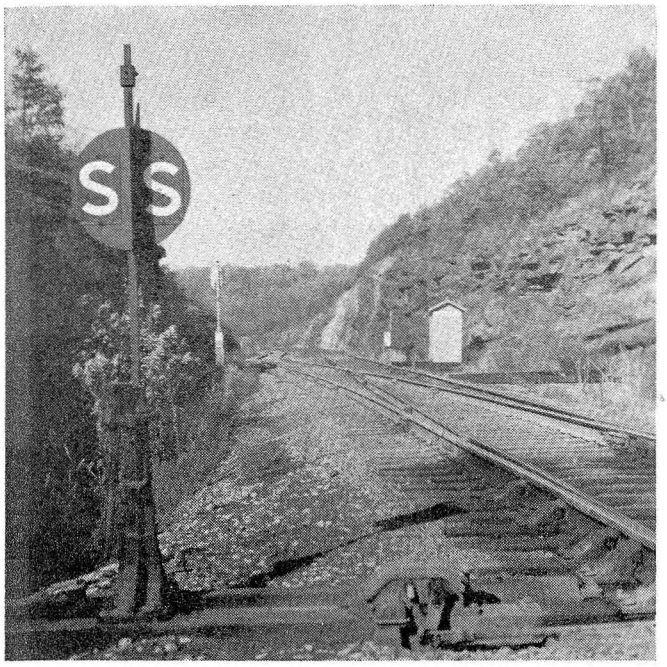
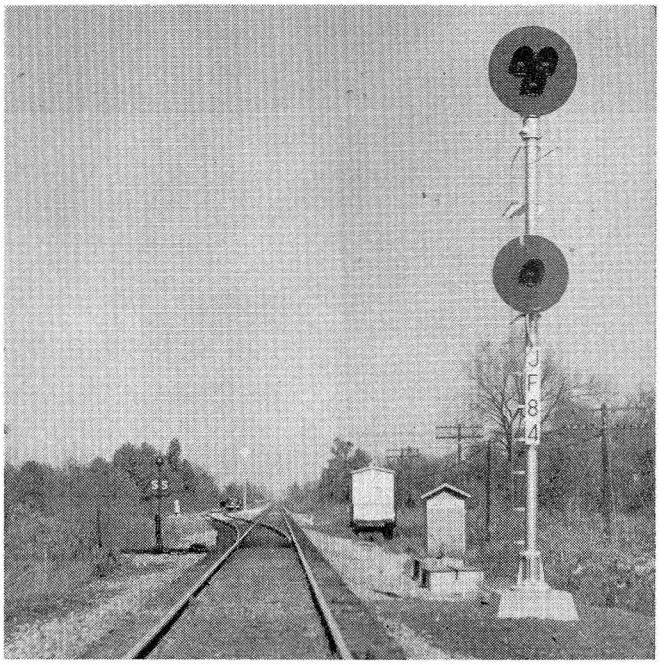
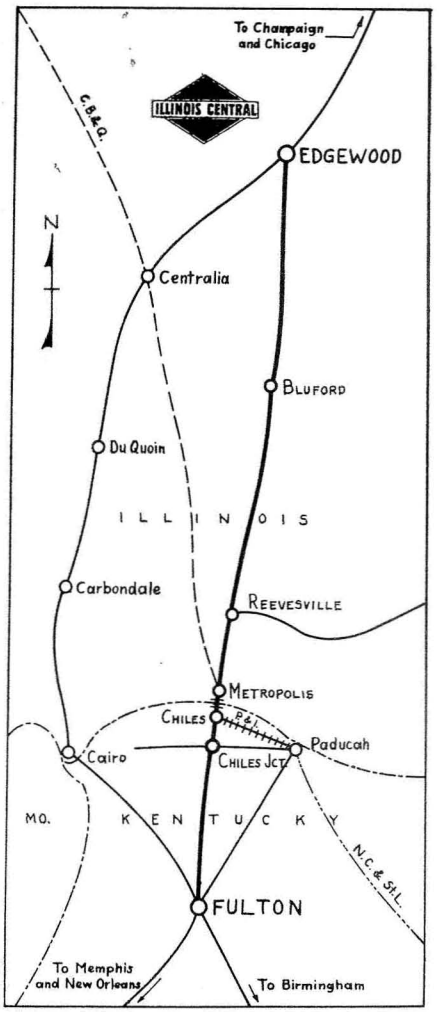




