What's the Answer?

An open forum for the discussion of maintenance and construction problems encountered in the signaling field. *Railway Signaling* solicits the co-operation of its readers both in submitting and answering any questions of interest.

TO BE ANSWERED IN A SUBSEQUENT ISSUE

(1) *Do you use color-light signals for train order purposes? If so, how is the signal controlled and what check is made to determine whether the proper indication is being displayed?*

(2) *What are the relative merits of the plain spark gap arrester, and the valve type arrester as applied to 440 and 550-volt signaling power lines?*

(3) *Would it be advisable to equip all signal relays with shock absorbing springs? Do you believe such cushion springs necessary where back contacts of relays are used?*

(4) *In the a-c. relay circuit shown below, a reader desires to know what the instantaneous polarities would be at the transformers and relays and along the common wire?*

(5) *What are the relative merits of a three-phase and single-phase 440 or 550-volt signal power line?*

Further Data—Question 4

In the first circuit diagram below, Fig. 1, there is a relay and transformer at each end of the three-wire circuit. In the lower diagram, Fig. 2, two transformers are connected in series at one end and two a-c. relays in series at the other end. This latter circuit is similar to an ordinary three-wire, single-phase distribution line.

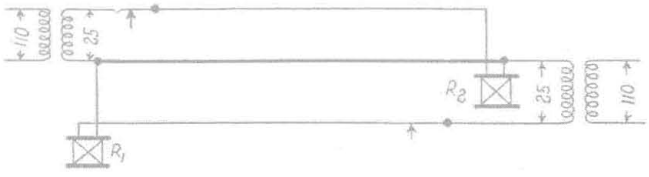


Fig. 1—Relay circuit in which it is desired to know the instantaneous polarities at the transformers and relays

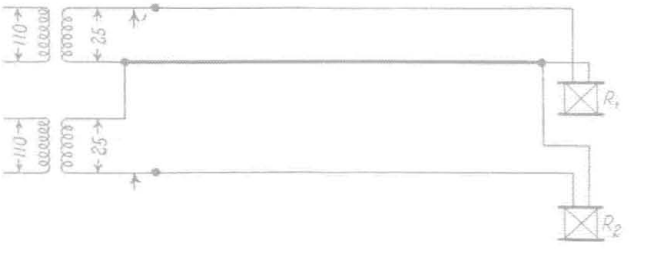


Fig. 2—Three-wire a-c. relay circuit in which it is desired to know the instantaneous polarities at each end of the circuit and in the common wire

Emergency Release Circuits

"Do you provide an emergency release on approach or stick locking of signal levers? If so, what means do you use to introduce a time element?"

Prefers Clock-Work Releases for Most Circuits Because of Length of Time Required Before Locking May Be Released

By C. A. DUNHAM

Superintendent of Signals, Great Northern, St. Paul, Minn.

WE have always used and will continue to use an approach and route locking circuit under our heaviest traffic. Such a circuit operates by the presence of a train on the approach sections; that is, a train approaching an interlocking plant with distant signals indicating the position of the home signal will automatically lock the home signal lever at any time it is reversed after the train comes in sight of the distant signal. The "emergency" release for such a circuit is preferably a hand-operated screw release with an adjustable time element. This instrument will only release the locking circuit if the home signal is in the stop position and the distant signal in the caution position. At interlocking plants where the traffic is not so heavy we have always used the stick relay circuit for approach locking and provide the same type of "emergency" release.

As stated above, we prefer the hand-operated release because it serves the purpose for which the time release

