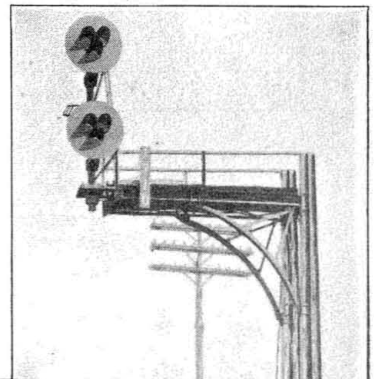
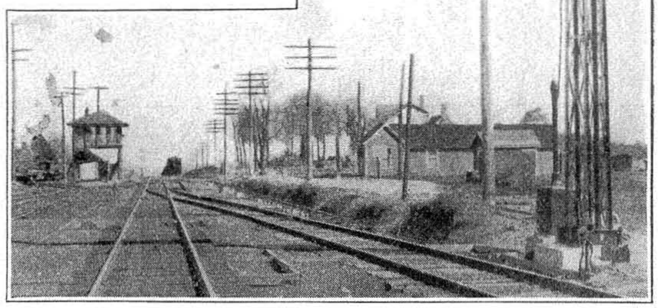
Signaling Special Layouts

The Seaboard met local operating problems at certain places by modifying the signal arrangement

By F. H. Bagley

Signal Engineer, Seaboard Air Line, Savannah, Ga.

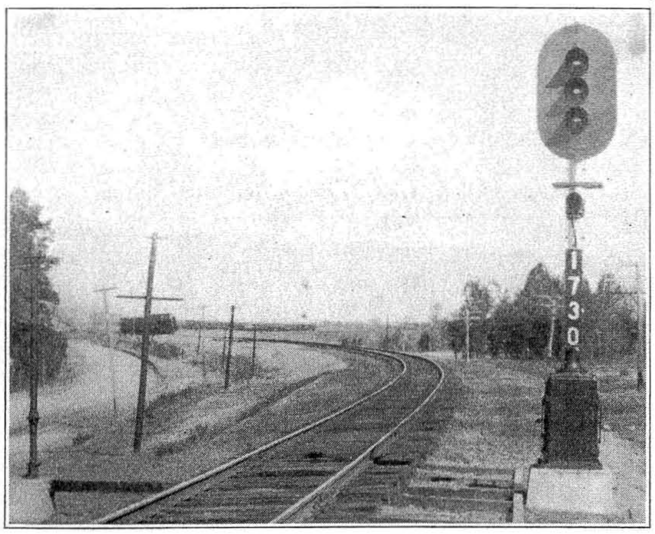
IN THE construction of its signal system, the Seaboard Air Line* encountered operating and other conditions which made it necessary to provide special circuits and changes from the standard A. P. B. layout through some of the cities, towns and yards along the line. Before the construction work was started, representatives of the Seaboard Air Line and the Union Switch & Signal Company went over the territory involved. Sketches were made of the track layouts through towns and cities where special conditions existed. The signals were located with their respective overlaps to provide for the most flexible operation. With these sketches as a basis, the circuits were then drawn up.

Style-TR two-unit, color-light, interlocking home signal at Apex, N. C., with cantilever mounting

Yard Limit Indications

One of the first operating problems considered was the number of indications to be given to trains through yard limits. While it is the customary practice to employ 3-indication signals on main tracks through yard limits, it was the feeling of the Seaboard officers that to use three indications would be to conflict with the operating department rules governing the operation of trains in restricted territory. Consequently it was finally decided, in order to make the



Style-R color-light signal with standard yellow grade marker located below signal unit

signals conform to the operating rules, that 2-indication, color-light signals should be used. The indications given are red and yellow for "stop" and "proceed with caution." Three-position signals are thus used to indicate to enginemen that they are in territory where trains may be run at the maximum speed permissible under the operating rules. If 3-indication signals had been used through yard limits, the signal controls would necessarily have been extended and this would have resulted in trains receiving an excessive number of yellow signals. The use of 3-indication signals in this territory also would have resulted in certain unwarranted costs without adequate return.

Another situation requiring study developed in deciding upon a means for preventing tonnage trains and through freights from being stopped unnecessarily in certain cities where a number of streets cross the tracks. This condition was met by making the signals tonnage signals in that territory. Other special locations were at such places as at the end of double track; at junction points, where it is necessary for trains to back into or out of stations; or where foreign line trains are operated into and out of stations over the Seaboard tracks.

Non-Directional and Directional Grade Signals

Extensive use has also been made of grade signals to facilitate the operation of tonnage trains on grades and at certain other special locations, one of which was mentioned above. When grade signal markers are placed on entering signals to sidings, the yellow marker light (indicating a grade signal) is given a non-directional control, but grade signals intermediate to passing tracks have their yellow marker light provided with directional control, the yellow marker light lighting up only for a close following movement. If a head-on movement was encountered between passing tracks, the yellow marker light would not light up and the indication given the enginemen would be that of a stop signal. This signal would then be observed as any other permissive signal, namely "stop" and "proceed."

In order better to illustrate the standard as well as the special locations, as developed for use on the Seaboard Air Line, diagrams are given showing the signal controls. Figures 1, 2, 3 and 4 represent the standard schemes applicable to 3-indication signals, while the figures following No. 4 show the 2-position

* For description of signal construction, Richmond to Hamlet, see article in February, 1926, issue of *Railway Signaling*, "254 Miles of Color-Light Signals Constructed."

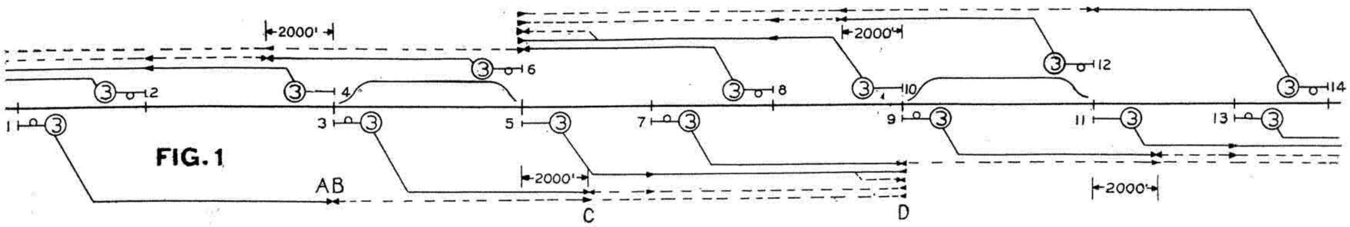


Fig. 1—Standard control used where two or more signals or blocks come between sidings

