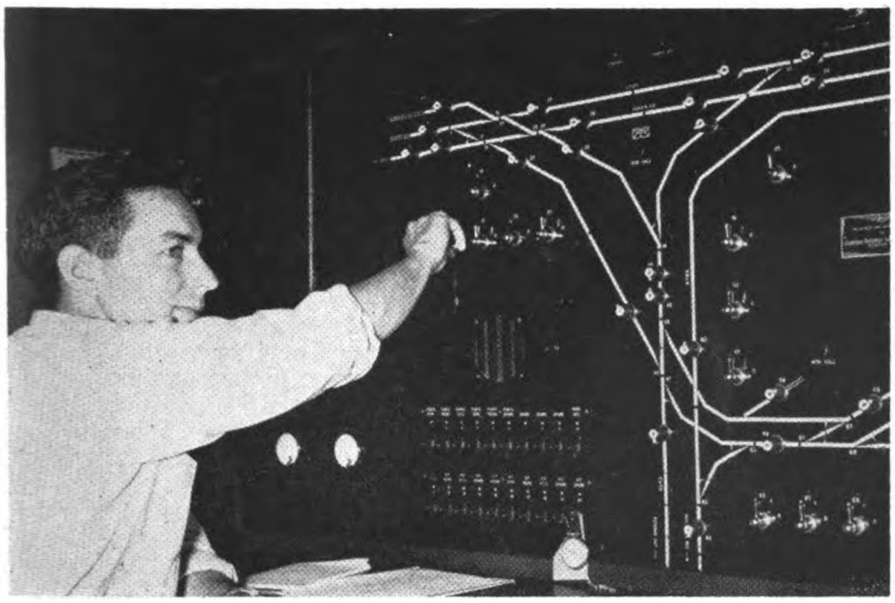
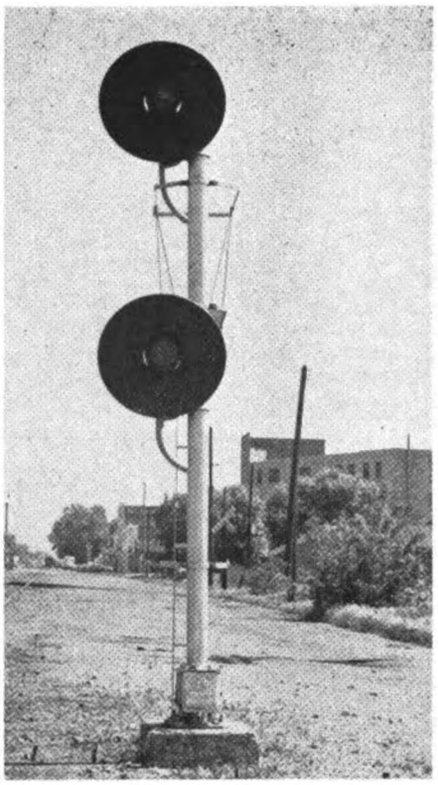


Interlocking control machine from which operator controls power switches and signals. Signal 30 (right) can display lunar-over-red to indicate Proceed through home signal limits into non-block signal territory



Electric Interlocking on the Rio Grande

Grant Tower interlocking in Salt Lake City consists of 18 power switches and 35 signals controlled from one control machine in a new brick tower. The Union Pacific and Western Pacific also operate through the plant which averages 95 train and switching moves daily

THE DENVER & RIO GRANDE WESTERN has installed a new all-relay "NX" type interlocking in Salt Lake City, Utah, known as Grant Tower. The plant, which forms a wye, is about a half mile north of the D&RGW-WP passenger station. The legs of the wye are essentially double track, one leg being two single-track lines of the D&RGW and the Union Pacific between Ogden, Utah, Salt Lake City and Provo. Another leg of the wye consists of the Western Pacific main line from Salt Lake City to San Francisco, Cal., and the UP freight line from Salt Lake City west to Los Angeles, Cal. The third leg is a connection between the UP Ogden-Salt Lake-Provo line and the Salt Lake-Los Angeles freight line, and a D&RGW connection from Roper yard to its Ogden-Salt Lake-Provo line. The Western Pacific has joint use of Roper yard with the Rio Grande.