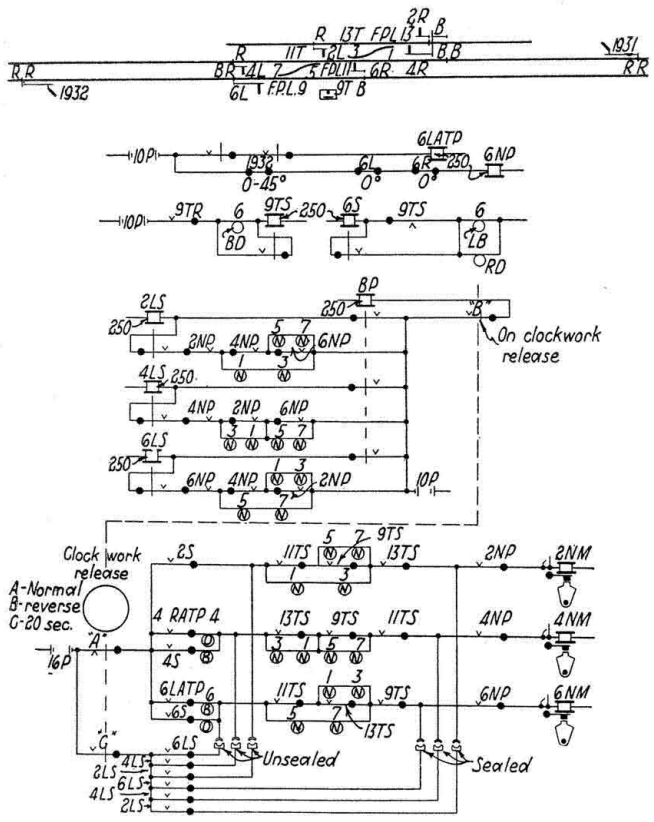
was originally designed, i. e., to force the operator to thing before acting. However, in a great many cases the original meaning of the time release has been misunderstood and time elements have been imposed of such duration to make it impossible to release the lock while a train was approaching through the locking section. This has made hand-operated releases impracticable because most of them would wear the operator out in the minute and a half or two minutes he is required to turn them. Consequently we have gone to the clock-work release to a great extent and have found it satisfactory although long releasing periods are not considered necessary. As a final emergency, release locks are sealed and the operator is permitted to break the seal and mechanically release the lock as a last resort, after he has made certain that his signals are in the proper position.

Santa Fe Has Completed Study of Electric Locking and Releasing Circuits—Jack and Plug Device is Used

By G. K. THOMAS

Assistant Signal Engineer, Atchison, Topeka & Santa Fe, Topeka, Kans.

WHEN approach locking is provided and an approaching train occupies the approach circuit while the home signal is indicating proceed, the route is locked so that the leverman cannot change the line-up. The same thing is true with stick locking when the signal



Electric locking and releasing circuits for small electro-mechanical plant—Note use of jack and plug device

indicates proceed, whether or not a train is approaching. This locking is released automatically when the train passes the home signal and occupies the detector section. If a train does not complete its movement by passing the home signal the route will remain locked and it is necessary to provide some method of releasing the route for other line-ups under this condition.

We have recently made rather a complete study of the requirements for electric locking and releasing circuits, and as a result of this study have adopted the scheme, indicated in the sketch, which appears to provide a maximum of facility and protection. The circuit shown in the sketch is arranged for electro-mechanical interlocking but the same general scheme may be applied to any other kind of interlocking machine with electric locks provided on switch levers, facing point lock levers, or master levers.

Only one clock-work release is used for each major portion of an interlocking plant, and this release is used with an unsealed jack and plug device for releasing approach and stick locking and with a sealed jack and plug device for releasing detector locking. The release pointer is normally in the extreme left position, contact *A* being closed. When it is desired to release the approach or stick locking so as to change the line-up, the leverman must perform this operation in the following sequence:

(1) Place signal levers in the normal position.
(2) The home and distant signals must assume the normal position.
(3) The operator must then turn the release pointer to the full reverse position to the right, thus picking up the stick relay. On releasing the handle the clock-work release will function and after the time interval elapses the pointer will reach the red spot, closing contact *C* for a period of 20 sec. during which the leverman may unlock and operate levers.

All electric locks are sealed and levermen are not permitted to break the seals but must use the time release when it is necessary to release electric locking. If the leverman performs the operation in any other sequence than that given above, or if the signals fail to respond when levers are placed normal, the electric locking will not be released.

Other Comments

R. A. Johnson, general electrical inspector, Delaware, Lackawanna & Western, states that no special circuit is employed on the Lackawanna as it is not considered necessary with the standard method of releasing signals. The standard practice is to use a time release on high signals or on each group of signals, and when it is necessary to use the release, the signal or signal group must be in the stop position during the interval of time that the leverman is waiting to get the corresponding lever in the full normal position. Owing to the fact that it is the practice on his road to use a time release on each signal or group of signals, it is possible while one time release is operating to clear other signals or other signals may remain clear for non-conflicting movements. This, of course, obviates the necessity of providing any special circuit to hold such other signals clear.