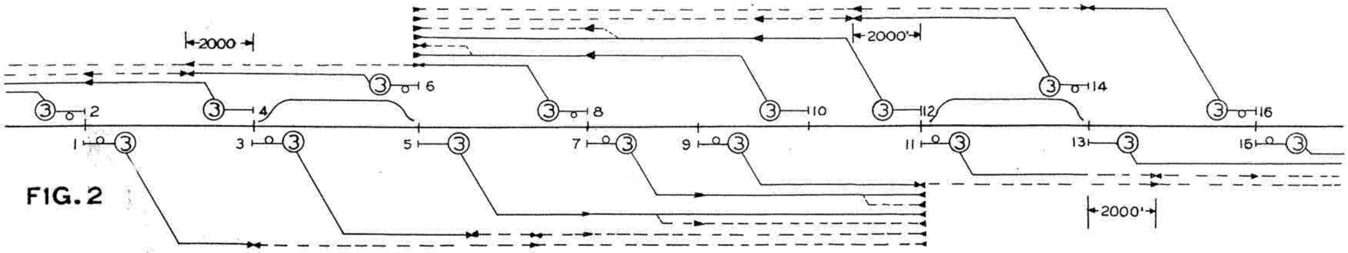


Fig. 2—Control scheme with four intermediate signals between sidings

signals and the special location layouts. The limits of control of a signal are shown in these diagrams rather than the actual circuits employed, as, if the signal limits and controls are known, it is then a comparatively simple matter to draw up the necessary circuit plans.

To make the figures clear, it will be well first to explain the references appearing in the diagrams. The solid lines indicate control limits for the red and yellow indications; the dotted lines indicate the control limits for the yellow and green indications. Arrows

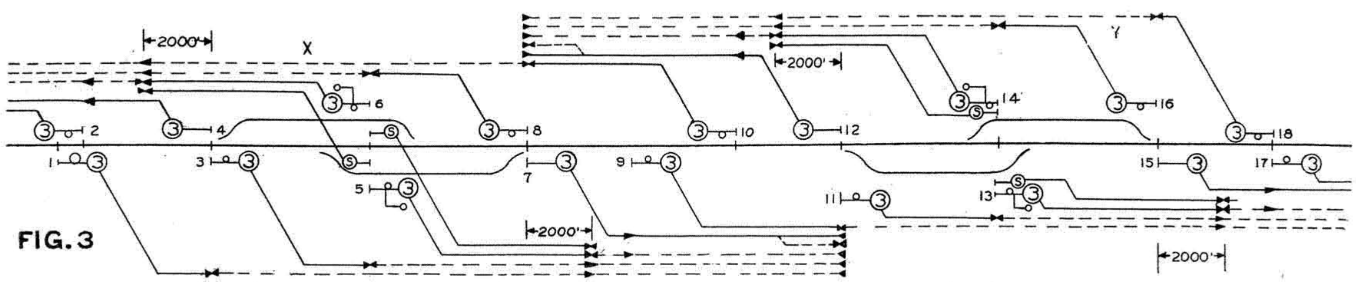
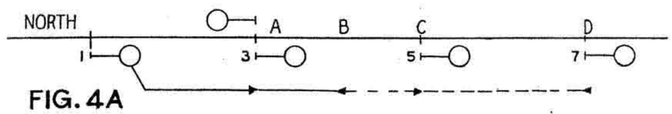


Fig. 3—Standard lap siding arrangement where "SYR" dwarf signals are used



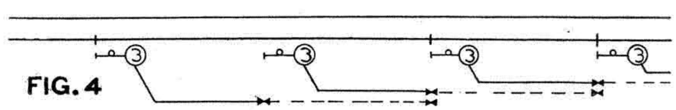


Fig. 4—Standard double track layout

on the control limit lines indicate the direction in which a train is moving and the place at which it affects the signal indication. Referring to Fig. 1 and Fig. 4A, arrows "A" & "B" being in the solid lines, indicate the "red-yellow" control. For example, the rear of a southbound train passing point "A" causes

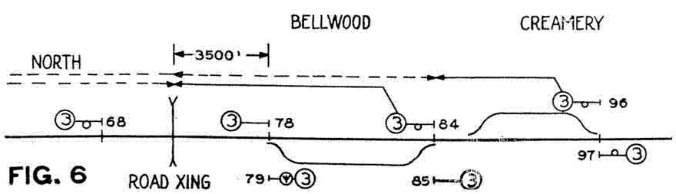
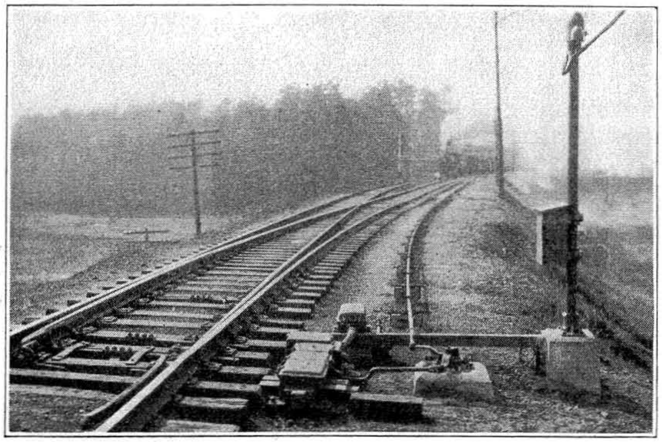


Fig. 6—Grade signal *79* governs the entrance to the siding —Opposing signal *84* is controlled 3,500 ft. beyond signal *79*

Signal 1 to change from red to yellow. The front of a northbound train passing location "B" will cause Signal 1 to change from yellow to red. Arrows "C" & "D" being on the dotted lines indicate the "yellow-green" control. The rear of a southbound train passing point "C" causes Signal 1 to change from yellow to green, while the front of a northbound train passing location "D" causes Signal 1 to change from green to yellow. Control points "A" & "B" may be at the same location, similarly "C" & "D." The symbols used in the drawing are as indicated.

Referring to the diagrams, Fig. 1 and 2 show the standard control used at plain passing siding where two or more signals or blocks come between sidings. It is to be noted that the "red-yellow" control of siding entrance signals, such as for Signals 3 and 6 in Fig. 1, extends 2,000 ft. beyond the opposing signal. It will also be seen that the "yellow-green" control of signals in approach to a siding, as shown at Signals 1 and 14, extends to the entrance of the second siding in advance. Fig. 3 shows the standard lap siding arrangement where "SYR" dwarf signals are used at the inner outlet of the lap. The "SYR" signals at siding "X" are placed between tracks, while at siding "Y" they are placed outside of the tracks because of the track layout. Siding entrance signals, such as Signals 3 and 8, are controlled to opposing Signals 6 and 5, respectively, instead of having the customary overlap of 2,000 ft., as in the plain passing siding scheme. Fig. 4 shows a standard double track layout. Certain diagrams such as Figs. 6, 8 and 9 are presented because the signal opposite a siding entrance grade signal has a special extended control. For example, in Fig. 6, Signal 79 is a siding entrance grade signal, and the opposing Signal 84 is controlled 3,500 ft. beyond Signal 79.