Traffic through the plant consists of trains and switching movements. On a typical June day, 49 train and 45 miscellaneous moves were made through the plant, apportioned among the three railroads as follows: D&RGW, 16 trains, 22 miscellaneous runs; UP, 20 trains, 20 miscellaneous runs; and WP, 13 trains, 3 miscellaneous runs.

Extensive track changes were made just prior to installing the new interlocking. To reduce delays to street traffic and trains, the Rio Grande's Ogden-Provo line, operated north and south on 6th West street and crossed the UP and WP at grade, was relocated adjacent to the UP's Ogden-Provo line. Previously, trains on all railroads were required to stop at the crossings. Street traffic north of the crossing was often delayed by D&RGW freight trains waiting to cross the other railroads. More efficient operation has resulted from the new interlocking, and delays to trains have been reduced. Speed within the interlocking limits is limited to 20 m.p.h.

To reduce delays to street traffic, control circuits of the flashing-light signals at West 5th street are tied in with the controls of the home signal near the crossing. For example, if a westbound train is approaching West 5th street on the UP freight line, the flashers at the crossing will not operate if signal 40 is at Stop. This avoids delay to street traffic until signal 40 clears, at which time the flashers will operate. Control of the flashers are similarly coordinated with signals 42 and 46.

New Brick Tower

A new two-story brick tower was erected in the triangle of the wye to house the control machine and equipment, including batteries, relays and a standby a.c. power supply. Also included as an integral part of the new tower is a garage for the maintainer's truck, and a place for him to work on signal equipment. He has a work bench, tool and equipment space. The operator's room, with the control machine, is on the second floor of the tower. This room has windows on three sides; north, south and west, which afford an excellent view. The

Insulated gauge plates extend under 110-volt d.c. switch machines

windows, which are slanted from the top in, are tinted green Thermopane. Inside, looking out, they appear clear; but outside, looking in, they appear light green. The effect is to reduce the glare and intensity of the sunlight entering the room, but still present a transparent window for the operator to look through. Washroom facilities are also provided on the second floor.

Control Machine

The control machine contains the conventional track diagram with its associated indication lamps. Each signal is represented by a knob on the track diagram at the location corresponding with its signal. In the face of this knob, there is a fixed clear lens with a black arrow pointing in the direction which the signal governs. The rim of the knob turns, its normal position being with its white dot at the base of the arrow. For stick control, the knob is pushed when the dot is at the base of the arrow. If several trains are to take the same route through the plant, the operator may utilize non-stick control by pushing and turning the knob for the signal, so that the dot is above the arrow. Sectional route release locking is provided.

The switches are controlled by small levers which are located below or to the right of the symbol on the diagram representing the corresponding switch. A white lamp in the barrel of the lever is lighted when the position of the switch is out-of-correspondence with the position of the lever. For the normal position of the switch, the lever stands vertical. To reverse a switch, the lever is turned 90 deg. to the right. In the track diagram, each switch is represented by a black triangular movable-point switch indicator which operates when the corresponding switch lever is thrown, so that the track lineup is shown by a continuous white line ¼ in. wide. Switches 63A and 63B, which are at the ends of the connection over which WP freight trains enter Roper yard, are operated by one lever. Because of its curvature and short length, the connection switches are treated as a crossover. Yellow lights and a single-stroke bell are incorporated in the annunciator circuits to indicate the approach of a train. When the operator presses the annunciator button to acknowledge such a train, the yellow light stops flashing, and burns steady.

