New Automatic Block on

Modern arrangements of signals at sidings, efficient use of flood-detectors, and protection by motor-car indicators, are some of the features of projects on 139 mi. in Texas.

THE Missouri-Kansas-Texas has recently completed installations of automatic block signaling on 96.4 mi. of single track between Denison, Tex., and Bethard, near Dallas, and on 42.2 mi. between San Marcos, Tex., and Benz, which is nearSan Antonio. With the completion of these two projects, signaling is now in service on the Katy route from San Antonio north through Dallas and to Kansas City, 729 mi. East of Parsons, the Katy has another main line to St. Louis, parts of which are now signaled and the remaining portions are to be so equipped as soon as practicable.

Referring to the accompanying map, the Katy operates over two lines between Denison, Tex., and Hillsboro —one line being via Greenville and Dallas, and the other via Denton and Ft. Worth. Much of the through freight to and from points south of Hillsboro is routed via Ft. Worth. The through passenger trains and the freight to and from Dallas and other points locally are routed over the line via Dallas. The traffic on the newly signaled section between Denison and Dallas includes six passenger trains, four through freight trains and a local freight each way daily except Sunday. Extra trains are operated as required, so that the average number of trains daily may vary from 10 to 15 or more.

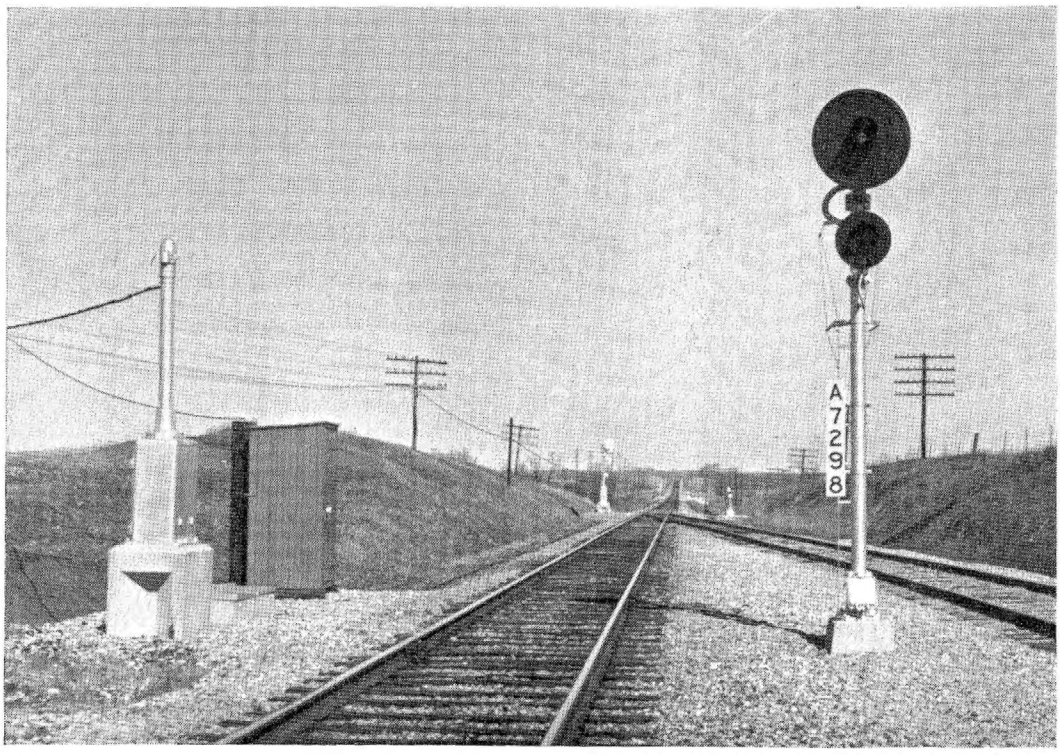
Rolling Country

Between Denison and Bethard, the railroad crosses rolling country except that there is an extended level area in the vicinity of Greenville. For the most part, therefore, the railroad line has numerous rolling grades, the maximum grade being 1.46 per cent ascending for 5 mi. between M.P. 66.5 and M.P. 661.5. Curves are frequent, but few are sharp enough to require trains to reduce speed. The maximum permissible speed is 75 m.p.h. for passenger trains operated by Diesel-electric locomotives; 70 m.p.h. for passenger trains operated by steam locomotives; and 45 m.p.h. for freight trains.