Figure 5 represents the layout at Rockett Junction. This junction governs the movement of trains to and from the union station at Richmond, Va. The Seaboard Air Line trains and Southern trains operate over these tracks to the station. The limits of Rockett Junction interlocking extend over a distance of approximately two miles and trains are operated in this territory by signal indication. The Southern Railway crosses the Seaboard at this point and its trains go into the station over the Seaboard tracks from the "Wye" connection. South of the Southern crossing there are a number of industry tracks leading off the main line. Each of these switches is electrically locked under the control of the operator at Rockett Junction and have telephones located near them. In the tower is a 2-lever machine operating the "Wye" switches by means of pipe connections, one lever of which is used for the facing point locks. Detector locking is installed between Signals 07, 06 and 08. The signals in this territory are controlled



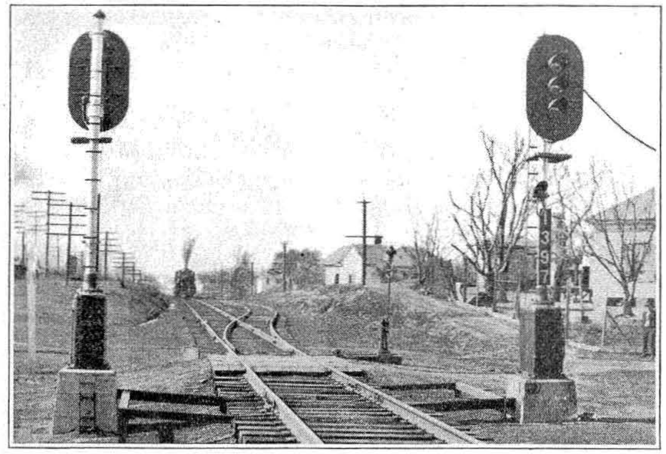
Style-M alternating current remote power switch movement at Edgeton Jct. (Raleigh, N. C.)

by interlocked circuit controllers, located on the operator's table. The automatic block signals begin at Signal 15.

In Fig. 6, Signal 79 is a grade signal and because of this, the preliminary control of Signal 84 was extended from 2,000 ft. to 3,500 ft. to provide earlier information and to stop opposing trains on a helping grade. The only variation in this location over a standard location is in the use of a grade signal governing the entrance to the siding. Provisions also have been made at this particular location for the installation of highway crossings protection apparatus at a future date.

Local Conditions at Petersburg

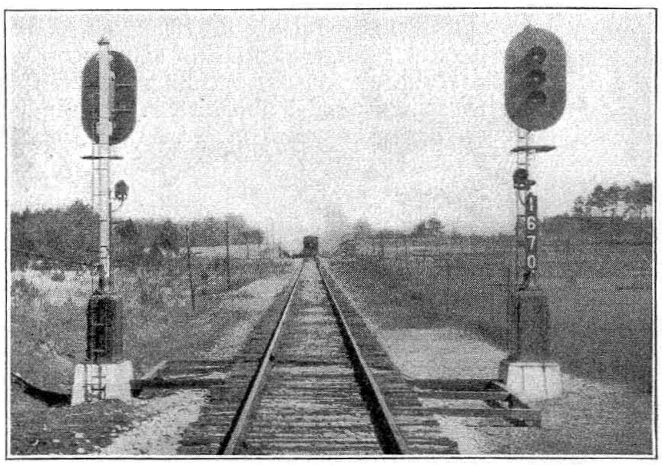
Figure 7 shows the layout in and around Petersburg, Va. Local conditions in Petersburg necessitated a careful study in planning the signal layout.



Style-R color-light signals at Wake Forest, N. C.

One condition encountered consists at a long, high viaduct, which is built with a reverse curve in it, made necessary because certain property rights could not be obtained. Another condition developed from switching in the yard limits and the use of a branch track leading off the main line to a downtown location. In the diagram, as shown, Signal 223 is a 2-indication signal only, because of the slow movement made necessary over the viaduct with its reverse curve.

Signals 228 and 229 are located north of the branch line switch, so that movements on to the branch line do not hold signals red back to the next siding on the north. Signals 229, 238 and 248 are 2-indication signals, showing red and yellow only, as they are



Style-R color-light signals, with staggered marker lights, between passing tracks

in the yard limits. Signal 247 is made the beginning of the absolute block, southbound, because of heavy switching on the main line south of Signal 238. Asylum crossing is an interlocked crossing with an electric line and is governed by a mechanical machine. The A. P. B. system is not carried through Petersburg, due to the special switching conditions encoun-

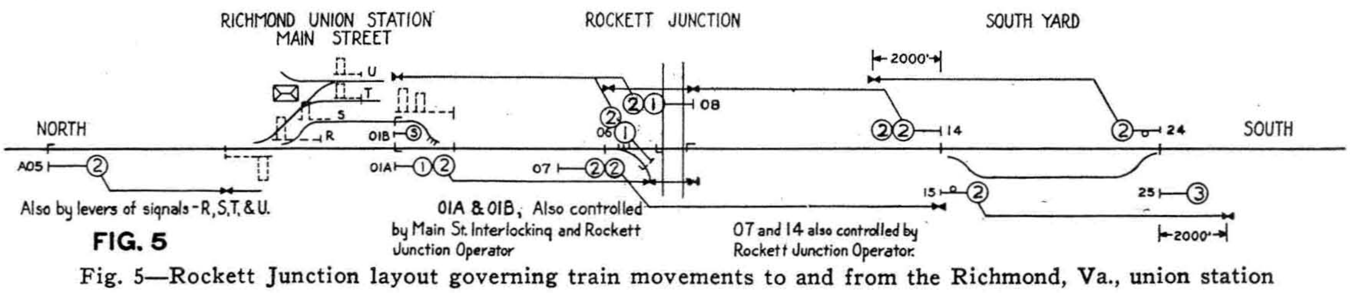


Fig. 5—Rockett Junction layout governing train movements to and from the Richmond, Va., union station

tered at this place as mentioned above. The signaling through the city consists of separate isolated blocks having preliminary over-laps. Figs. 8, 9, 11, 12 and 13 show typical layouts for grade signals at the entrances to passing sidings and control limits.

Figure 10, Alberta, Va., shows the signal layout provided to facilitate switching at this point. It will be seen from the diagram that Signals 610 and 611 1001 and 1006, which act as approach signals to the intermediate signals.

