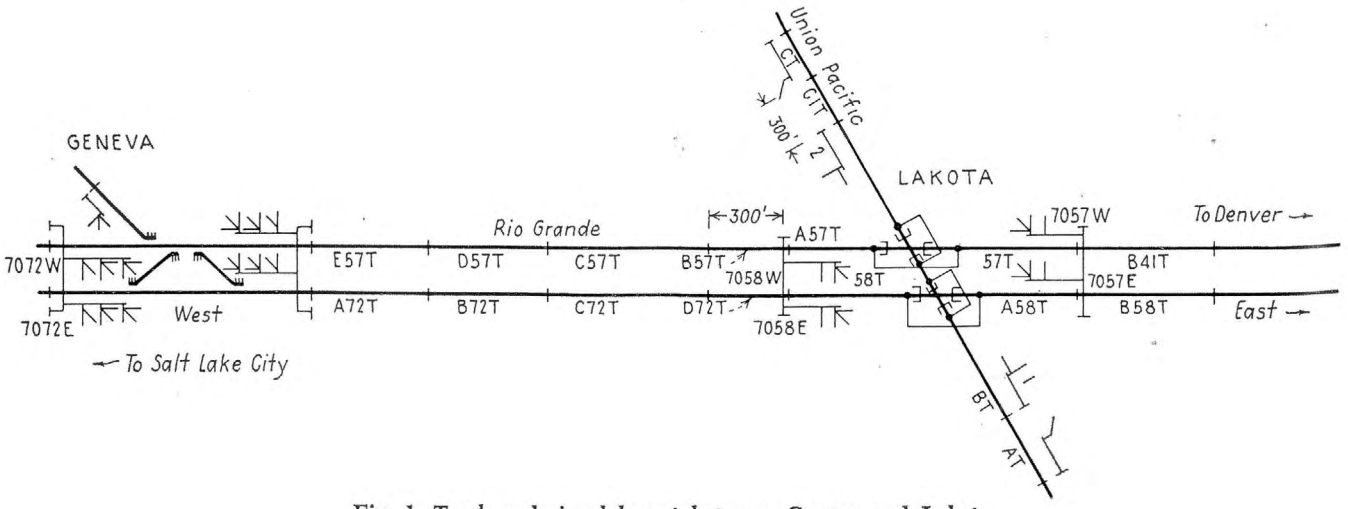



Fig. 1—Track and signal layout between Geneva and Lakota

# Automatic Plant

## Installation at crossing of Rio Grande double-track and Union Pacific single-track lines, at Lakota, Utah, includes power-operated movable-point frogs and special release circuits.

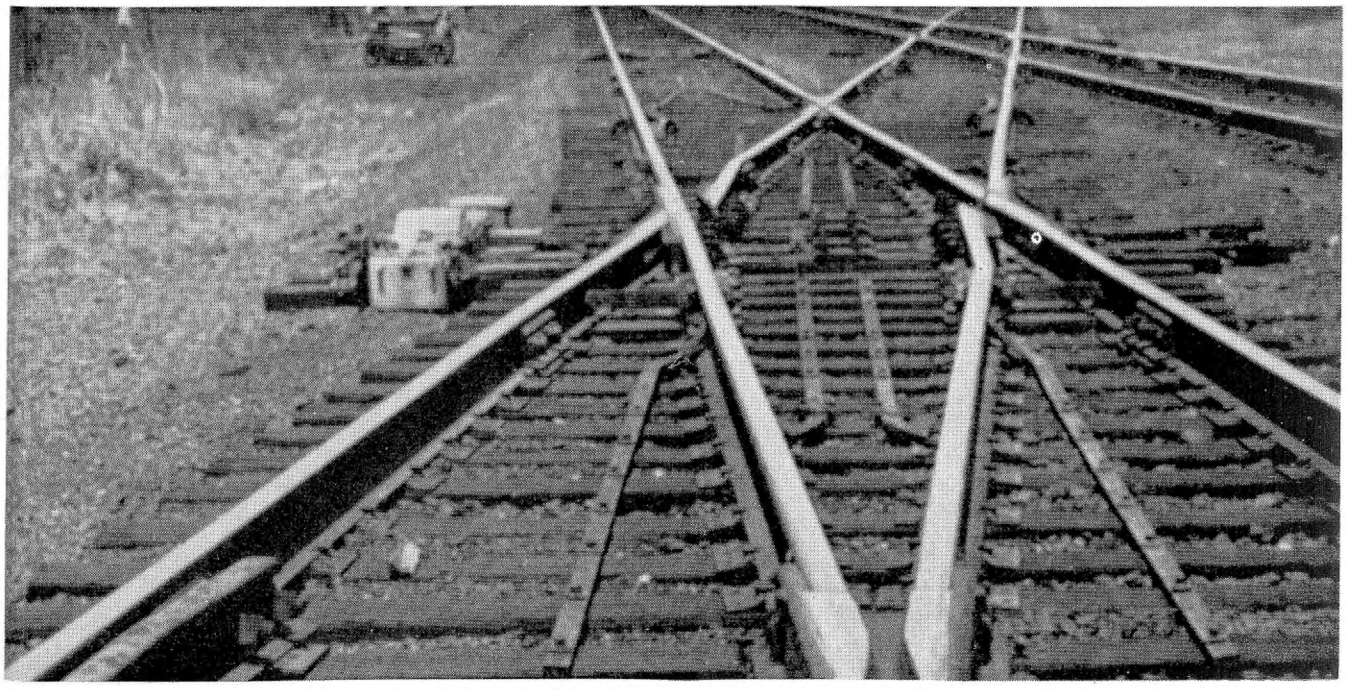
aspect signals located on signal bridges. The Union Pacific home signals 1 and 2 are two-aspect signals. No derails are used on either road.

