Railway Signaling & Communications

Progress in the Automation of CTC Advances Rapidly

In 1948 the Seaboard Air Line incorporated into its CTC system between Hamlet, N. C., and Savannah, Ga., 248 miles, circuits which automatically transferred the system to approach clearing, station-to-station automatic block upon failure of the code line. However, the switches had to be worked by trainmen using a switch key operated circuit controller (see RSC, Sept. 1948, p 540).

In February 1960, RSC (p 15) reported that the Norfolk & Western had developed and installed on a 96-mile line, a system for automatically clearing CTC signals in advance of a moving train. However, it would not make meets. It rang a bell when a meet was imminent and the dispatcher took over the controls. The controls for this automatic feature were in the central office, and depended upon the integrity of the code line.

Another U. S. railroad has installed over 500 miles of completely automatic CTC, which will make meets. Like the N&W system, the controls are in the central office and a working code line is a requirement. This system senses a meet far enough in advance to have the first train to arrive take the siding, allowing the meeting train to hold the main. The system usurps the controls usually used for fleeting to obtain this automatic feature. (RSC will publish an article on this system in the very near future.)

The system described by Mr. Nucci provides for operation of the switch machines as well as the signals. It can be transferred into automatic operation at the will of the operator, or by the failuré of the code line. Since the automation is in the field circuits, the system will work automatically with a faulty code line. The first train to arrive at a siding holds the main, while the second takes siding. Plans for a 100-mi section are ready but installation authority has not been granted.

Brazilian Automatic CTC Will Make Meets

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This paper discusses field circuits for automatic traffic control in single-track territory. In field automated CTC, the trains cause the signals to clear and meets to be made without manual attention and without control code action. A transfer relay is provided which permits operation either by distpatcher controlled code, or by automatic control. During part of the day, or over part of the CTC territory, trains may be controlled automatically, while at other times, or in other parts, the trains are controlled by the dispatcher.

The transfer from manual to automatic control may be effected by the CTC machine operator, or by a failure of the code line. In order to make this automatic operation possible, it is necessary to accept station-to-station block. Thus the circuits were designed so that one train cannot follow a preceding train until the block is clear up to the far end of the next siding.

The economic advantages of the field automated CTC are: first, the use of the existing facilities and equipment during code line troubles, although the preference of trains is given by track occupancy; second, the reduction of delays with no loss of safety in case the code system fails to operate; and, third, the reduction of operating expenses by permitting one dispatcher to handle more miles of CTC territory.

The transfer from operator to automatic controlled CTC may be accomplished by the operator pushing a button or by an open or shorted code line. To restore operator control, a code is sent to each desired field station, picking up its transfer relays. If the CTC operator had placed the CTC in automatic control, indication codes are sent to the central office and the indication lamps are lighted. In case an emergency transfer occurs, because of a code line failure, indications will not appear on the control machine, but the trains will continue to operate by signal indication.

