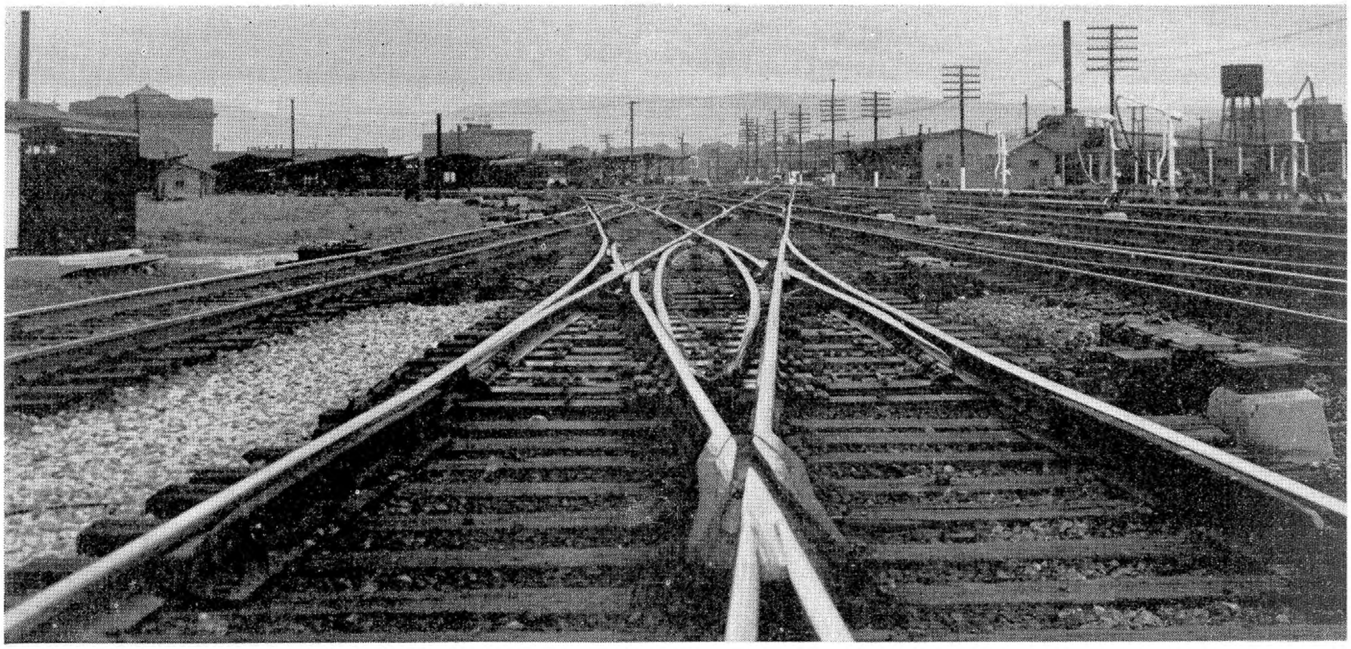


View looking over throat toward passenger station with a double-slip switch in the foreground.

New Interlocking at Chattanooga Terminal

Modern electric plant, with improved signaling arrangement and panel-type all-relays controls, saves train time by faster manipulation and better utilization of track lengths, as well as facilitating maintenance

AT the passenger station in Chattanooga, Tenn., the Chattanooga Station Company has installed a modern all-electric interlocking, including 60 signals and 60 switch machines, controlled by all-relay circuits from a panel-type machine with button knobs for controlling signals and small-interlocked toggle levers for controlling switches. An early General Railway Signal Company Model-2 electric interlocking, in service at this terminal since 1909, included an electric interlocking machine with 107 working levers and 13 spare spaces. The old switch machines were the Model-2. All of the signals were of the dwarf type—some being color light and others being of the semaphore solenoid type.

