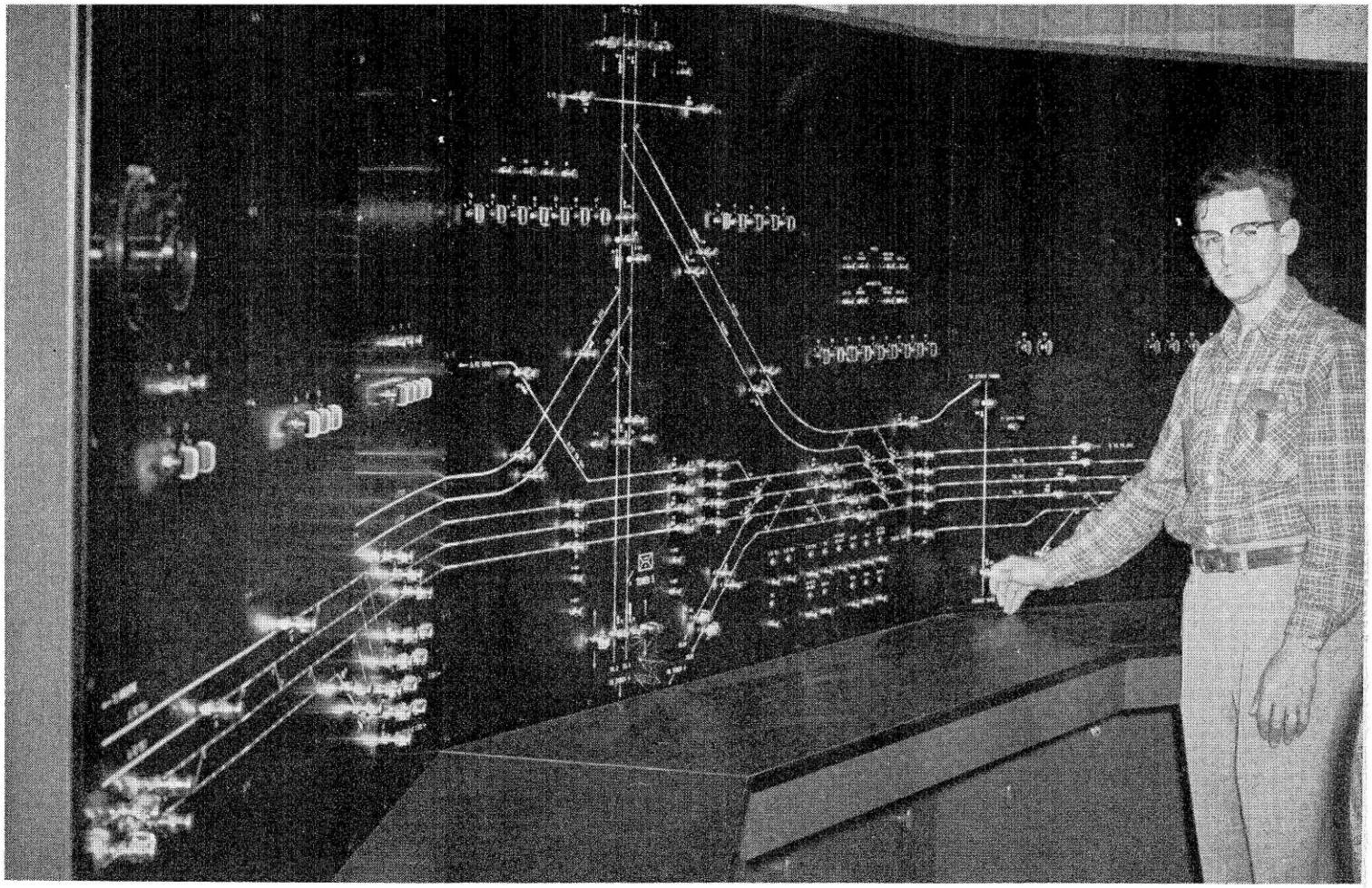


New Three-Track Interchange Includes . . .