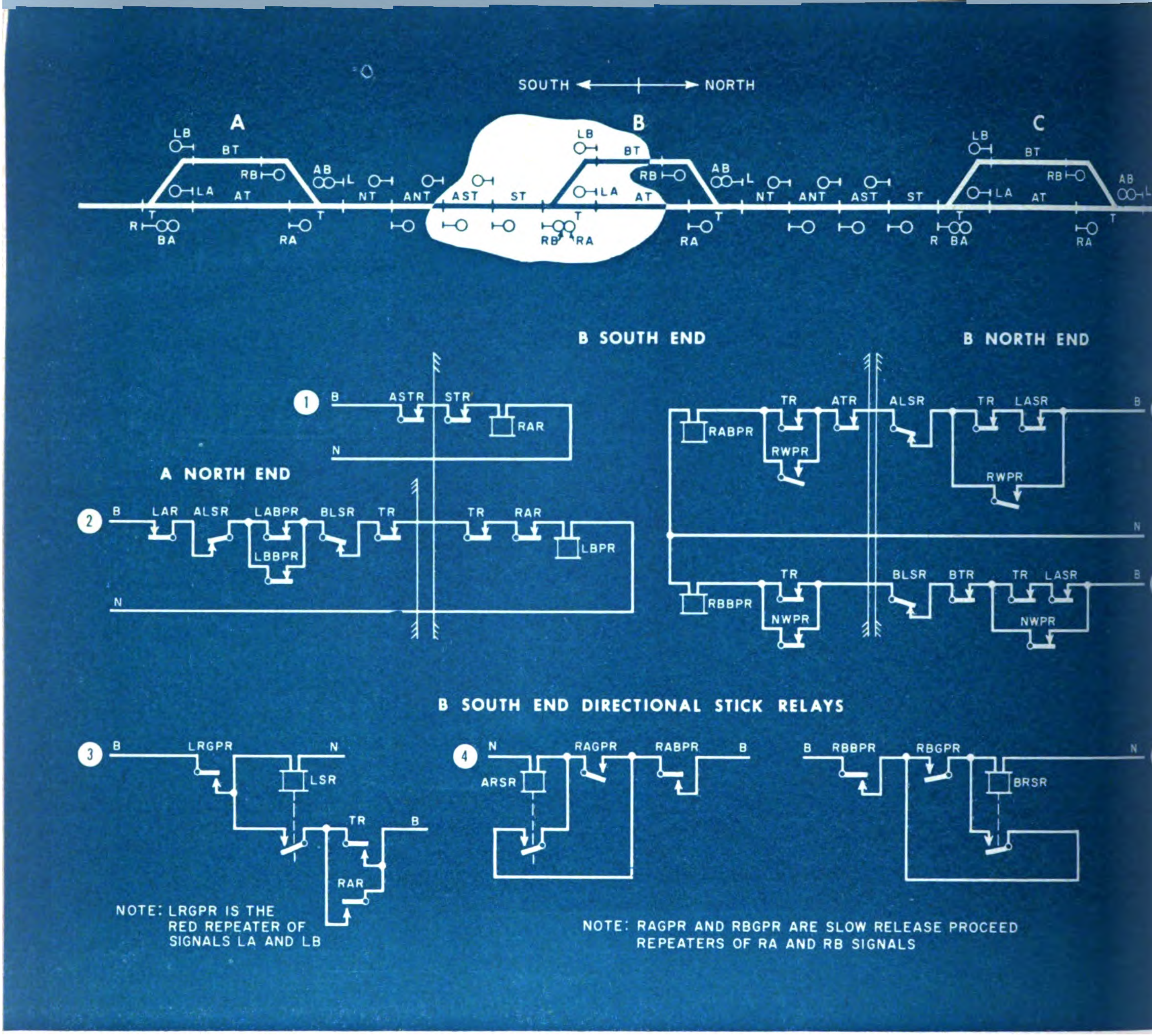
If the CTC operator wishes to transfer the traffic control to automatic, he pushes a button in the control machine. The code line is held open for an unusually long impulse. The field line relays release, and thereafter relays RP (8)* and RPP (9). With these two relays down, the field function relays are operated by the automatic control circuit, instead of the control code impulses. The RP and RPP relays are the same as used by US&S 506-A code system for field station disconnect. This transfer feature is an alternative application of the same principle. All the field stations will now be in the automatic control condition. To restore dispatcher control, a control code is sent to each desired station to pick up its transfer relays.

In case the code line breaks open or shunts at some point, the field stations whose R relays are released, act as described above. An emergency transfer takes place and the field automatic control circuits handle the traffic, with siding-to-siding block. No indications will then be displayed in the control machine.

The diagram shows the automatic control circuits for the south end of station B. The south end of station B will be used as an example, and the action here will be indicative of all end-of-siding locations. Only relays LBPR (2) and LSR (3) need be added to existing CTC and interlocking field relays. The diagram shows only the circuits that are necessary for a good understanding of the automatic operation. Track, signal control, and other circuits are omitted.

These circuits are so arranged that a train will normally route itself onto the main track at a station. When two trains are approaching a station from opposite directions, the first train to occupy the approach track circuit will hold the main, and the second train will be routed into the siding.

* The numbers in parenthesis are intended as an aid in locating a particular circuit. They refer to the circled numbers on the circuit diagram.



