

Remote

Power machine at left and spring buffer at right on "power-spring" switch at west end of crossover No. 12

A REMOTELY-CONTROLLED all-relay electric interlocking has been installed by the Denver & Rio Grande Western at the east end of the yard at Helper, Utah. This interlocking includes three crossovers and nine signals which, by means of direct-wire circuits, are controlled from a miniature-lever panel-type control machine in the operator's office at Helper, the distance between the office and the instrument house at the two principal crossovers being 4,050 ft.

From the east into Helper, the grade is ascending westward at about 1 per cent. From Helper west to Soldiers Summit, 25 miles, the grade is about 2 per cent ascending westward. The main line is single track east of Helper and double track westward from Helper, the end of double track being at crossover No. 12 at the east end of Helper yard, as shown in the accompanying diagram.

Helper is a sub-division point at which engine and train crews are changed. As a general rule, the locomotives are not changed at this point, but helper locomotives are required on westbound trains up the 2 per cent grade to Soldiers Summit. Passenger trains, and freight trains handling merchandise, hold the main tracks at Helper while changing crews. Other freight trains enter and depart from the yard.

In addition to through traffic, this yard handles several hundred cars of coal and empty coal cars each day. Mine-run trains bring loaded cars into this yard from mines on branch

lines east of Helper. In the Helper yard, these cars are made up in trains for movement westward. Eastbound empty coal cars are received at and dispatched from the so-called "high-yard" which is at a higher level than the regular yard. The traffic through this interlocking includes from 6 to 10 passenger trains and from 18 to 26 through freight trains daily, in addition to 10 to 14 mine-run local trains and numerous switching moves.

Layout of the Interlocking

The primary purpose of this interlocking is to improve the safety of train operations and to expedite train movements. The plant includes power switch machines at the two crossovers; No. 12 crossover forms the end of double track, and No. 10 crossover extends between the westward main track and the No. 1 track from which switches connect to the various yard tracks. The crossover No. 16, between the single track main line and the "independent lead," has an ordinary hand-throw stand at the west switch and a spring switch mechanism at the east switch.

Aspects and Indications

Westward home signal 6257 has three operative units. The upper unit governs over the straight track route to the eastward main track. The second unit governs over crossover No. 10 reversed to the westward main. This is a No. 18 crossover good for

25 m.p.h. The lower signal unit, when displaying yellow, authorizes trains to proceed at a speed not to exceed 8 m.p.h., to either the eastward or the westward main track when such track is occupied, or to proceed to No. 1 lead track of the yard.

Westward dwarf 6257F has two operative units. The upper unit governs westward moves from the "independent lead" to the westward main. The lower unit, when displaying a yellow aspect, is authority to proceed at a speed not to exceed 8 m.p.h., and may govern to the westward main track when it is occupied, or to the No. 1 lead of the yard.

Westward dwarf 6257FS and eastward dwarf 6258F normally display the yellow aspect, so that switching moves can be made back and forth on this No. 1 yard lead, without action on the part of the leverman in control of the interlocking machine, after these signals have once been cleared. A red aspect is displayed on these signals as a warning that a through train, approaching on a main track, is to enter the yard, and, therefore, yard engines occupying the No. 1 yard track must clear this yard lead without unnecessarily delaying the approaching trains.

Eastward dwarf 6254A on the "independent lead" normally displays a yellow aspect when the west switch of No. 16 crossover is normal for the route to Spring Glen. Above this dwarf signal there is a normally-extinguished "S" unit. Westward

Control Interlocking on the D. & R. G. W.

Plant at end of double track and yard entrance near Helper, Utah, includes combined spring and power switches

main-line high signal 6253 has a signal and an "S" unit. The purpose of these "S" units will be discussed later.

Interlocking Machine

The interlocking control machine is the desk panel type with miniature levers, as shown in the accompanying pictures, and a sketch of the face plate is shown in one of the drawings.