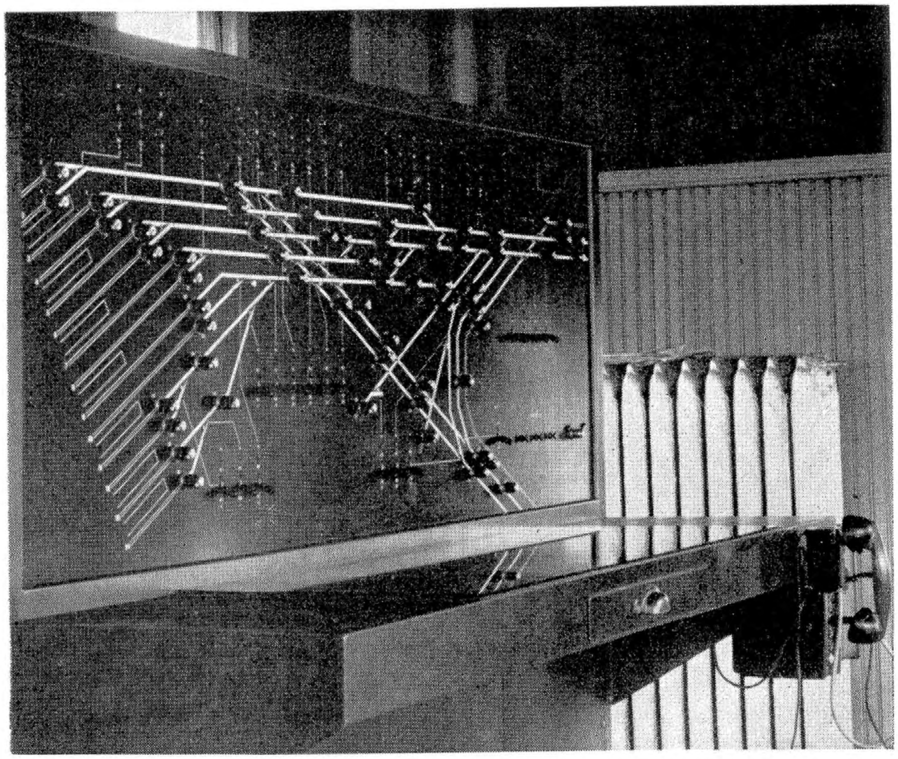
This old interlocking, and the old 85-lb. rail throughout the terminal area, were worn. As a part of a general improvement program, the old rail was replaced with new 100-lb. rail. The new turnouts are No. 8 with 15-ft. 6-in. points. As this rail change progressed, the old switch machines were replaced with new Model-5A machines, and new color-light dwarf signals were installed. All the old wires and cables throughout the plant were replaced with new underground cable. New relays, circuit arrangements and control machines were installed in the tower. Therefore, when the progressive changeover was finished, the result was an entirely new modern interlocking in all respects. The existing tower was remodeled to accommodate the new equipment. Also, the first floor was extended on one end to provide additional space for relay and terminal racks.

Because of limited space, it was not possible to lengthen the station tracks in order to accommodate the long trains. Therefore, additional dwarf signals were installed between the end of station and the throat of the interlocking to avoid tying up the plant when long trains were hanging out or leaving the station.

Layout of Plant

As shown in the accompanying plan, the passenger station is of the stub-end type, including 14 tracks which converge toward the east to four tracks and then to two main tracks. The two main tracks, as shown extending to the right of the plan, connect to through routes of the Southern Railway extending north to Cincinnati; east through Knoxville to Washington; and southeast through Atlanta to Jacksonville. The wye connections to the three main tracks extending off the bottom of the plan connect to routes of the Southern Railway extending west to Memphis, and southwest to Birmingham and New Orleans. Also trains of the Central of Georgia, for connection to a line southward to Macon, Ga., enter and leave the Chattanooga Terminal on these tracks shown at the lower portion of the plan. A total of 30 passenger trains use this station daily, which means that each makes three moves through the plant; one to enter, one to back around the wye and the other to depart. While trains are at the station, numerous switching moves are made to take off certain cars and add others, such as sleeping cars, mail cars and express cars. Also, within the limits of the interlocking, there is a special platform and pipe rack for refueling Diesel-electric locomotives.

On account of all these through trains and switching moves, this is a very busy interlocking especially during peak periods.