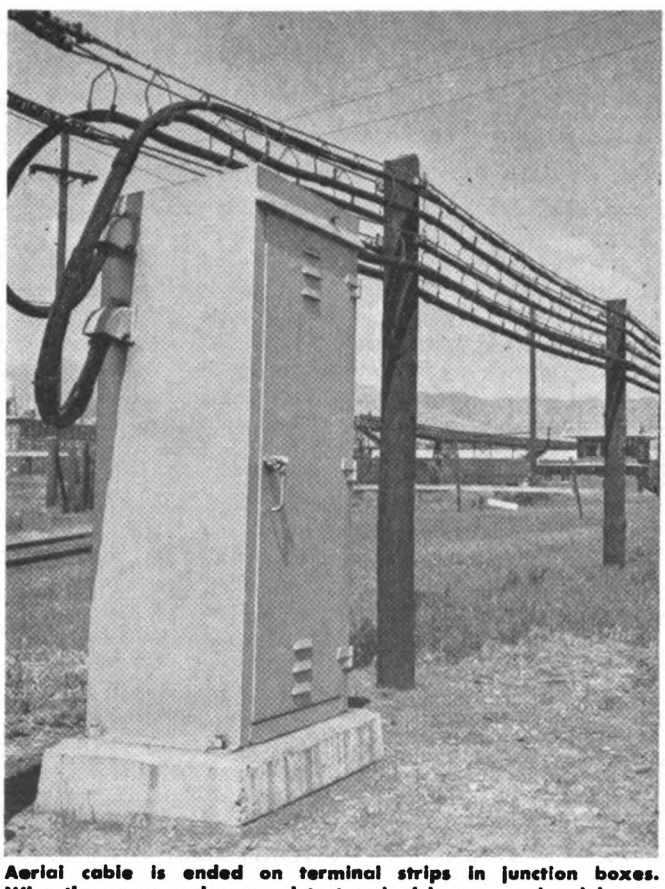
Communications Circuit

Incoming communications circuits are terminated at a concentration unit in the control machine with a key lever or toggle, with its associated indication lamp, for each circuit. These toggles connect Grant tower with the message, dispatch and CTC operators' telephone lines of the three railroads; D&RGW, UP and WP. A dial telephone on the operator's desk connects the tower to the Rio Grande PBX.

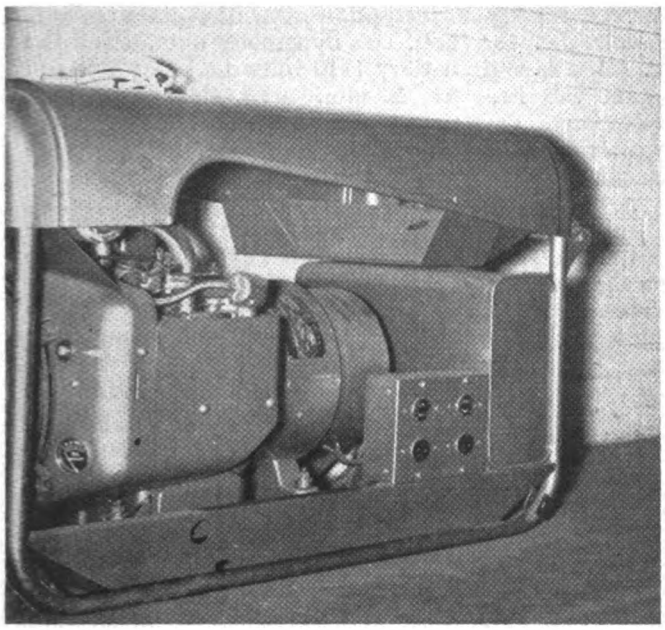
Coordination with CTC Operation

The UP and WP lines running west from Grant tower interlocking are equipped with centralized traffic control which begins at the west end of the interlocking. When a UP or WP train either enters or leaves CTC territory, the dispatcher or CTC operator calls Grant tower to inform the operator about the train. The D&RGW has CTC on their main line south toward Provo, and thus the Grant tower operator and the CTC operator are concerned with trains operating between Ogden and Provo. Because of these direct wires, the dispatchers, CTC operators and the Grant tower operator are able to communicate quickly. Also the Grant tower operator is able to inform the dispatchers promptly concerning the passing of trains through the plant.

