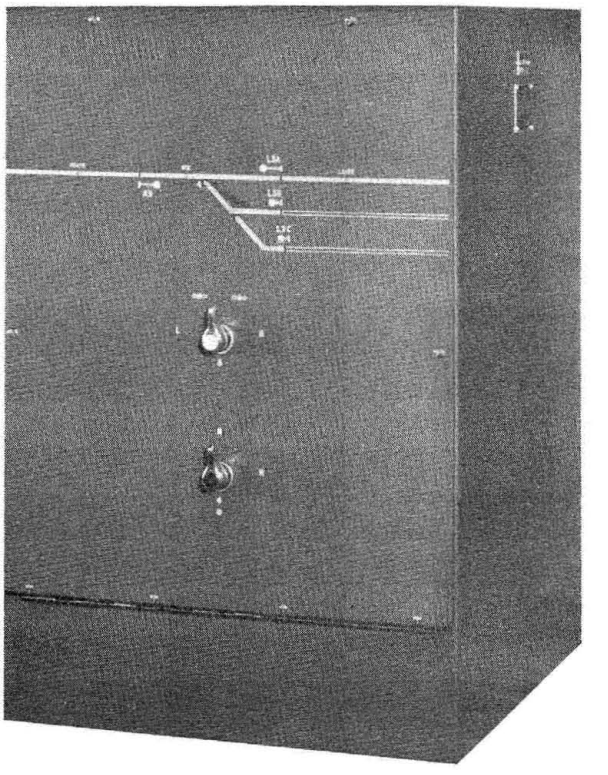
Remote Control Installation



The control machine is located about 1.2 miles east of the layout, and consists of two levers and a track model

Installation at North Fond du Lac, Wis., includes exclusive use of plug-in type control relays, all of which are contained in a small instrument case at remote switch and in machine cabinet in the office

AT THE west end of the freight yard at North Fond du Lac, Wis., the Wisconsin Central, operated by the Minneapolis, St. Paul & Sault Ste. Marie, recently installed a remotely controlled interlocking, including a yard entrance switch, two operative high home signals, two operative dwarf home signals and two fixed-position distant signals. An electric power switch machine is used on the yard entrance switch No. 4 from the main line to No. 1 yard lead, while the switch leading from the No. 1 lead to the No. 2 lead is the hand-throw type. North Fond du Lac is on the Stevens Point division of the main line of the Soo Line between Chicago and Minneapolis, Minn., being located 159 miles north of Chicago. All train movements in the vicinity of this installation are operated and governed by time-table and train orders, there being no automatic signals in service.

Reasons for Installation

Prior to the installation of this remote-controlled interlocking, eastbound freight trains had to stop on the main line to permit trainmen to operate the yard entrance switch. Likewise, westbound freight trains departing from the yard had to stop to permit trainmen to line up the yard departure switch, and stop again to permit this switch to be placed normal and for the trainman to board the caboose. As this layout is located on a slight ascending grade westward, delays of freight trains departing were incurred by the hand operation of the switch, which are now avoided by the power operation thereof. An eastbound freight train is also saved an appreciable amount of time by the power-operated switch.

Switch and Signals

The one power switch machine is of the General Railway Signal Company's Model 5B, dual-control, equipped for operation on 20-volt d-c. The turnout is a No. 15 with 20-ft. switch points. The operative high home signals on the main line, R3A, R3B and L3A, are all of the SA searchlight type equipped with 11.3-volt, 14.4 watt lamps. The eastward home signal R3 has a two-aspect upper "arm," R3A, green and red, for directing through movements on the main line, and a two-aspect lower "arm," R3B, displaying red or yellow for directing diverging moves from the main line into the yard leads. Signal L3A has a two-aspect upper "arm," red and green, for directing train moves west on the main line, and a Type W fixed vertical red marker light as the lower "arm." Signals 26 and 31 are fixed distant signals displaying continuous yellow aspects. The two dwarf signals, L3B and L3C, are of the two-aspect, red and yellow, ME type, the display of which are selected through the power and hand-operated switches.

