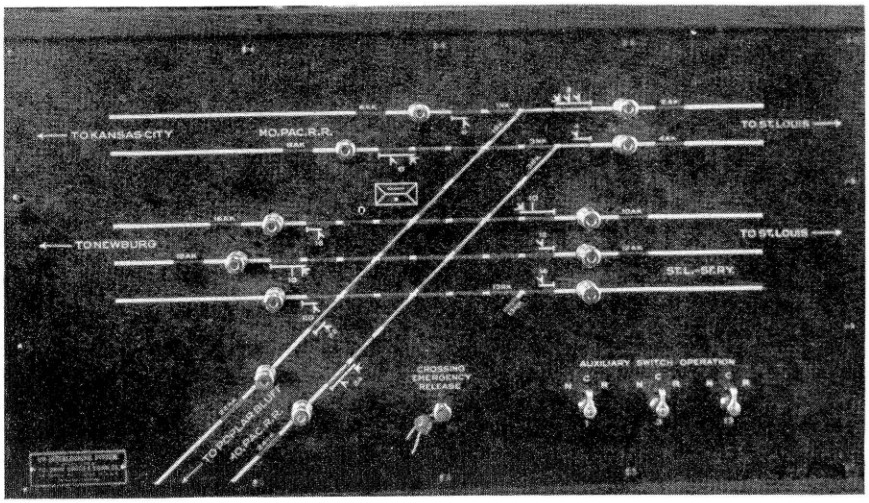


The button-type route-control interlocking machine has a panel 15 in. high and 30 in. wide including an illuminated diagram of tracks as well as signals

Route Type Interlocking

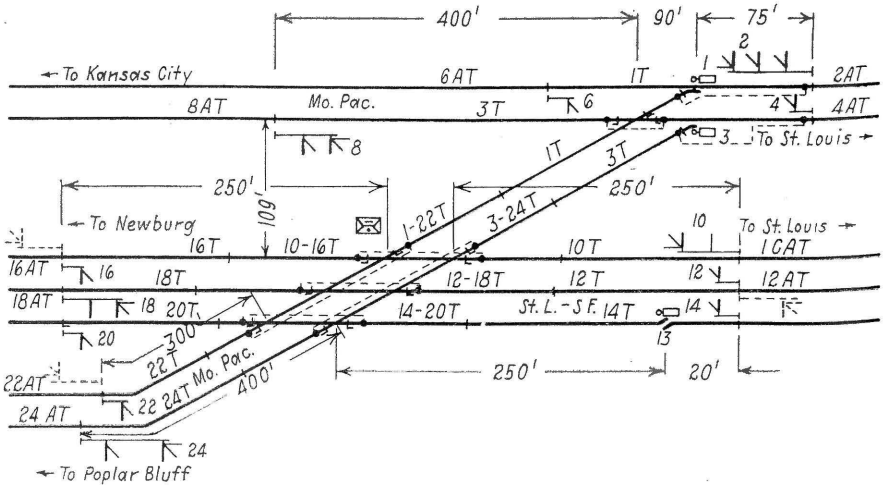
St.L.-S.F. installs plant including crossing with M.P. and a double-track junction which involves 120 train movements daily over busy layout

At Tower Grove, three miles west of the Union passenger station in St. Louis, Mo., the St. Louis-San Francisco has installed an interlocking including a crossing of the double-track line of the Frisco with a double-track line of the Missouri Pacific, as well as a junction of this north-and-south line of the M. P. with an east-and-west double-track line of the same road. The interlocking is one of the most modern of the route type, in which interlocking between functions is accomplished by interconnection of circuits rather than by mechanical locking, and each route is established by operation of two push-buttons rather than by operation of individual levers controlling their respective switches and signals.

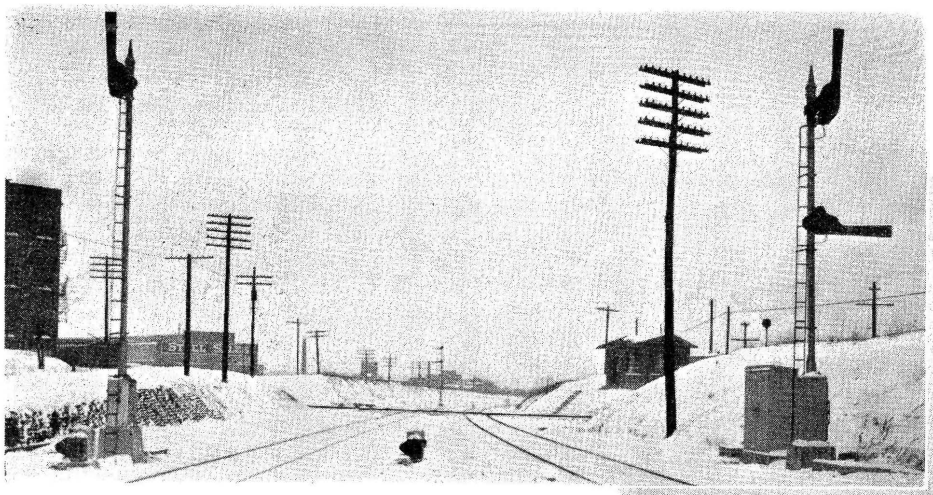
The St.L.-S.F. line involved in the plant is the main line extending from St. Louis to Springfield, Mo. and on to Tulsa, Okla., Oklahoma City, Okla. and Dallas, Tex. The main line is double track between St. Louis and Pacific Junction, Mo., 34.1 mi., and at the crossing, the St.L.-S.F. has one switching track on the south side of the two main tracks. The double-track east-and-west main line of the Missouri Pacific between St. Louis and Kansas City, Mo., lies parallel and approximately 125 ft. north of the St.L.-S.F. tracks through Tower Grove. Also, at Tower Grove a double-track line of the M. P. branches off from the east-and-west line and extends southward across the St.L.-S.F. tracks, this north-and-south M. P. line being a main route to Little Rock, Ark. and points in Texas.