Interlockings and Sidings

An electro-pneumatic interlocking is in service at the crossing of the Katy and T. & N. O. at Leigh (Denison). Electro-mechanical interlockings are in service at crossings with the Texas & Pacific at Bells, and the Santa Fe at Celeste. Also automatic interlockings are in service at crossings with the Cotton Belt at Whiterwright and Greenville, and Santa Fe at Garland. Sidings ranging from 40-car capacity to 100-car capacity are located at 15 towns between Denison and Bethard, and there is a yard at Greenville. Thus, sidings are spaced an average of 5.8 mi., with a minimum of 3.2 mi. and a maximum of 7.0 mi.

The signals are located and controlled in accordance with conventional absolute permissive block practices. At each end of every siding,



The new automatic block signals are located so that no changes would be required when changing to C.T.C.

the Katy

the station-leaving head-block signal is immediately at the right of the main track and is opposite the fouling point of the turnout. Accordingly, at one end or the other of every siding, the siding track was thrown over to 20-ft. centers so that the signal could be located between the siding and the main track. In this respect, these signals are located properly to be included in centralized traffic control, if added later.

Where the distance between sidings is less than 6 mi., as for example

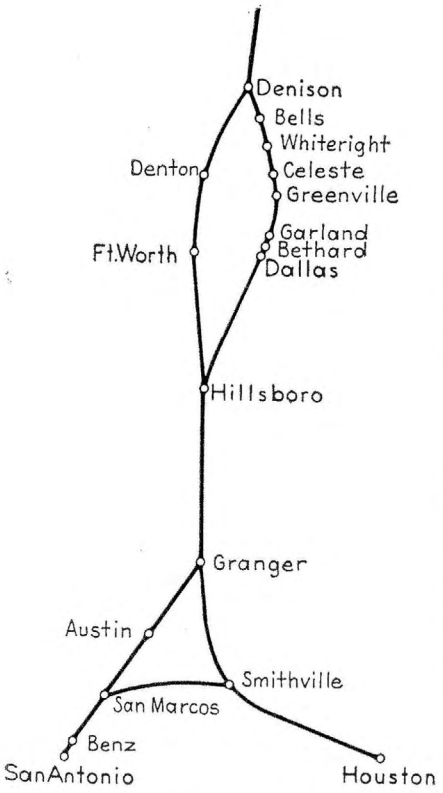


Fig. 1—Map of Katy main lines in Texas showing sections recently signaled

4 mi. between Rowlett and Garland, there are only two sets of intermediate signals. Where the distance between sidings is up to 7.8 mi., as for example between Caddo Mills and Roise City, there are three sets of intermediates. The first automatic block out from each head block is about 1.5 mi. to 1.8 mi. and, therefore, the "middle" automatic block may be up to 3.5 mi. The shorter block adjacent to the sidings gives a train a better chance to get in the clear of a following train that is to pass.

Each signal is equipped with a light-out unit which saves train stops in case of a failure of the lamp in the searchlight signal

Searchlight Signals

The signals are the H-5 searchlight type. These signals are on masts with the center of the lens 14.5 ft. above the level of the top of rail, and are at the immediate right of the track governed. On the mast of each signal and 2.5 ft. below the center of the lens of the searchlight signal, there is a single lamp known as the emergency or "light-out" unit. This unit has a yellow glass, and the lamp in this unit is normally dark. If the lamp in the searchlight signal is burned out and the spectacle is positioned for either yellow or green, then the lamp in the "light-out" unit is lighted. The control of the lamp in each "light-out" unit is through a back contact of an 0.08-ohm DN-22 relay which is in series with the filament of the lamp in the searchlight signal. The use of these "light-out" units eliminates train stops and delays if signal lamps are burned out.