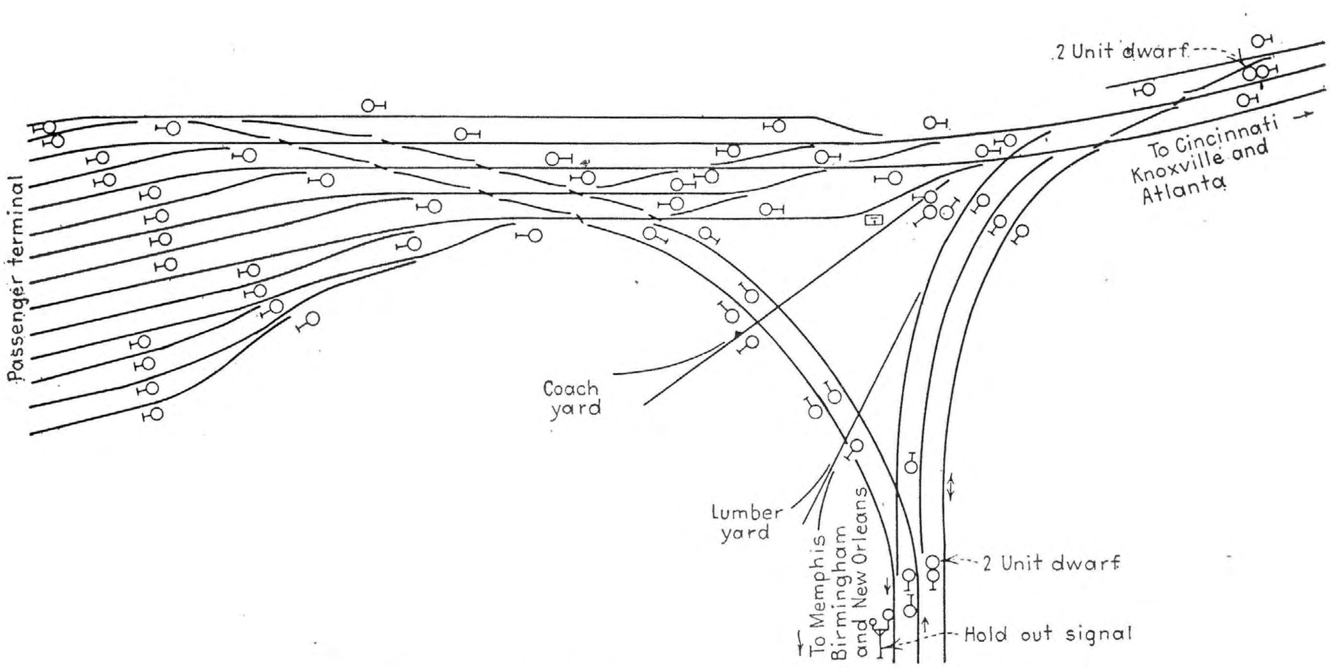


The new control is of panel-type construction

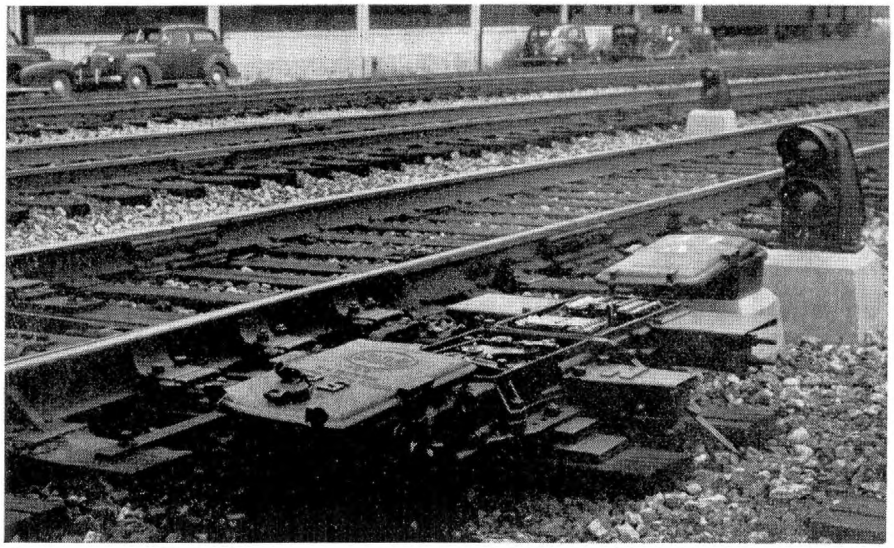
Switch Machine on Top of the Ties

The new switch machines are the G.R.S. Model-5A with outboard brakes. These machines fit between toe plates welded to 1-in. by 7-in. plates that are laid on top of the ties. This practice is used to set these machines up out of the dust and dirt which normally accumulates. The solid wire cables extend to terminals in a cast-iron junction box on a small concrete foundation near each switch machine. From these terminals, flexible No. 14 insulated conductors extend through flexible conduit to the machine. Adjustable rail braces are used on three ties, including the No. 0, the No. 1 and the No. 2 ties. Also rail braces are used on the gage side of the rails on the No. 0 tie to prevent "rolling" of the rails.

