ducing the current to be interrupted. This explanation is hardly adequate for the following line of reasoning. In Fig. 1, it is obvious that the ammeter indicates the full lamp current of 1 amp., and the voltmeter the potential across the open contact, which will be nearly 10 volts. Therefore, the contact interrupts maximum current across maximum voltage, causing local heating and contact deterioration.

In Fig. 2, the ammeter must read practically the same as in Fig. 1, because the resistance of one lamp, 10 ohms, is so great in comparison with that of one contact, about 0.1 ohm, that approximately 99% of the current chooses the path of lesser resistance. However, in Fig. 3, showing the contact in the center position, the voltage indicated by the meters can never be greater than 5 volts instead of 10, because the two lamps in series each account for 5 of the 10 volts available from the battery, and a change of only 5 volts has been made in the circuit. Therefore, the product of the volts, amperes and time, that is, energy to be gotten rid of as heat, must be lower than with the other circuit. This accounts for most of the improvement in contact life. If current can be reduced without an increase in voltage, it will also improve the situation, but the benefits are due to the reduction in voltage.

Another advantage of the shunting circuit shown in Fig. 2 is that contact resistances are not very important, since it is only necessary to shunt the lamp enough to darken it. On the other hand, good operation cannot be expected in the make-and-break circuit with high contact resistance without an increase in voltage, which would further tend to increase arcing. Contact pitting due to mechanical wear or abrasion, of course, may be expected with any kind of circuit.

Controlling Four-Aspect Automatics

"What practical circuit arrangement can be used to control a four-aspect signal by using neutral track circuits and one two-wire line control circuit?"

Two Typical Circuits

EUGENE INGLES
Signal Maintainer, Michigan Central, Monroe, Mich.

The accompanying diagrams show details circuits for such an arrangement. Figure 1 is the detail of both line and local signal circuits. For the four signal aspects, I have used: Red, yellow, yellow over yellow, and green.

As some may not prefer these aspects, I have enclosed Fig. 2. The aspects used in Fig. 2 are: Red over red, yellow over red, yellow over green, and green over red. It will be noted that the line plan is the same; only the local signal circuit need be changed. I have, however, on this plan, shown a slow-release relay, repeating the polar relay, and used in place of the polar line relay itself; this makes a better circuit and would be preferred in almost every case. I have applied this circuit to color-light signals, but it will work very well with any type of signal if the local circuits are properly rearranged.

In some instances it might be desirable to use a line relay which would repeat the various track section relays in a particular block, and which would be line controlled through switch circuit controllers. This could be done without any change in the present circuit, the only difference being that the added line relay would take the place of the track relay in the present arrangement.

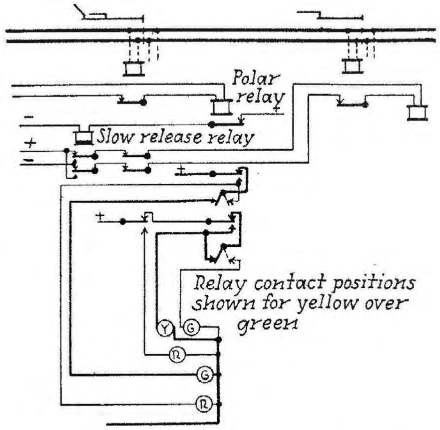


Fig. 2—Circuit using slow-release relay

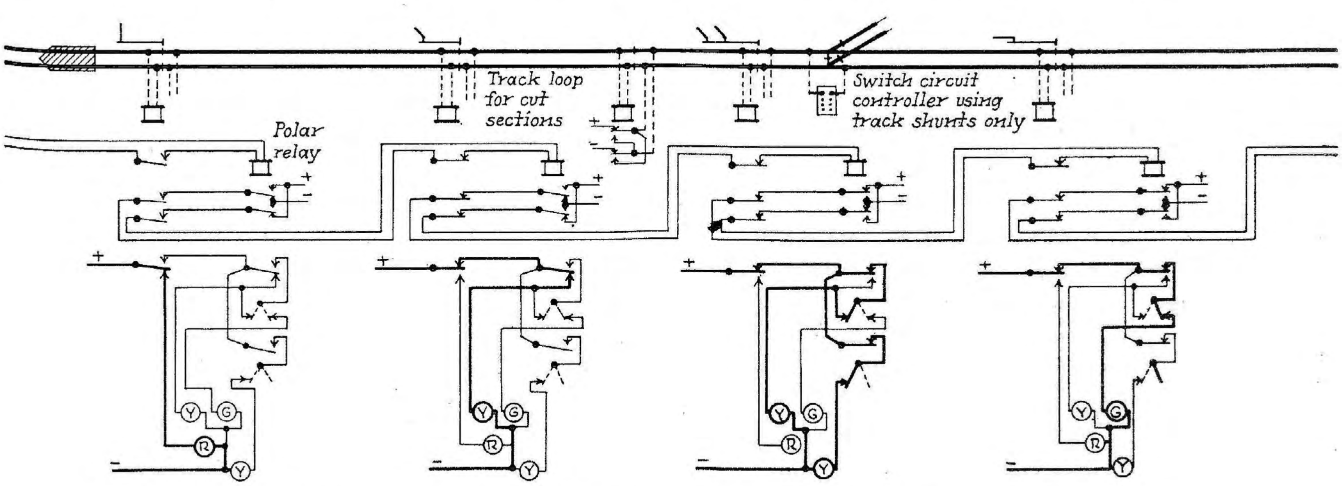
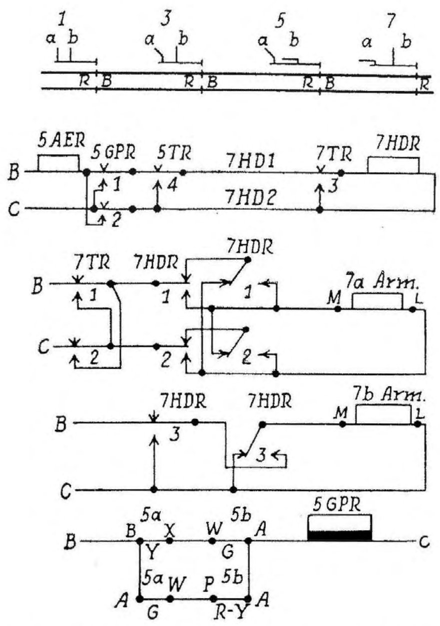