C. A. Taylor, signal engineer, Chesapeake & Ohio, replies that it is the practice on his road not to provide an emergency release on approach or stick locking of signal levers. He states: "We use standard approach and time locking circuits on all of our interlocking signals which provide for a clock-work release cutting around the portion of the circuit controlled through the approach relay, and the track repeating stick relay. No other type of release is provided to cut around any other portion of the signal indication circuit, and in case of failure of such circuits, locks are released by hand by the maintainer and then only after the necessary precautions have been taken."

L. R. Stahl, assistant signal engineer, Louisville & Nashville, states that a clock-work time release is used on the L. & N., to operate a stick relay to take care of the following conditions: first, when the line-up has

been made and it becomes necessary to change to another line-up; second, when a track circuit failure occurs; and, third, when the leverman fails to put the high signal lever back to normal position during the time interval that a train is within the interlocking limits. In addition to this clock-work release, a knife switch is provided located in a break-front glass box. This knife switch, when operated, connects the battery direct to the signal lever lock. This knife switch box is used only in emergency and in every instance a report must be made to the superintendent when it is broken into.

H. W. Cooper, signal maintainer, Wabash, at Forrest, Ill., replies that emergency releases are provided for approach locking of signal levers in order that the interlocking plant may be released in case a train stops after passing the signal or in case switching movements are made after the signal has been cleared. On the Wabash it is the practice to use a clock-work time release in which the time element is adjustable from a few seconds to four minutes. It is the practice to set this interval at one minute because during such an interval of time the train has stopped or has moved over the derail. A clock-work time release may be used for not only approach locking but detector locking as well.

Special Release Circuits for Color-Light Signals

"Where color-light home signals are used at interlockers, what scheme is employed when it is desired to hold a signal clear, during operation of an emergency release?"

Illinois Central Employs Rotary Dial Switch in Conjunction With Master Relays for Release of Any Route

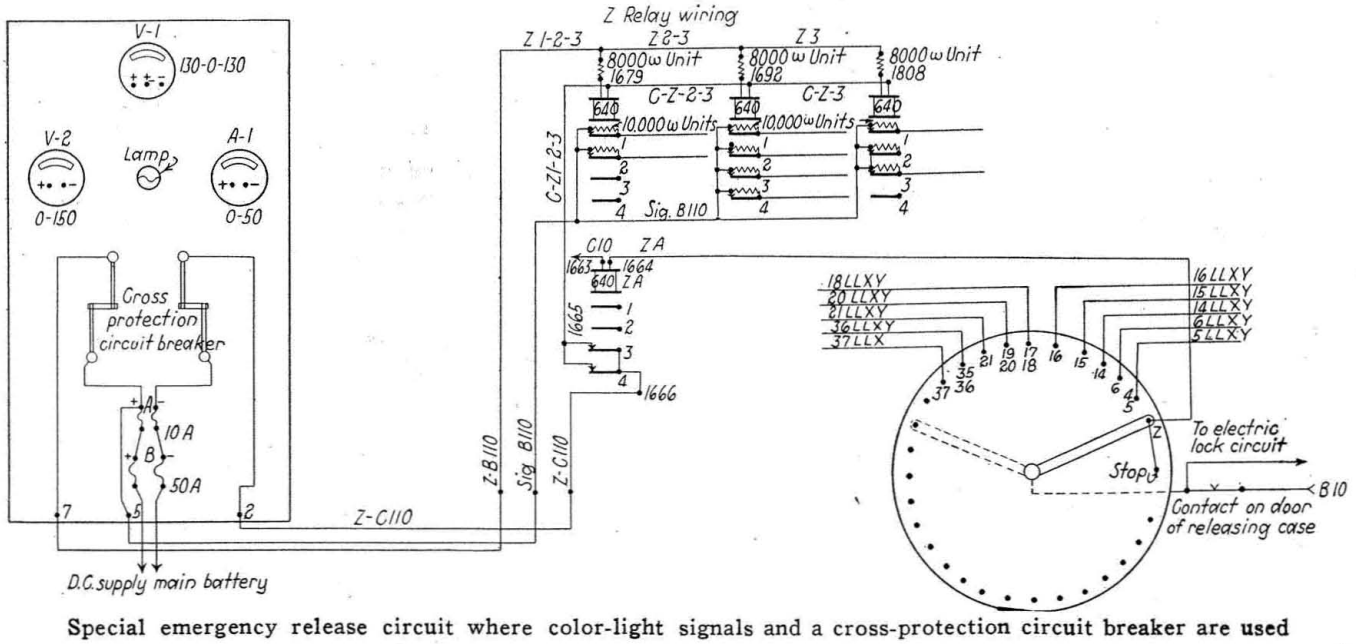
By R. B. Amsden
Assistant Engineer Signals, Illinois Central, Chicago.