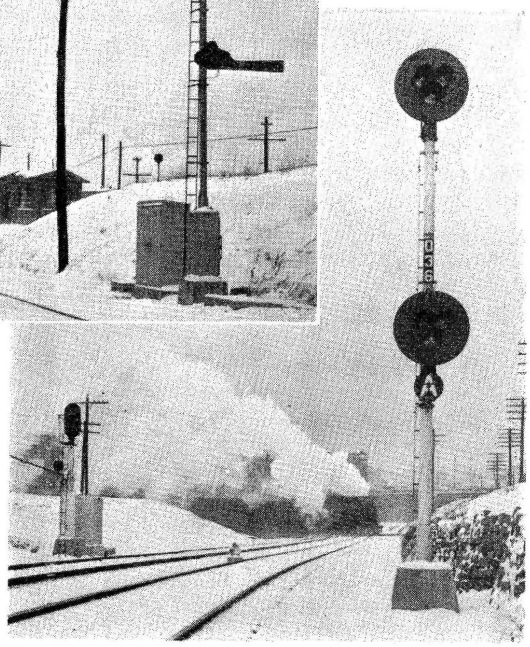
The traffic through Tower Grove on the St.L.-S.F. includes six passenger trains each way daily as well as numerous freight transfer and switching moves. On the north-and-south line which crosses the St.L.-S.F., the M. P. has five passenger trains and two freight trains in each direction daily, in addition to numerous freight transfer and switching moves. The trains operated on the east-and-west line of the M. P. do not cross the St.L.-S.F., but operate over the junction which is included in the interlocking. These trains include 7 passenger trains in each direction daily as well as numerous freight and transfer moves. As a whole, approximately 120 to 130 train and switching moves are made through the interlocking daily.

In the track arrangement prior to the installation of the interlocking, the double track of the M.P. from the south ended at a spring switch located 750 ft. south of the St.L.-S.F. crossing and from the north, at a



A plan showing the arrangement of tracks, signals and track circuits at Tower Grove





at Tower Grove

in St. Louis, Mo.

mechanically operated switch approximately 75 ft. north of the crossing the single-track line extending across the St.L.-S.F. This north-and-south line made a junction with the east-and-west double track of the M. P. and a crossover between the two main tracks was located east of these junction switches. The junction switches, the end-of-double-track switch north of the St.L.-S.F. crossing and the crossover were operated by centrally-located non-interlocked stands which were pipe-connected to the switches, and were operated manually by a switch tender. No interlocking was provided, but the automatic signals protecting the switches would display proceed aspects when the switches were lined properly, and the track sections were unoccupied.

The St.L.-S.F. Tower Grove station is located a few hundred feet east of the crossing, and the M. P. Tower Grove station is located just east of the junction. All passenger trains, both inbound and outbound, make regular scheduled stops at these respective stations. For this reason, trains are operated at comparatively low speeds either when just starting from the station stop on an outbound run or when coming to a station stop on an inbound run. The station stop served as a crossing protection stop for westbound St.L.-S.F. trains, but eastbound trains had to make an extra stop west of the crossing. Likewise, both the northbound as well as southbound M. P. trains on the north-and-south line had to make an extra crossing protection stop. Comparatively high embankments in three angles of the crossing, plus a factory building in the fourth angle, obstructed the view from an approaching locomotive along the tracks of the opposing line.

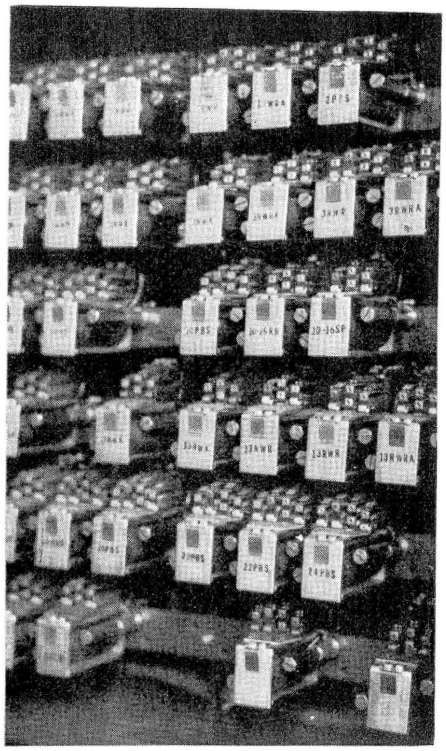
Reasons for Interlocking

In order to improve safety and to facilitate train movements over the crossing, as well as to improve the safety of train operation at the junction on the M. P., a decision was made to make certain track changes and to install an interlocking. On the M. P., double track was extended over the St.L.-S.F. crossing and the previous end-of-double-track switches eliminated. The junction switches remain in their previous location, the only change being to change them from mechanical pipe operated to power operated.

These track changes reduced the number of switches to be interlocked to two, and also gave the advantage of permitting inbound and outbound train movements simultaneously in this area which is frequently quite busy, especially in the morning and evening hours. The new interlocking provides for the operation and protection of the M.P. junction, as well as for the crossing and, therefore, three men, who were formerly switch tenders, were transferred to the new control station of the interlocking.

The interlocking includes power switch machines for the two M. P. junction switches and a switch machine for a derail east of the crossing on the St.L.-S.F. switching track. This latter derail was considered necessary on account of the fact that the grade on this side is slightly descending toward the crossing and the cars left standing on this track while switching moves are being made on industry tracks might drift back on the crossing.