Interlocking and Talk-Backs

Transfer moves and service to industries are being expedited by new track arrangement, power switches and signals in large interlocking, including special communications facilities

A MAJOR PROJECT, known as the three-main-track-interchange, and including important new interlockings and unique communications facilities, is now being pushed toward completion in an extensive area on the Kansas City Terminal Railway.

Kansas City is served by main lines of 12 railroads: AT&SF, Burlington, Great Western, Milwaukee, GM&O, KCS, MKT, MP, CRI&P, Frisco, UP and Wabash. A large percentage of the interchange movements between these roads must pass through the Kansas River valley area, which includes yards of some of the roads, as well as numerous industries, large stock yards and packing plants.

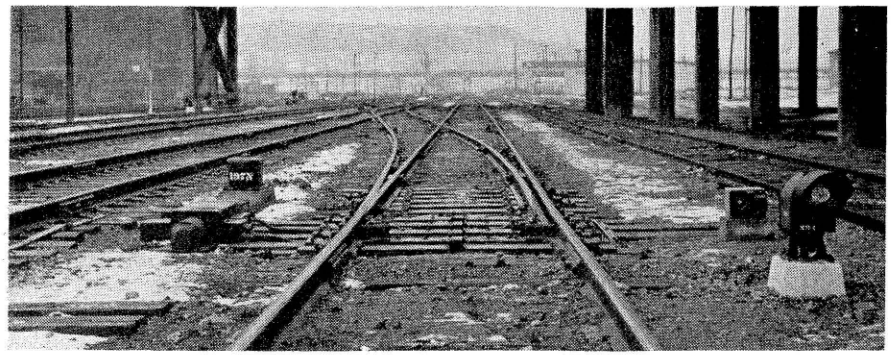
Santa Fe Junction Was Interlocked

The previous No. 3 interlocking, controlled from old tower No. 3 as shown on the track plan, included the railroad crossing just north of this old tower and the two switches west of the tower, as well as four single switches, five crossovers and home signals southwest of this old tower, in the area marked Santa Fe junction, all of which is now included as part of the new interlocking No. 3. A study conducted some time ago revealed there were an average of 524 conflicting moves in this territory in a 24-hour period.

The Santa Fe has six tracks extending southwest, and the tracks extending off the lower part of the plan go about 1.2 miles to the Union Station, and on east through the city. Santa Fe trains to and from the west are routed over these tracks, a total of 28 passenger trains and about 24 freight trains passing through this junction daily.

Area North of Tower

The new interlocking tower No. 3 is just across the track north of old tower No. 3. Previously there was a non-signaled double-track main northward from old tower No. 3. In this area there are no through train movements, all operations being switching moves to serve industries, or transfer moves to deliver cars to yards of connecting railroads. In this area there was no interlocking before, and hand-throw switch stands were in service at all main track switches and cross overs. One group of these switches, in the area marked Chicago Junction, was operated by switchtenders, on duty 24 hours daily. The remainder of the switches were thrown by switch crews as required when making moves. Conflicts between transfer moves caused extended delays, which were intolerable in present-day railroading. For example, Union Pacific perishable trains arriving from the west at 5:30 am include cars which must be delivered by 7:00 am to the Wabash



MAIN TRACK SWITCHES are interlocked

yard to the north across the Missouri River. In too many instances the transfer crews encountered such delays that the connection was missed. Similar situations applied concerning numerous other transfer moves, as well as deliveries to stock yards and industries. Therefore, major improvements were required to reduce the useless delays to transfer and switching crews.