Lever 10, when thrown either to the left or to the right, controls the No. 10 crossover, and similarly lever

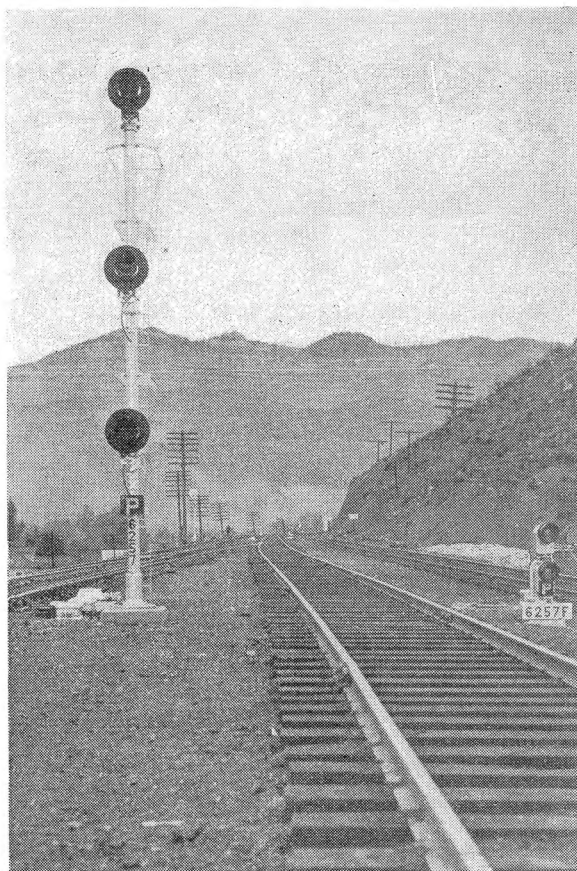
12 controls the No. 12 crossover. Lever No. 16 is a dummy lever for the hand-throw crossover No. 16.

The signal levers normally stand on center. The lever in the top row at the right, when thrown to the right, controls signal 6254, or signal 6254A, depending on the selection set up by the dummy switch lever No. 16. This signal lever, when thrown to the left,

clears either the upper "arm" of signal 6253 or the take-siding "S" unit, as will be explained later.

Counting from the right end of the machine, the second signal lever, when thrown to the right, controls signal 6258E, or when thrown to the left, controls signal 6257. The third signal lever, when thrown to the right, controls signal 6258W, or when thrown to the left, controls signal 6257F. The fourth lever, when thrown to the right, controls signal 6258F, for moves over No. 10 crossover reversed, or when thrown to the left, controls signals 6257FS and 6258F for switching moves on the No. 1 lead as outlined in the discussion of aspects and indications. The normal position of this lever is turned to the left except when moves are to be made to or from No. 1 track to the westward main track.

The fifth lever from the left in the top row, when thrown to the right, controls signal 6264W, or when thrown to the left, acts as a traffic lever by breaking the controls for signal 6264W and completing control circuit for signal 6257 for moves on the westward main track. The last lever in the top row controls signals 6263W and 6266W. The last two levers to the left in the bottom row control signals 6264E and 6257, and 6263E and 6266E. When the signal controlled by a lever is cleared, an indication lamp is lighted in the face



Westward high signal 6257 on main track and dwarf 6257F on the lead

Panel type control machine is mounted on the operator's desk at the station



of the corresponding lever. When a switch lever is thrown, a lamp in the face of the corresponding lever is lighted until the switch operates and is locked in the position corresponding to that of the lever. Normally-extinguished lamps in the track diagram are lighted when corresponding sections of track are occupied.