I. C. Installs Automatic Block

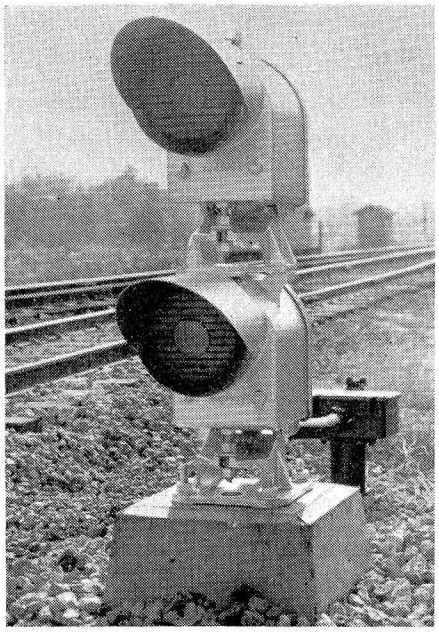
Signals at sidings are located properly for conversion to CTC. Special lunar-marker for spring switch protection. Directional overlap controls avoid train stops. Leave-siding dwarfs save train time



THE ILLINOIS CENTRAL has installed automatic block signaling on 170 mi. of single track on the Edgewood cut-off between Edgewood, Ill., and Fulton, Ky. This cut-off, completed in 1927, was built to handle through freight trains, because the construction of this new line was less expensive, and would permit more efficient train operation, than would have been accomplished by revising grades and reducing curvature on the original route via Cairo, Ill., which is 16 mi. longer. In spite of the fact that much of this Edgewod cut-off traverses rough country, through the Illinois Ozarks, the line was built "straight and flat," to handle heavy tonnage at fast speeds.

The construction involved deep cuts, high fills and three tunnels, one of which is 1⅛ mi. long. The grades are low, the maximum being 0.16 per cent. For the most part the line is straight with one section of tangent track 63 mi. long. The maximum curvature is ¾ of 1 deg. The principal motive power is derived from mountain-type locomotives with 70-in. drivers which are rated on this district at 9,590 tons. Manifest trains generally consist of about 90 cars, totaling about 5,500 tons.

Passenger trains are not operated on this line except in emergency. The schedules include four manifest dispatch freight trains each way daily on the entire 170 mi. between Edgewood and Fulton. At Chiles Jct. there is a connection with an Illinois Central line that goes east through Paducah and on to coal fields in Kentucky. Traffic to and from the Paducah line adds three more scheduled trains on the 126 mi. of the Edgewood cut-off between Chiles and Edgewood. Extra trains are operated nearly every day, so that in eight days in October an average of 17.5 trains were operated daily on the Fulton-Chiles Jct. section, and 29.3 trains daily on the Metropolis-



Absolute leave-siding dwarf

Edgewood section. Thus this Edgewood cut-off is an important part of the "Main Line of Mid-America" which gives 6 p.m. to 11 a.m. freight service between Chicago and Memphis, 527 mi.; and "second-morning" delivery between Chicago and Birmingham, or Chicago and New Orleans.

The cut-off has now been further improved by the construction of automatic block signaling which includes numerous special features. This signaling was installed in combination with spring switches which were already in service at the sidings, and operators are on duty at all offices where needed to prevent train delays. The signals at sidings, including leave-siding dwarfs, are in the same locations as would be required in a centralized traffic control system. Thus the new signaling, including the spring switches and the operators, make a combined system that not only contributes to safety but also facilitates the train operation by timetable and train order.

Between Metropolis Junction and Chiles, 4 mi., which includes a bridge over the Ohio river, the Illinois Central operates over the Paducah & Illinois, owned jointly by the I.C., the C.B.&Q. and the N.C.&St. L. This section was equipped with centralized traffic control, in 1929, including power switches and signals at the junctions and ends of the siding at Chiles with control point at Metropolis Jct.