The Solution of the Problem

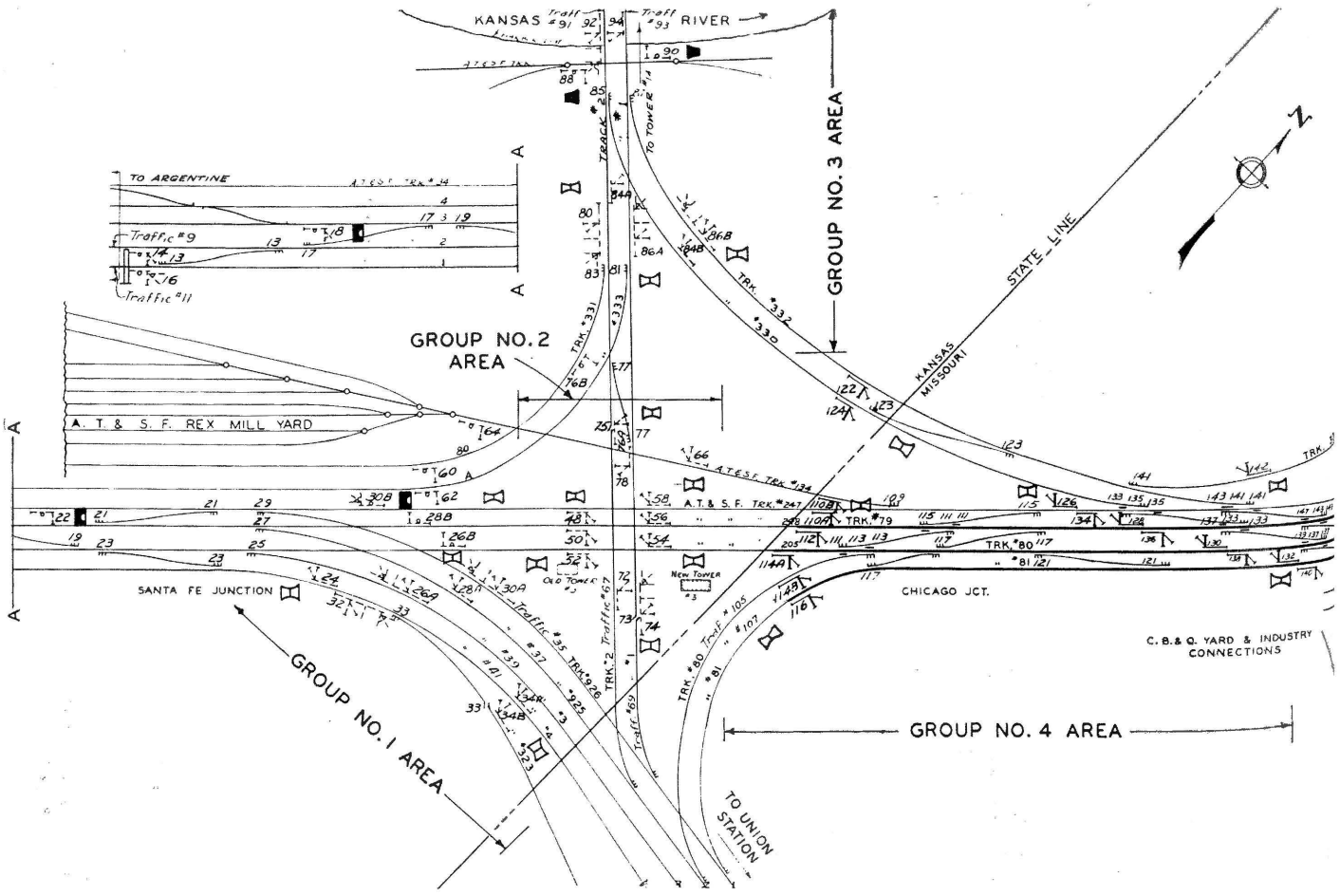
A major item of the project was to extend another through track, making three running tracks on the 2.3 miles north from Tower 3, to a point from which some lines extend on east, and others extend across the Missouri river. The new interlocking, known as Tower 3, now controls not only the Santa Fe junction and crossing, but also the main track switches throughout the territory northward for 7,850 ft. Beyond this interlocking, to the north is a second area to be included in an interlocking now being built to be known as Tower 2. The following discussion applies to the area included in new interlocking No. 3, which is typical of construction to be used also in interlocking No. 2.

It's a Big Interlocking

The new interlocking No. 3 includes an extensive area involving 48 single switches, 3 derails, 14 double slip ends, 8 movable-point frogs and 90 signals. Trains or switching moves can enter this plant at 30 different home signals. Most of the signals govern over more than one route, and some signals govern as many as eight routes, so that a total of 205 different lineups can be established in this interlocking. In numerous instances, separate routes can be in use simultaneously.