As there is considerable switching at Henderson to and from the fertilizer switch north of Signal 1128, and also between Henderson and the cotton mill switch, the absolute block is started at Signal 1128, north of the cotton mill switch as shown in Fig. 15, so that switch movements to the cotton mill will not

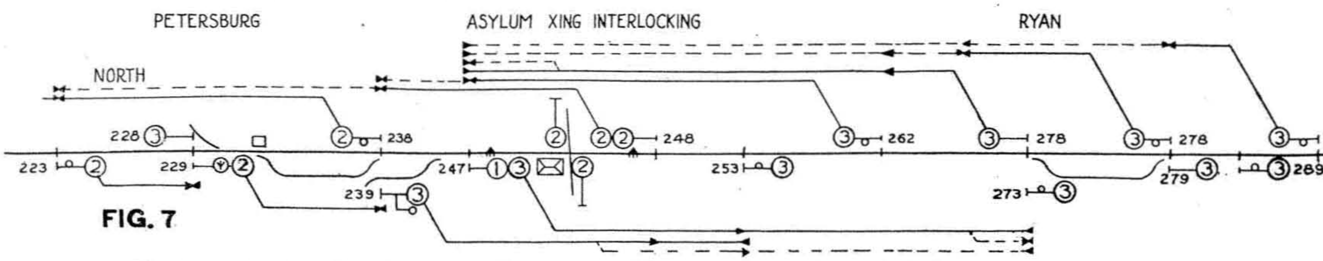


Fig. 7—The signaling layout at Petersburg, Va., was planned carefully because of local conditions

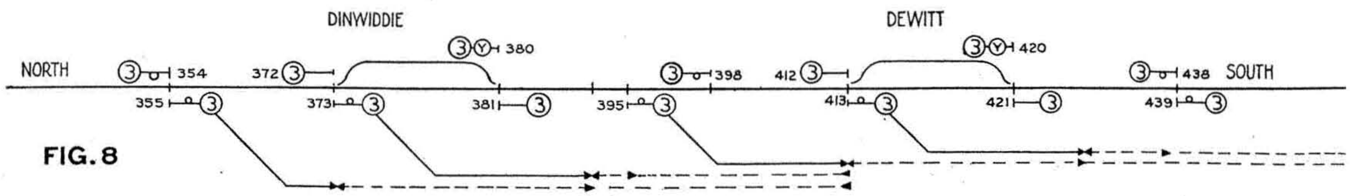


Fig. 8—Typical grade signal layout at entrance to passing siding

have been moved out for this purpose. Figure 14 shows the location and the use of 2-position signals through the yard limits at Norlina, N. C. The layout in this territory consists of individual blocks with preliminary overlaps instead of the A. P. B. control. Absolute block extends from Signal 1001 to 1006, as the distance between these signals is so short that the intermediate signals cannot be staggered. The signals were therefore placed opposite and extended opposing green controls were provided for Signals affect the movements of trains leaving Greystone. Switching from Henderson to the fertilizer plant does not stop southbound trains governed by Signal 1107, which is located at Greystone, as 1,000 ft. separate the fertilizer switch and the point at which a train will set Signal 1107 at Greystone at stop. A train passing Signal 1128 will not set the opposing absolute Signal 1107, but a southbound train passing Signal 1107 will cause a stop signal to show at Signal 1128. Intermediate Signals 1114 and 1115 are placed

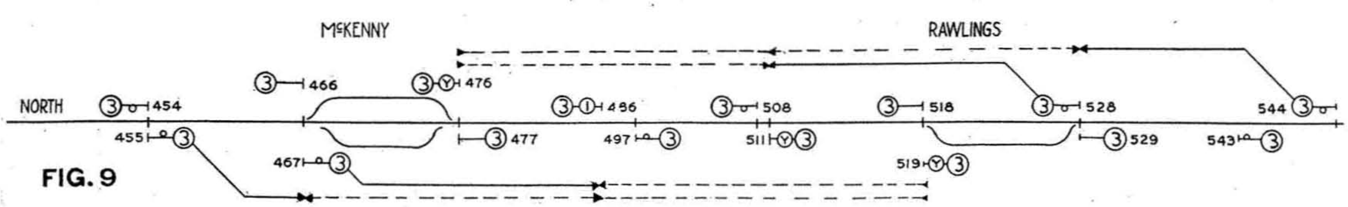


Fig. 9—Another grade signal layout at entrance to passing siding

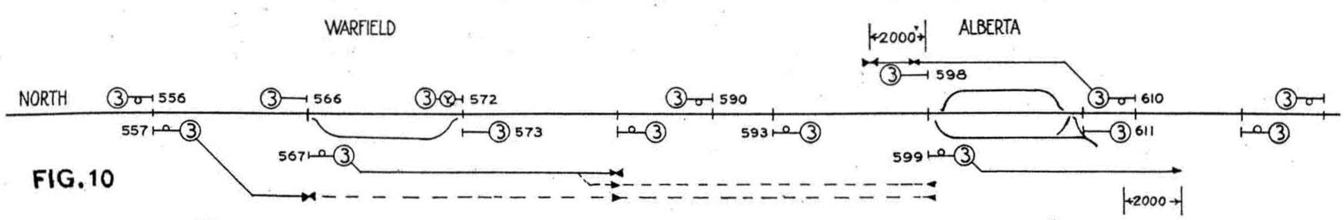
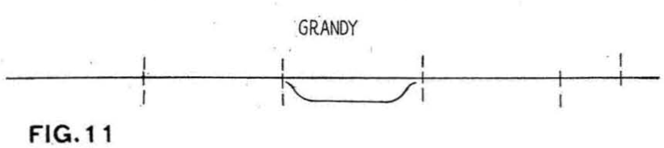
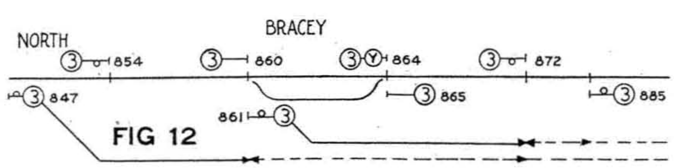
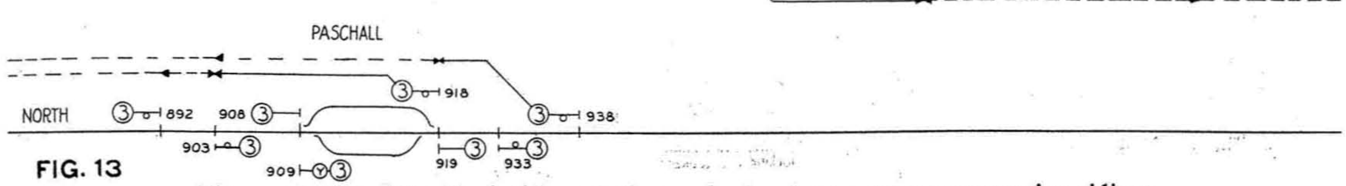