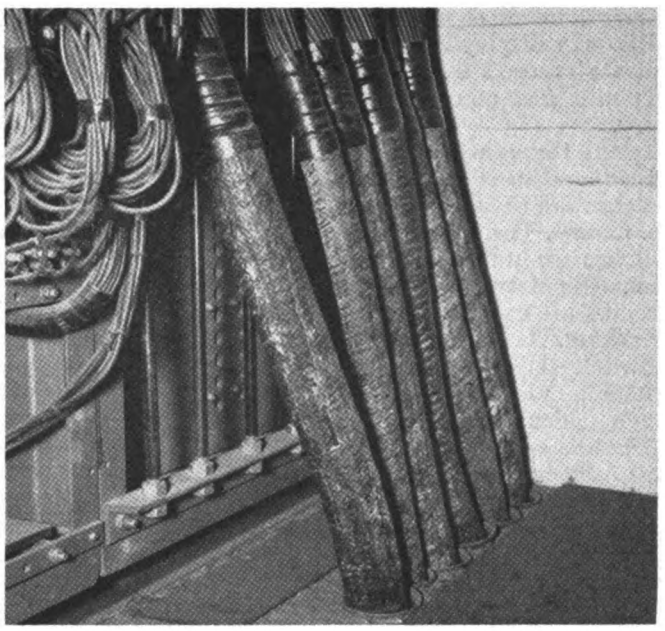
As an extra convenience for maintenance of the interlocking, a separate telephone system was installed



Aerial cable is ended on terminal strips in junction boxes. Wire then runs underground to terminal boxes at signal bases.



Gasoline-engine generator supplies standby a.c. power

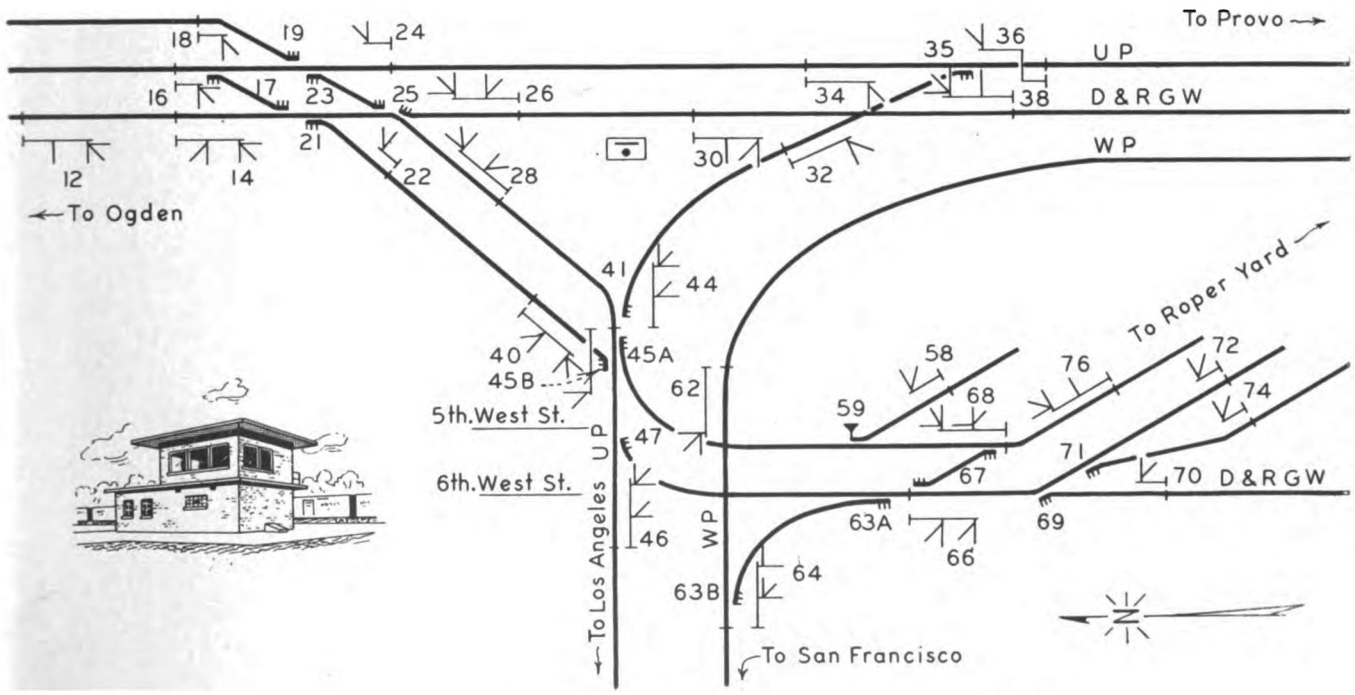


All wiring enters the tower in underground cable

throughout the plant, consisting of telephones at all relay cases and junction boxes, as well as phone jacks at all switch machines and junction boxes. This is a party-line system which is connected through to the control machine to a "plant teleph" key on the panel. Train crews talk to the operator by using one of the phones at a relay case. The maintainer can do this, or he can use his handset which he can plug in at a phone jack. When he is working in a junction box or on a switch machine, and he wants the operator to operate the switch or clear a signal, he calls him on the phone. The phone system was of great aid during the final testing and cutting over of the plant into operation. These plant phones have voice actuated relays which operate the light on the panel over the "plant teleph" key signaling the operator.