Route Control Interlocking

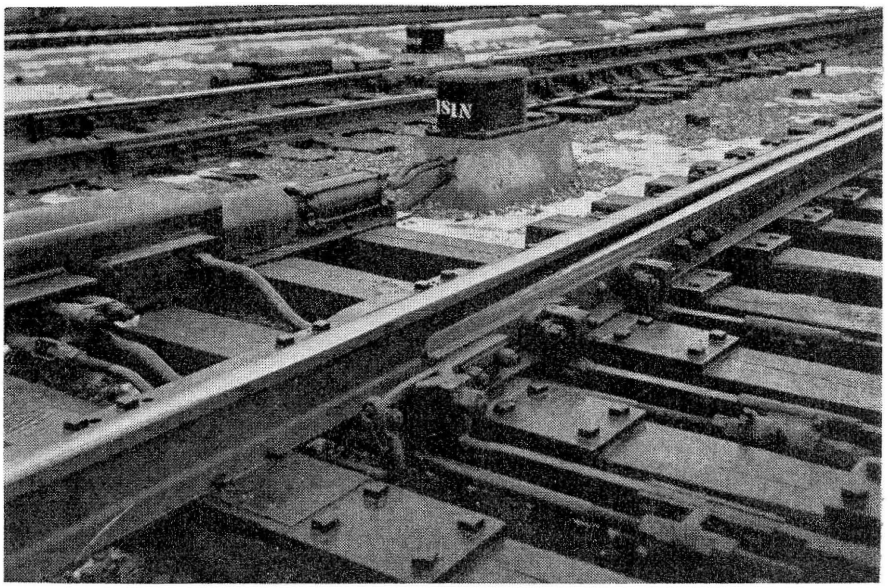
To control this extensive interlocking efficiently from one tower, the Kansas City Terminal decided to install a "UR" route control pushbutton interlocking system. The surface of the control panel is nonreflecting black Formica. Each track is represented by a line which consists of slots ⅛ in. wide and 1 in. long, placed end-to-end about ⅛ in. apart. Behind each slot are translucent plastic pieces, backed by units containing two lamps with color filters. Thus each slot can be illuminated different colors, and these lights can be flashed to indicate certain conditions. On the line representing each track, and at the location corresponding with each home signal, there is a pushbutton which represents that signal. To line up a route, all the towerman has to do is to push two



buttons, the first of which is the button representing the home signal for the track on which the train is approaching, and the second button at the place on the diagram representing the track and location at which the train will depart from interlocking limits.

When the first button is pushed, all possible exits are indicated by white illumination in a 1-in. line-of-light section at the exit button at each possible exit, and the lamp at the entrance signal is lighted red. When the towerman pushes the exit button, all the white exit indications are extinguished except the one at the exit button that was pushed, and controls go out to control the switches. While each switch is in transit, the sections of line-of-light, which represent that switch, are flashed red until the switch is over and locked. When all switches are in proper position, the signal clears and is indicated by a change from red to green in the signal indication lamp at the entrance signal, and also the established route is indicated by white continuous line-of-light sections for the entire route.

When the train accepts and passes the signal, the signal indicating light is extinguished and the track occupancy is indicated by sections of line-of-light changing from white to red. When the rear of the train clears each track circuit, the corresponding section of line-of-light goes dark. After the train departs, no action by the towerman is required to restore the plant to normal, the switches being left in the position where they are until a change is called for when lining up another route.