Control Machine

The control machine is located in the telegraph office DY at North Fond du Lac, approximately 1.2 miles east of the layout. The machine is of the C.T.C. type, 14 in. wide, 22 in. high and 18 in. deep, consisting of an illuminated track diagram, one switch lever and one signal lever. The signal lever No. 3 operates to three positions, center, left and right. Lever No. 3 to the left clears signal L3A when switch No. 4 is normal; signal L3B when switch No. 4 is reversed and the hand switch is normal; signal L3C when the power switch is reversed and the hand switch is reversed, providing the detector section 4T and track section L3T are unoccupied. Lever No. 3, to the right, clears signal R3A when the power switch No. 4 is normal and the detector section 4T and track section R3T are unoccupied; and signal R3B when the switch No. 4 is reversed and the detector section 4T is clear. Lever No. 3 in the center position holds all signals at the most restrictive aspect. A small white light corresponding with the position of the signal lever is lighted when a signal is cleared.

The switch lever No. 4 operates to two positions, N and R. Before

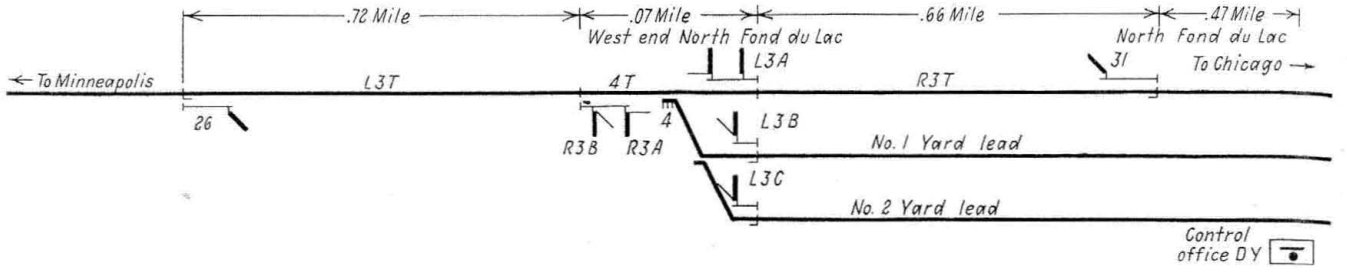
switch No. 4 can be reversed, all signals must be at Stop and lever No. 3 in the center position. A small white light below lever No. 4 indicates when the switch is in operation or out of correspondence with the position of the lever. A red light is lighted in the center of the lever when the switch is either locked reverse or normal and a route is set up.

L3B or L3C is "taken-away," a two-minute time release must be run down before a route can be changed.

Primary-Secondary Detector Track Circuit

As a means of protection against the loss of shunt, maintenance of detector locking, and the elimination

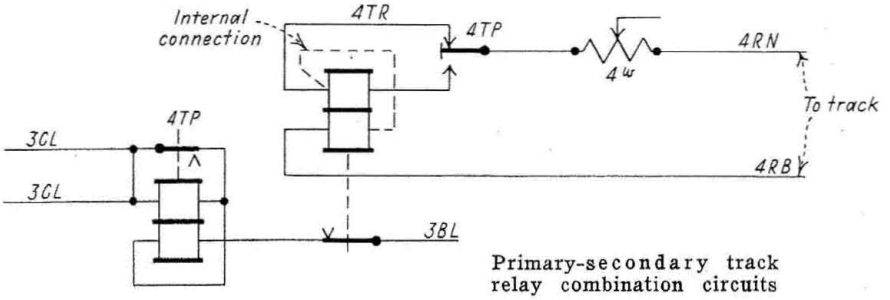
track relay 4TR being the primary relay and the track repeater relay 4TPR the secondary relay. This arrangement retains the quick-shunting characteristic of the primary relay 4TR and the slow-pickup characteristic of the secondary relay 4TPR, the factors effecting the time margin or overlap. Because the secondary relay changes the connec-



Track and signal layout at the west end of the North Fond du Lac freight yard

The indication lamps are of the telephone type rated at 12 volts. A route cannot be set again by moving this

of flashing or "flipping" of the signals, a special primary-secondary track circuit is incorporated in track



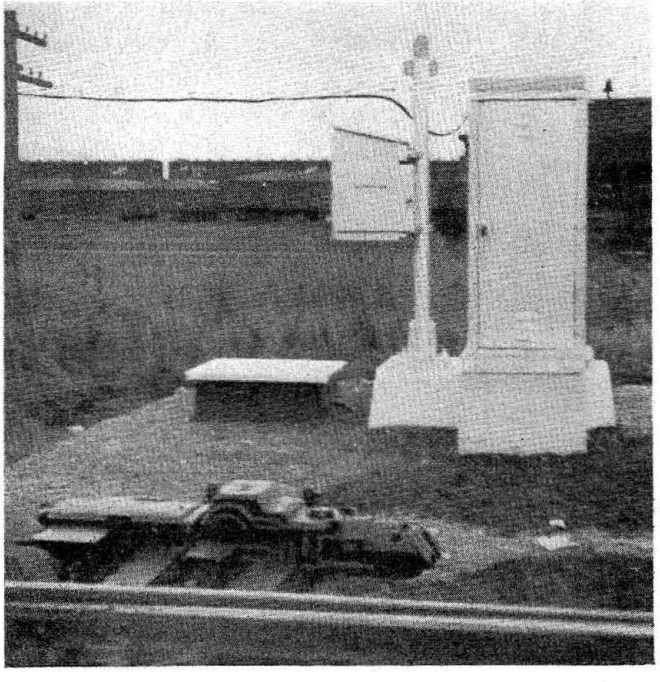
Primary-secondary track relay combination circuits