The searchlight signal-operating coils, rated at 250 ohms, are connected directly to line circuits thus avoiding the use of line relays. Each signal mechanism is repeated by a 500-ohm slow-acting repeater relay. The stick relays for securing directional control for following trains are the 500-ohm slow-acting DN-11 type. The track relays are the 4-ohm DN-11 type. Separate two-wire line circuits are used, one for each direction, thus avoiding the use of common wires. The signal mechanism and all the relays are equipped with plug couplers which facilitate making replacements.

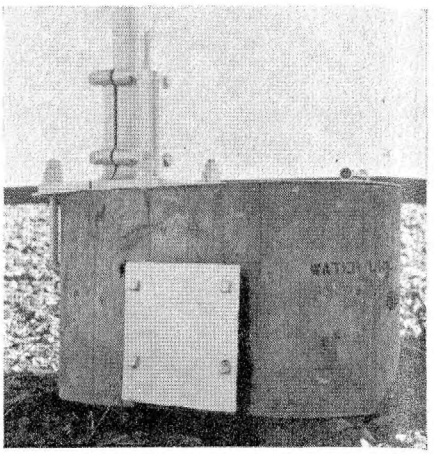
Flood Detectors

This territory is subject to heavy local rain storms that cause flash floods in small streams, which have resulted in hazardous conditions on the railroad, without knowledge to the track forces or other railroad employees. For this reason, as a part of the new signaling, flood detectors were installed at nine locations on the 94-mi. territory. Some of these detectors are located where flood damage had occurred previously. Others were placed at locations according to calculations based on the area of the water shed, direction of stream near the right of way, size of bridge opening and other local factors. The detectors are located on the railroad right-of-way at a level at which flood water might cause damage to the embankment, ballast, track, bridges or trestles.

Each detector includes an air-tight float made of sheet copper. This float operates in a hollow concrete chamber which serves also as a foundation for the post on which the controller case is mounted. Holes through the foundation wall, near the ground line, permit the ready entrance of water. The float is on a lever, so arranged that when water rises, the lever raises an up-and-down rod extending up through the pipe post to operate the controller in the case. Having once operated to open the controller contacts, the controller sticks open mechanically, and remains open until restored by the signal maintainer.

The operation of a flood detector controls, to the red aspect, the first automatic signal each way governing toward the detector location, and the second signals are controlled to the yellow aspect. Special controls are used to prevent cascade knock down of signals all the way back to the next siding. For example, as shown in Fig. 2, when high water operates the flood detector 7290, it opens the line circuit for northbound station-leaving signal 7298. However, a special relay is required to control southward signal 7281 to set it at the red aspect without also cascading, to the stop aspect, the remaining southward signals all the way to the next siding. As shown in Fig. 2, when the detector is operated by rising water, it opens the line circuit for signal 7281, but connects this line circuit to an extra line wire which extends to a special relay FR at signal 7281.

When searchlight signal 7281 goes to the red position, its repeater 7281P is released, and a back contact of this relay completes the circuit to energize the flood relay FR. A front contact of this FR is connected in parallel with the front contact of the stick relay to feed the line circuit for the signal in the rear, thus controlling that signal to the yellow aspect. When a train reports flood conditions or red signals, the maintainer is called. After inspections have been made by track forces, the signal maintainer restores the flood detector to normal positions.