MANY railroads at busy interlocking plants have found it desirable to provide means whereby in emergency the towerman may release the electric locking to avoid delays to traffic occasioned by an electrical or mechanical failure or defect which may require considerable time to repair. Some roads employ knife switches mounted in break-glass boxes or sealed boxes located behind the interlocking machine or on the lower floor of the tower. Other roads are using a clock-work release in combination with a jack box for this purpose while others use a master release lever in the interlocking machine.

For several years the Illinois Central has been using a rotary switch having 28 contacts for releasing individual circuits. The switch is mounted in a sealed case having a contactor on the door through which battery is taken to the electric lock circuits, thus requiring that the door be closed before any operation is made. The door is kept sealed and the towerman is entirely responsible for the proper use of the release, requesting the maintainer to replace the seal each time it is broken. A separate contact is provided for the emergency release of each route which avoids the necessity for any hold-clear devices for signals governing over other routes, regardless of whether the home signals are the color-light type or the semaphore type, so far as the release itself is concerned. But it is not considered good practice to permit the towerman to clear any signals on the plant until the release has been restored to its normal position and the door closed. This feature may be taken care of by means of a stick relay.

When color-light signals are controlled through a cross-protection circuit breaker it is undesirable to have all signals go to the stop indication should the circuit breaker open. To guard against setting a stop signal in the face of a train under these conditions the Illinois Central controls a set of *Z* relays through the circuit breaker as shown in the sketch. The individual signals are controlled through the contacts of the *Z* relays. Bridging each contact is a 10,000-ohm resistance unit through which the signal control relay will hold up but will not pick up. The signal control relays are adjusted for high pick-up and normal release and are so marked.

In applying the emergency release at plants where the cross-protection circuit breaker is used the *Z* relays also are controlled through contacts of a *ZA* relay which is energized only when the emergency switch is in its normal position and the door closed, as the sketch shows. To release the electric locking the towerman breaks the seal, opens the door of the case, places the switch on the proper contact and closes the door. Any signals that may have been clear at the time will remain clear but no additional signals can be cleared until after the release has been restored and the door closed.



Special emergency release circuit where color-light signals and a cross-protection circuit breaker are used

Non-Conflicting Signals Can Be Held Clear by Providing Master Relay Control With High-Resistance Shunts Across Contacts

By CHARLES MACGREGOR
Circuit Engineer, Signal Dept., Interborough Rapid Transit, New York

A LIGHT signal home control relay may be held picked up (energized) to retain a yellow or green aspect during the operation of an emergency release by the following means, and no doubt by others. Connect up the emergency release switch so that in the normal position it completes the circuit of a master relay, which will be normally energized. Through the front contacts of this master relay are looped all the light signal control home relay circuits, and in shunt with each relay finger is a resistance unit so that when the master relay is not picked up (is de-energized) current in a reduced amount will continue to flow through those signal control circuits that were energized when the master relay was picked up.