Track Arrangements

Southward trains enter the cut-off at Edgewood, Ill., where an interlocking is in service at the junction point with the double-track main line. From this interlocking, a siding extends south to a spring switch at the south end. Between Edgewood and Bluford, 40 mi., there are four sidings with spring switches at both ends. Bluford is the terminal point for freight trains operated between Bluford and Champaign, 128.4 mi., and between Bluford and Fulton, Ky., 127.2 mi. In addition to the main track, an outbound lead extends from Bluford yard to connect with the main track by a spring switch about 1 mi. north of Bluford. Likewise, a southward outbound lead from the yard connects to the main track by a spring switch about 2 mi. south of Bluford.

Reevesville, 68.8 mi. south of Bluford, is a coal and water stop with a restaurant where the train crews eat. A long second track extends through Reevesville with spring switches at each end that are normally set to diverge trains to the right-hand track. At North Yard, 2 mi. from Fulton, there is a spring switch which connects to a yard lead track extending into North Yard at Fulton.

Passing sidings equipped with spring switches at both ends are, and were previously, in service at four locations between Edgewood and Bluford; nine locations between Bluford and Reevesville; and six locations between Reevesville and North Siding, just north of Fulton. Counting the siding at Edgewood, this totals 20 sidings in addition to the layouts at Reevesville, Bluford and on the CTC between Metropolis, Ill., and Chiles, Ky., on the Paducah & Illinois.

Automatic block signaling was installed in connection with both ends of these sidings; as well as at the south end of Edgewood siding; the north and the south leads at Bluford; at both ends of Reevesville; and at the switch at North Siding. This totals 44 spring switches and signal layouts. Four sidings not used normally for passing trains, were not so equipped but were protected by electric locks installed on the hand-throw stands. These sidings are at Bethel, Belle Rive, Anson and Dukes.

Absolute Permissive Block

This signaling is controlled on the Absolute Permissive Block basis, i.e., absolute stop protection for opposing trains in a siding-to-siding block; and permissive to permit following train movements in such a block. The signaling arrangement at ends of sidings is as shown in Fig. 2. A main track station departure signal such as signal 6 at North, is a color-light signal with the color units in a triangle on a circular disc background. Such a signal is designated as an Absolute Stop and Stay signal by its location and absence of a number plate.

Absolute Leave-Siding Dwarf

Each leave-siding dwarf, such as signal 8 at North, consists of two search-light heads in a vertical row, the upper one operating to display three aspects, red, yellow and green, and the lower one displays red only. This red-over-red, with absence of number, is the Absolute Stop aspect. The fixed red, under green or yellow, completes the aspect which authorizes an engineman to pull his train through the turnout at slow speed and then accelerate. The aspect is yellow-over-red if only the immediate block has been cleared by a preceding train of the same direction, or green-over-red if the train ahead has cleared two or more blocks.

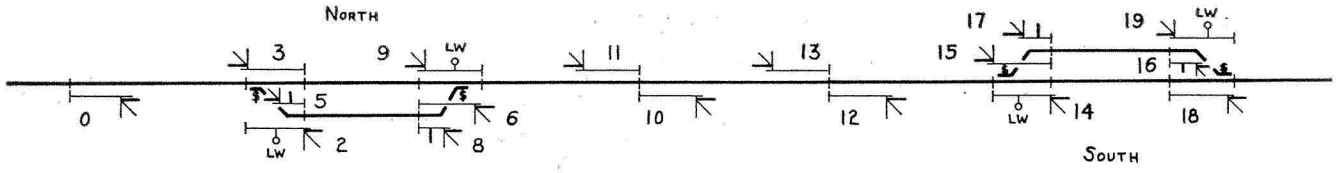
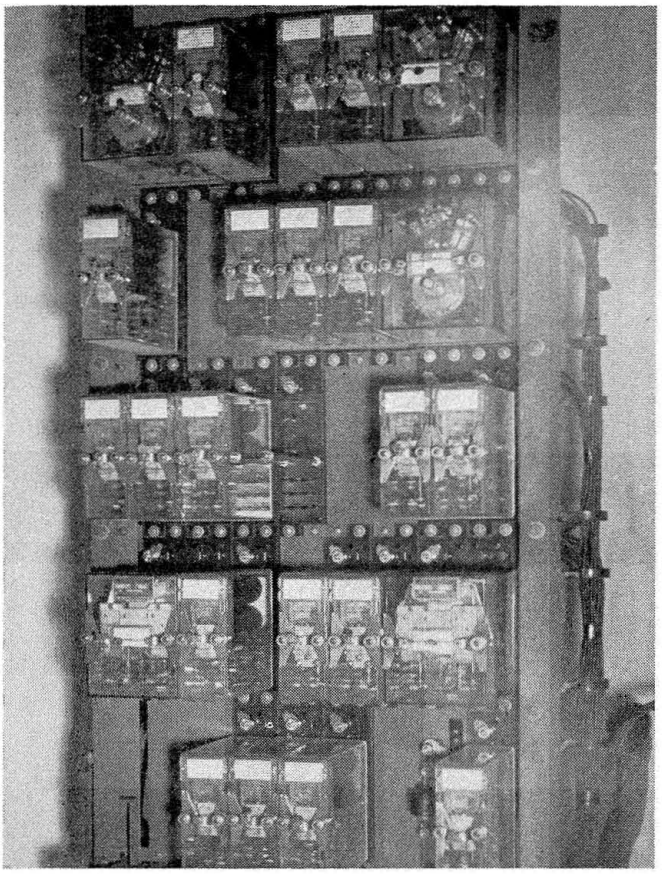