Flood detector float is in this base which serves also as the foundation

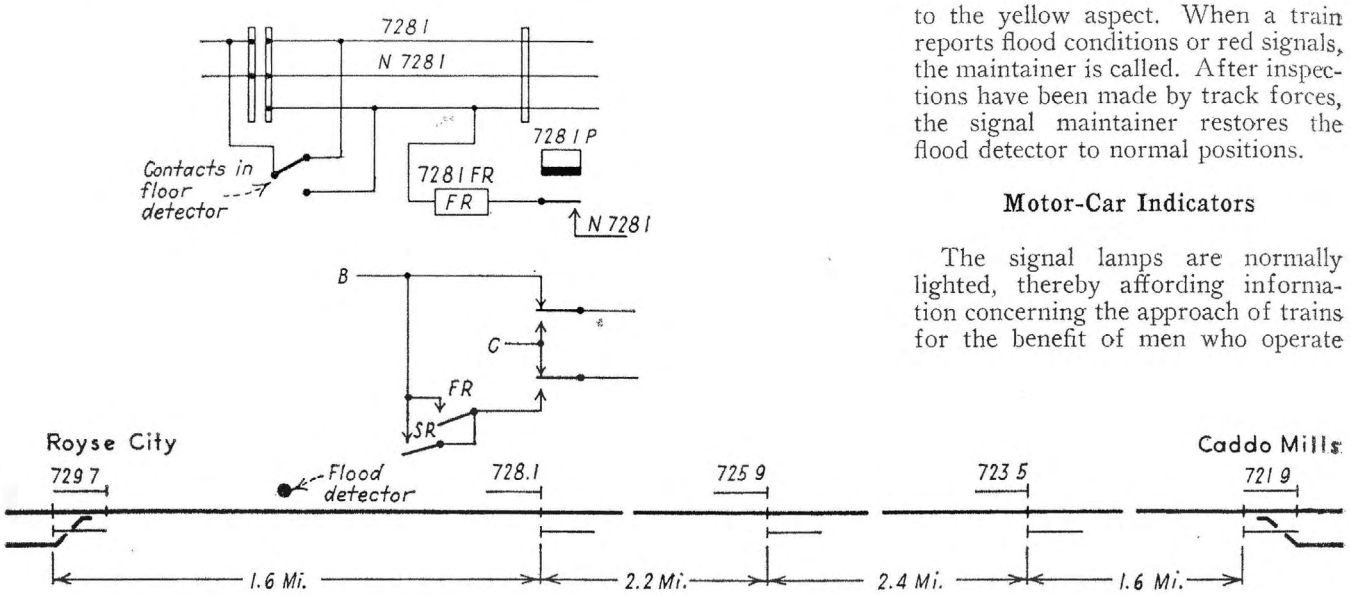


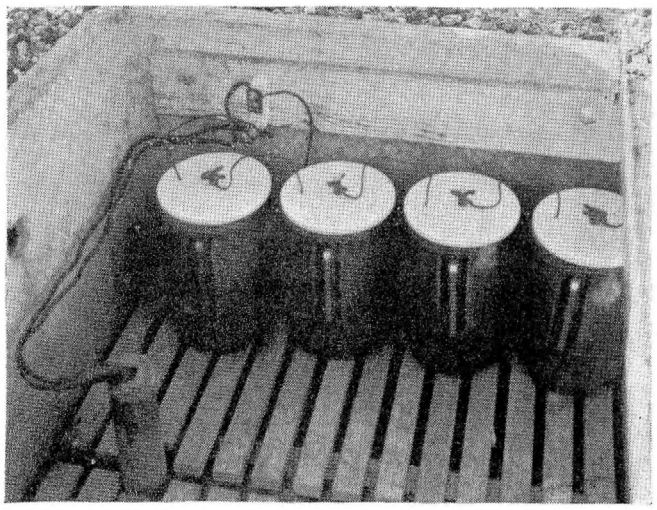
Fig. 2—Track and circuit diagrams to illustrate operation of the control of a flood detector

Motor-Car Indicators

The signal lamps are normally lighted, thereby affording information concerning the approach of trains for the benefit of men who operate motor cars. At intermediate points where curves and high banks cut off the view of approaching trains, special lamp-type motor-car indicators were installed as part of the new signaling system. Each indicator consists of an iron case mounted on a pipe mast near the track. The case includes two lamps and a push button.