Push-button releases for each road are located in boxes on the side of an instrument house at the crossing, for the use of trainmen in emergencies. In that the Rio Grande has two main tracks, there is a push-button for each track. In the Rio Grande box there is a light indicator which is illuminated when the Union Pacific home signals are at Stop. A small semaphore indicator serves the same purpose with the Union Pacific box, indicating Stop when all Rio Grande signals are red.

If any one of these push-buttons is operated, all signals at the plant are placed on Stop immediately. If it is a Rio Grande button, the home signal will normally clear in 2 min. On the other hand, if it is the Union Pacific button, the home signal will normally clear after 4 min. These time intervals are effected by motor-driven time-element relays. In the event that home signals fail to clear, trains are governed over the crossing by hand signals after all precautions have been taken to protect the movement. The movable-point frogs may be operated by hand in emergencies, in that they are equipped with dual-control power machines.

### Determination of Route

The automatic line up of the frogs and signals for train movements through the plant is determined by three polar-type route relays, one for each main track on the Rio Grande and one for the single-track Union Pacific line. These include the westward and eastward route relays 57-58 WRR and 57-58 ERR, respectively, for the Rio Grande and the 1-2 RR route relay for the Union Pacific, which are shown in Fig. 2. Both the 57-58 WRR and the 57-58ERR relays are controlled over a back contact of the 1-2RR relay, which checks that a Union Pacific line up has not been initiated, a front contact of the B-CTP track repeater relay, which checks that a Union Pacific train is not within U. P. home signal limits; as well as a back contact of the (UP) push-button stick relay, which checks that a Union Pacific trainman has not pushed the emergency release push-button at the crossing to release the plant. Henceforth, the 57-58 WPR relay is controlled over a front or back contact of the 57 WAP westward approach repeat-