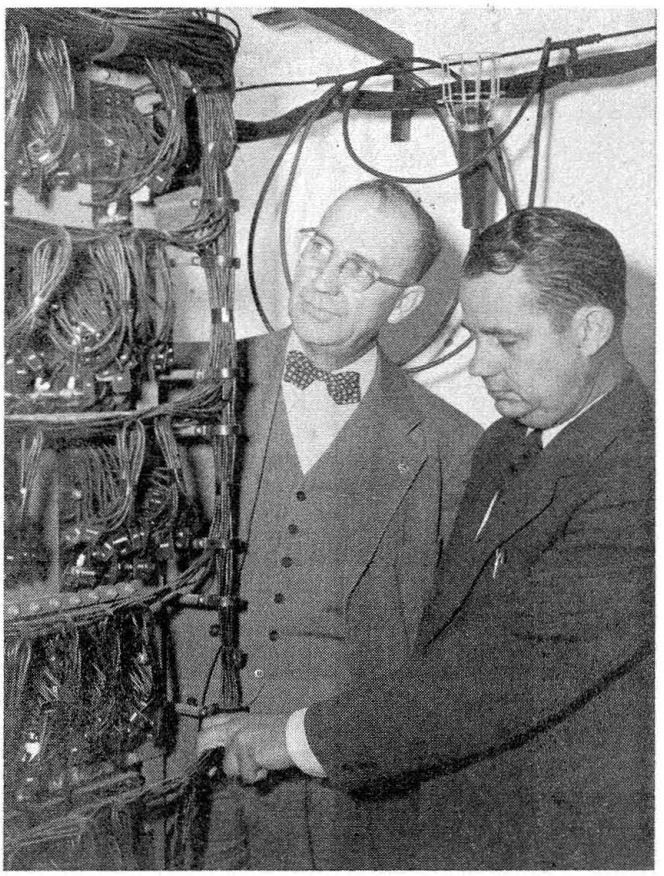
Fig. 2—Track and signal plan of arrangement of automatic signals

Control of Dwarf

Normally, the controls are in condition for all signals to display the Proceed aspect. Referring to Fig. 2, the control for main-track station-leaving signal 6, at North, also normally controls leave-siding dwarf signal 8, so that both of these signals normally display Proceed. When a southbound train passes a certain point, as for example when it passes signal 0, then the leave-siding dwarf 8 is controlled to display the red-over-red aspect, but signal 6 contin-



The relays are the plug-in type



L. R. Griffith and T. B. Thompson inspect wiring

ues to display Proceed, for the train on the main track to proceed to station South. The "certain point" mentioned above is based on braking distance plus a minimum of 1,500 ft. in approach to signal 6.

If a southbound train on the main track stops short of signal 6, and train orders authorize a southbound train on the siding to proceed ahead of the other train, then the conductor of the train on the siding goes to a controller box at the dwarf signal. The insertion and turning of a switch key in a controller marked "Siding" places signal 6 at Stop. After a time interval (on the same basis as time locking), the leave-siding dwarf will indicate Proceed. A small white indicator lamp, on the controller case, indicates to trainman, operating the key controller, when the releasing circuit is in operation.