Fig. 1—Circuits for four-aspect signaling using neutral track circuits and one 2-wire line circuit

Polar Line Circuit

CHARLES K. ROBISON
Signal Wireman, Canadian Pacific, Weston, Ont.

I have assumed that the four-aspect signal mentioned in the question is one that is to be used in three-block, four-indication signaling. On the accompanying sketch, therefore, signal circuits for double-track, three-block, four-indication signals of the searchlight type are considered. The track circuits will have neutral relays located at the end of the circuit where traffic enters, or at the signal governing the use of the block. If the signals are located too far apart for the efficient operation of a single track circuit between them, it may be necessary to have two or more track circuits with neutral relay cut sections, thus making the track relay at the signal a repeater of the track conditions through the



Another solution to the circuit problem

entire block. The line circuit will be carried over two wires extending from signal to signal. The relay operated by the line circuit will be a polar line relay, which is used to control the approach, approach-medium, and the proceed indications of the signal.

Detector Fence Control

"In your opinion, should the controllers on rock-slide fences or flood detectors control signal line circuits directly, or should the detectors control a relay, fed from a separate battery, and this relay control the line circuits? What are the advantages and disadvantages of each type of control? (Other answers to this question were published on page 346 of the June issue.)

Advantages of Slide Fence Relay

T. J. Jensen
Signal Supervisor, Norfolk & Western
Shenandoah, Va.

In my opinion there are certain economic and maintenance advantages which will be derived by use of a "Slide Fence Relay." The term "Slide Fence Relay" is construed as meaning a relay whose control is wired in series with the circuit breaker or breakers of the rock-slide fence and through whose contacts the controls are broken for the signals protecting the side area. By this method a ready means is provided in case of signal failures for quickly determining if they are due to defects in the detector fence breakers. Also insulating protection can be provided for the signal circuits in case grounds should develop in the fence breakers, thereby confining such irregularities to a comparatively small area. This insulating protection can be more economically provided in a-c. signaling systems, where it is accomplished by means of an insulating transformer, than perhaps in d-c. signaling, where it would be necessary to provide a separate battery for the control of the "Slide Fence Relay." Furthermore, economy can be secured by a reduction in the number of drop wires or cable conductors at individual circuit breakers.

Relay Shopping Charges

"How do you charge out the expenses incurred for shopping signal devices such as relays? (Other answers to this question appeared on page 346 of the June issue.)

North Western Practice

S. E. Noble
Signal Engineer, C. & N. W.,
Chicago, Ill.

The expense incurred for shopping signal devices, such as relays, is charged direct to Account 249, as well as the cost of shop operation. We do not keep a record of the labor and repair parts to charge to each instrument. However, we do make estimates of the cost of making certain repairs when it is very evident that the cost of the repairs may amount to a sum which may indicate that it would be better policy to purchase new instruments. We do not have one general shop to do this work. Each district has a shop of its own with a small force, and the charges are made locally on the division.

Repairing Spring Switch Mechanisms

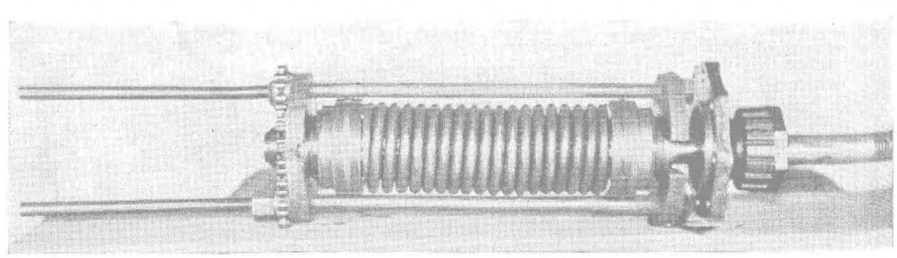
"What special equipment have you designed and built for use when tearing down and assembling spring switch mechanisms while cleaning and repairing such equipment in a shop?"

Testing Device Described

H. B. Garrett
Assistant Signal Supervisor, S. P.,
San Jose, Cal.

The accompanying illustration of a device recently built in our San Jose signal shop shows a Mechanical Switchman with the spring almost completely compressed and end of piston rod exposed to where it is a simple matter to remove piston rod shoulder and retainer.

The end caps are made of 1-in. flat iron 7¼ in. in diameter, machined to fit over the end of the piston with a 2⅛-in. hole to permit passage of the piston rod shoulder and retainer, and connected with two ¾-in. bolts, 31 in. long and threaded for 14 in. The bolt heads are welded to the rear cap to prevent turning. The rear cap has a section 1⅝ in. wide cut out to pass over the piston rod. Where the bolts pass through the front cap, we inserted two ball thrust bearings, from a hand drilling machine, for the nuts to turn on when the bolts are tightened; these nuts are welded inside the chain sprocket from a hand drilling machine; another hex nut 2 in. long,



Device for testing spring switches