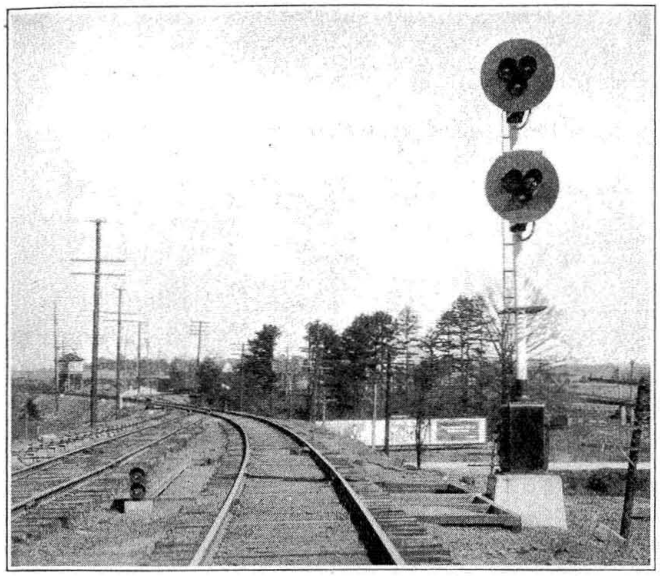
Fig. 10—Signal layout at Alberta, Va., provided to facilitate switching at this point







Figures 11, 12 and 13—Typical layouts for grade signals at entrances to passing sidings opposite each other because of a long curve just north of these signals; if Signal 1115 was moved north of the curve it would be too close to Signal 1107. Signal 1114 could not be moved south, as it was necessary to keep it sufficiently far north to



Style-TR two unit, color-light, northbound home signal at Edgeton Jct. (Raleigh, N. C.)

secure a 1,500-ft. preliminary over-lap between Signal 1114 and a point 1,000 ft. north of the fertilizer switch. Because Signals 1114-1115 are opposite each other, the opposing green control of 1107 and 1128 are extended further than provided for by the standard arrangement. The yard limit territory through Henderson has 2-indication signaling with individual blocks and preliminary over-laps.

The absolute signals on each side of Franklinton are 1288 and 1311, located some distance from the ends of the passing siding to permit switching without setting the absolute signals at the adjoining passing sidings at stop as shown in Fig. 16. Special green controls for the signals approaching Franklinton are used to prevent the indications for opposing movements from being too long. Signal 1299 is not set to the stop position by opposing trains leaving the next siding; this also applies to Signal 1294.

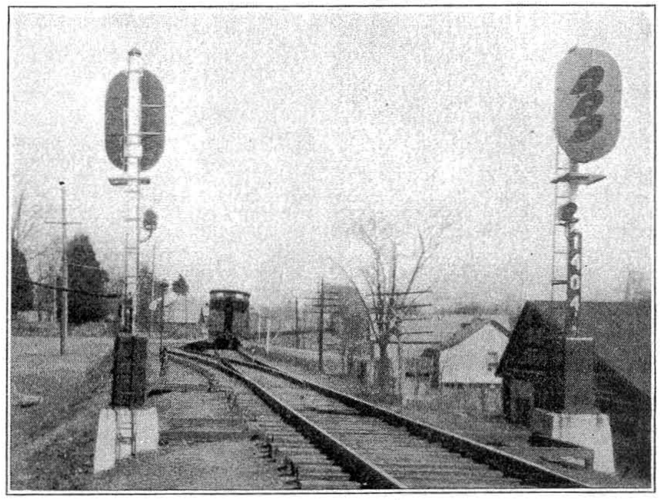
Passing Siding Arrangement

A layout where two passing sidings are located alongside of each other with intermediate signals is shown in Fig. 17. Figure 23 shows a non-interlocked diagram is typical of lap siding layouts in yard territory. Figure 25 shows another variation of a lap siding.

Interlocking and Signal Arrangement at Raleigh, N. C.

The layout of the yard and the tracks leading to the union station at Raleigh, N. C., is shown in Fig. 18. Absolute block begins with Signal 1538 because of switching to an ice plant located south of this signal. The interlocking plant is so arranged that movements past Signal 1547 to the yard can be made simultaneous with movements from Signal 1558 to 1548 when the yard switch is reversed. The circuit arrangement between 1535 and 1548 provides for simultaneous movements when the Norfolk Southern switches are reversed; movements then can be made from Signal 1535 to Signal 1457. Yard limit territory extends from Signal 1547, south.

An "SYR" dwarf signal is used in connection with the switch near Signal 1561. This is used to govern the movement of trains out to the main line. The letter "S" on the "SYR" dwarf is used as an indication to show when the block is clear, so that the main line switch may be thrown. Signal 1565 is an abso-



Style-R color-light signals at Wake Forest, N. C.

lute signal and is controlled by the Raleigh interlocking because of trains making reverse movements on the double track.

Double Track Signaling

Figures 19 (not shown on diagrams), 20 and 26 represent certain special double track layouts. In

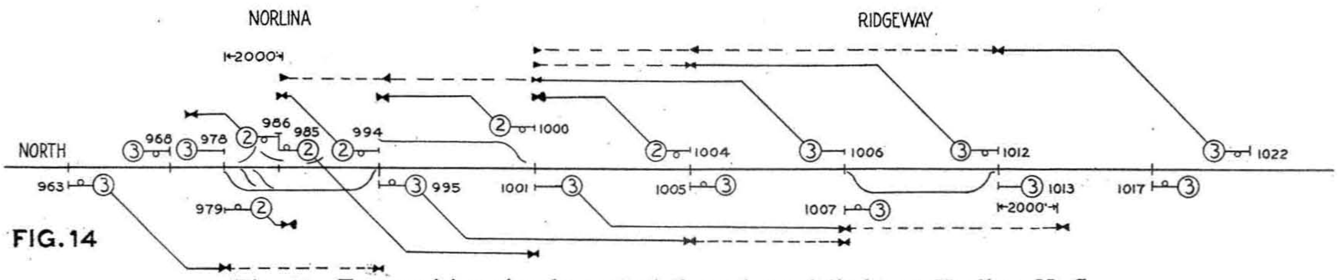


FIG. 14

Fig. 14—Two-position signals control through yard limits at Norlina, N. C.

crossing with two passing sidings, intermediate signals and yard limit territory in which the 2-indication signals are used, as found at Sanford. Figure 24 is a modification of the lap siding arrangement; 2-indication signals are used in yard territory. This

Fig. 19, Signal 1580 on the double track is an absolute signal used to protect trains running against traffic. This signal is controlled by the track circuit ahead of the signal and by the opposing interlocking levers governing the approach to the Raleigh station

