

NO REROUTING,

NO SCHEDULE DELAYS

OR DISRUPTIONS



**when you push pipe under
tracks, roads, streets with a
GREENLEE HYDRAULIC PUSHER**

Here's the fast, low-cost way to install underground pipe while keeping your tracks clear. GREENLEE Pipe Pusher is one-man-operated (by hand or with power pump), portable, simple to use. No tearing up of roadbed or pavement . . . eliminates extensive ditching, tunneling, back filling, tamping, rebuilding. Saves time, saves work.



GREENLEE Hydraulic Pipe Pushers are available in two sizes: Model shown at top for pushing 3/4" to 4" pipe . . . average pushing performance — two feet per minute with power pump. Larger unit, lower illustration, for pipe over 4", concrete sewer pipe and large drainage ducts. Power pump available for extra speed and ease of operation. Write for literature.



Greenlee Tool Co., 2406 Herbert Avenue, Rockford, Ill.

What's the Answer?

Interlocking Relays

As a means of stopping highway crossing signals when the rear of a train passes the crossing, what are advantages and/or disadvantages of using interlocking relays as compared with stick relays.

Two Basic Schemes

By R. C. FOSTER
Assistant to Signal
Engineer, System
Atchison, Topeka & Santa Fe
Topeka, Kan.

Briefly, interlocking relays are more economical and can be controlled with simpler circuits, while the stick relays provide a much greater choice of schemes to meet local conditions. All schemes to cut out the operation of highway crossing signals when the rear of a train passes the crossing can be classified as: (1) How the cutout feature is set up; (2) How the cutout feature is retained.

For example, with an interlocking relay the cutout feature is set up by occupancy of the approach section with the receding section unoccupied, and the cut-out feature is retained by occupancy of the receding section.

With stick relays, the cutout feature may be set up by the same conditions as with an interlocking relay or by occupancy of the approach and highway section with the receding section unoccupied, or simply by occupancy of the highway section without regard to the other sections, or by several other combinations of conditions. With stick relays, the cutout feature may be retained by occupancy of the receding section as with an interlocking relay, or cutout feature may be retained by the receding section occupied with the approach section unoccupied.

In practically every case the results for any one scheme will be desirable under one set of conditions and undesirable under another set of conditions. For example, where a siding switch is in the approach section, it is desirable to delay setting up the cutout feature until the highway section is occupied to avoid improper cutouts when meets are made at the siding; but use of this scheme may result in failure to cut out for

fast movement of a light engine or single self-propelled car. Setting up the cutout feature by occupancy of the highway section alone is often desirable to avoid excessive operation where switching is carried on over the crossing, but it has the disadvantage that an accidental shunt on the highway section could cut out the protection with a train on the approach section.

Retaining the cutout with the receding section occupied and the approach section unoccupied seems desirable, because if the receding section fails to pick up behind a train, then the next train over the crossing will leave the crossing signals in operation; however, with this scheme a second train following closely behind another train may prevent retention of the cutout feature with the result that the signals will operate when the second train is receding from the crossing.

There is no one scheme which

Do you have Signaling Problems?

COMPLETE SIGNAL
CONSULTING, ENGINEERING
AND PLANNING SERVICE
FOR THE RAILROAD AND
TRANSPORTATION
INDUSTRIES

Traffic Studies
Economic Studies
Signal System Studies
Signal System Circuits
Specification Preparation
Contract Analysis
Construction Drawings
Construction Supervision

MASS TRANSPORTATION CONSULTANTS

11 West 42nd Street Telephone
New York 36, N. Y. Oxford 5-5359

possesses all desirable features, and it becomes necessary to select the best arrangement to fit requirements at the location involved.

Stick Relay Advantages

By J. E. K. KRYLOW
 Engineer Communication
 and Signals
 Pennsylvania
 Buffalo, N. Y.

In my opinion, the outstanding advantage in using the stick relay arrangement as compared with the interlocking relay as a means of stopping the operation of automatic highway crossing protection after the rear of a train clears the crossing, is the elimination of mechanical moving parts. The stick relay has other advantages—the front contacts can be more universally used and generally these relays can be adjusted for more sensitive shunting characteristics than the interlocking relays.

Use Stick Circuit

By GEORGE PIPAS
 Signal Engineer
 Illinois Central
 Chicago, Ill.

On the Illinois Central both the stick circuit and the interlocking circuit are used. The stick circuit however was made the standard circuit a few years ago for the following reasons:

(1) Management demands that the operating expense at protected highway-railroad grade crossings be reduced consistent with principles of safety and good practice. This has resulted in crossings being programmed for automatic protection that heretofore were considered unsuitable. Circuits have had to be developed to meet all conditions, both with respect to railroad traffic and the wholesale increase in highway traffic. The stick circuit has been found to be flexible and economical with respect to such controls, particularly where adjacent crossings are protected and overlapping starts are involved.

(2) Experience with interlocking relays has been excellent. However, it should be remembered that they contain a mechanical feature which presents shop problems not found in other relays. Consequently, the elimination of the mechanical feature by using the stick circuit is a step forward.

(3) Some roads desire to use plug-in relays. At the present time, no

don't
 get caught
 off base



Play Safe with

RELIABLE MINIATURE TUBES



Your communications equipment will run up a consistently higher performance score if you replace the ordinary tubes in your line-up with stellar performing Raytheon Reliable Miniature Tubes.

These top quality tubes are given a heater reliability test exactly like that given Military Reliable Tubes; they are operated for 48 hours to eliminate early life failures and are given rigid life, shock, vibration, fatigue and glass strain tests and tests for characteristics uniformity. When you get them, they are ready to give you the finest performance tubes can provide and, best of all, they can replace ordinary tubes without rewiring.