The interlocking signals on the St.L.-S.F. are of the semaphore type, according to standards of this road. A lower inoperative arm is provided on the high signals to complete the aspect for a home interlocking signal. Automatic block signals are located opposite the leaving end of home signal limits on the two main tracks, this being in accordance with St.L.-S.F. practice, which is based on the following premises: the home signals control only through the plant to the leaving signal and in case trouble occurs within the plant which prevents the home signal from being



L-Type relays in control machine

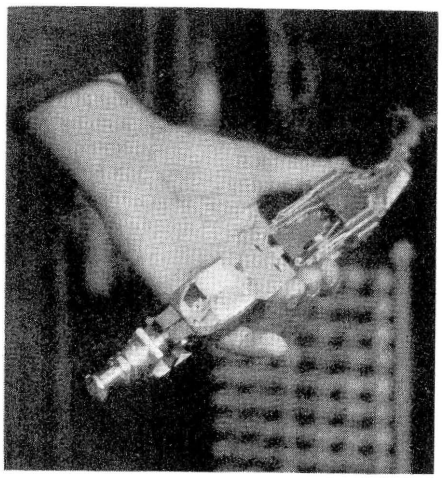
cleared, the only flagging necessary is through the plant, and the train is then governed by the indication given by the automatic leaving signal. If these leaving signals were not provided and for any reason a home signal could not be cleared, the train, in addition to being flagged through the plant would have to proceed at restricted speed to the next automatic block signal, which would cause unnecessary delay. These leaving signals also eliminate the necessity of call-on signals to move trains through the plant when the advance block is occupied.

The interlocking signals on the M. P. are the color-light type. A second operative "arm" is provided on signal No. 2 to govern to the diverging route, and a third arm serves to display a "call-on" aspect. The bottom "arms" on signals No. 8 and No. 24 likewise display "call-on" aspects. In addition, each M. P. high home signal is designated as a "stop-and-stay" signal by a reflectorized "A" marker mounted on the mast below the signal light units.

The control station consists of a new one-story brick building on a concrete foundation located on the embankment to the north and west of the crossing. Large windows in steel frames are provided in all four walls so that the towerman, when seated at the control machine, can see trains on the St.L.-S.F. as well as on the north-and-south line of the M. P.

The panel of the control machine, as shown in an illustration herewith, is 15½ in. high and 30 in. wide. The illuminated diagram reproduces the complete track layout. The lines representing the tracks within the home signal limits are cut out of the steel plate panels and are backed up by short sections of glass. When the plant is normal, these sections of glass are not illuminated. When a route is lined up, the route is indicated by these glass sections being illuminated white. As a train enters and passes through the plant, the lights in the sections of glass are changed from white to red to indicate the progress of the train through the various track circuits. The track indication sections which represent each switch or derail are flashed with red light, by means of a flasher relay, during the operation of the corresponding switch, and, when the switch is over and locked in the position corresponding to the route to be set up, the lamp behind the indication section of the track diagram is lighted with continuous white lights.

The signals are represented by small symbols, and adjacent to each symbol is a push-button mounted on the line which represents the track on which the signal governs. The approach of trains is indicated by an annunciator bell and by the illumination of a section of the diagram which represents the track on which the train is approaching. In order to line up a route, the operator pushes the button corresponding to the signal at which an approaching train is to arrive at the plant, and then pushes the button on the line representing the track on which the train is to depart from the plant limits. The switch or derail, if such are involved in a proposed route, will be lined properly, following which the signal for the route will clear. A small lens in the face of the first button is lighted red when the button is pushed, but when the route is complete and the signal clears, this lens is lighted green. Normally no light indication is shown in the face of the buttons. If a route which has been set up is to be canceled, the first button, which was pushed, is pulled forward. Approach locking, including time-element relays, is provided for all main-line routes, and time locking is provided on the St.L.-S.F. switching track because no track circuits are provided beyond home signal limits.

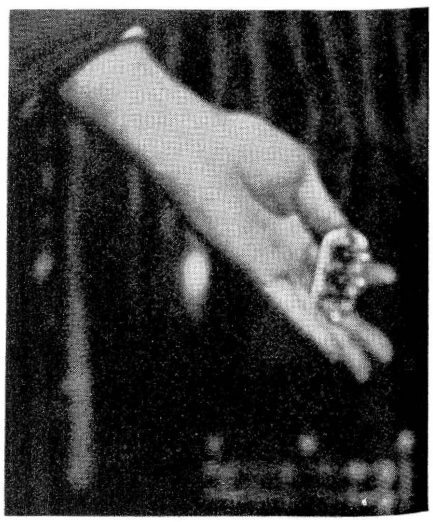


Above-Push-button control lever unit with contacts and the indication lamps. Right-Track section indication unit including the two lamps and the wiring

Individual Switch Control

When the switches and the derail are being adjusted or inspected, individual lever control, apart from the route control, is necessary. For this reason, three miniature-type levers, one for each switch and one for the derail, are mounted in the lower right-hand section of the control panel. The normal position of each of these levers is on center, being thrown to the left to place a switch normal, or to the right to operate a switch to the reverse position. If a switch point is blocked by ice or a piece of coal, the operator can use the individual lever to throw the switch back and forth to smash the ice. The setting up of a route removes the control from the individual switch levers so that the operation of such levers has no effect on the switch or switches until the route is released, either by trains passing through the plant or by cancellation.

A special feature of this plant is the use of "trap" circuits on each of the two M. P. tracks over the three St.L.-S.F. tracks and on each of the three St.L-S.F. tracks. In case one of these "trap" stick track relays fails to be energized over the pick-up circuit as a train moves over the crossing,



a major portion of the plant would be tied up. In order to restore the "trap" circuit to the normal condition and keep trains moving, a special "Crossing Emergency Release" button is provided on the lower center portion of the control panel. This button is sealed. The seal must be broken in order to operate this button, and a record is made of such an occasion.

Operation of this special push-button energizes a relay which operates a time-element relay, set at 1½ min., after which time interval, the pick-up circuit of the "trap" stick track relay closes and the "trap" stick track relay is energized.