With no southbound train approaching station North, signals 6 and 8 indicate Proceed. Therefore, if a southbound train on the siding is ready to depart, as authorized by timetable and train orders, the engineman accepts the Proceed indication of the leave-siding dwarf 8, and pulls his train out through the spring switch, and departs, no stops being required for trainmen to operate the switch. In making this train movement, when the front pair of wheels of the locomotive shunts the track circuit on the turnout, the main track signal 6 is controlled to the Stop aspect, and signal 2 to Approach.

For Opposing Moves

As previously stated, signals such as 6 and 8 at North, normally display the Proceed aspect. When the front end of a northbound train passes signal 15 or 17 at South, signals 6 and 8 at North are controlled to display the Stop aspect, and the Stop then Proceed aspect is displayed on intermediate signals 10 and 12. When the rear of the northbound train passes signal 6, the aspect of leave-siding dwarf 8 changes to Proceed so that, if a southbound train is waiting on the siding, it can leave at once. This directional stick control is thus effective for clearing the leave-siding dwarf 8, but is not effective for clearing main-track signal 6. The directional stick holds until the northbound train has passed the approach limits of signal 6.

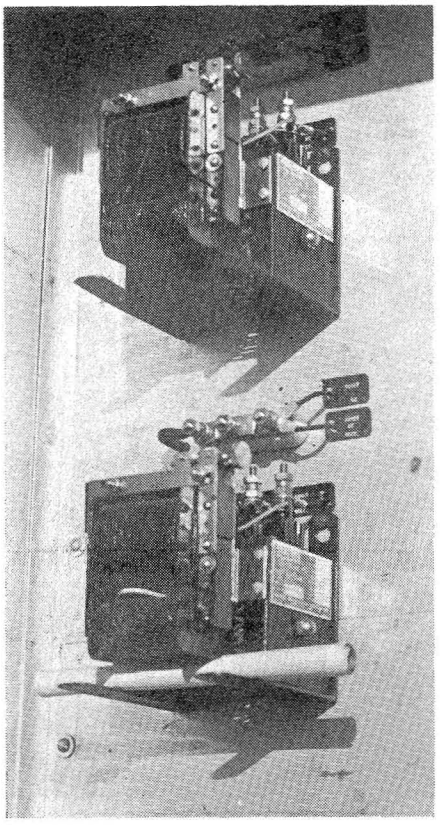
If a northward train, such as a work train, does not clear the approach circuit but then desires to again move southward, the operation of the switch key controller marked "MAIN" will place dwarf signal 8 to Stop, and provide a Proceed aspect on signal 6, after a predetermined time. If the northward train heads into the siding at signal 9, signal 8 will continue to indicate Stop, and signal 6 will indicate Proceed, if a southward train is in approach limits to signal 6.

Spring Switch Signal Protection

The main-track trailing point signal 6 is checked through the full-normal position of the switch points. Signal 8 is checked through the full-normal or full-reverse position of switch points. Signal 6 and 8 are also block signals controlled through track circuits for following and opposing movements. The restrictive indication of these signals is Stop, and emergency movement past either signal, as a result of false restrictive indication, includes the examination of spring switch points.

The facing-point movement over the spring switch is governed by a Stop and Proceed signal, such as signal 9. The aspect consists of a three-unit colorlight signal with a lunar spring switch marker light below.

Under restrictive conditions, the train stop at Stop and Proceed signals is abrogated except as otherwise provided. When a restricting condition prevails and the spring switch points are in proper position, the lunar marker is displayed in combination with a red aspect to allow train



Rectifiers wall-mounted

to pass the signal without stopping. However, if the spring switch points are not in proper position, the lunar marker is not displayed in combination with the red aspect, and a stop must be made and the switch points examined.

Time-Controlled Overlaps

Where the distance between adjacent sidings may be such that there is not twice train stopping distance between opposing intermediate signals, such as 10 and 13, time-controlled overlaps are applied, as outlined in *Railway Signaling* of April, 1949. It should be recognized that opposing trains do not ordinarily leave adjacent sidings simultaneously except through wrong interpretation or application of train orders. The time-controlled overlap is automatic in operation, based on speed at which trains approach station-leaving signals. The section of main track in siding limits is divided into track circuits such as A-B-C-D. The speed of train approaching signal 6 is measured in track section A. If this speed is such as not to enable the train to stop at Signal 6, then signals 11-13-15 and 17 are automatically overlapped into track section B. In a corresponding manner, signals 6-8-10 and 12 are overlapped into track section C with a northward train in track section D operating at a speed not enabling it to stop at Signal 15.