Automatic operation (RPP down) is as follows: When a train enters the track circuits in approach to the station entering or leaving signal, the switch operation and the clearing of signal are initiated, if traffic conditions allow. The approach relay RAR (1) selects direction. A signal will be called only after the route is properly lined, which is indicated by the switch repeaters NWPR and RWPR.

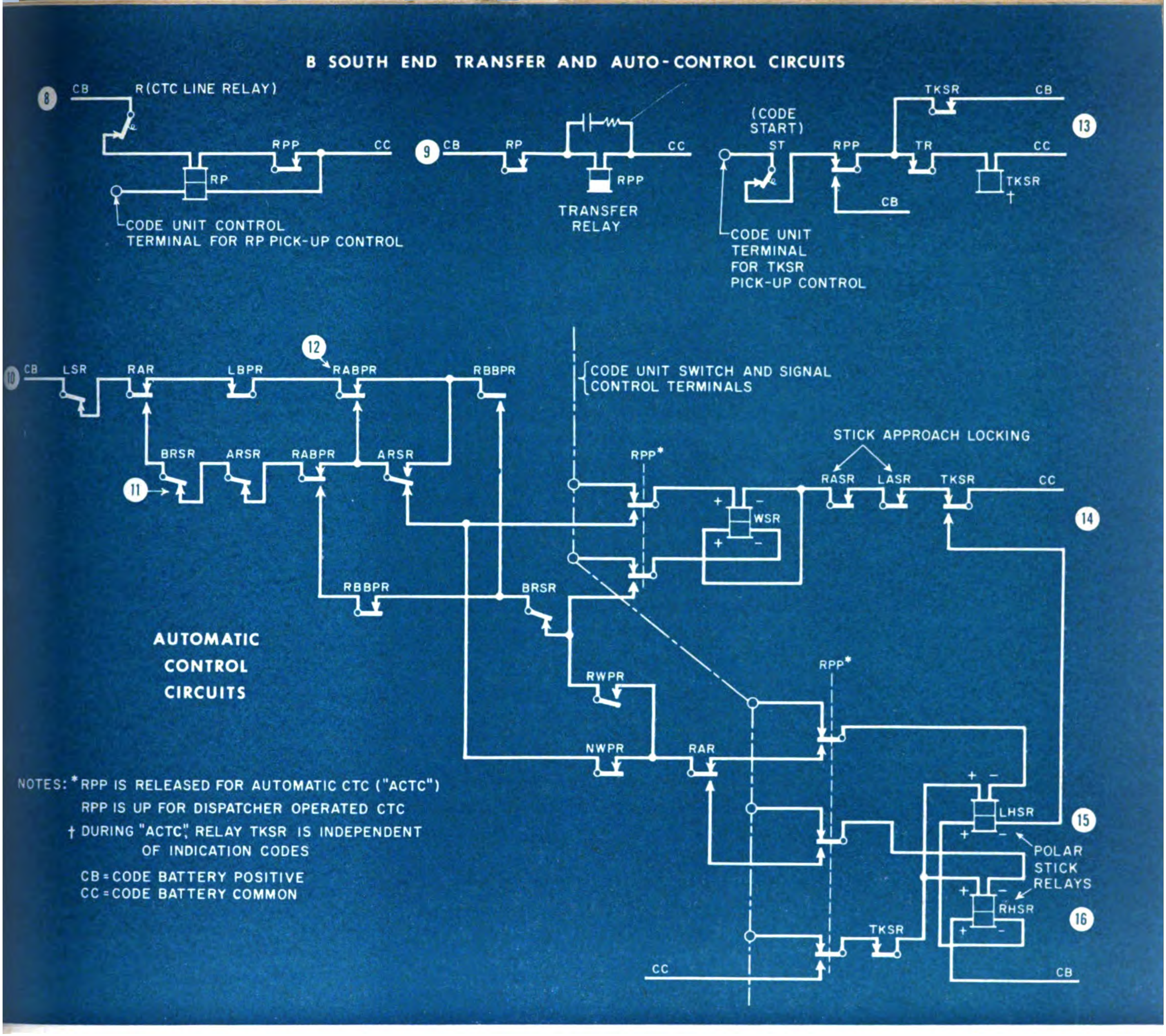
The directional stick relays LSR (3), ARSR (4), and BRSR (5) prevent switch operation and clearing of signals to the rear of the trains. Contacts of BRSR and ARSR are also used between the first RAR back contact and the heel of RABPR (11), to prevent the entrance of following trains. It will also prevent the traffic blocking that would occur if an opposing move were made.