Preliminary Consideration and Switch Controls

The following explanations of some of the typical circuits for the Tower Grove plant were prepared especially for the readers whose past experience has been based primarily on mechanical interlocking or power interlocking including mechanical locking between levers. A study of the diagrams will indicate that "networks" are used to an advantage. A "network" consists of a portion of a circuit with the same selection over contacts on track repeater, switch repeater, route locking or other relays for two or more control circuits, and where the circuit arrangement is such that but one control circuit is used at a time. This simplifies the circuit wiring, reduces the number of contacts, and effects economy.

Before a study is made of the UR route interlocking circuits, an understanding should be had of the arrangement for control of the switches. As shown in Fig. 1, each electric switch machine is directly controlled by a Style DP-14, 670-ohm d-c. polar relay known as the WR relay. When the polar armature is normal with the neutral contacts closed, the switch operates to the normal position, and when the polar armature is reversed with the neutral contacts closed, the switch operates to the reverse position. Each WR relay is controlled to the normal polar position by a NWR relay, and to the reverse position by a RWR relay, these being d-c. neutral relays. The two wires of the control circuit for a WR relay cascade through front and back contacts of the NWR and RWR relays to provide the proper selection of polarity. Only one of the two relays, NWR or RWR, can be energized at one time because the control of each breaks through a back contact of the other. When a switch is in the full normal or reverse position, and the approach, route or detector locking is effective, its switch-locking LSR relay is released, transferring the two control wires for the WR relay to a hold-up circuit through a two-wire polar selection of contacts in the NWP and RWP switch-repeater relays to maintain the proper polarity of energy on the WR relay and hold the switch in the proper position. Thus the control of the NWR and RWR relays is cut off from the control of the switch and the switch locking is accomplished by direct control of the WR switch control relay. The two switch-repeater relays, NWP and RWP, are Style DN-11, 1000-ohm, d-c. neutral relays, and are each controlled by a two-wire circuit selected through contacts on the indication circuit controller in the switch machine and contacts in the switch circuit controller used as a switch point detector.

Push-buttons and PB Stick Relays

In order to set up a route, the towerman pushes the button on the control panel corresponding with the signal on the track on which the approaching train is to arrive, and then pushes the button corresponding to the track on which the train will depart from the plant. Each push-button is normally held in a central position by spring pressure which tends to prevent backward or forward motion. When a button is pushed, a "push" contact is closed. When a button is pulled, a normally-closed "pull" contact is opened. The "pull" contact, however, does not open when the button is pushed. Referring to Fig. 2, Frisco route selector relays, when push-button 10 is pushed, the "push" contact is closed, and, starting with battery XTB at the right, battery feeds through contacts as follows: A front contact of track relay 10TR, the "push" contact, a back contact in 16PBS, the coils of 10PBS, a front contact in a route locking relay MPLR, and a front contact in signal route locking relay 2-24LR, and to common TC. Having energized 10PBS, it sticks up by a circuit through its own front contact and the "pull" contact of the push-button, so that when pressure is removed from the button, and it springs back to normal position, the 10PBS sticks in the energized position. This ar-

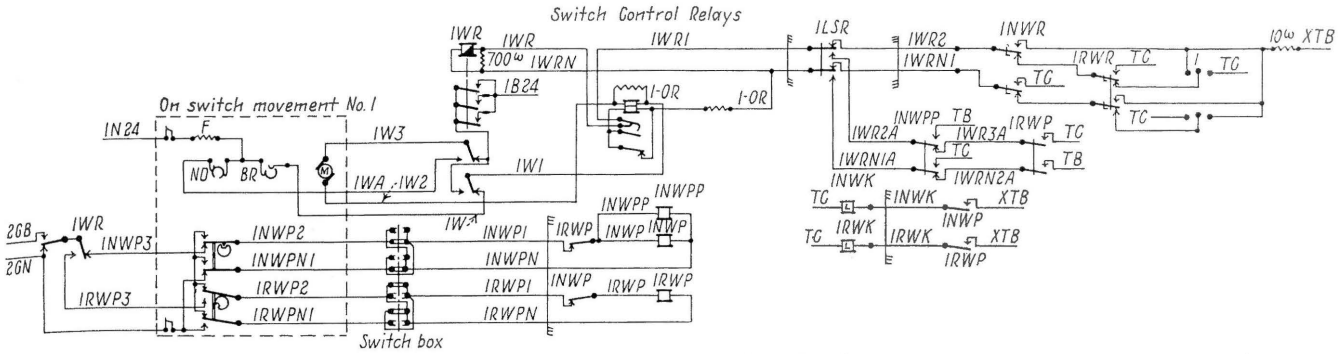


Fig. 1—Typical switch control circuit. These are for switch No. 1 which explains the fact that the number 1 precedes each nomenclature

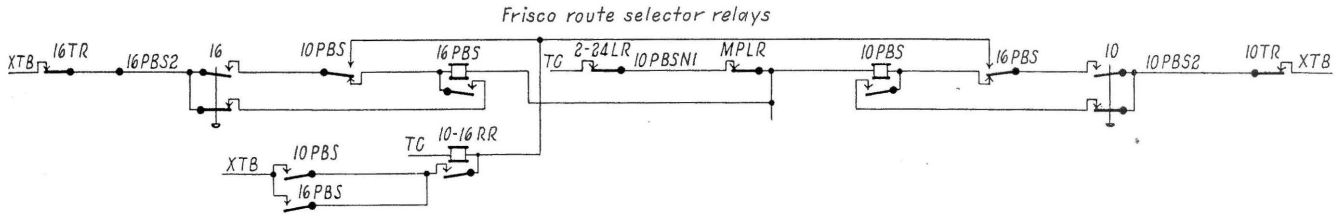
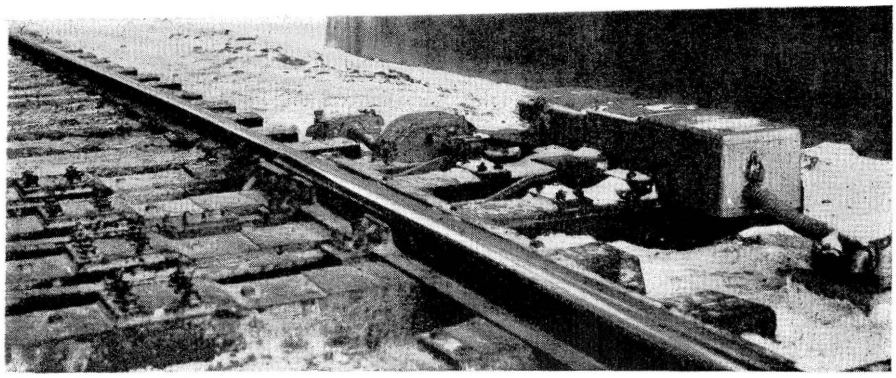