lever without a two-minute time release period once a train has entered either of the two approach sections, L3T or R3T. Likewise, if signal

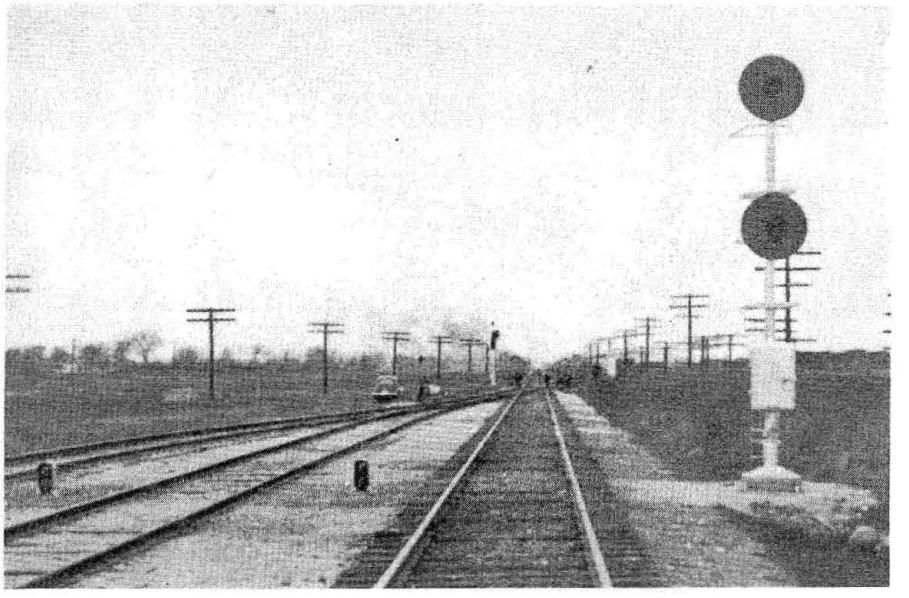
section 4T. The accompanying schematic diagram illustrates the circuits of the primary-secondary detector track relay combination,

tions through a make-before-break contact, a change occurs in the efficiency of the primary relay so as to raise the release current close to the pickup or working current which are the factors effecting the shunting sensitivity. The advantages which were mentioned heretofore depend entirely upon a continuous shunt, and, therefore, an important contributing element thereto is that the pickup time of the secondary relay, 4TPR, is longer than otherwise.

Each of the factors effecting the value of the shunt resistance, as rail surface condition, foreign matter on the rails, area of contact between rails and wheels, contact pressure, angle bar movement under train, deceleration, acceleration, etc., vary continuously as a train moves through the vicinity of switch No. 4. Should these factors result in short intermittent periods when the shunting resistance increased to a point where the current flowing past a train became great enough to energize momentarily the primary relay, the secondary relay would not become energized unless the primary relay remained energized in excess of 1.5 sec., and as high as three or more seconds depending upon the local conditions. Since a train traveling at 60 m.p.h. traverses a distance of 132 ft. in 1.5 sec., approximately one third of the distance of the total length of track circuit 4T, or proportionate distances at proportionate speeds, the probability of both relays becoming energized during normal operation is minimized, which means that, with the primary-secondary relay combination, the slow-pickup secondary relay, 4TPR, materially assists the high shunting sensitivity of the primary relay 4TR in effecting a positive and continuous