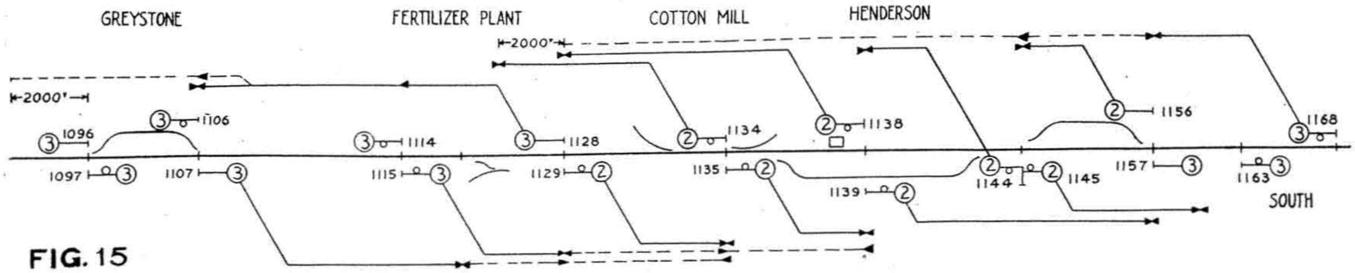


FIG. 15

Fig. 15—Special control scheme at Henderson, N. C., to facilitate switching

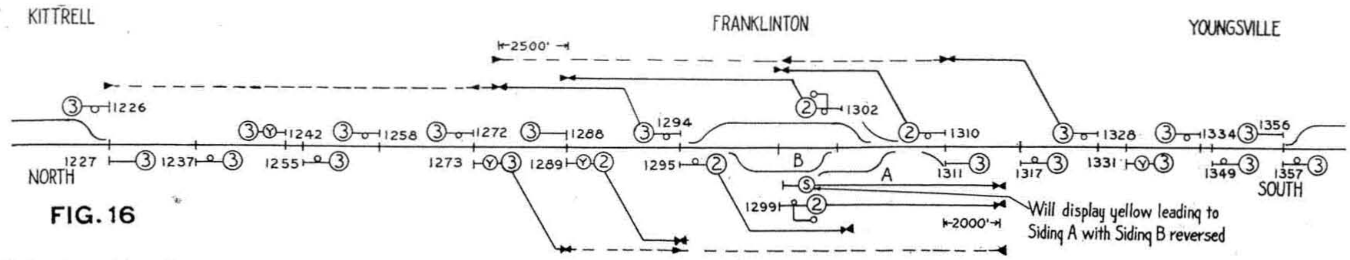


FIG. 16

Fig. 16—Absolute signals *1288* and *1311* are located some distance from the ends of the passing siding on account of switching movements

on the track used by the Seaboard, the Southern and the Norfolk Southern. The end of double track and junction with the Southern is shown in Fig. 20. A passing siding is located just beyond the end of the double track. Figure 26 also shows another end of double track arrangement with special intermediate signals, made necessary by extending the sidings.

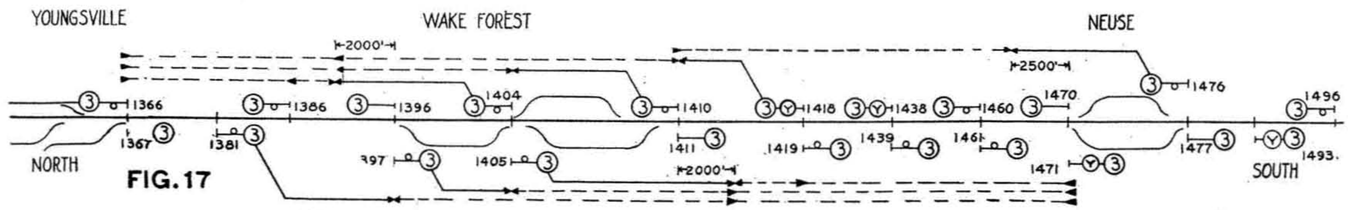


FIG. 17

Fig. 17—Signal control arrangement with parallel passing sidings

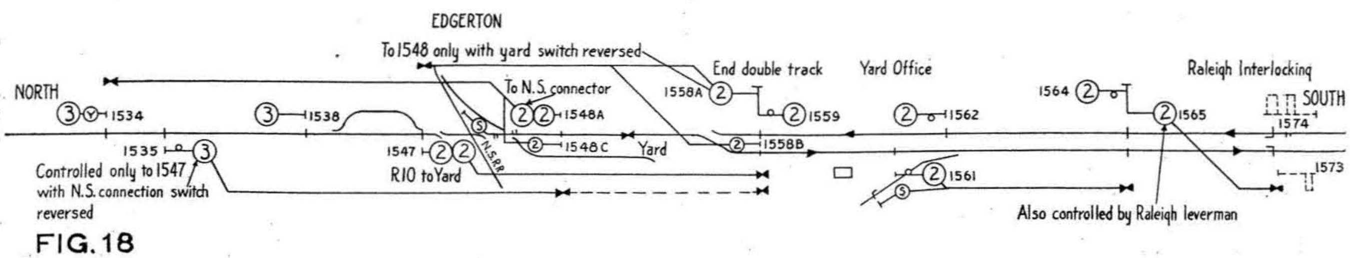


FIG. 18

Fig. 18—Yard layout leading to Raleigh, N. C., union station

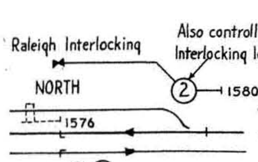


FIG. 19

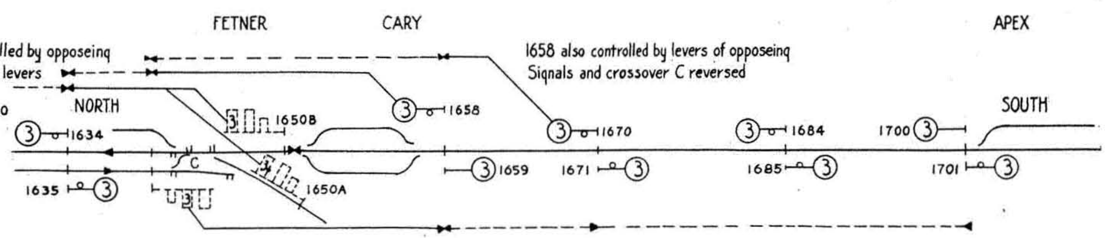


FIG. 20

Fig. 19—Special double track layout

Fig. 20—End or double track and junction with the Southern (Raleigh, N. C.)