When a northbound train approaches the south end of station B, it will initite the clearing of signal RA. As the train occupies track circuit AST, relay RAR (1) will be released. With RABPR up, a circuit is closed through LSR, RAR, BRSR and ARSR back contacts and RPP down, to operate WSR normal (10, 11), if necessary. The same circuit, over a front contact of NWPR and another RAR back, applies code battery to reverse the signal control relay RHSR (16), thus clearing signal RA.

The train, accepting signal RA, releases the OS track relay TKSR (13), which restores RHSR to normal. The relay TKSR breaks the reverse circuit through the top coils of RHSR and LHSR and closes the normal circuit through the lower coils of RHSR and LHSR. At the same time ARSR (4) picks up, preventing signal RA from clearing for a following train.

The RB signal is operated in a similar manner. The control circuit includes RABPR back and RBBPR front contacts, to reverse WSR. RABPR is down because a southbound train had caused signal LA at the north end of station B to clear before the northbound train had reached track circuit AST. RWPR completes the circuit to operate RHSR. BRSR (7) picks up when the train passes the signal, preventing the signal from clearing for a following northbound train.

The clearing of the LA signal will be initiated when a southbound train causes RABPR (5) to release. If traffic conditions allow, LBPR (2) will be picked up. The control circuit (10) may be traced through LSR back, RAR and LBPR front, RABPR and ARSR back contacts (12), to operate WSR normal, when necessary. The signal control relay LHSR (15) is reversed over NWPR and RAR front contacts, thus clearing signal LA. When the train passes the signal, TKSR restores LHSR to the normal position. LSR (3) picks up by the release of the red signal repeater LRGPR and sticks over TR and RAR down. Thus, the control circuit is opened and the entrance signal RA or



RB cannot be cleared to the rear of the train.

In the case where a northbound train is meeting a southbound, and the northbound has occupied track circuit AST before the southbound train occupied track circuit ANT at the north end of station B, the southbound train would have been routed into the siding. Relay RBBPR would be down, and relay RABPR would be up. When the northbound train enters track circuit T, RABPR (5) will drop, causing ARSR (4) to pick up. As soon as the northbound train clears track circuit T, TKSR (14) would pick up, allowing WSR to reverse the switch. When RWPR picked up, signal LB would clear. The control circuit (10, 12) may be traced over RABPR back, ARSR front, and RBBPR back contacts. RABPR would have been released by the northbound train occupying track circuit T.

In the event the southbound train does not leave the siding while the northbound is causing RABPR to be released, or if the dispatcher has manually routed the southbound into the siding without a meet, signal LB will clear over RABPR front (12) and RBBPR back contacts.

The circuits were designed so that a southbound train at station B cannot follow a preceding train until the block is clear up to the south end of station A. This condition appears logical because the preceding train may wait at A for a meet, in which case the following train must not move. This condition is checked by the LBPR relay (2), including ALSR and BLSR back contacts at the north side of station A. Certain precautions are taken regarding the transition period between the centralized and automatic control, supposing its application to be a complete conventional CTC system, including full complement of siding and intermediate signals. This is the reason for including back contacts of ARSR and BRSR between RAR and RABPR (11) in the automatic control circuits. This is also the reason for LABPR and LBBPR front contacts in the LBPR circuit (2).

Other situations must be considered to permit good performance of this CTC automation system. These will depend upon the particular case. The terminal stations, for instance, must be locally controlled when the system control is transferred to automatic. When authority is given by the CTC operator to perform local switching at sidings along the main line. the LBPR and RBPR at the adjacent station ends will be released; if an emergency transfer to automatic occurs while these relays are released, the traffic blocking action of these relays will need to be reset by the train crew.

It is not the object of this paper to indicate and prevent all the problems that may arise. These problems will have to be considered at the time the automatic control is applied to a particular CTC system. **RSC**