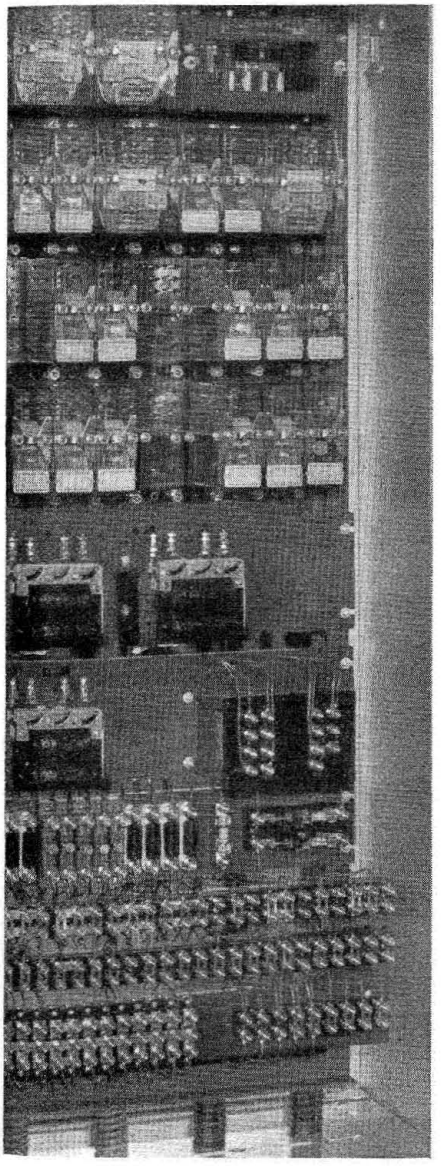
A welded sheet steel instrument case, located at the remotely-controlled switch, shelters the necessary field control relays, rectifiers, etc. The battery box at the left contains the control battery for the field equipment. Model 5B switch machine is shown in the foreground



View looking west over new remote control installation, showing home signals L3A, L3B and L3C from the right to the left, respectively

or stabilized shunt condition while track section 4T is occupied, thus assuring the advantages which were mentioned previously.

Referring to the accompanying circuit diagram, it will be noted that negative battery 4RN, from the track, is normally fed through a 4-ohm variable resistor, over a front make-before-break contact of the secondary slow-pickup track repeater relay 4TPR to the lower coil of the 4TR relay by an internal connection, thence back to the track and positive battery 4RB. With the track relay 4TR energized, positive battery 3BL is fed through a front contact of the 4TR relay to the lower coil of the 4TPR relay, thence through the upper coil of the same relay in series to negative battery 3CL, thus retaining the 4TPR relay energized. With a train in section 4T, the 4TR relay will be de-energized as well as the 4TPR relay. However, when the 4TR relay is de-energized because of a train in section 4T, the 4TR relay should pick up momentarily because of a loss of shunt, the 4TPR relay would not pick up also, because of the slow-pickup feature of this relay, incorporated in feeding negative battery 3CL through a back contact of the same relay to cut out the upper coil, thus preventing this relay from picking up before a certain time, which, when it is energized, will only pick up on the lower coil. When the 4TPR relay is down, the coils of the 4TR relay are placed in series, thus increasing the efficiency of this relay when it is to pick up.



Left—Interior view of the field instrument case, showing plug-type relays, rectifiers, terminals, etc. Switch control relay is in upper right-hand corner. Below — Relays located in the rear of control machine

Field and Office Equipment

The remote-controlled layout is controlled by the polarized unit-wire system, utilizing five No. 9 w.p. copper line wires mounted on a crossarm of the communication pole line, extending east and west on the north side of the right of way between the control office and the layout. The 110-volt a-c. power supply is also carried on this pole line on two No. 9 w.p. copper wires.

The field unit at the switch consists of a welded steel case, housing plug-type relays and rectifying equipment, arranged in a typical circuit, which, with slight variations, is suitable for controlling single outlying switch machines as in this instance, or in connection with centralized traffic control. The sheet-metal case is 6 ft. 3 in. high, 2 ft. 7 in. wide and 23 in. deep, and is mounted on a concrete foundation near the switch. Underground multiple-conductor parkway cables are used between each signal, the switch and the case.

The control machine in the office, likewise, is a complete self-contained unit, consisting of a sheet-metal cabinet, with the levers, track diagram and indication lamps on the panel on the face of the cabinet, and with adequate space in the cabinet for housing a standardized arrangement of indicating relays of the plug-type, together with associated apparatus.