Power-operated movable frogs at crossing of the Rio Grande and Union Pacific

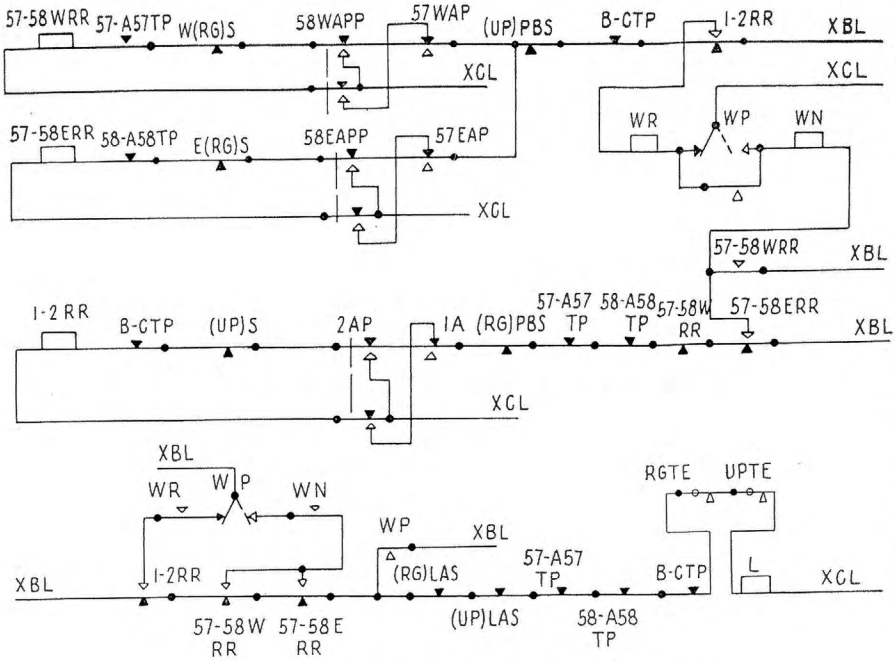



**Fig. 2—Route relay and frog-locking relay circuits**

er and the 58 WAP westward approach repeater-repeater relays, a back contact of the W (RG) S westward Rio Grande stick relay and a front contact of the 57-A 57TP track repeater relay, through the coils of the 57-58WRR relay and to common over a front or back contact of the 58 WAPP relay. The W (RG) S relay, just mentioned, is the receding stick relay which is energized when the train is in home signal limits and remains energized while the train is receding from these limits. This provides a means of holding out the 57-58 WRR after the crossing is made, thus releasing the plant for the Union Pacific route. The sequence of operation of the 58 WAPP and the 57 WAP determines the direction in which the 57-58 WRR is to pole for initiating the clearing of the home signals. In other words, under normal conditions with both of the approach relays energized, the 57-58 RR is deenergized and the home signals are at Stop. When an approaching train releases the 58 WAPP, the 57-58 RR is energized to pole its contact to clear signal 7058W, in a similar manner the releasing of 57 WAP will condition the RR relay to clear signal 57 W. Should both approach relays be down, the RR relay will not be energized until one of the approach relays is again picked up.

The controls for the 57-58 ERR route relay are similar to those for the 57-58 WRR relay. The circuits for these two relays are arranged so that Rio Grande trains can pass or meet on the crossing. In other words, signals 7058E and 7057W or 7058W can be cleared simultaneously and, likewise, all other combinations of one signal on each track can be cleared simultaneously. As can be seen in Fig. 2, the controls for the Union Pacific route relay 1-2 RR are similar to those for the Rio Grande route relays.

The movable-point frogs normally remain in the position they were last lined for. For example, assume that a Union Pacific train had used the crossing, and the frogs remained lined for that road. Upon approach of a Rio Grande train the 57-58 ERR of 57-58 WRR route would be picked, completing the pickup circuit for the WN frog normal relay, thence through a right-hand polar contact of the WP frog repeater relay to common, resulting in the frogs lining up for the Rio Grande. The same applies in the event that the frogs are lined for the Rio Grande, and a Union Pacific train enters the approach. The frogs are locked by a lock relay L, shown in Fig. 2, the control of which normally extend over back contacts of the route relays 1-2 RR, 57-58 WRR and 57-58 ERR, and front contacts of the (RG) LAS and (UP) LAS lock approach stick relays, 57-A5TP, 58-A58TP, B-CTP track repeater relays, which check that no track section between home signals is occupied, as well as contacts of the RGTE and UPTE relays.

### Directional-Stick and Push-Button Stick Relay Control Circuits

As mentioned previously, the W(RG)S, E(RG)S and (UP)S directional-stick relays in the controls of the 57-58 WRR, 57-58 ERR, and 1-2 RR relays, check the route used and are held by a receding train on an approach section. As shown in Fig. 3, the W (RG) S stick relay is picked up when the 57-A57TP track repeater relay, for the section between home signals on the westbound track, is knocked down by a train in that section, and providing the emergency release push-button for that track has not been operated. The control of the W (RG) S relay is broken over a back contact of the W (RG) PBP push-button repeater relay to check this. Once the W (RG) S relay is up, it is stuck up over one of its own front contact and a front and back contact of the 57 WAP and 57 WAP approach repeater relays, resceptively, if the train is westbound. If the train is eastbound, then the W (RG) S is stuck up over a front and back contact of the 58 WAP and 57 WAP relays, respectively. Thus the W (RG) S relay is held up as long as a receding train is on the approach on either side of the crossing, and until it is released the 57-58 WRR route relay cannot be energized. A similar arrangement of circuits applies to the E (RG) S east stick relay for the eastbound Rio Grande main track, and also for the (UP)S stick relay.