Fig. 2—Typical route-selection relay circuit



Power switch layout No. 1. Note the gage plates and extension of plates to switch machine

rangement permits the use of self-restoring control buttons, so that after a train accepts a route and passes through the plant, the control arrangement returns to normal without further attention of the towerman. The feed for the stick circuit is opened when the train passes Signal 10 and occupies track circuit 10TR, opening the contact first mentioned in the circuit. If the route, which has been established, is not to be used, it can be cancelled by pulling No. 10 push-button, which opens the "pull" contact and drops the 10PBS relay.

The circuit for the 10PBS relay includes a front contact in route locking relay MPLR, the control circuit for which is shown in Fig. 3. Starting with battery XTB at the left of this diagram, battery feeds through contacts as follows: A back contact of 22PBS, a back contact of 24PBS, a back contact of M.P. route selector relay 1RWRA, a back contact of M.P. route selector relay 3RWRA, and the coils of MPLR relay to common TC. Relays 1RWRA and 3RWRA, being de-energized, check that switches 1 or 3 are not being moved to the reverse position for conflicting moves over the crossing. The remaining contacts in the circuit for MPLR check that the push-button stick relays for Signal 22 or 24 for conflicting moves have not been picked up, and that the relays which control switches No. 1 and 3 reversed are not picked up.

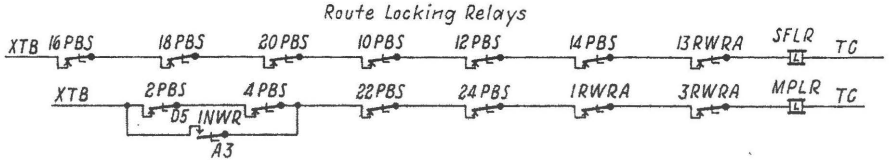


Fig. 3—Route-locking relay circuits

The circuit for the 10PBS relay includes a front contact in relay 2-24LR; the control circuit for this relay, which is shown in Fig. 4, checks various conditions. Starting with battery TB at the left of Fig. 4, a front contact in relay 22ASR checks that the approach locking for Signal 22, as used according to standard practice, is not effective; a front contact in 22TP checks that track section 22T is unoccupied; a front contact in "trap" stick track relay 1-22TRS checks that the "trap" circuit on the M. P. southward track is not occupied; if switch No. 1 is reversed, track section 1T is not occupied as checked by a front contact in 1TP, and 2ASR, the approach stick locking for Signal No. 2 is not effective. The term "approach locking is not effective" means that an opposing or conflicting signal is not clear, or, if a signal has been cleared for an approaching train, that the signal has been placed at stop and the time element has expired, thus providing adequate time for an approaching train to observe the Stop aspect and stop short of the signal. The remainder of the circuit shown for relay 2-24LR represents the same checks with reference to the northward M.P. track, Signal 24, and switch No. 3. All of the six St.L.-S.F. PBS, push-button stick relays, check through to negative battery through the same circuit through a contact in relay MPLR and 2-24LR. Summarizing, relays 2-24LR and MPLR check to prove that every condition with reference to the M.P. tracks, switches and signals are correct for setting up a St.L.-S.F. route. If all these conditions are correct, and the track in the home signal limits on the westward St.L.-S.F. track is unoccupied, the push-button No. 10 causes relay 10PBS to pick up. With 10PBS energized, the opposing signal, No. 16, is locked out because the control for 16PBS breaks through a back contact of 10PBS.

Push-button No. 16 represents the only possible departure track for a route starting with Signal 10. When push-button No. 16 is pushed, a circuit starting at the left of Fig. 2, feeds XTB battery through a front contact of the track relay for track circuit 16TR, through the "push" contact of No. 16 push-button, through a front contact of relay 10PBS, which is now closed, and to the coils of Frisco route selector relay 10-16 RR. This relay sticks up by a feed from XTB through a front contact of 10PBS, now closed.

The operation explained so far has had to do with the determination of whether conditions are such that a route can be set up, and nothing yet has been accomplished to operate the switches as may be required or to clear a signal. The checking through of circuit MPLR through 3RWRA and 1RWRA both released, merely indicated that no route was then established to control either switch to the reverse position. With these relays released, however, one of the switches can be in the normal or the reverse position, having been left there as a result of a route previously lined up and used. The purposes and operation of the RWR and NWR relays were explained previously.

Having energized relay 10-16RR as explained in connection with Fig. 2, one of the front contacts in that relay completes a circuit to energize relay 3NWR which causes switch

Fig. 4—Circuit for 2-24 LR, lock relay

control relay 3WR to move switch 3 to the normal position if it is not already there. A front contact in relay 3NWR closes the circuit for the picking up of relay 1NWR. This then energizes switch control relay 1WR to move switch 1 to the normal position if that switch is not already in that position, thus providing derail protection against a train movement being made over switch 1 reverse, while a train is moving over switch 3 normal. When the switches are properly po-

sitioned and locked, route agreement relay 10R is energized as follows, as shown in Fig. 5: XTB through a front contact of 16ASR, a back contact of 16PBS, a front contact of 10-16RR, a front contact of MPLR, a front contact of 10PBS, through the coils of 10R relay, a front contact of 3NWK and a front contact of 1NWK to TC. Relays 1NWK and 3NWK are additional repeaters of the respective switch repeater relays.