In the previous interlocking, there was a total of 46 dwarf signals. When planning the new interlocking, an objective was to place the signals at the exact locations as required to permit the most effective utilization of track lengths, as well as to minimize the extent of pulling out and backing down when making switching moves. This required 14 more signals than used previously. All the 60 home signals on the new plant are dwarfs so that they can be located between tracks



Track and signal layout at the new interlocking in Chattanooga



Typical switch machine with cover removed and color-light dwarf signals

at the right of the track governed which places them at the exact spots to accomplish the objective explained above.

Maximum Speed 15 M. P. H.

All train and switching moves within the limits of this terminal interlocking are limited to a maximum of 15 m.p.h. Accordingly, the signals are all equipped and controlled to display only two aspects; red for Stop, and yellow for Proceed at restricted speed.

The handling of through trains at the Chattanooga station is expedited because of the improved arrangement of interlocking signals and the facility with which routes can be changed by the new panel-type control machine, as compared with the previous machine which was 24 ft. long and thus required considerable walking by the leverman, as well as time waiting for releases, etc.

On some occasions, it may be necessary to hold trains out until station tracks are cleared, or in some instances, trains are operated on the double track against the current of traffic. For this reason, a "hold-out" signal No. 20 was installed to govern inbound trains approaching on the tracks which are represented by the lines entering at the bottom of the plan. This hold-out signal is a high signal of the searchlight type. It normally displays a yellow aspect, but, by operation of a lever, the towerman can set it at Stop.

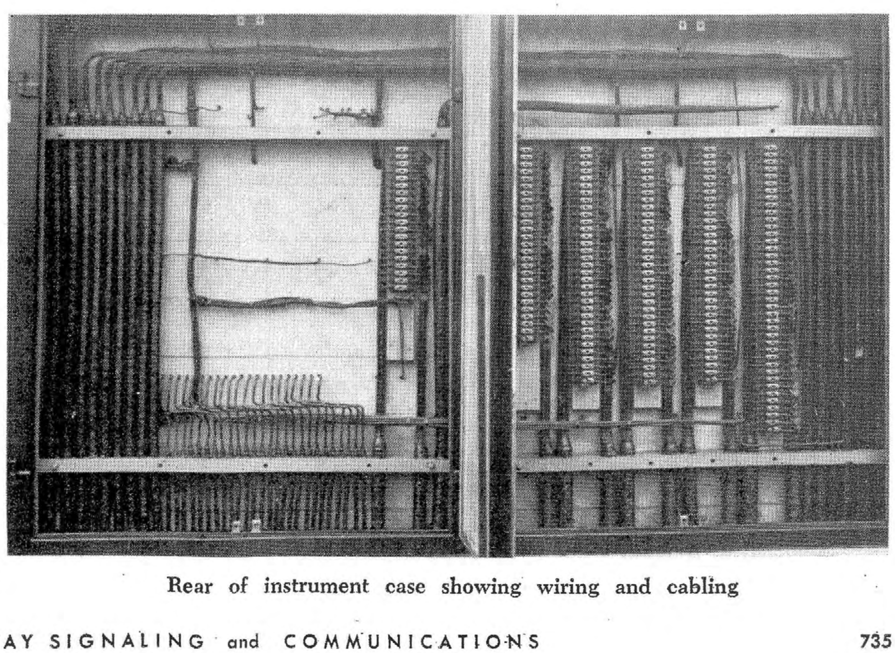
The panel of the new interlocking control machine, 72 in. long and 30 in. high, is made of sheets of laminated plastic, each 1/16 in. thick. The outer layer is black and the next one is white. Each track is represented by a white line ¼ in. wide which is made by milling out the black layer down to the white. On these lines, small white lamps are lighted to indicate track occupancy. Switches are represented by small triangular sections of black sheet-metal which rotates on pivots, so that a full ¼ in. width line shows the track route lined up.