Routes for Trains

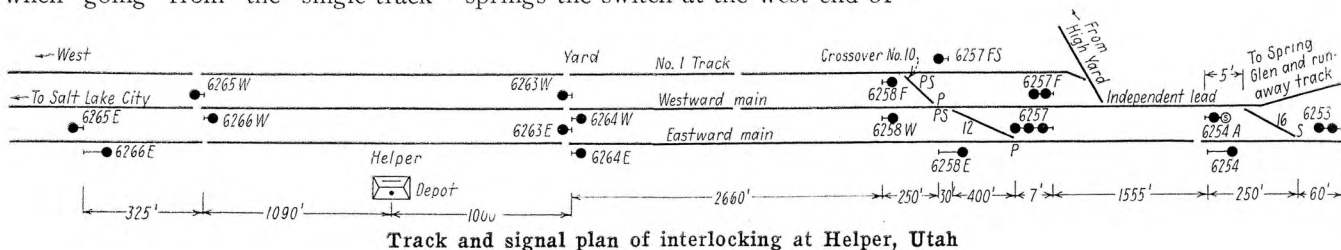
Incoming westbound trains use crossover No. 12 when going from the single track to the westward main. Incoming westbound freight trains, when going from the single-track

The crossovers are normally lined for moves in either direction on the three straight track routes. If an incoming westbound train on the single track is to be routed to the westward main track, the operator throws switch lever No. 12 to the left which causes the switch at the east end of the crossover No. 12 to be reversed, but the switch at the west end of this crossover does not operate. When both signal levers 6257 are thrown, this signal displays an aspect of red over yellow or green depending upon track occupancy. When the train accepts the signal and proceeds, it springs the switch at the west end of

in service. The spring housing is attached to the front connecting rod of the switch. The oil buffer, located on the side of the track opposite the switch machine, is connected to the front rod. When the switch is being operated by the switch machine, a special connecting rod operates a valve to relieve pressure in the buffer.

Line-Ups for Eastward Moves

For an eastbound train movement from the yard lead track No. 1 to the single-track main line east, the lever-



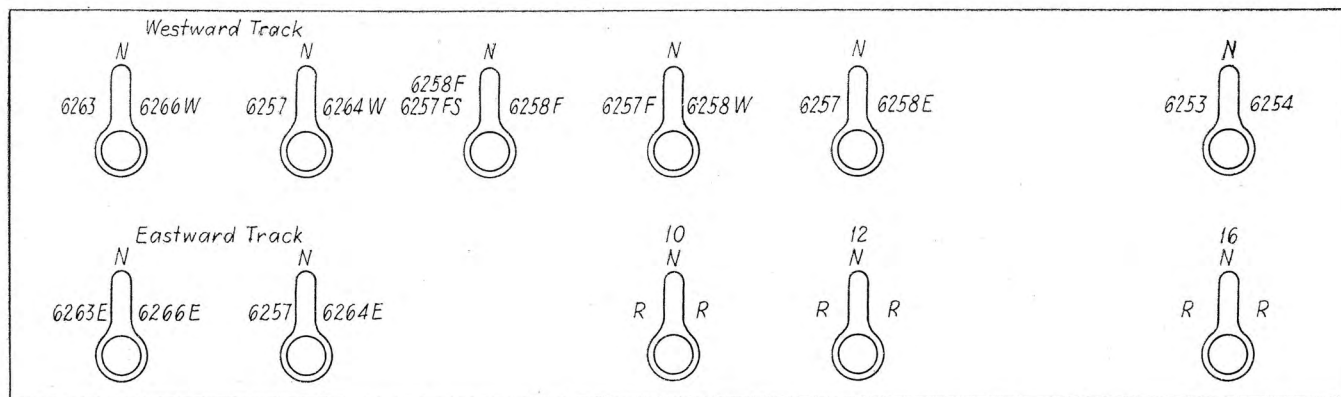
Track and signal plan of interlocking at Helper, Utah

main line to the yard lead, use both the crossovers reversed. Similarly when an eastbound freight train is departing from the yard, both the crossovers are reversed.