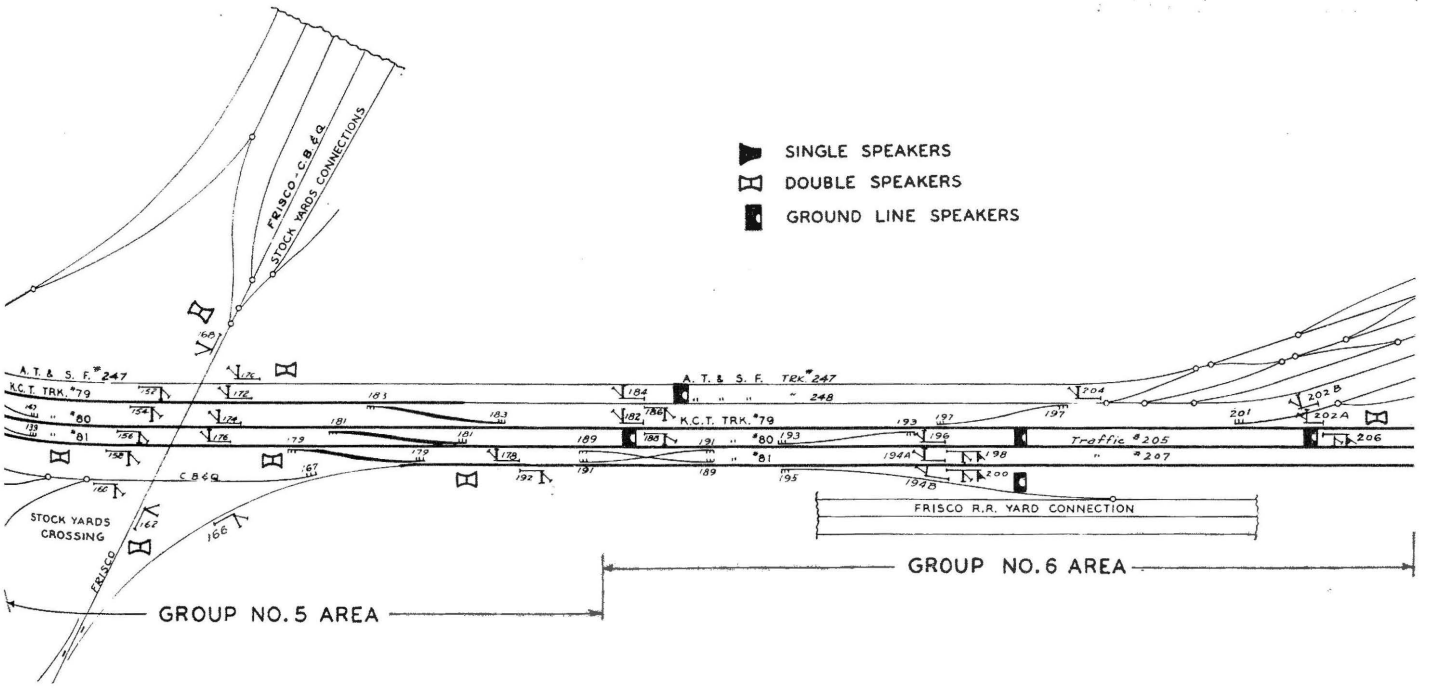


SWITCH LAYOUTS are well built

Through Routing

Because of the complexity of this track layout, a route from any of the entering home signals to any points within the interlocking and vice versa, and in some instances the departure from the far end of interlocking limits, may include several intermediate home signals on the way. For example, a route from entering home signal 92 to 74 would also include interlocking signals 80 and 78. However, in such an instance the towerman lines up the entire route by pushing only two buttons, 92 and 74. When the control is complete all three signals, 92, 80 and 78, will clear. This is known as through routing.

Further because of the complexity of the layout, it is possible to have a move from one point to another point via more than one route. In these situations, the control is arranged to automatically select the most preferred route. If conditions do not permit this route to be lined, the alternate preferred route is auto-



SWITCHES AND SIGNALS shown dotted in this plan were part of old No. 3 interlocking, and are now included in the new No. 3 interlocking. Switches and signals in the entire six group areas are now controlled from one machine in a new Tower No. 3

matically selected. This is known as preferred routing.