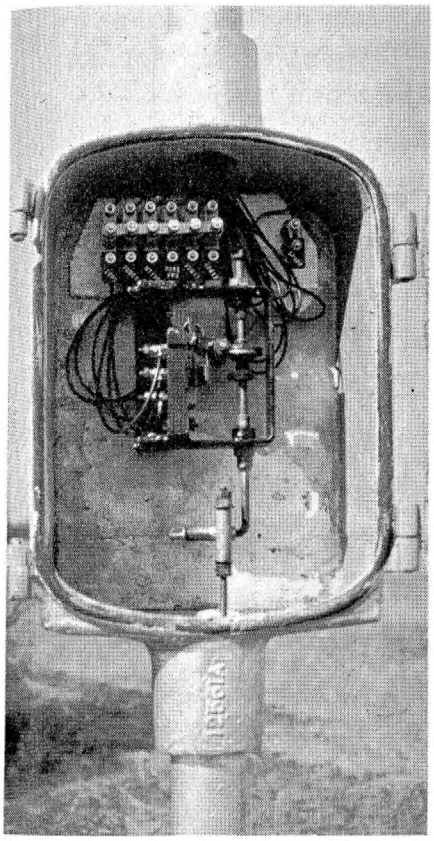
Before departing from such an indicator, a man operating a motor car pushes the push button and if the "South Bound" lamp is lighted, this indicates that no southbound train is approaching within the limits of the control. Similarly, if the "North Bound" lamp is lighted, this indicates that no northbound train is approaching. In general, the controls are planned so that a man has plenty of time, if he gets a "clear," to put his car on the track, proceed around the curve and to a location where he is on straight track again, or arrives at another indicator.

These motor-car indicators are con-



At each signal there is a set of 12 500-a.h. cells primary battery with a rectifier

trolled from the signal line circuits. One scheme, shown in Fig. 3, illustrates the controls of a motor-car indicator at a point midway in an automatic block. With a normally-open push button in series, a 1,000-ohm relay is connected across the line control circuit. If no train is occupying the block, the line circuit will be energized, and, when the push button is pushed, the 1,000-ohm relay will pick up, and the motor car indicator lamp will be lighted. If the control section for the motor-car indicator

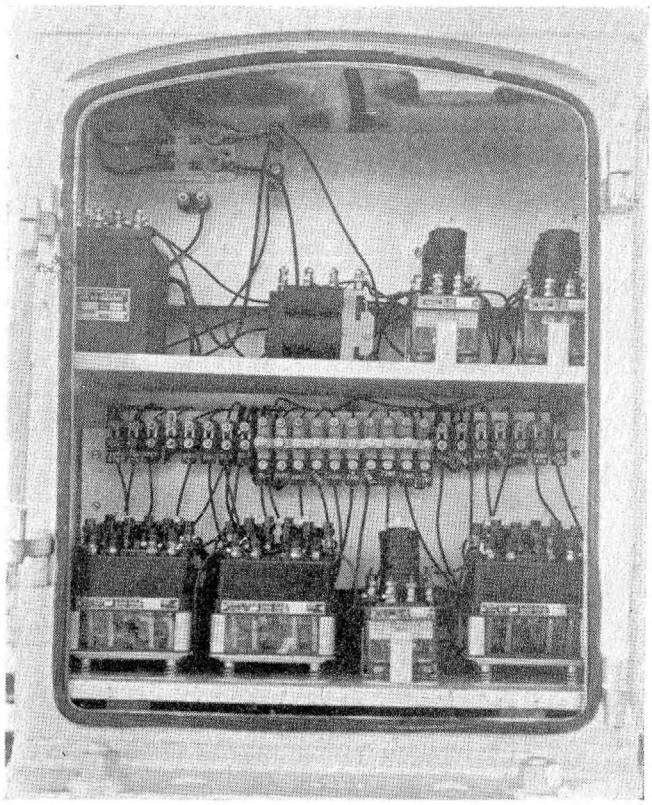


Flood-detector controller

is to be extended throughout the next automatic block, a polar relay is used at the indicator location, the circuits being arranged so the indicator lamp will be lighted only when the line circuit is fed the proper polarity, i.e., when the next block is unoccupied.