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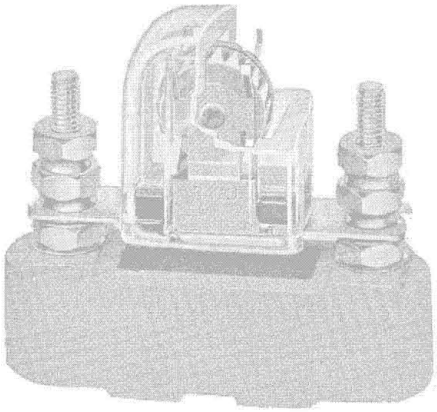
NEW DEVICES

Lightning Arrester

THE Railroad Accessories Corporation has recently introduced a new device, known as the Raco Clearview lightning arrester. The new arrester is the result of a number of types which have been designed and tested by the Railroad Accessories Corporation during two years of development. It was developed especially to meet A.A.R. Specifications for C.T.C. systems, which call for particularly sensitive arresters for coded lines that will also provide insulation resistance equivalent to an open space or air gap. The Raco Clearview lightning arresters are recommended by the Railroad Accessories Corporation for general use in all signal circuits within the rating of 0 to 30 volts, d-c. or 0 to 125 volts, a-c.

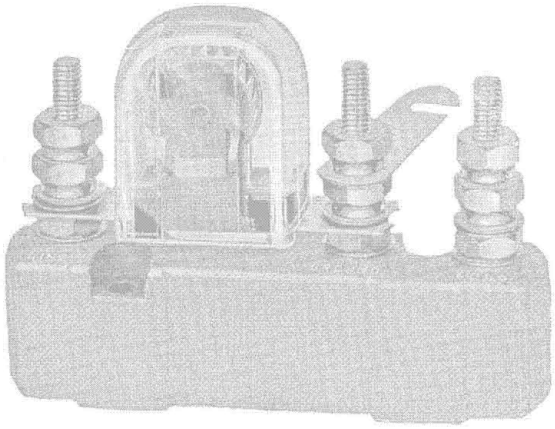


Raco arrester mounted on 2⅜-in. binding post centers of standard terminal block

The arrester has two air gaps, one of which is metal to Everohm block, .005 in. to .010 in., and the other is metal to metal, .030 in. to .040 in. The smaller gap provides a low impulse breakover and ionizes the larger gap. The Everohm block used in this arrester, while of very high internal resistance, nevertheless, readily passes the small current necessary for ionization of the air between the metal gaps, but its high resistance prevents it from carrying enough current to maintain an arc. The arc, if any, must be between the metal plates, which, on account of their design and spacing, quickly extinguish the arc or burn back to a point where the arc is extinguished due to the gap being widened.

The Raco Clearview arrester is designed for mounting on 2⅜-in. binding post centers. It is furnished either with or without high tensile grey porcelain standard terminal blocks. It is also furnished as a three-post arrester, with separate posts for line and load.

Some of the outstanding characteristics of this new lightning arrester include the fact that it provides infinity insulation between the line and ground; is very sensitive, its normal impulse breakover being 1,200 to 2,000 volts; has low 60-cycle a-c. breakdown of 900 to 1,000 volts and a d-c. breakover of 600 to 700 volts. It is stated to be extremely fast with superior volt-time and ampere-time characteristics. It is said to meet every vital operating requirement, in addition to being safe against improper grounds. The arrester is glass enclosed, insuring against foreign substances entering and bridging the gaps; is vented to allow gases that are formed by discharges to escape; and it can be used with equal safety and effectiveness to protect all low-voltage signal apparatus, either as a shunt, a line arrester, or between relays and track.



Raco Clearview lightning arrester with three separate terminal posts for both line and load

Remote Control Installation

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The equipment assemblies at the switch and in the control machine are novel only in that they may be procured in standard form and are received fully-fabricated ready for connecting to the field and local circuits. In this particular installation, inoperative approach signals are used, but if a change is made to operative approach signal, the changes would include the addition of one plug-type relay for each signal and the removal of a terminal strap. Although the case at the switch and the cabinet at the control office are comparatively small, adequate space is available to permit ready access and inspections.

The power supply at the field location for switch operation, signal lighting, relay controls, etc., consists of two sets of 6 cells of 50 a.h. storage battery, thus providing a 24-volt battery, which is located in a concrete box adjacent to the instrument case. Three cells of Edison 500 a.h. primary battery, in multiple, feed each track circuit. A 24-volt split battery of six cells of 10 a.h. storage battery, located at the control office, feeds the signal and switch relay controls, indication lamps, etc. The rail in service at this layout is all of 125 lb. stock, and the track is in good condition, using gravel ballast. Each rail joint in track circuited territory is bonded with a ⅜-in. plug-type cable bond. This installation was made by the signal department forces of the Soo Line. The plans and equipment were furnished by the General Railway Signal Company.