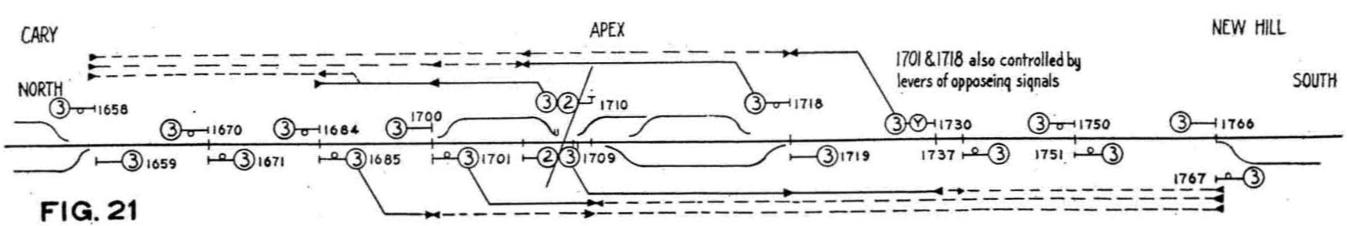


FIG. 21

Fig. 21—Interlocking at Apex, N. C., protecting the Durham & Southern crossing

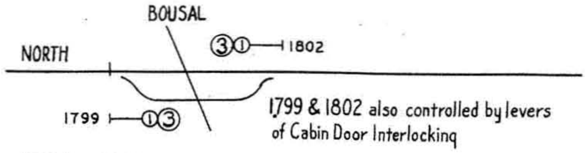


FIG. 22

Fig. 22—Cabin door interlocker

used in connection with the signal installation. In general, one type is used for track circuits at passing sidings. The arrangement for a lap siding is somewhat different from that used at a passing siding. End-fed track circuits are used between intermediate signal locations, while on the double track a pole-changed end-fed track circuit is employed.

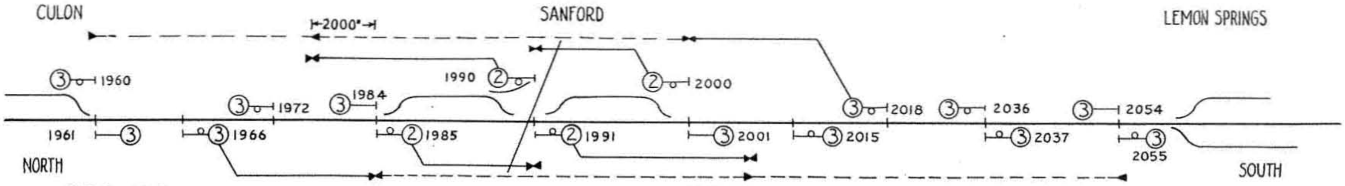


FIG. 23

Fig. 23—Non-interlocked crossing using two-indication signals

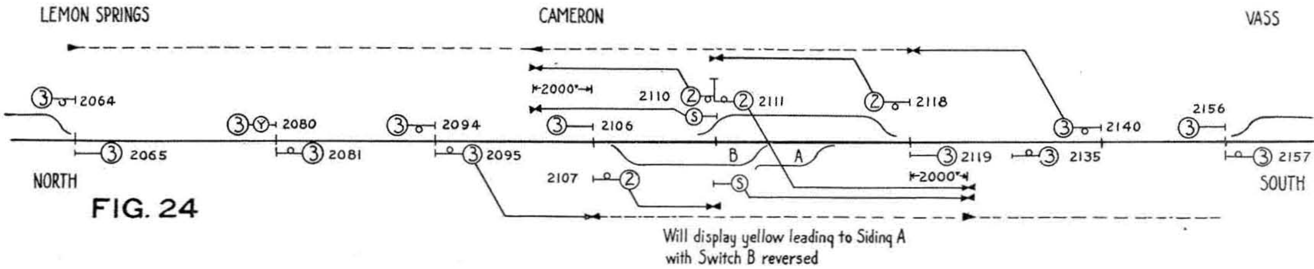


FIG. 24

Fig. 24—Typical lap siding layout in yard territory

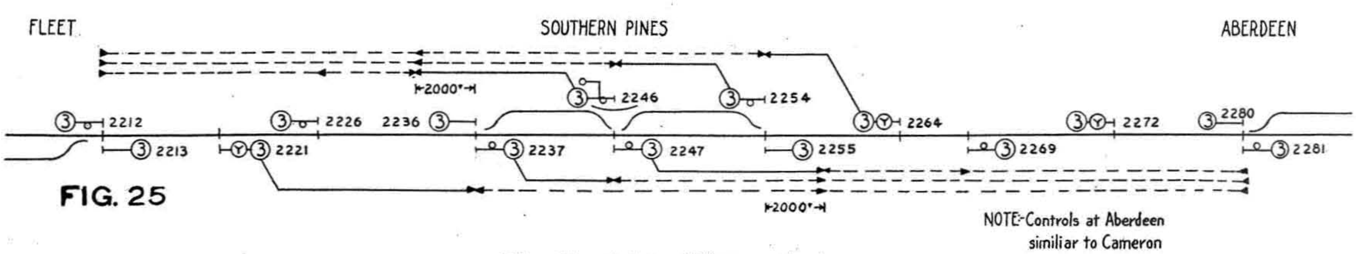


FIG. 25

Fig. 25—A lap siding variation

Apex interlocking, protecting the Durham & Southern crossing is shown in Fig. 21. At this location there is a passing siding located on each side of the crossing and the interlocking home signals also act as intermediate siding signals. This location is arranged to provide for the addition of electric levers to the mechanical machine for future remote control switch operation. Figure 22 shows a cabin door interlocking location.

Track Circuits

Four types of alternating current track circuits are

Referring to Fig. 1, showing the signal circuit controls, the control of Signal 6 overlaps Signal 4 by 2,000 ft. and the control of Signal 3 overlaps Signal 5 by 2,000 ft. This is secured by breaking the signal control circuit of Signal 6 over the floating track relay shown at Signal 4 in Fig. 27. In a similar manner, the signal control circuit of Signal 3 is broken through the floating track relay located at Signal 5. The floating track relay will be de-energized with a train at any point in the territory between the track transformer and a place 2,000 ft. distant. This arrangement provides a safe overlap,