This installation includes a switch indicator at every main track switch. The indicators are normally energized by circuits which check the approach of trains from both directions, this result ordinarily being accomplished by a local circuit through "yellow" or "green" contacts in the two searchlight signals at a siding switch. Thus, the circuits check occupancy of the automatic blocks in both directions. Accordingly, with a train on a siding ready to depart, if the indicator is "clear" and a trainman throws the switch, any approaching train will encounter yellow and red signals.

Plug couplers on relays expedite replacement and prevent mistakes in connections



Power Supply

At each signal location, there is a set of 12 cells of 500-a.h. Edison single-plate type primary battery, across which is an RT5 rectifier, that is adjusted to carry all but about 10 m.a. of the load. This battery feeds the line circuit to the rear, and also the directional stick relay when energized. The signal lamp is normally fed from the W-10 transformer but if the a.c. power fails, a power-off relay transfers the lamp load to the battery, but at the same time, the circuit is switched from constant lighting to approach lighting.

Four Cells on Track

Each track circuit is fed by a set of four cells of Edision 500-a.h. primary battery. On most all of this territory, the rail is comparatively new. The Katy track department follows the practice of keeping the rail joints properly oiled not only to keep the fishing surfaces from wearing but also to maintain rust free contact between the angle bars and the rail. The bolts are tightened by using power wrenches. As a result of these track practices, the Katy has for several years found it unnecessary to bond the rail joints on main track where the rail is comparatively new. On all turnouts, however, the joints are bonded with S-1 type bonds.

The switch circuit controllers are the U-5 type. The shunt connections from these controllers to ⅜-in. plugs in the webs of the rails are ¼-in. bare stranded bronze, which is run in a groove in 1½-in. by 1½-in. capping, nailed to the side of a tie near the top.

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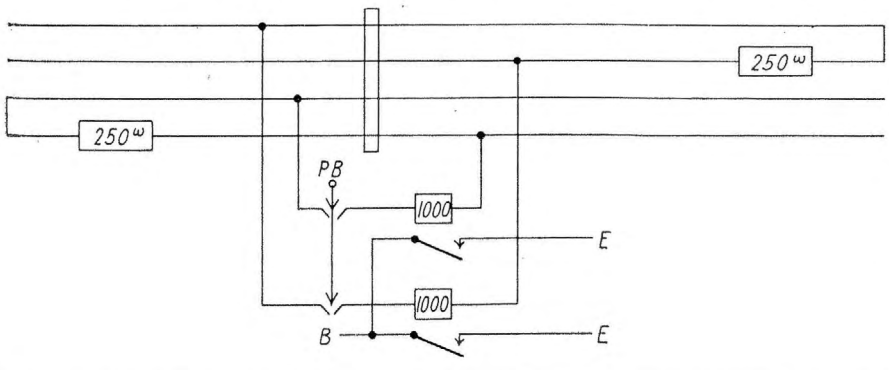

Fig. 3—Circuit for control of motor-car indicator

This picture shows typical arrangement of the paging speakers, mounted on 60-ft. butt-treated Western cedar pole—These speakers have a range of about 500 feet

& Rio Grande Western, under the direction of W. W. Pulham, superintendent of communications, and under the immediate supervision of R. E. Moore, telegraph and telephone engineer, and S. J. Wirz, assistant to superintendent of communications. The new tower was planned and installed under the direction of O. K. Peck, engineer structures. Design of the communication facilities was based on previous Rio Grande installations elsewhere and incorporated ideas, improvements and corrections suggested by maintainer E. A. Anderson, at Grand Jct. Colo.; maintainer F. J. Spiers, Salt Lake City, Utah; maintainer L. W. Vassmer, Denver; maintainer R. E. Woodward, Pueblo; and system installation maintainer A. L. Stor.