Signals and Switches

Signals are the SA searchlight type, continuously lighted. High signals are used, except where clearances would not permit; in which case, dwarf signals are used. Where there is a "two-arm" signal, the bottom "arm" is for the diverging route. Aspects are red, yellow, green and lunar. On some high signals, such as signal 14, the aspect red-over-lunar indicates Proceed on a diverging route. On dwarfs, such as signals 72 and 74, the lunar aspect indicates Proceed. Signal 66 displays red-over-lunar for the diverging route into the yard, and lunar-over-red for Proceed on main track through interlocking home signal limits leading to non-



New brick tower erected as part of new Grant tower interlocking installation in Salt Lake City. Prior to new interlocking, D&RGW ran north on 6th West street

automatic block signal territory. Signal 30 can display lunar-over-red to indicate Proceed through home signal limits into non-block signal territory.

Speed through interlocking limits is restricted to 20 m.p.h. The power switches are Model 5C with 110-volt d.c. motors. The controllers for these switches are in the relay cases at the track side near the switch. No. 10 turnouts are used throughout the interlocking.

Switch layouts are well constructed. Ramapo Ajax insulated gauge plates with Racor adjustable rail braces are on the No. 0, 1 and 2 ties. Adjustable rail braces are also on the gauge side of rail on the No. 0 tie. The insulated gauge plates on the No. 1 and 2 ties extend under the switch machine. Pairs of 1-in. by 1¾-in. by 8-in. toe plates are welded to these gauge plates, forming a seat for the switch machine, which is milled to fit snugly between these toe plates. They will prevent lateral motion of the machine. The switches are equipped with GRS adjustable switch rods. A metal junction box is set on a metal pedestal at each switch machine. Flexible stranded wire runs through a steel pipe from the junction box to the switch machine. The rigid steel pipe connection is used to prevent the wires from being broken when "small" boys stand on the connection.