The power switch machines are controlled by individual small sized toggle levers which are mounted on the panel in rows above and below the track diagram. A white line extends from each of these levers to the track diagram symbol of the switch it controls. Two small lamps are in a vertical row above each lever. The upper lamp, which is white, is lighted when the lever is out of correspondence with the track switch. When a lever is thrown, this lamp is lighted and stays lighted until the switch is over and locked. If the lamp remains lighted for some time, the leverman knows that something is wrong.

The lower lamp above each switch lever is red, and is lighted when electric locking is in effect to prevent operation of the switch. The circuits include indication, time and sectional route locking. If a switch lever is thrown when the red lock lamp is lighted, the switch will not operate after the locking is released. The lever must be restored to the position corresponding with that of the switch in order for the leverman to regain control.

Control of Signals

On the panel, each signal is represented by a knob which is on the line representing the track governed and at the location corresponding to that of the signal. The face of each knob includes a black arrow pointing in the direction that the signal governs. After lining up the switches in a route, the signal is cleared by pushing the corresponding button. When the signal clears, a white lamp is lighted behind the arrow. If the signal does not clear because the switches are not properly lined, then the lamp in the knob flashes as an indication to the towerman. Ordinarily, the lamp in the knob stays lighted until the train passes the signal and puts it



Rear of instrument case showing wiring and cabling to Stop, at which time the lamp is extinguished and the controls revert to normal with no action by the towerman. A signal which has been cleared can be restored to the Stop indication by pulling the corresponding knob about ¼ in.; after which it springs back to its normal position.

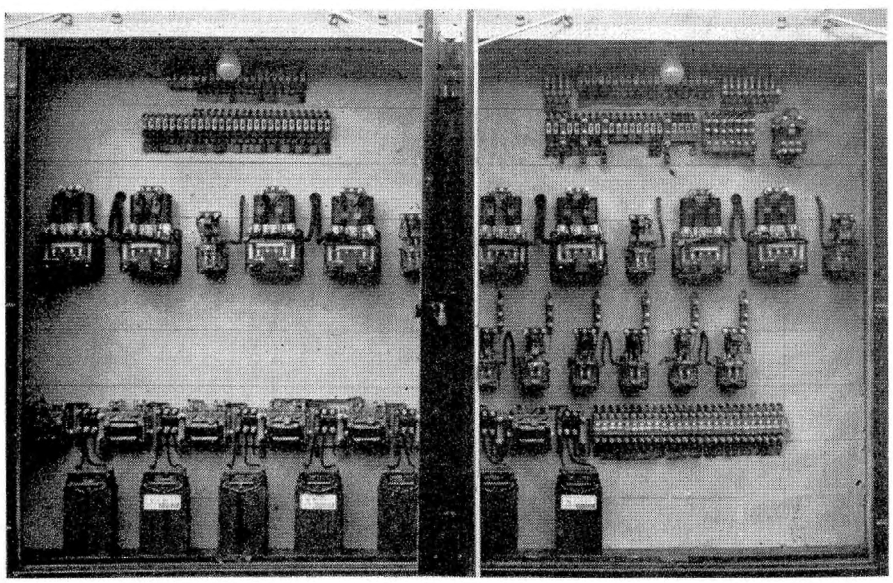
Good Cable Construction

The buried cable was installed with care, thereby preventing damage that might cause trouble later. The track connections are No. 9 single-conductor cable. For the main runs from the tower to junction boxes, the cables vary up to 40-conductor. These cables include No. 14 wire for controls and No. 5 for power. The cable to each switch machine includes two No. 10 for the 110-volts d.c., and five No. 14 wires for controls, one of these being spare. The multiple-conductor underground cable on this entire plant, made by the Kerite Company, is of the mummy finish type with no metal in the outer protective coverings.