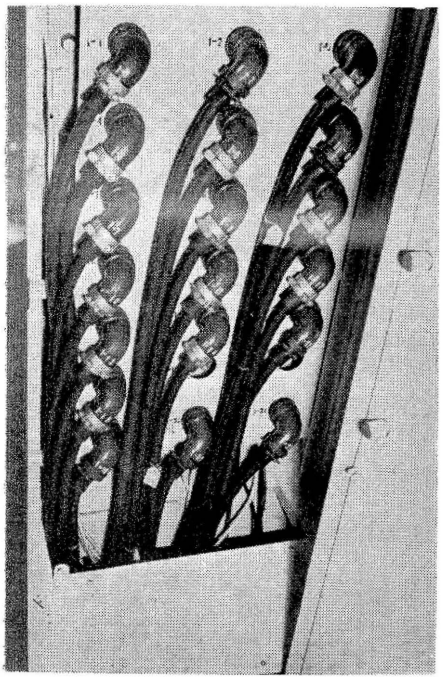
If a route, that has been lined up, is to be cancelled, the towerman pulls the signal button. This extinguishes the green light in the symbol representing the signal, but the amber line-of-light sections, for the route as a whole, remain lighted until the electric time locking is released. Route locking with sectional release is provided. If the track circuit control limits for an interlocking signal are occupied, as for example when setting out or picking up cars, and the leverman wants to clear a call-on aspect to direct an engine to return to its cars, the leverman operates the entrance and exit buttons as usual, then pushes a special call-on button, numbered the same as the signal to be cleared. These call-on buttons are in a row at the top of the panel. The call-on is available on the principal entrance home signals and on certain other signals where needed, there being a total of 15 signals so equipped and controlled.

On the control panel, in a location above the lines representing tracks, there is a horizontal row of three position push-turn levers, one each for every switch and crossover. These levers are for direct control of the corresponding switches when the maintainer is testing or adjusting the switch. These levers must be in the center position to return the controls to the route control system.

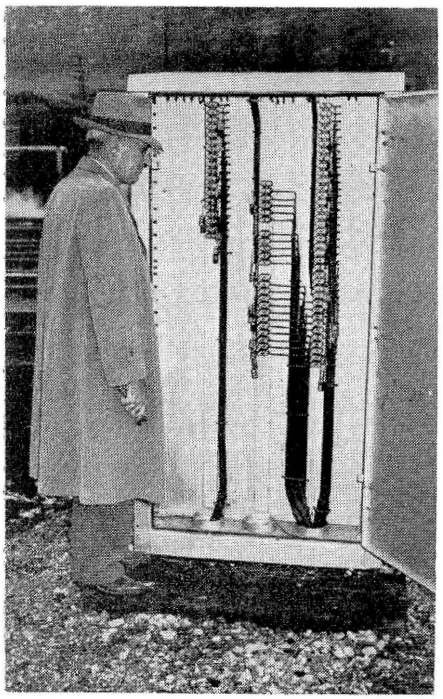
The relays for controlling the numerous indications on the control panel are the Style LP-70. Separate large sheet-metal cases were located immediately to the rear of the machine to house these relays. All relays for signal control, switch control, route locking, switch locking and associated circuits are of the PN-50B plug-in type. These relays are mounted on racks which are located in the room below the control machine. The track circuits are the a.c. type, using SLV-13 relays. The track relays are located in instrument cases, and repeater relays are located in the tower. Likewise the switch and signal indication relays are located in the tower. Thus all circuits except for the control of switches and signals are contained in the tower.

The switch machines are the A-5 electro-pneumatic type with CP valves. The signals are the searchlight type. Single-conductor No. 9 buried cable runs from cases to bootleg outlets at the rail. For longer runs, over 100 ft. in length, No. 6 is used. The control circuits going out from the tower to signals and switches are No. 14 wire in cables ranging up to 61 conductor.

The various control circuits in the tower are fed by a plant battery consisting of eight cells of Exide lead storage battery rated at 240 a.h. Indication circuits are fed by a set of eight cells of 120-a.h. battery of the same type.