This entire main track and yard layout is on an ascending grade of

the crossover, and, of course, as soon as the rear of the train trails through, this switch returns to the normal position. Thus the line-up is automatically restored for eastward run-away cars from the westward track to be routed to the "independent lead,"

man throws the two crossover levers from the center position to the right position and signal lever 6258F is thrown to the right. Then the switch at the east end of each of the two crossovers are operated to the reverse position, but the switches at the west



Arrangement of levers on the panel of the interlocking machine in the Helper station

about 1 per cent westward. Therefore, cars on the westward main track or cars in the yard may get away and drift eastward, an important item being to have the switches set to route such cars not to the main line, but rather to the "independent lead" which extends around the hill and up grade on the branch line to Spring Glen, thus this "independent lead" is a safe run-away track.

Dependence could not be placed on the leverman to control the crossovers to the normal position as soon as the rear of trains cleared the home signal limits. For this reason, a special arrangement consisting of a power switch machine and a spring switch, is used at the switch at the west end of each of the two crossovers.

regardless of whether the operator restores the levers to normal.

Similarly if an incoming westbound train is to be routed to the No. 1 track of the yard, the operator throws both switch levers to the left, which causes the east end switches of both crossovers to be reversed, but the switches at the west end of these crossovers do not move. When the train proceeds, it springs these switches when trailing through. After the rear of the train passes, these switches spring back to the normal position. Lock rods cannot, of course, be used on these so-called power-spring switches. The switch machine connecting rod is connected to the spring device the same as if a hand-throw stand and connecting rod were

ends of these crossovers do not move at this time.

The eastward train departing from yard lead track No. 1 must occupy a track circuit 310 ft. long in approach to signal 6258F, for 48 seconds, then the switches at the west ends of the two crossovers operate to the reverse position, and then signal 6258F displays a yellow aspect to authorize the train to proceed via the two crossovers reversed to the single-track main line.

If the train did not consume more than 48 seconds in the track circuit before passing the signal, the switches at the west ends of the crossovers would not be operated to the reverse position. Such would be the case if run-away cars were drifting eastward

on track No. 1, and, therefore, such cars would continue on the extension of track No. 1 east of the crossover rather than following a route that might foul the main tracks.

Under circumstances in which all the crossover switches are reversed and signal 6258F is clear, then, when the rear of the train clears the detector circuits, each of the switches at the west end of each crossover is automatically returned to the normal position, thus again establishing line-ups to route eastward run-away cars to the "independent lead" rather than to the main tracks.

For an eastbound train movement from the westward main track to the single track, the control and operation of the one crossover and signal 6258W is in part similar to that explained previously.

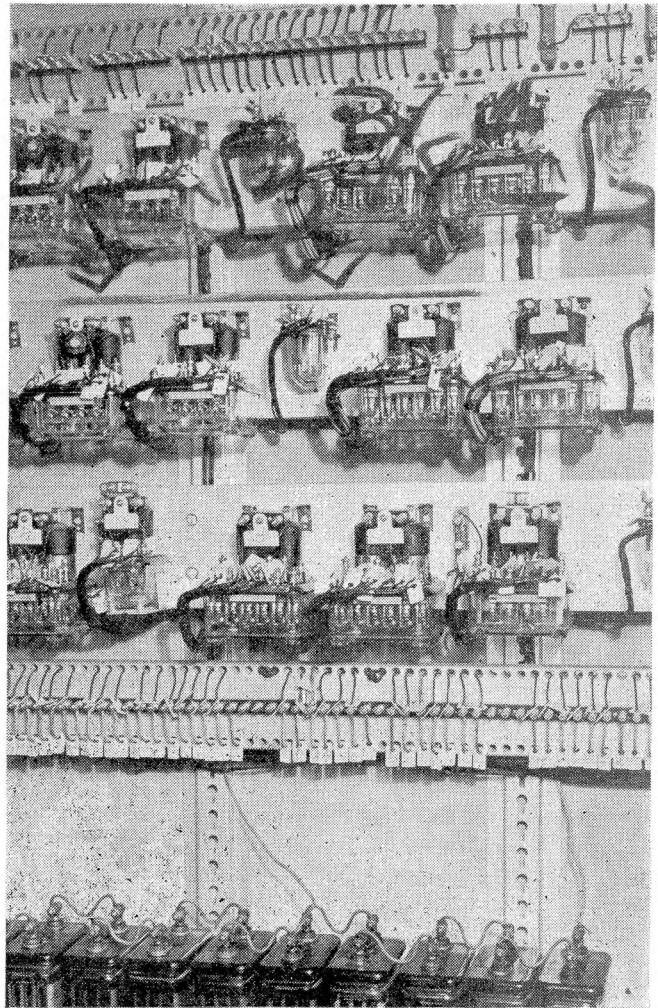
Mine-run local trains, consisting mostly of empty coal cars, depart from the "high-yard" via the "independent lead" and the crossover No. 16. Although this is a hand-throw crossover, nevertheless there is a lever in the interlocking machine which is operated to establish selections of signal controls. When this switch lever is thrown and signal lever 6254 is thrown, the letter "S" is lighted in a unit above the dwarf signal 6254A. This directs the head brakeman to reverse the hand-throw stand on the switch at the east end of the crossover No. 16. Then the lamp behind the letter "S" is extinguished, and a yellow aspect is displayed in the signal. The train then proceeds through the crossover, springing the east switch, which is equipped with a spring and buffer spring switch equipment and a mechanical lock.