Ask your Raytheon Tube Supplier about Raytheon Reliable Miniatures. He'll show you why they score a hit with communications experts everywhere.

THESE STANDARD TUBES
 CAN BE DIRECTLY RE-
 PLACED (NO REWIRING)

By these RAYTHEON
 RELIABLE
 MINIATURE TUBES

6AK5.....	CK5654
6AL5.....	CK5726
6AQ5.....	CK6005
6AS6.....	CK5725
6BA6.....	CK5749
6BE6.....	CK5750
12AU7.....	CK5814A
12AX7.....	CK5751



Excellence in Electronics

RAYTHEON MFG. CO.

RECEIVING AND CATHODE RAY
 TUBE OPERATIONS
 NEWTON 58, MASSACHUSETTS

RELIABLE SUBMINIATURE AND MINIATURE TUBES • SEMICONDUCTOR DIODES, POWER RECTIFIERS AND TRANSISTORS • NUCLEONIC TUBES RECEIVING AND PICTURE TUBES MICROWAVE TUBES

satisfactory interlocking relay of the plug-in type has appeared on the market. Consequently, the benefits of the plug-in type are lost, if some relays are of the plug type and some of the conventional type.

(4) In some instances, because an interlocking relay does have special features and is not used by all roads, deliveries of this item are sometimes not as good as the more standard equipment, and this may result in holding up an important project.

Many Factors

By V. J. DOUGHERTY
Leading Signalman
Southern Pacific
Tucson, Arizona

The choice of the type of relays to be used in highway crossing protection circuits is governed by many variable factors, each individual location presenting its own operating problems.

The use of a track interlocking relay with the extended shunt scheme which would prove ideal on a non-signaled portion of railroad, where switching moves are not encountered, is of course, ruled out entirely in signal territory. In this type of circuit, a train having cleared the crossing does not actuate the crossing protection apparatus on a back-up move until the train has crossed the entire roadway. This would make this scheme objectionable where switching moves are made across the roadway.

To overcome this weakness an independent track circuit could be installed over the crossing with the controls of one or both sides of the track interlocking relay broken through this track relay. This provides absolute protection while the train is on the crossing.

Where line interlocking relays are utilized, the use of two interlocking relays will provide a cut-off where shuttle moves are made across a roadway, regardless of the number of moves back and forth.

The simplest and one of the most economical schemes utilizes the track (or line) relays and one stick relay to provide the cut-off feature. Its greatest weakness is the fact that a momentary failure of the crossing track circuit with a train on the approach section will nullify the crossing protection.

The scheme utilizing a directional stick relay for each direction, while it involves the use of one additional relay overcomes the weakness outlined in the previous scheme. By the use of key-operated controllers or push-buttons, train crews can cancel

the directional stick set-up and initiate protection for a back-up move. Under this method of operation, directional cut-off can be made effective after every move over the crossing. To provide an additional margin of safety, directional stick relays may be checked in the signal circuits to insure against a high speed train approaching the crossing with the cut-off feature in effect. In this respect the directional stick relay scheme has an advantage over the interlocking relay, which cannot be readily checked for integrity. Since the directional stick relays are

a conventional relay and can be interchanged with relays of the same type used in the standard signal circuits, the necessity of stocking a special type of relay is overcome.

The trend would seem to be away from interlocking relays since little effort has gone into the development of a plug-in interlocking relay. Rather, the progressive thinking seems to be channeled toward directional controls rather than directional cut-outs by utilizing various impulse circuits and special track circuits which are of a directional nature.

Centralized Checking

In LCL freighthouses where you install centralized checking systems, do you provide the men working in the freight cars with portable loudspeakers or with telephone handsets? Please discuss the practice on your railroad.

Speakers in Cars

By J. F. YERGER
Chief Engineer-
Signals & Communications
Lehigh Valley
Sayre, Pa.

On the Lehigh Valley, we provide the men working in the freight cars with portable loudspeakers which they hang in the car. These speakers enable the men to talk to the checkers while moving around in the car, which, we feel, is desirable. Foremen, however, carry a handset which can be used at any of our 148 outlets to talk to the checkers. This system has been in operation for several years and has proved very satisfactory.

Use Loudspeakers

By C. H. WESMAN
Assistant Superintendent
of Communications
Great Northern
St. Paul, Minn.

In LCL freighthouses where the Great Northern has installed centralized checking systems, the men working in the freight cars are provided with portable loudspeakers. The decision to use loudspeakers rather than telephones was arrived at, only after much careful thought and investigation. The fundamental advantages of the loudspeaker is the fact that a man working in a car need not

walk to the instrument in order to use it, nor need he pick it up. He can call out information from wherever he is.

The loudspeakers are each of the permanent magnet dynamic type mounted in the center of an aluminum reel on which is wound 50 ft. of microphone cable terminated in a plug. They are kept together in a cabinet, and one is issued to each man or crew who is to work in a given car. The speaker is hung on an "S" hook or a nail on the inside wall of the boxcar or highway trailer, while the cable is plugged into a receptacle on a nearby post.

Our greatest maintenance problem in connection with checking systems is the plug at the end of the cable and the receptacle into which it fits. Anyone considering the installation of such a system should give this careful consideration.

Portable Speakers

By J. A. PARKINSON
General Superintendent
of Communications
Atchison, Topeka & Santa Fe
Chicago, Ill.

We use portable loudspeakers on all installations on the Santa Fe. The use of handsets was considered before the first installations were made, but the idea was discarded because it required the loaders to go to the handset and use it for each checking operation, whereas with the loud-