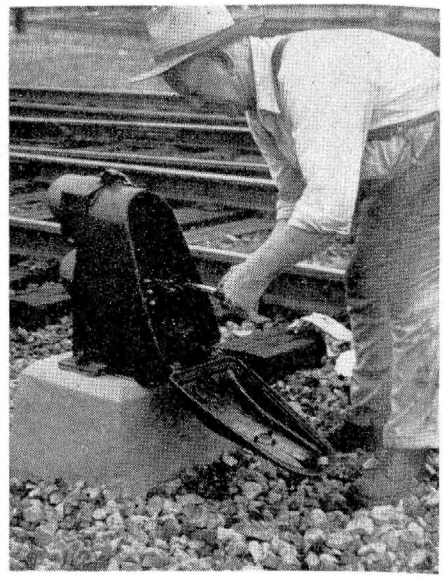
When installing these buried cables, the trenches were dug at least 1 ft. wide and 30 in. deep. A 6-in. layer of clean clay was placed in the bottom and the cables were laid in this clay. Then another 6-in. of clay and 12-in. of back filling were placed on top. In order to prevent track men from damaging cables with picks, cypress planks 2-in. thick, were placed on top of the 12 in. black filling at all locations where such digging might logically be expected. At no place above ground is cable subject to damage mechanically, or by the weather, and special practices are used to prevent moisture from creeping in at the ends of the outer coverings.

When making the concrete foundations for out-door instrument cases, a vertical duct is cored in the foundation. This duct is 8 in. square at the top and 16 in. square at the bottom. After the cables are brought up through his duct, the voids are filled with sand and clay; then the top is sealed with compound to prevent sweating and dampness. Similar protection for cables entering junction boxes and dwarf signals is provided.

The cables extend into a compartment at the rear of the case which is made accessible by hinged doors. A piece of wood plank about 2 in. by 4 in. is cut to fit across wiring space as shown in one of the accompanying pictures. In this "2 by 4", a hole is drilled for each cable, these holes each being slightly smaller than the cable for which it is to be used. The plank is then sawed end-to-end vertically through the center of the holes. One half is screwed in the case, and the cables are placed as shown. Then the other half of the plank is placed over the cables and screwed up to grip the cables. The outer protective covering is potheaded, wrapped and sealed above the plank. Then the individual insulated wires extend to terminals or through holes in the board, to the front of the case.



Front side of case showing relays, rectifiers and storage battery



Maintainer A. S. Pell at Chattanooga

Between each sheet-metal case and its concrete foundation, there is a coating of sealing compound which prevents rust due to an accumulation of moisture. These cases are lined with asbestos sheets, and ventilators are provided to minimize condensation of moisture. These sheet-metal cases are connected with No. 6 copper wire to ½-in. by 8-ft. Copperweld ground rods. Raco Clearview type lightning arresters are used on track circuits.

In the tower, the cables coming up through holes in the floor are potheaded above the floor line. Wires which extend from the relay rack to the control machine in the tower are run in Square-D sheet-metal conduit which is manufactured in various lengths, elbows, etc., that are assembled as required and fitted together with stove bolts. In the tower, all the relays are the quick-detachable plug-in type mounted on racks each of which is 2 ft. wide and 8 ft. wide. In the outdoor instrument cases, the relays are the wall-mounted type.

When installing the new rail through this plant, new Continuous insulated joints were applied and the rail joints were bonded with plug-type Copperweld stranded bonds, and conductors of this type were used also for bootleg connections and for jumpers at turnouts.

Power for this interlocking is secured from the railroad transmission line at 2,400 volts which is taken from a 5 kva. transformer with a secondary 240/120 volts.

The 110-volt switch machines

(Continued on page 745)

Loudspeakers

(Continued from page 739)

such systems on the Southern revealed that more than 50 per cent of the cost of the installation was spent for the outside cable and wire plant—the wiring connecting each speaker with the control tower. The use of relay circuits designed to permit connection of several talk-back and paging loudspeakers in multiple has resulted in savings of as much as 40 per cent of the total installation cost. Not all of the speakers, of course, should be connected in multiple. However, we have found that on any yard installation the majority of the conversations are carried on between the control tower and a relatively small number of locations—places such as the yard office, the roundhouse office, and some strategic point on a lead. In a multiple installation, these important points are still connected to the tower by the conventional two-wire individual line method; the remaining speakers are connected in multiple, with a maximum of 12 speakers to one set of line wires.