PLUG-CONNECTED machine cables



VIRGIL DRYER inspects wire

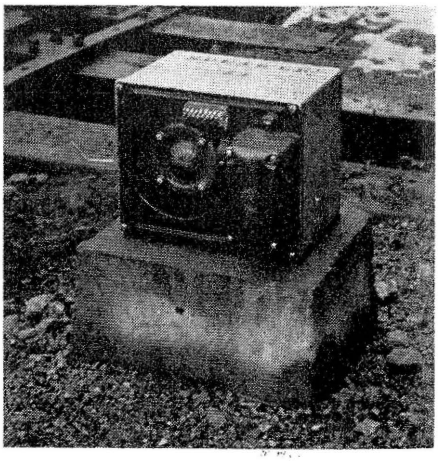
This Interlocking Includes Talk-Back Loudspeakers

In the previous layout with hand-throw switches leading to transfer connections and industries, the various switch crews "worked their way" through this area "on sight." When planning the new interlocking with all main track switches and crossovers power operated, and every train and engine move to be authorized by a home signal, there was an obvious need for some means by which the towerman could know (1) when each crew is ready to move; (2) from what entering home signal; and (3) to which exit. This need was met by installing a complete system of talk-back loudspeakers, connected to a console on the interlocking towerman's desk.

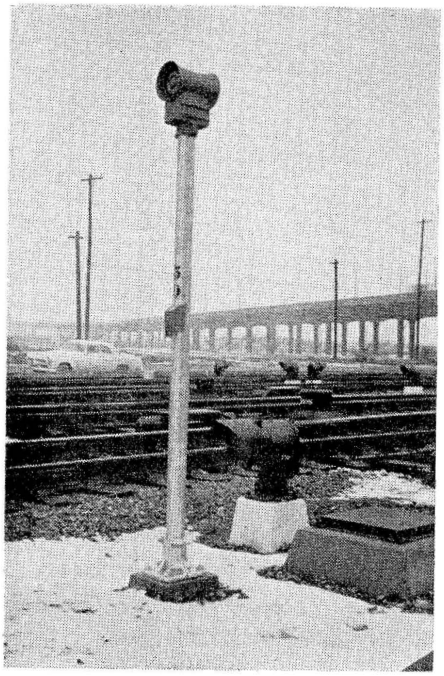
The talk-back speaker system is also used extensively by the signal maintainers when adjusting switch movements, testing wires and relays, etc. In most cases the maintainer can carry on a conversation with the tower operator without leaving the movement he is repairing. The system also enables the tower operator to contact the maintainer anywhere in the plant at once to give him information regarding failures, etc.

The project includes a total of 38 talk-back speakers which are located at various places throughout the interlocking area, usually near home signals, or at other places along switch leads where switch crews or transfer crews may want to tell the towerman who they are and where they want to go. At 28 of these locations there is a pair of loudspeakers, one faced each way, and this pair is on a 3-in. pipe mast 8 ft. high in a cast iron base on a concrete foundation. Because of limited area between tracks at nine locations, there is no space for loudspeaker masts, and therefore, at these places, the loudspeakers are the so-called dwarf type.

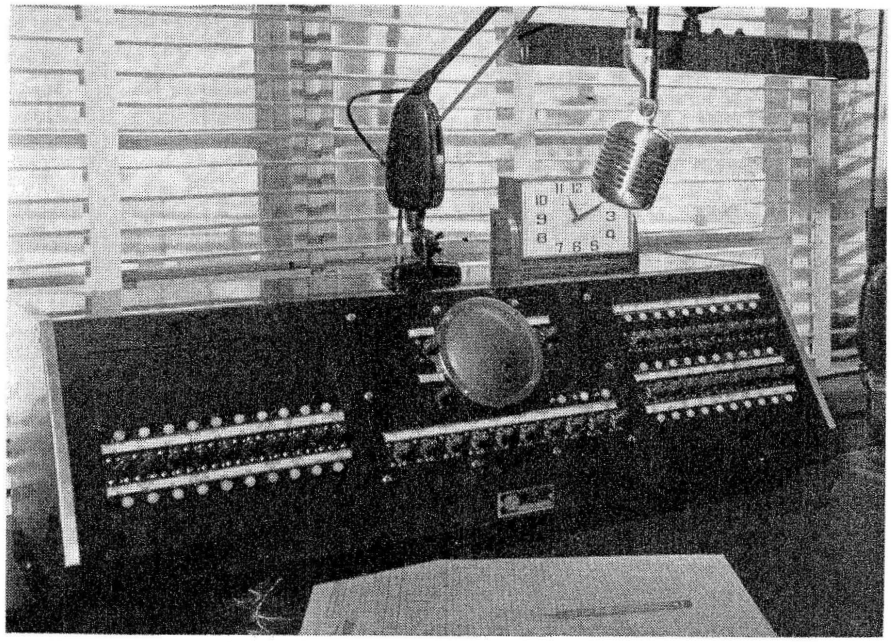
When the towerman, seated at his console, wants to talk to a crew which is in the general vicinity of a certain talk-back loudspeaker, he operates the key corresponding with