Equipment Manufacturers

The major items of the loudspeaker system were furnished by the Electronic Communication Equipment Company and the Kellogg Switchboard & Supply Company. The underground cable was furnished by the General Electric Company and the overhead drop wire by the Graybar Electric Company.

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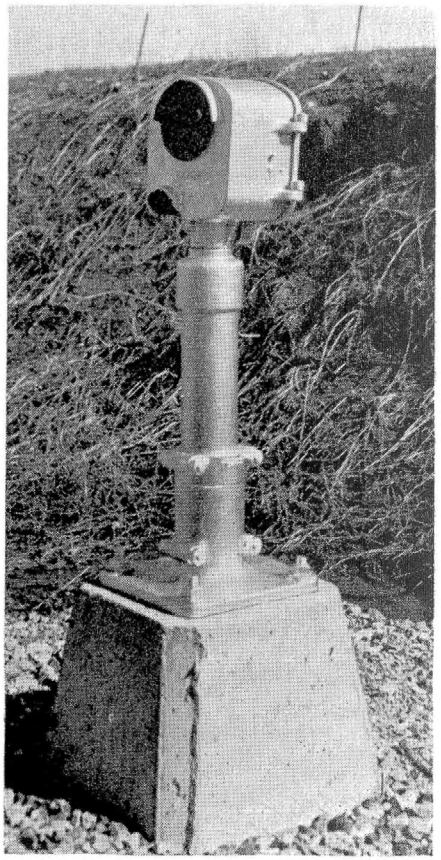
These bare bronze conductors enter a switch circuit controller through a special insulated hood, made of aluminum. This hood seals the entrance water tight. The connections from a case to the track are single-conductor No. 9, solid, buried cable. The cases are on the pole line side, and at any location, the track connections run in buried cable to bootlegs which are all on the case side of the track. These bootlegs are the Western Railroad Supply Company Type 1185-1. The connection from the bootleg to the "far" rail is enclosed in a groove in a 1½-in. by 1½-in. capping, nailed on one side and near the top of a tie. This practice, of placing both bootlegs on the case side of the track, eliminates digging a trench under the track which thus saves work and avoids disturbing the ballast. The cable from a case up to each searchlight head is a nine-conductor No. 12. The buried cables on this project were furnished by Kerite.

Line Construction

The signal line wires are on a 10-pin crossarm added to the existing communications pole line. The four signal line control wires are No. 10 copper, weatherproof. The two 220-volt a.c. power distribution wires are No. 8 with the same kind of covering. The line wire joints are made with Nicropress sleeves. Raco type dead-ends are used at the signal locations. Kearney solderless connectors are used to connect line taps to conductors of the line cable to the case. These cables are made up on the job, using No. 14 insulated wire tied to ¼-in. steel messenger with short pieces of No. 14 insulated solid wire. This cable wire as well as the insulated wire in the cases is a General Electric Company product with Flamenol insulation.

Power for A.C. Primary

The 220-volt a.c. line distribution circuits extend in both directions from several towns. A gap of one automatic block exists between the end of one feed and the end of the next feed. This saves a pair of these line wires for 2 or 3 mi. in each such instance. The arresters for the 220-volt a.c. power circuit are the General Electric pellet type, mounted on the crossarms. Western Railroad Supply Company Type 0037LV arresters are used on the signal line circuits.



At each main track section there is a lamp-type indicator

This signaling was planned and installed by the signal forces of the Katy under the jurisdiction of R. R. Wood, signal engineer, the major items of signaling equipment being furnished by the Union Switch & Signal Co.