In the case of short trains approaching in sections A or D, in excess of the critical speed and then stopping short of signals 6 or 15, the overlap into sections B or C is relieved after a predetermined time. If the speed of train enables a stop at signal 6, the control of opposing signals 11-13-15 and 17 ends at signal 6. In a similar manner, the control of signals 6-8-10 and 12 normally ends at signal 15.

Flashing Yellow Aspect

Where the distance between signals does not provide adequate braking distance with the use of the Approach indication with the constant yellow aspect, the braking distance is extended to include the next signal in rear with the use of the Advance Approach indication. The Advance Approach aspect consists of flashing yellow, used extensively on the Illinois Central.

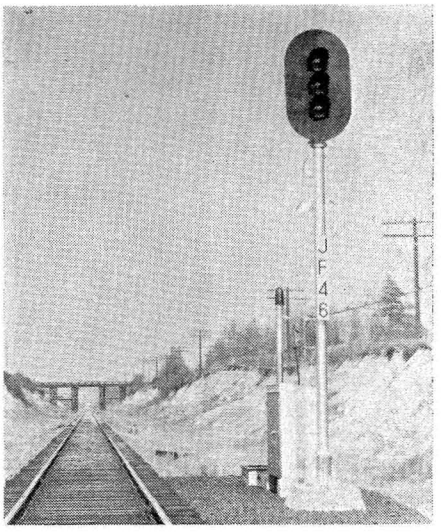
The three line wires for the signal line control circuits are No. 12 Copperweld with 7/64-in. neoprene covering. From various locations on this territory, 120-volt a.c. power is fed on a power distribution circuit consisting of two No. 10 copper wires, with 7/64-in. neoprene covering and No. 6 copper with 3/64-in. neoprene covering. At various locations, Fansteel selenium rectifiers charge the storage batteries. At each signal, a set of five 80-a.h. Exide cells feed the line circuits, and the stick relays, and also act as standby for signal lamps, which are normally constant lighted on a.c. Signals are approach lighted on d.c. during power interruption. One cell of the same type or Edison type feeds each track circuit.

Connections from the relay housings to rail are No. 9 single-conductor undergound cable. Other circuits, except light wires, are in No. 14 multiple-conductor buried cable. The wiring in the houses and cases is No. 14 flexible, using solderless connectors made by Aircraft-Marine Products, Inc., except on connections to contacts of plug-in relays, where wire is soldered direct to removable terminal.

Signals and Relays

Each signal is controlled by a 200-ohm polar line relay controlled by a line circuit consisting of one line wire and connection to a common line wire, used also by the line circuit for the opposite direction. The track relays are the 1.8 ohm neutral type, and the track circuits range up to 6,000 ft. in length.

At each siding switch, a switch circuit controller includes contacts which control two biased neutral relays, one of which repeats the normal



Case at intermediate signal

position of the switch, and the other repeats the reverse position. Line control circuits, and other circuits as required, are broken through contacts of these relays.

At each passing track switch, the relays and batteries are in a concrete house, 6 ft. by 8 ft. These houses are set on creosoted pine piles, the lengths of which depend on the soil conditions at each location. At intermediate signals, the relays are in sheet-metal cases, and the battery is in concrete boxes.

The signals on this project are P5 and TP5, made by the Union Switch & Signal, Division of Westinghouse Air Brake Company. Retained neutral-neutral relays are U.S.&S. type DN26B with plug couplers. All other relays, including the track relays, line relays, sticks, switch repeaters, etc., in these houses, as well as at intermediate signals, and cut sections, are the General Railway Signal Company style B plug-in type. Swing-type racks are used in concrete houses.

The 44 oil buffer spring switch mechanisms are the Mechanical Switchman type, made by the Pettibone-Mulliken Company. Each spring switch is so designated by two letters "S" on the round disk of the target on the switch stand. As originally installed, these letters were white with reflector buttons. On several test installations, white Scotchlite reflector material is being used now.

This signal project was planned and constructed by signal forces of the Illinois Central, under the direction of H. G. Morgan, signal engineer, and T. B. Thompson, assistant signal engineer. L. R. Griffith and R. O. Ringland, signal supervisors, had charge of construction forces on their respective divisions.