One At a Time

Since only one loudspeaker is connected to an intercommunicating circuit at any one time, the multiple arrangement provides just as efficient transmission as does a separate circuit for each speaker. In fact, since it is necessary in the multiple installation for the man at the speaker to operate the push button or foot switch before two-way conversation can be held, the average communication is somewhat less noisy than it would be if the man were at some distance from the loudspeaker. The use of multiple speakers has not decreased the flexibility of the installation.

Circuit Diagrams

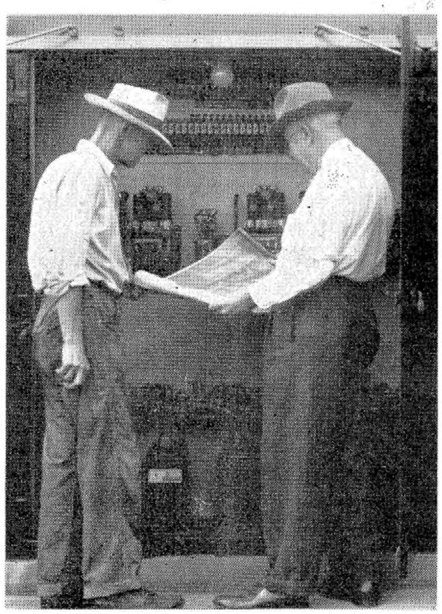
The first multiple talk-back loudspeaker installation employing relays at the speaker location went into service at our Meridian (Miss.) Yard on June 30, 1947. Since then the idea has been used in other installations and will be of continued benefit in the future. The accompanying drawings show two circuit arrangements, using relays at speaker locations. The relay designated "S" on both drawings is the Adams & Westlake Comany's mercury delay relay; all other relays used are products of C. P. Clare & Company.

Chattanooga

(Continued from page 736)

are operated from a main battery consisting of 84 Edison-A4H 150-a.h. storage cells. This battery is normally on floating charge by a Type-BP Size 648 G.R.S. Co. rectifier. A motor-generator, rated at 120 volt, 15 amp. d.c. output, is used to cycle charge this battery.

Each track circuit is fed by one cell of 1.5-volt Edison-B4H storage battery charged by a BT-104 rectifier. A 2-ohm resistance unit is in series between the battery and rails, and a 12-ohm adjustable resistance unit is in series between the rails and the 4-ohm Type K-2 G.R.S. Co. track relay.



Supervisor J. Waller (right) and assistant maintainer M. T. Payne at case

This interlocking at the Chattanooga Station was planned and installed by company forces under the general jurisdiction of L. C. Walters, assistant vice-president, signal and electrical, Southern Railway, Washington, D. C., and H. A. Hudson, signal and electrical superintendent, Western Lines, Cincinnati, Ohio. Actual construction was under the direct supervision of J. Waller, signal supervisor, R. H. Youngblood, construction supervisor and A. S. Pell, signal foreman. The major items of interlocking equipment were furnished by the General Railway Signal Company, and the insulated wire and cable by The Kerite Company.

NEW BOOK

Electrical Engineers' Handbook, Electric Power—Volume 1, fourth edition, compiled under editorship of Harold Pender and William A. Del Mar. 19 sections. 8¼ in. by 5½ in. by 2 in. Bound in imitation leather. Illustrated. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. Price $8.50.

THE first edition of Pender's **Handbook for Electrical Engineers**, compiled by a staff of specialists under the editorship of Harold Pender, appeared in 1914. The second edition, under the joint editorship of Pender and William A. Del Mar. was published in 1922. Both these editions covered all branches of electrical engineering, as well as a large amount of material dealing with allied fields of interest to electrical engineers. The third edition, published in 1936, was divided into two volumes—one on electric power, under the editorship of Pender, Del Mar, and Knox McIlwain and the other on electrical communication and electronics, under the editorship of Pender and McIlwain. Certain tables and fundamental theory were duplicated in the two volumes, in order that each might be complete and independent of the other. This plan met with such enthusiastic response that it has been continued in the fourth edition. The growth of knowledge and the greater degree of specialization in the various phases of electrical engineering have necessitated a considerable enlargement of both volumes. Careful selection and compression have been exercised in an effort to keep the books compact and readable. The treatment of subjects of decreased importance and those which are adequately treated by other handbooks of the Wiley Handbook Series has been either curtailed or left unchanged in length.