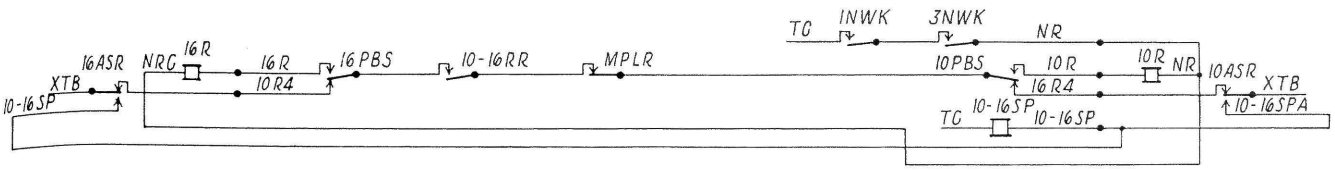


Fig. 5—Circuit for Frisco route-agreement relay 10R

The description so far has dealt with the operation of the push-buttons, circuits and relays in the UR control machine. The PBS relays act as the start of the route selection and are energized from the starting push-buttons. The NR, RR, NWR and RWR relays act for the establishing of a route through the plant including the operation of any switches in the route, if necessary, and are energized by the leaving push-button in addition to the PBS relay for the particular route to be set up. The LR relays act as the route locking relays and are energized only when conditions are satisfactory for the lining up of their respective routes. The R relays act as a route agreement check and are energized only after all circuit conditions in the UR control machine are properly set up for the establishing of a route. These last noted relays transfer the control from within the machine to the external circuits. The circuit selection and check within the machine is somewhat similar to the manual operation of levers with a mechanical interlocking machine or a power interlocking machine with mechanical locking between levers.

It will be noted that up to this point no actual operation of switches or clearing of signals have been involved and the actual safety features in standard interlocking practice, such as detector and route locking, approach locking and switch and signal indication locking, are not included in the machine. These features are included in circuits external to the control machine, such as switch locking (LSR relays), switch control (WR relays), switch repeating (NWP and RWP relays), approach locking (ASR relays) and the signal control (HR relays). These protective or safety features are accomplished in much the same manner as for all relay interlocking, automatic interlocking or C.T.C., and will be described later.

The R relays are standard relays used to repeat the "L" type relay selections and are located in the relay house with other standard relays. The use of these relays allows the HR relay circuits to be entirely separate from the circuits in the control machine. It should be noted that the selections in the HR relay circuits are made entirely through standard relays, and the failure of control machine circuits or "L" type relays therein can in no way effect the safety of operation through the plant. In other words, the circuits are checked through both "L" type and standard relays, providing a double check on the failure of any relay.

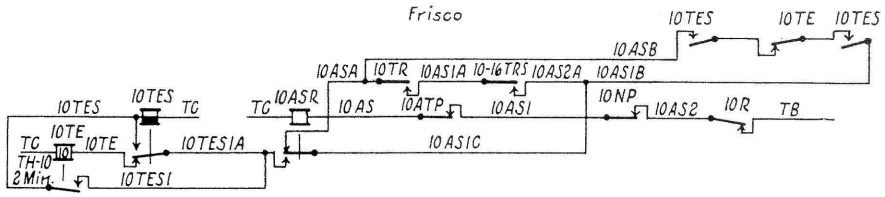


Fig. 6—Circuit for Frisco time-element stick relay

up from signal No. 2 to No. 22. Referring to the diagram of M.P. route selector relays, Fig. 8, operation of push-button No. 2 causes relay 2PBS to be energized. Operation of push-button No. 22 completes a circuit to feed through a back contact of 6PBS and a front contact of 2PBS, now closed but shown open, then to a back contact in 1NWR, the normal switch control relay for switch No. 1, to energize relay 1RWR. Relay 1RWR causes switch No. 1, and in-

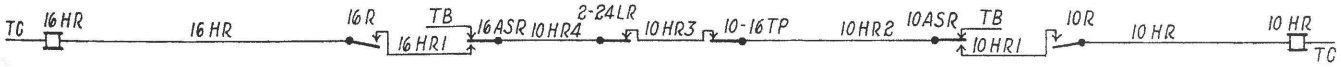
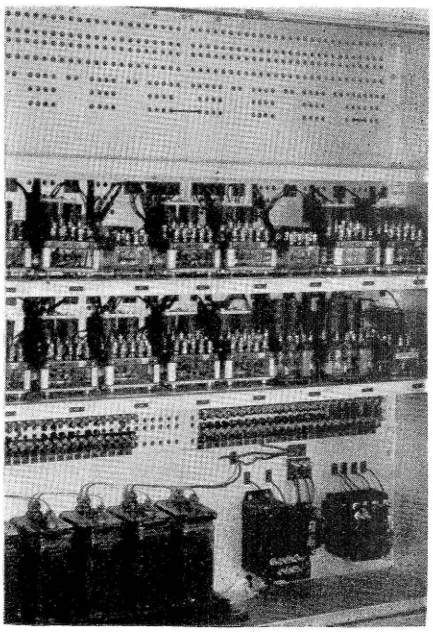


Fig. 7—Control circuits for Frisco Signals 16HR and 10HR

Control of Signal Relay 10HR

When 10R picks up, a circuit is broken in the approach-locking circuits, Fig. 6, to release approach stick relay 10ASR. Referring to the signal control circuits in Fig. 7, and keeping in mind that relay 10R is up and 10ASR is down, a circuit is complete to energize relay 10HR which causes Signal 10 to display the Clear aspect.

Controls for the routes starting with the ten signals mentioned previously are practically the same as the controls for signal No. 10. Controls for signals No. 2 and No. 4, however, include additional features because in



Instrument case at a signal

directly switch No. 3 also, to be placed in the reverse position, providing they are not already there. The energization of 2PBS causes the signal control relays to be energized to display a proceed aspect on the second "arm" the WR relays to operate the switches; next the route relay R is picked up if the route is complete; and finally the signal control relay HR is picked up. Opposing signals are locked out when the PBS relay picks cabinet is equipped with a tight-fitting, dust-proof, rear cover.