The resistance unit is introduced into the signal control relay circuit when the master relay armature drops,

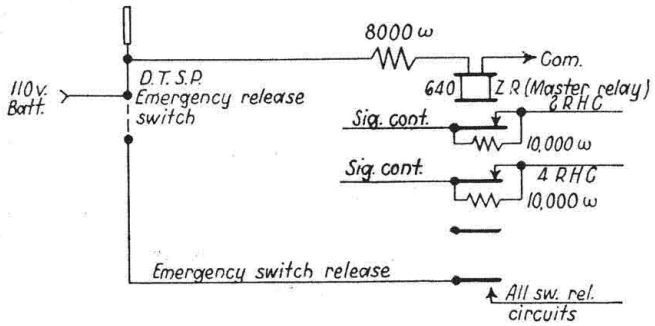


Diagram showing principle of master relay control of signals during operation of emergency release

which is when the emergency switch is reversed. The resistance unit also is such that it reduces the flow of current to an amount that is just sufficient to hold up the armature of any relay that is energized, but is not sufficient to pick up the armature of any relay not energized at the time of the reversal of the emergency release switch. Thus the emergency release switch can be operated to release any switch or route desired, and at the same time any non-conflicting route over which a train may be operating is not restricted in any way.

The restoring of the emergency release switch to normal is required before any other signal can be cleared, and the de-energized position of the master relay can be checked by looping the circuit for the emergency release of the switch levers through a back contact of the master relay. The mechanical locking will of course force the replacement to normal of any signal lever governing over the switch or route that the emergency release switch is being operated to release, before release can be obtained. The advantages of such a method are that the hurried use of the release switch will never change a green or yellow aspect to red in the face of an approaching train over a non-conflicting route or make it necessary to wait for a train on one track to clear the interlocking before the switch on another non-conflicting track can be released by means of the release switch.

The scheme is general in application and can be modified to suit most any conditions, such as clock-face type of emergency switches; and it can be readily enlarged, by merely adding enough master relays to give a sufficient number of contact fingers. One contact finger can be used for all of a number of conflicting signal controls, such as opposing, converging and diverging signals, where only one can be clear at a time, if circuits are designed to suit.

In the diagram *ZR* represents a 640-ohm d-c. master relay, in series with an 8,000-ohm resistance to cut down the current, and also in series with the normal position of the emergency release switch. The home signal control relay circuits are numbered *2RHC* and *4RHC* with 10,000 ohms resistance in shunt to cut down the current as explained; and the release circuit for the switch levers, etc., is shown looped through the back point of the master relay *ZR*. This arrangement is applicable to 110-volt d-c. electric interlockers using 640-ohm d-c. home signal control relays.

Polarized Relay Operation

"Why does the neutral armature of a polarized relay always drop when the polarity of the relay is reversed?"

Explains Action on Basis of Magnetic Time Lag

By D. GUIGUE
Signal Maintainer, Canadian National, Montreal, Que.

A POLARIZED relay circuit is open momentarily while the pole changer is operating. With most pole changers, however, this time is of such short duration that its effect alone I do not believe would be noticeable on the neutral armature of the relay. The neutral armature of a polarized relay drops whenever the polarity is reversed because of the fact that the pole faces are completely demagnetized by the reversal in current before they are remagnetized with opposite polarity. There is thus a short time interval when the pole faces do not attract the armature at all and there is a further short time interval when there is not sufficient attraction to hold up the armature because during the cycle of demagnetization and remagnetization in opposite polarity, the magnetic field must decrease to zero and then build up in the reverse direction to such a value as will attract the armature. There is sufficient time interval during this pole changing cycle to allow the neutral armature to drop. Even if the reversal of the current were practically instantaneous, the process of demagnetizing and remagnetizing the relay pole faces and armature is gradual due to the magnetic time lag.

Momentary Opening of Neutral Relay Circuit Coupled with a Slight Time Lag in the Reversal of Magnetic Flux Through the Neutral Armature Causes the Latter to Drop

By W. D. LEONARD
Assistant Signal Supervisor, Chicago & Eastern Illinois, Evansville, Ind.

IN order to answer this question, let us first consider what occurs when the polarity of the energizing circuit is reversed. The first action of the pole-changer is to open the circuit and then to close it in the reverse direction, impressing current of opposite polarity on the relay. This, of course, is almost instantaneous and on first thought it would seem as though this relay should stay picked up but it does not, due to the fact that the magnetic field through the neutral poles is reversed.

When current is impressed on a polar relay in one direction, one of the neutral poles of the relay will become "north" and the other pole will become "south," according to the direction of winding of the relay coils. A reversal of the energizing current will reverse the magnetic field because the direction of the coil winding