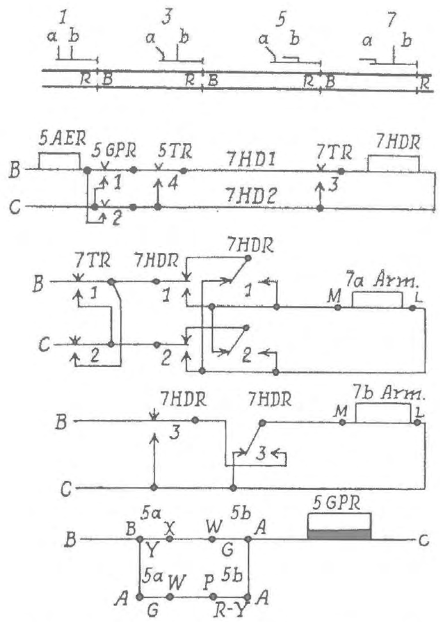
have two or more track circuits with neutral relay cut sections, thus making the track relay at the signal a repeater of the track conditions through the




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

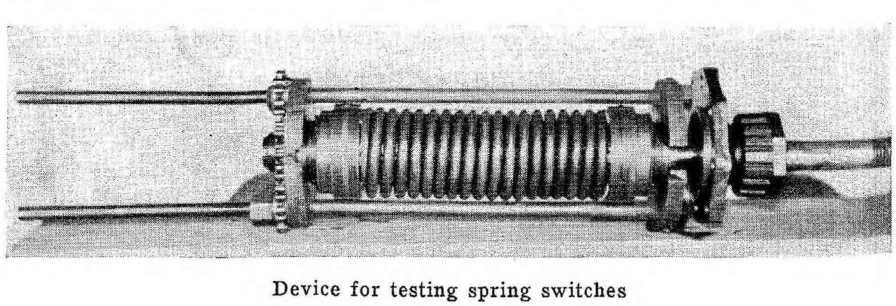
*"What special equipment have you designed and built for use when tearing down and assembling spring switch mechanisms while cleaning and repairing such equipment in a shop?"*

## 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

to which a socket wrench is applied to operate the device, is also welded to one of the sprockets. The sprockets are connected with a short piece of chain, also from a drilling machine.

The reason for using the sprockets and the chain was to insure equal tension on both bolts at all times, which would be impossible if each nut was not turned down at the same rate of speed, with possibility of the bolts breaking due to spring tension of 2,000 lb. or more when spring is fully compressed. Using a socket wrench with an 8-in. sweep, one man can compress a spring 7¼ in. with very little effort. In addition to making it possible to renew rods or springs in these Mechanical Switchmen, we test all springs, by compressing them as part of the inspection when they are cleaned and checked once each year. If there are one or more coils of spring which compress more readily than others, careful inspection is made, and in most cases we find that there is a crack or some other defect in the spring, which often cannot be detected with spring expanded in the normal position on the piston rod.

After repairs are made to any type of oil buffers or mechanical switchmen, they are tested for operation, using a switch stand mounted on ties which are framed and drilled to hold various types. Accurate record is maintained on all repairs, as to date, nature of repairs, and where installed.

# Railroad Operation and Railway Signaling

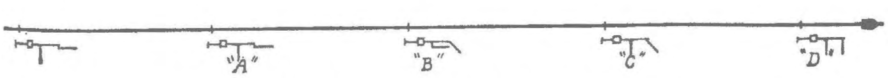
**Note: Answers to these questions are not solicited. If you have questions, please submit them to the What's the Answer department.**

205-Q: *What aspects are used commonly in three-block automatic signaling?* A: The same three aspects as are commonly used in two-block automatic signaling and, in addition, a fourth aspect, the Approach-Medium, illustrated in column (11) of the table of fundamental aspects previously presented on page 532 of the September, 1938 issue. The Approach-Medium aspect is termed an Approach-Restricting aspect on some roads.

206-Q: *What indication usually is conveyed by the Approach-Medium aspect?* A: "Proceed approaching next signal at medium speed."

207-Q: *How would you arrange the four aspects used in three-block automatic signaling in the order of the restrictiveness of the indications which they convey?* A: As follows: The Clear aspect; the Approach-Medium aspect; the Approach aspect; and the Stop-and-Proceed aspect; the latter being the most restrictive.

208-Q: *Are these aspects used in the same order on successive signals to the rear of a train in three-block automatic territory?* A: Yes; their use is illustrated in the accompanying diagram. The first signal in the rear of the train, Signal D, displays the "Stop-and-Proceed aspect, indicating: "Stop; then proceed at restricted speed." The second signal to the rear of the train, Signal C, acts as a distant signal for Signal D, displaying the Approach aspect and indicating: "Proceed preparing to stop at next signal. Train exceeding medium speed must at once reduce to that speed." The third signal to the rear of the train, Signal B, acts as a distant signal for both Signal C and Signal D, governing the approach of trains thereto by displaying the Approach-Medium aspect, indicating: "Proceed approaching next signal at medium speed." The fourth signal to the rear of the train, Signal A, displays the Clear aspect, indicating: "Proceed." Thus, when a Clear aspect is displayed in three-block automatic signaling territory, at least three blocks in advance of that signal are unoccupied by a train.



Typical three-block signaling aspects

209-Q: *Do these aspects move along, in order, from signal to signal, behind a moving train where a series of successive signals are controlled as a three-block automatic system?* A: Yes; in exactly similar manner to the way in which the three aspects used in two-block signaling move along behind a train, as illustrated in Fig. 1 and 187-Q in the May issue.

210-Q: *Does the zone of protection vary in length as the train moves through a particular block?* A: Yes: in a similar manner to that illustrated for two-block signaling in 188-Q and Fig. 2 in the May issue.

211-Q: *Where is three-block automatic signaling used?* A: It is a premise of multiple-block signaling that the use of more signals spaced at shorter intervals than normally used in the two-block system will provide for the conveyance of information to enginemen at more frequent intervals, and thus will allow trains to follow more closely, providing greater traffic capacity and faster average movement of trains. Three-or-more-block signaling, therefore, is usually installed where traffic density is great, where heavy descending grades are involved, in approach to interlocking plants where traffic may possibly be delayed due to interfering movements or speed restrictions, and in territories where a few trains are operated at considerably higher speeds than the average for the bulk of the traffic.

212-Q: *Why may signals in three-block automatic territory be spaced closer together than signals in two-block automatic territory?* A: In two-block territory, the spacing between any two successive signals must be sufficient to allow a train traveling at maximum permissible speed, and encountering an Approach aspect on a particular signal, to stop at the next signal. In three-block signaling the spacing between signals may be reduced to either of the following, *whichever is greater:* (1) The braking distance required to bring a train down from maximum permissible speed at a signal displaying an Approach-Medium aspect to medium speed at the next signal in advance, which is displaying an Approach aspect, or (2) the braking distance required to bring a train down from medium speed at a signal displaying an Approach aspect to stop at the next signal in advance, which is displaying a Stop-and-Proceed aspect. Signals spaced on this basis will allow the indications conveyed to be obeyed by trains receiving those indications; we have seen that this is the fundamental requirement which must be met in establishing minimum spacing of signals. Either of the two braking distances listed above, of course, is less than the distance required to bring a train down from maximum permissible speed to stop, and signals in three-block territory may be spaced closer together, therefore, than signals in two-block territory.

213-Q: *Which of the two braking*