For inspection, each push-button unit, including the two lamps for indications, the contacts and attached wires, can be pulled out through the

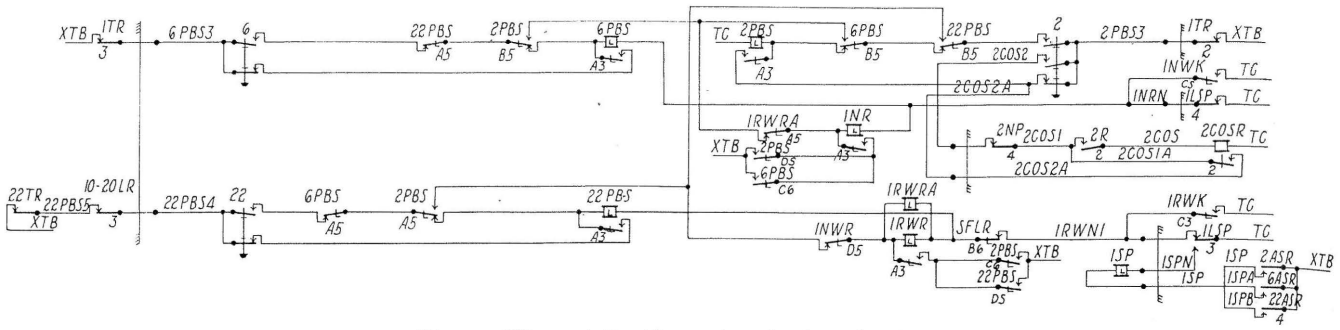


Fig. 8—Missouri Pacific route-selection circuits

of signal No. 2, similar to the circuits previously explained for signal No. 10.

On the other hand, if after operating push-button No. 2, the push-button No. 6, rather than No. 22, is operated for a westward route on the east-and-west line, then a circuit as shown in Fig. 8 feeds through a contact in push-button No. 6, through a contact in 1RWRA, the reverse switch relay, to energize relay 1NR and complete the connection through to common. The other selections are not discussed here because the purpose of the explanation is to show the system of selections when a facing-point switch is involved in a route. When 1NR picks up, it controls switch relay 1NWR, which causes switch No. 1 to be moved to the normal position, but does not affect the control of switch No. 3. After switch No. 1 is normal, controls to display a proceed aspect on the top arm of signal No. 2 are completed in a manner to that which has previously been explained.

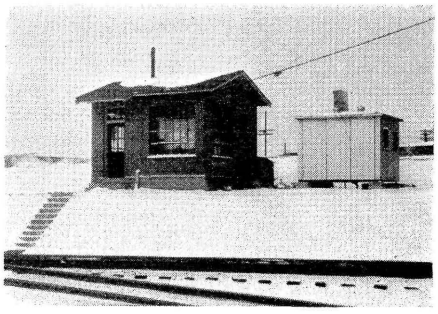
A Summary of Route Control

A summary of the push-button type of UR interlocking, as used at Tower Grove, compared with lever-type plants with mechanical locking shows that in this route control circuit arrangement of interlocking, operation of the first button for a route initiates a circuit to check whether conditions are correct for a route to be set up starting from the point represented by that button, and if so, the corresponding PBS relay is picked up; energization of the PBS relay locks out the PBS relay for control of opposing signals on track lineups leading to the button first pushed; then the pushing of the departure button causes an RR relay to be picked up which energizes the proper NWR or RWR relay and they in turn control up. Signals for conflicting routes and switches for conflicting routes are locked out when the the R relay picks up. The switches in the route are locked in proper position for the route set up by the release of the LSR relays. After a train enters an approach section, standard approach locking is in effect. Detector and route locking is effective by direct control of the WR switch control relay, controlled through the LSR switch locking relay.

Control of Call-On Signals

The extra "push" contact on the push-buttons for the M.P. high home signals are for the controls of the "call-on" aspect displayed in the two-aspect third "arms" on these signals. When switches for a route are properly positioned and no conflicting route is set up, but certain track circuits within home signal limits are occupied, a "call-on" aspect can be given by pushing the entrance button a second time.

The relays used for the control of indications on the machine, for push-button stick route selector and route locking relays, are all of the Style LP53 type arranged for "plug-in" mounting, and are housed in the cabinet of the control machine, as shown in an accompanying illustration. This



Control station and instrument house

rear of the panel. One of the illustrations show a man holding one of these push-button units in his hand. Likewise each track-indication unit including two lamps can be removed for inspection.

The standard DN-11 relays for control circuits, the TH-10 thermal time-element relays, copper-oxide rectifiers and storage batteries, which are associated with the circuits at the control station, are located in an 8 ft. by 10 ft. sheet-steel house located a few feet north of the control station. An interesting feature is that a piece of 1½-in. pipe 2 in. long was placed over each anchor bolt, between the top of a foundation and the bottom of the house, which prevents the accumulation of moisture and deterioration of the metal. To have provided space in the control station for the apparatus in this house would have required a larger brick building or perhaps a second story which would have cost more than the steel housing. Use of the steel house for this purpose permitted the interior wiring to be done prior to the completion of the brick building, thus expediting the construction work. If at a later date, track changes, new grade separations, or rerouting of trains make it necessary to eliminate the interlocking, the steel housing can be utilized elsewhere, whereas equivalent construction in a brick building would be practically a total loss. In the vicinity of each group of signals and switches, large-sized sheet steel instrument cases are provided to house the instruments. The batteries are located in concrete boxes.