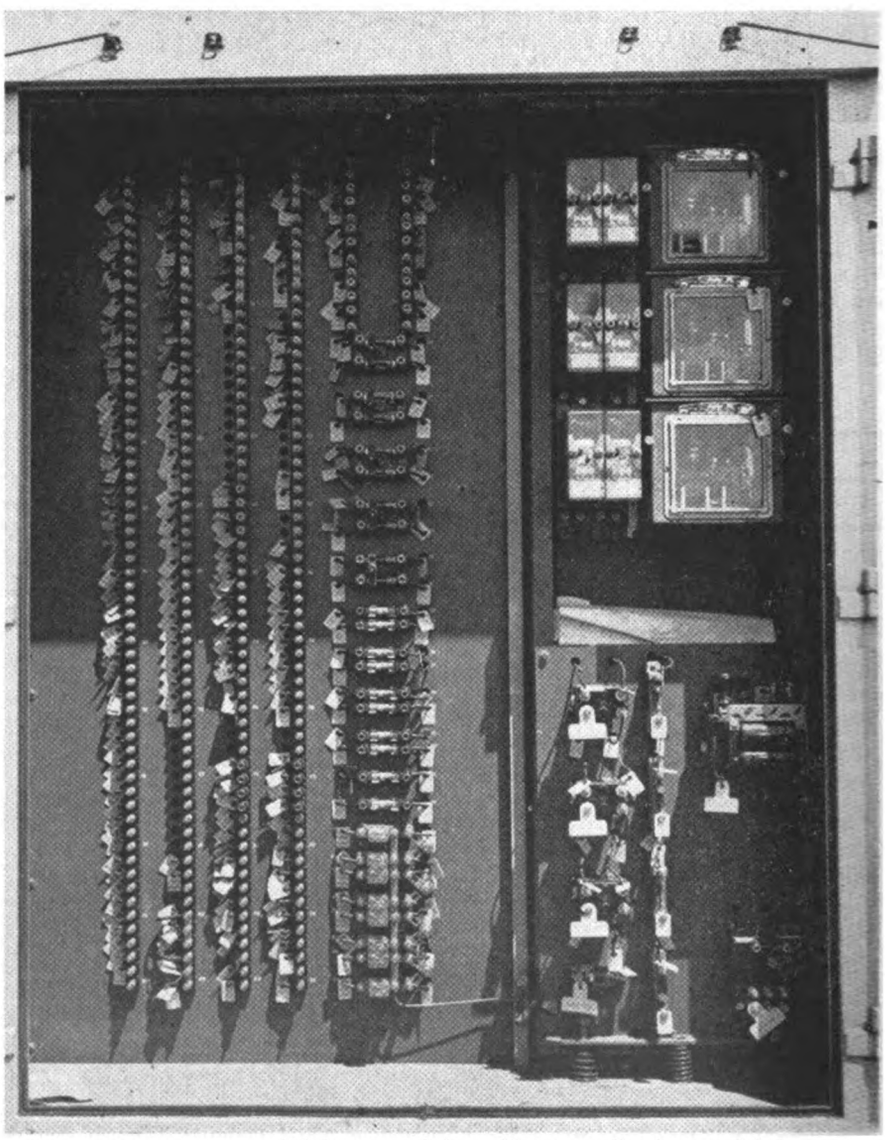
Track Circuits and Wiring

Rectified alternating current track circuits are used throughout the interlocking. A transformer feeds a.c. to the track, which at the relay end is fed through a transformer into a half-wave rectifier, and from there to a 4-ohm d.c. neutral track relay. American Steel & Wire rail-head electric welded bonds were used.

All wire and cable entering the tower comes in underground, including the a.c. commercial power. Ten 61-conductor cables of No. 14 wire and one 27-conductor cable of No. 14 wire run underground out of the tower, under the tracks and then on treated wood posts as aerial cable to junction boxes. These junction boxes are metal relay cases in which the cable is ended on Raco terminal strips with Clearview arresters and Buss fusetrons. Junction boxes are equipped with an electric light inside, for the convenience of the maintainer. Nineteen-conductor cable runs from the junction boxes to terminal boxes at the base of each signal. From here, No. 14 single conductor wires are run to the signals, and No. 9 single conductor wires are used to the bootlegs. Number 9 wire is used to carry 110-volt a.c. for signal lighting and 110-volt d.c. for switch machine power. All wire and cable for this installation was furnished by the Kerite Company.

The first floor of the tower contains the local and switch machine batteries, relays and standby power equipment. The relays are Type B plug-in. Ventilating fans in this room automatically turn on when the commercial a.c. power fails. They keep the air circulating, and remove any gases given off by the batteries, especially during long periods of power failure. Concrete steps, painted white, serve as battery racks. Type EME17 Exide 320-a.h., battery supplies power for the switch machines and local circuits; 60 cells for the switches, and 6 cells for local circuits. These batteries are charged through GRS full-wave rectifiers, there being one spare rectifier. When the commercial power fails, a.c. is provided by a General Electric dynamotor which takes over the load in less than ¼ sec. with no interruption affecting train operation. This dynamotor operates off the battery (110-volts d.c.) and will run for 5 min. after the commercial power is restored. After a prolonged failure, an Onan 3-kva portable gasoline engine generator is manually started. This will produce 100 or 220 volts a.c. On January 14, 1953, the commercial power failed at 11:33 a.m., and the dynamotor took over immediately. At 11:36 p.m. on the same day, the gas engine generator was started. The voltage of the battery at this time had only dropped to 1.93 volts per cell. At 4:40 p.m. on January 15, commercial power was restored.

Grant tower interlocking was planned and installed by Rio Grande forces under the jurisdiction of B. W. Molis, signal engineer. W. E. Peeler, signal supervisor at Salt Lake City directed the work in the field. The signaling equipment was furnished by the General Railway Signal Company.



Relay case near switch houses switch machine controller (upper right)