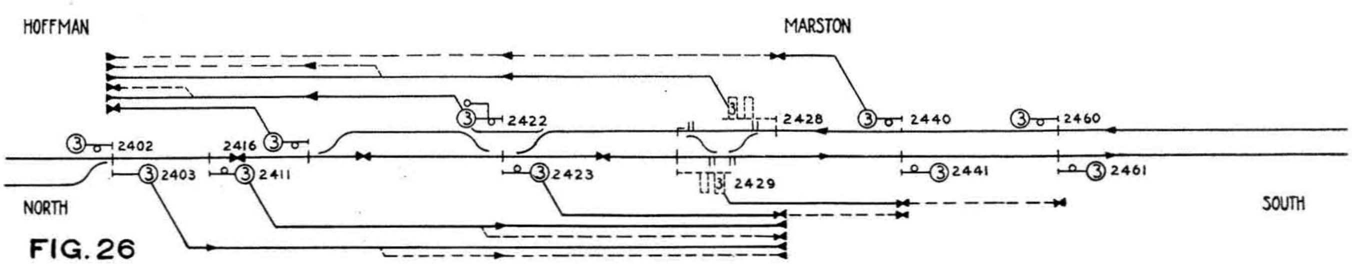


FIG. 26

Fig. 26—End of double track arrangement with special intermediate signals

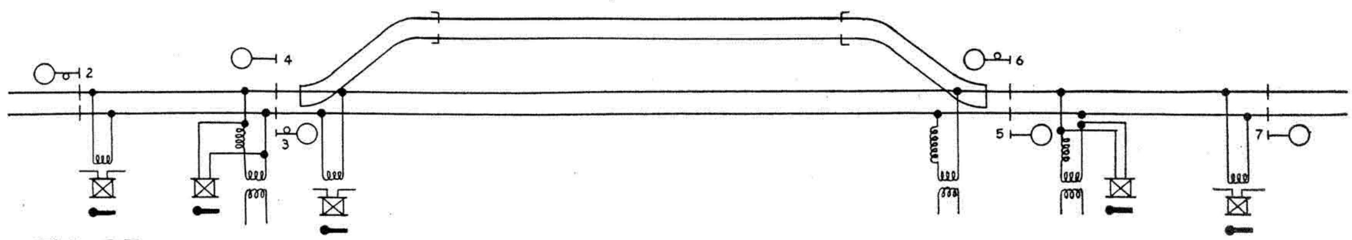


FIG. 27

Arrangment of Track Circuits at Passing Sideing

Fig. 27—Overlap controls obtained by breaking signal circuits through "floating" track relays at a passing siding

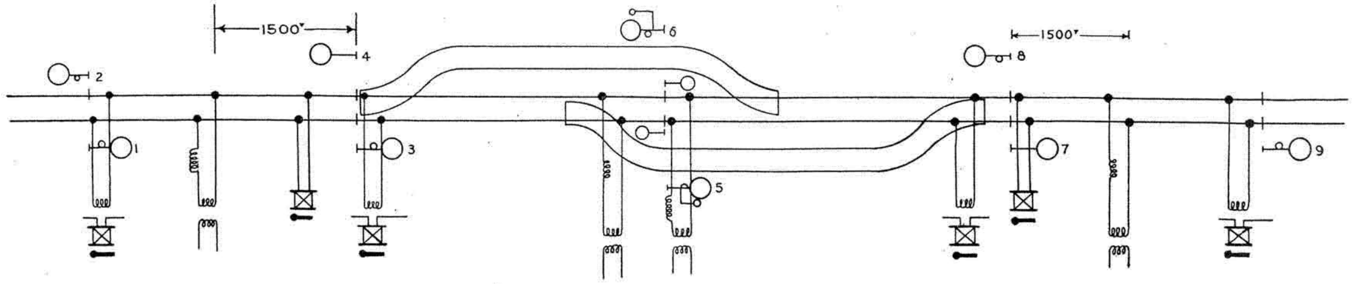


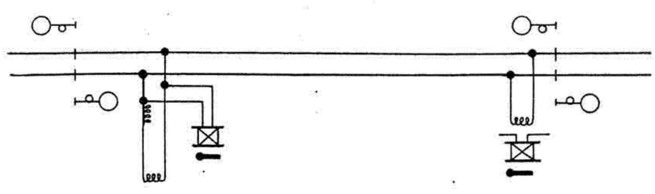
FIG. 28 Eccentric Fed Track Circuits generally used between end of Lap Siding and Intermediate Signals

Fig. 28—An eccentric fed track circuit used between the end of a lap siding and an intermediate signal

as should either floating relay fail to de-energize, a safe overlap is still provided for the signal governing movements in the opposite direction. For example, should a train approaching Signal 4 fail to de-energize the floating track relay at that point, due to some unusual condition, Signal 6 would not display a red indication. However, with Signal 3 also overlapped, there is no possibility of trains, governed by yellow indication, passing Signals 3 and 6 simultaneously. The track circuit between Signals 3 and 5 is of the usual two-element end-fed type.

Eccentric Fed Track Circuits

The eccentric fed track circuit is generally used between the end of a lap siding and an intermediate signal location. Such locations are illustrated in Fig. 3 showing signal control limits. The signal element relay is used on this track circuit as shown in Fig. 28. With this type of circuit, the track transformer is located at a point 1,500 ft. distant from Signal 7. The control circuit for Signal 5, to the rear of Signal 7, is controlled through the single element relay, providing an overlap of 1,500 ft. The two-element "detector" track relay performs the usual functions of a track relay. The track circuits between Signals 3 and 5 and between 5 and 7 are of the usual two-element end-fed type.



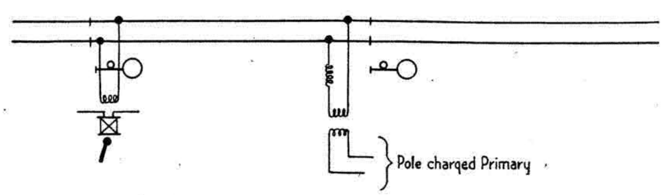
End Fed Track Circuit used between Intermediate Signals

FIG. 29

Fig. 29—End-fed track circuit as used between intermediate signals

The end-fed track circuit is used between intermediate signal locations. This arrangement employs the usual track transformer, two-element "detector" track relay and the single-element "floating" track relay. The detector track relay performs the usual functions of a track relay and has been termed "detector" to distinguish it from the "floating" track relay which is connected directly to the track leads.

Signal control circuits are controlled by contacts in the detector relay which is also used in connection with the stick feature of the A. P. B. system. The



Pole changed End Fed Track Circuit

FIG. 30

Fig. 30—A pole-changed end-fed track circuit is employed on double track

sole function of the floating relay used with this track circuit arrangement is to control the stick relay properly. The detector relay is, of course, de-energized with a strain at any point within the limits of the track circuit, while the floating track relay is de-energized with a train at any point in the block between the track transformer and an intermediate point, depending upon the adjustment of the circuit. This point generally is about 1,500 ft. from the track transformer. As previously stated, the floating relay is used in connection with the control of the stick relay, this control being such as to require that the floating relay made its back contacts only with a train passing directly over the track connections, although this relay could remain energized with a train at any point within the limits of a track circuit and not interfere in any way with the proper operation of the signal control circuits.

On the double track work the pole-changed end-fed track circuit is used. This double track territory is near Hamlet, N. C., and Raleigh, and the track circuits consist of the usual two-element track relay and track transformer, properly pole changed.