The (UP) PBS push-button stick relay, which is in the control of the 57-58 WRR and 57-58 ERR route relays, checks that the Union Pacific push-button at the crossing has not been operated when a Rio Grande line-up is taking place. For example, this stick relay is picked up over a front contact of the (UP) PBP push-button repeater relay, which is energized whenever the Union Pacific release button is operated at the crossing. The pick-up circuit for the (UP) PBS relay is also broken over back contacts of the (RG) PBS push-button stick relay and the (RG) LAS lock approach stick relay. Once the (UP)PBS relay is up, it is held up over one of its own front contacts

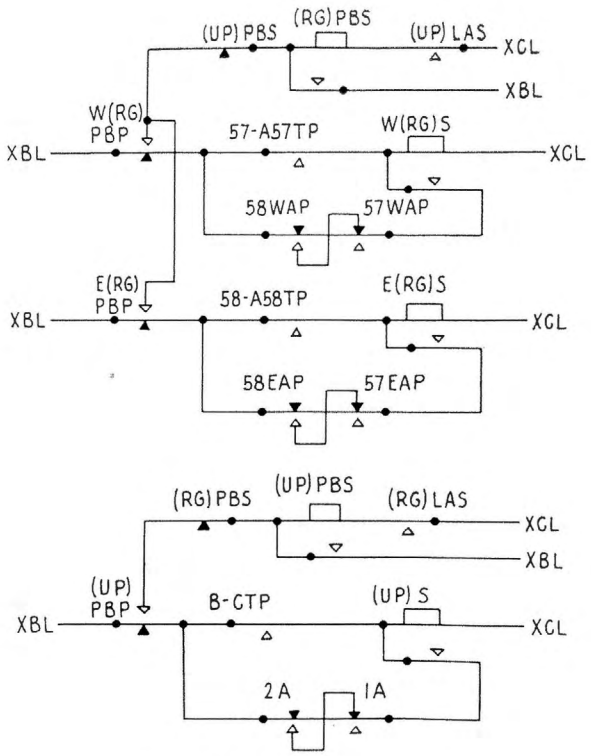



**Fig. 3—Directional-stick and push-button stick relay circuits**

as long as the (RG)LAS relay is down. When the latter relay is energized, the (UP)PBS relay is, of course, knocked down. The control of the (RG)PBS push-button stick relay is similar, being controlled over a front contact of both the W (RG) PBP and E(RG) PBP push-button repeater relays, which are energized whenever the corresponding release button at the crossing is operated.

### Lock Approach Stick and Emergency Release Time Element Relay Controls

Recalling the (RG)LAS lock approach stick relay in the control of the (UP)PBS relay, in referring to Fig. 4, it will be noted that the control of the former relay is normally over front contacts of the 57 EM, 58 EM, 57 WM, and 58WM red signal repeater relays, checking that Rio Grande Signals are at Stop, and front contacts of the Rio Grande approach relays 57 WAP, 58 WAP, 57 EAP, and 58 EAP. The normal stick circuit of this relay is over one of its own front contacts. Consequently, when any one of the approach relays are knocked down, the (RG)LAS remains up. However, when the Union Pacific release button at the crossing is operated to release the plant from the Rio Grande and change the route to the Union Pacific, the (UP) PBS relay picks up, opening the circuit to 57-58 WRR or 57-58 ERR, which places the Rio Grande signal to Stop, permitting the M to pick up. The M relay picking up closes the circuit to (RG)LAS, and an approach section being occupied is no by-pass around the open stick contact to permit positive feed. With the (RG)LAS relay down, a circuit over the front contacts of the four M relays is completed over a back contact of the (RG)) LAS relay and front contacts of the 57-A57TP and 58-A58TP relays to start the motor-driven time-element relay (RG)TE. After four minutes the (RG)TE relay picks up, and positive battery feeds over a front contact of that relay to pick-up the (RG)LAS relay. The (RG)LAS picking up drops the (UP)PBS and closes the circuit to the L relay which picks up, permitting the route to be changed to the Union Pacific and the home signal to clear on that road. The circuits for the (UP) LAS lock approach stick relay are similar to those of the Rio Grande, the only difference being that the (UP)TE time element relay is a two-minute relay instead of four.