DWARF TYPE loudspeaker



MAST-TYPE loudspeakers



COMMUNICATIONS CONSOLE on leverman's desk, is connected to 38 talk-back loudspeakers at signals where trains enter interlocking limits

that loudspeaker; steps on his foot switch, and speaks into his microphone. His call is reproduced by the corresponding loudspeaker. Then he removes his foot from the foot switch. Any of the crew, within a range of 50 to 75 ft. of the talk-back loudspeaker, can answer without approaching any closer. If the towerman receives no answer from the crew he is calling, he can assume that they are not within range of the speaker. Therefore, he throws a key which connects the outgoing circuit to several more speakers in the same general area, so that by this group paging he can call the crew he wants, and receive an answer. For this group paging and answering, the loudspeakers are in six different groups. The remaining 4 talk-backs in the Santa Fe Junction area are not connected for group paging.

Incoming Calls

If any one in a crew wants to talk to the tower, he goes to the nearest talk-back loudspeaker, and pushes the button on the pipe mast. (On a dwarf speaker he steps on a foot switch.) This causes a buzzer to sound in the tower, and, on the console an indication lamp is lighted above the key corresponding to the talk-back from which the call is being made. Then the towerman throws that key; steps on his foot-switch, and speaks into his microphone to answer the call. The purpose of the foot switch is to connect the amplifier for "outgoing" or "incoming" use. The talk-back communications equipment including loudspeakers, control console, amplifier apparatus and relays, were furnished by the Electronic Communication Equipment Company, Chicago.

The circuits from the tower to junction boxes near the various loudspeakers are on No. 19 copper wire in cable, which ranges from 6 to 26 pair. From the junction boxes to each talk-back loudspeaker location the circuit is in a two-conductor No. 16 cable. These cables are made up with individual plastic insulation and with overall covering consisting of waxpaper, copper tape shielding, and an outer jacket of polyethylene. This cable can be buried in the ground or run aerially. The copper shielding is grounded, thus preventing cross-talk. When a switchman pushes a "call" button at a talk-back speaker, a button contact grounds both wires in the pair, thus forming a circuit to energize a stick relay in the tower which closes the circuit to sound the buzzer and light the corresponding indication lamp, as previously explained.

The trenches for cables for communications as well as signal circuits on the interlocking were dug by a machine mounted on a jeep. The trench machine was made by the Auburn Machine Company, Auburn, Neb., and the snow plow blade mounted at the front for filling the trenches was made by the Meyer Snow Plow Company, Cleveland, Ohio.

The original study and plans for the three-track interchange project were made by a committee consisting of representatives from the operating, engineering and signal departments of the 12 railroads which own the Kansas City Terminal Railway. The entire project, including track work, interlocking and communications facilities has been constructed by Kansas City Terminal Railway forces under the direction of A. R. Shaw, president, and

POWER DITCHER saved time

Thomas W. Avery, chief engineer. W. M. Peters, signal engineer during the construction of this interlocking, has retired. Virgil Dryer, who designed the field circuits is now signal engineer. W. R. Hossman is superintendent of construction, and E. L. Henzlik is supervisor of communications. The major items of signal and interlocking equipment on this project were furnished by the Union Switch & Signal Division of Westinghouse Air Brake Company.