Switches Well Constructed

The two junction turnouts on the M.P. are No. 10, with 15-ft. switch points. Insulated gage plates, 1 in. by 9 in., together with adjustable rail

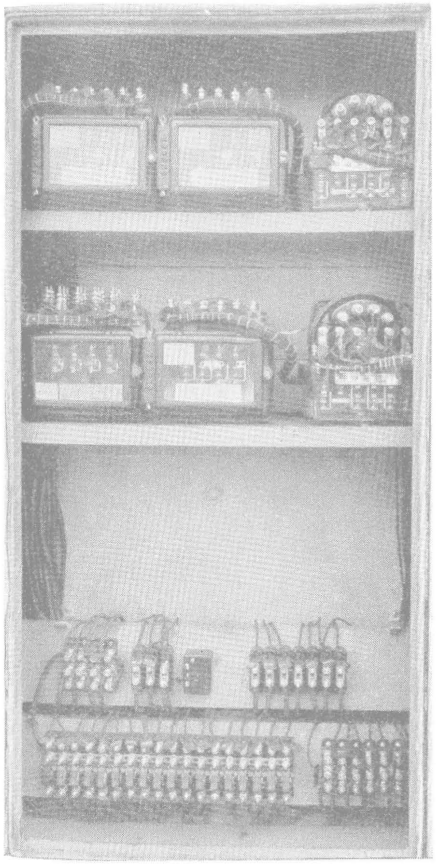
(Continued on page 271)

in the center position, and are operated to the L or the R position to clear the respective signals. Electric locks on these levers prevent the levers from being placed full normal until the corresponding signal assumes the Stop aspect. Indicators on the panels above the lever repeat the Clear aspect of the signals. The two switch levers operate to two positions. By means of electric locks on these switch levers, complete approach, route, and detector, electric locking is provided.

An illuminated track diagram on the wall reproduces the track and signal layout with track indication lamps repeating occupancy of the track circuits in the home signal limits and on the approaches.

Yard Track Indicator

The yard track indicator, as shown in one of the illustrations, consists of a metal case with six separate compartments, each containing an electric



Instruments at signal

lamp. As only five yard tracks are now in service, the sixth lamp is a spare. The east face of each compartment is covered by a panel, with a figure cut out of the metal, and backed by white glass. Any one of the six figures can be illuminated, and, when so lighted, can easily be seen day or night by the engineman and head brakeman of an incoming westbound train when entering the yard entrance lead track.

The six track indication lamps are each controlled by a two-pole, single-throw toggle-type electric switch, which is mounted in a row on a panel just below the interlocking desk levers. All of the switches are normally in the DOWN position. To cause lamp No. 1 to be lighted, the toggle switch No. 1 is thrown to the UP position, and the operation is the same for the remainder of the lights; no two switches, however, are to be in the UP position at any one time. Two positive connections from a split secondary 110-volt transformer extend through a combination circuit in contacts of these switches, and two wires extend to the field location where two 110-volt three-position a-c. polar relays are controlled by these wires, with connections to common, which is the center connection to the split secondary. Circuits through contacts in these relays feed the lamps in the yard indicator. Relay A poled to the left and relay B de-energized, causes lamp No. 1 to be lighted; relay A poled to the right and relay B de-energized, lights lamp 2; relays A and B both poled to the left, lights lamp 3; relay A poled to the left and B to the right, lights lamp 4; both poled to the left, lights lamp 5; and relay A to the right and B to the right, lights lamp 6.

The control and operating circuits throughout the interlocking installation are of the a-c. type. Kerite insulated wire and cable is used, and the low-voltage arresters are the G.E. Thyrite type. The installation was planned and installed by the signal forces of the Southern Railway, and the major items of equipment were furnished by the General Railway Signal Company.

Route Type Interlocking

(Continued from page 268)

braces, are used on the first three ties under the points as well as on the tie ahead of the point, and, on the tie last mentioned, rail braces are used also on the gage side to prevent "rolling" of the stock rails. The gage plates on two ties extend and are attached to the switch machine to prevent lost motion.

The derail on the St.L-S.F. switching track is the split-point type with standard tie plates and rail bracing. Each of the two switches and the derail is operated by an M-2 electric switch machine equipped for operation on 24 volts. A switch will operate from one position to the other in about 16 sec. The standard arrangement of lock rods is used on each machine.

Power Supply System

The two machines on switches No. 1 and 2 are operated from two 12-cell sets of storage battery in multiple, and derail No. 13 is operated by a 12-cell set of the same type. The M.P. color-light signals are normally fed from the a-c. supply, but, in case of an a-c. outage, they are fed from storage battery. Signals No. 10, 12 and 14 are fed from 5 cells of the storage battery at the derail location. Signals 2, 4 and 6, in case of power outage, are operated from 5 cells of the switch operating storage battery at the junction. A separate set of 5 cells of storage battery of the same type is provided for operation of signals No. 22 and 24 in case of power outage. A set of 5 cells at the control station feeds relays, and signal No. 8 in case of power outage, and also acts as standby for the indication lamps on the control machine which are normally fed a-c. The normal load on this battery requires a constant floating charge of 2 amp. The battery leads extending to the control machine include 5-amp. fuses which are provided to protect high currents from damaging the wiring in the machine. The storage batteries are of Exide manufacture, the DMGO-9 type being used for the switches and the DMGO-7 for other purposes. Each track circuit is fed by one cell of Edison 500 a.h. primary battery, with an RTA rectifier floated across the battery.

Wiring Distribution

The wiring distribution over the plant is in underground cable buried at least 18 in. below the surface. The cable which has no metal in the protective covering but has an outer covering known as "mummy" finish, was furnished by the Kerite Insulated Wire & Cable Company. For control circuits the conductors are No. 14 copper, and for battery circuits, No. 9. Also, No. 9 conductors are used for connections from instruments or batteries to track connections using Union bootleg outlets and stranded Copperweld rail connections. The 110-volt a-c. circuit is distributed over the plant in No. 12 two-conductor underground cable.

This interlocking was planned and installed by the signal department forces of the St. Louis-San Francisco under the direction of R. W. Troth, acting signal engineer, the major items of equipment being furnished by the Union Switch & Signal Company.