Automatic release track sections are installed 300 ft. west of the eastward home signals 7058E and 7058W on the eastbound and westbound tracks, respectively. These sections are designated by signs along the right-of-way reading "Release Section." An eastbound train occupying the section of track between eastward home signal 7072E or 7072W, at Geneva, 1.5 mi. west of Lakota, and the "Release Section" sign for more than 8 min. automatically releases the plant at Lakota, and home signal 7058E or 7058W assumes the Stop aspect. This arrangement was installed to release the plant for a Union Pacific train if a Rio Grande train stops and switches in the approach limits. In such an instance, to again clear signal 7058E or 7058W, an eastbound train is required to proceed into the release section. If the UP approach section is unoccupied, the Rio Grande signal will clear immediately, but if the UP approach is occupied, a two min-

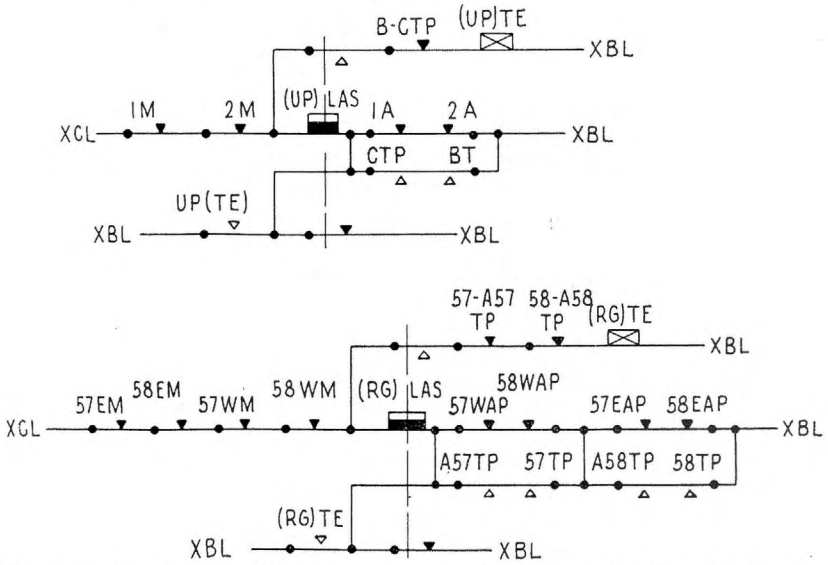



**Fig. 4—Lock approach stick and emergency release time element relay circuits**

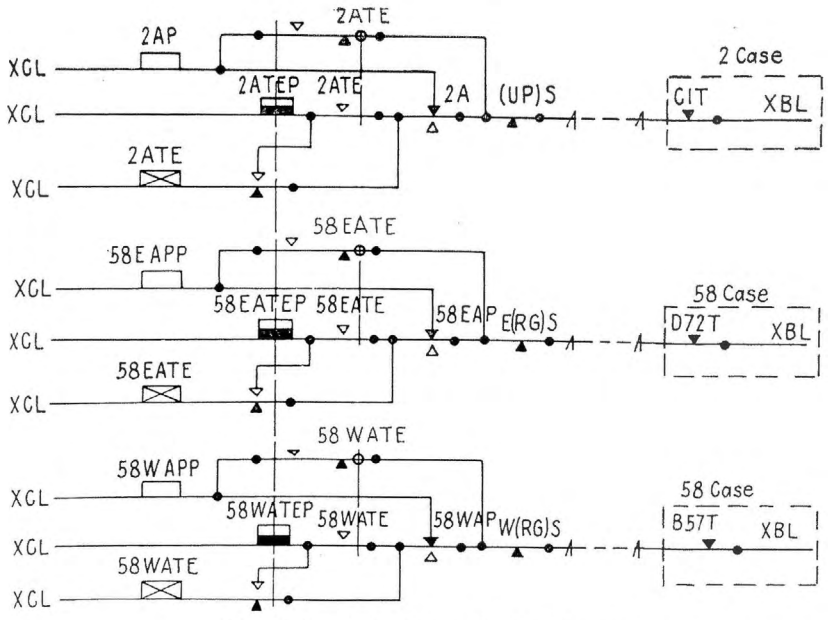



**Fig. 5—Special release circuits for crossing**

ute time interval must elapse after signal 1 or 2 assumes the Stop "position" before 7058E or 7058W will clear to Approach or Clear, depending upon block condition.