Westward main-line signal 6253 has a lower unit which is normally extinguished but when illuminated shows the letter "S" which indicates that an approaching train is to stop, and that the head brakeman is to throw the switches of this crossover No. 16 for the train to head in onto the "independent lead." Such moves may be made by some of the local coal trains.

Throughout the Helper layout each of the two main tracks is equipped with signals for train movements in either direction on both tracks. These signals are dwarfs with the exception of eastward high signal No. 6266E.

These signals are controlled, not only by track circuits in the usual manner, but are also controlled by levers in the same panel as that used for the levers of the remote interlocking. Signals 6263W and 6266W are controlled from one lever. When the lever is vertical the signals display Stop, when turned to the left it clears signal 6263W for a normal move on

Relays and battery in the house north of the tracks at the crossover layout



the westward track, and when turned to the right, it clears signal 6266W for a reverse movement on the westward track. In a similar manner signals 6263E and 6266E are controlled by one lever.

Helper is a sub-division point so that all trains stop here, and, therefore, train speeds when arriving or when departing are slow. The purpose for these semi-automatic signals is to provide protection for train movements so that when proceed aspects are displayed, the enginemen of incoming trains may have confidence to move their trains promptly up to the places where they are to be stopped, rather than dragging along because the enginemen could not see whether the track was clear ahead to the stopping point.

On the other hand if a train is to be stopped at a certain signal or if traffic is to be reversed on either of the two main tracks, the leverman can manipulate the levers to effect the controls desired. Thus these semi-automatic signals on the two main tracks throughout Helper have aided in expediting train movements.

As a general rule the D. & R.G.W. uses sheet metal houses for the relays and batteries at such interlocking.

However, in this instance there was no space for a house except to dig out a hole in the side of a hill on the north side of the track. Therefore, a concrete house, poured in place, was constructed at a location near the two power-operated crossovers.

The relays in this house are the wall-mounted type with spring hangers attached to 2-in. planks set out about 3 in. from the wall to allow wiring space. The controls operating and track circuits are all of the direct-current type fed from storage batteries on floating charge, these batteries being of Exide manufacture.

The circuits between the control machine and the field station house are of the direct-wire type, the wires being in aerial cable part of the distance and as open line wire the remainder of the way. The total distance from the control office to the crossover layout is 3,660 ft.

This remotely controlled interlocking and semi-automatic signaling were planned and installed by the signal department forces of the Denver & Rio Grande Western, under the direction of B. W. Molis, signal engineer, the major items of equipment being furnished by the General Railway Signal Company.