Similar switching is done on the Union Pacific, and trains enter the northward approach without using the crossing. Consequently, a release track section was also installed 300 ft. north of home signal 2. If a train does not use the crossing within 5 min. after entering the approach section, the plant is released and the home signal goes to Stop, and will not clear again until the release track section has been occupied, similar to outlined for signals 7058E and 7058W.

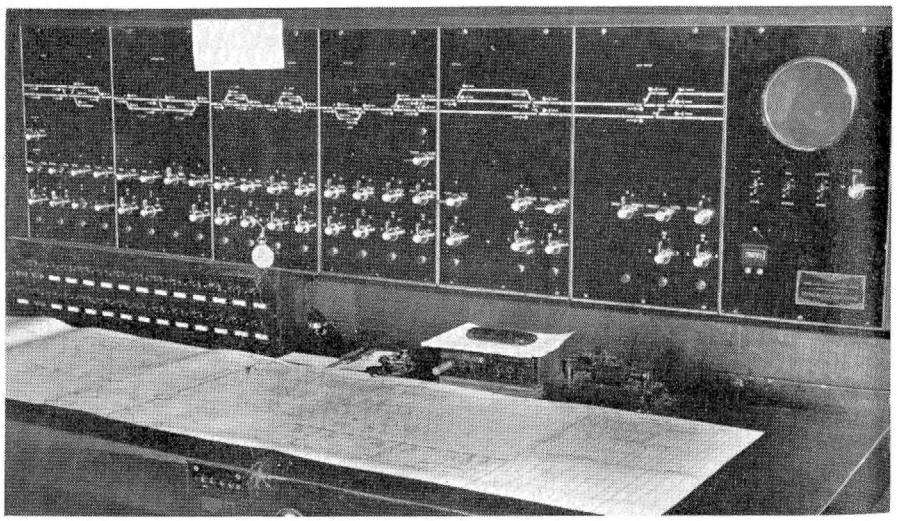
As shown in Fig. 5, and assuming that an eastbound Rio Grande train is approaching the plant on the eastbound main track from Geneva, when the train passes signal 7072E, the 58 EAP approach repeater and the 58-EAPP approach repeater-repeater relays drop. Positive battery passes over a front contact of the D72T track relay (special release section 500 ft. west of the automatic plant), over a back contact of the E-(RG)S relay, and back contacts of the 58EAP and 58EAPP approach time element repeater relay, thus causing the 58EATE time element relay to start operating. The 58EATE relay up closes the pickup circuit for the 58EATEP approach time element repeater relay over one of its front contacts. Once the 58-EATEP relay is up, it is stuck up over one of its front contacts, after which the dropping out of the 58 EATE relay has no effect, and providing the 58EAP and E(RG)S relays remain down. With the 58 EATE relay down after the 8 min. interval and the 58EATEP up, the pickup circuit for the 58EAPP relay is completed, providing the E(RG)S relay remains down, thus releasing the plant. When the train is ready to proceed over the crossing and enters the special release track section, then track relay D72T drops, which opens the circuit holding up the 58EAPP relay, and the home signal will clear with or without time interval as previously described.

A similar circuit is in service on the westbound main track. Operation of the circuits are identical to those on the eastbound track. Operation of the special release circuits on the Union Pacific are similar to those on the Rio Grande, except that the time interval is set so that the plant will be released 5 min. after a southbound train enters the approach and does not use the crossing.

### Power Supply

The power frog machines are fed by 15 cells of Exide seven-plate leadacid storage battery, rated at 80 a. h. on the 72-hr. rate. A separate set of 4 cells of Exide 174-a.h. storage battery is used for local line control circuits, while another set of 5 cells of the same type battery is used as a standby on the lighting circuits.

The relays, rectifiers and storage battery at the crossing are sheltered in a 6-ft. by 8-ft. welded sheet-steel instrument house painted aluminum. Underground parkway cable was installed as required, consisting of 3, 5, 7 or 19 conductor No. 14. Single-conductor No. 9 is used for track circuit connections. Line control circuits on the pole line are on No. 10 weatherproof copper line wire. Line drops are made up from No. 14 wire, supported by a No. 8 wire messenger. Line wire and line drop connections are solderless, using Nicopress sleeves, furnished by the National Telephone Supply Company.



**The new C. T. C control machine at Salt Lake City**

This automatic plant was planned and made by the regular signal department forces of the Denver and Rio Grande Western, under the jurisdiction of B. W. Molis, signal engineer. The major items of signaling equipment were supplied by the General Railway Signal Company.