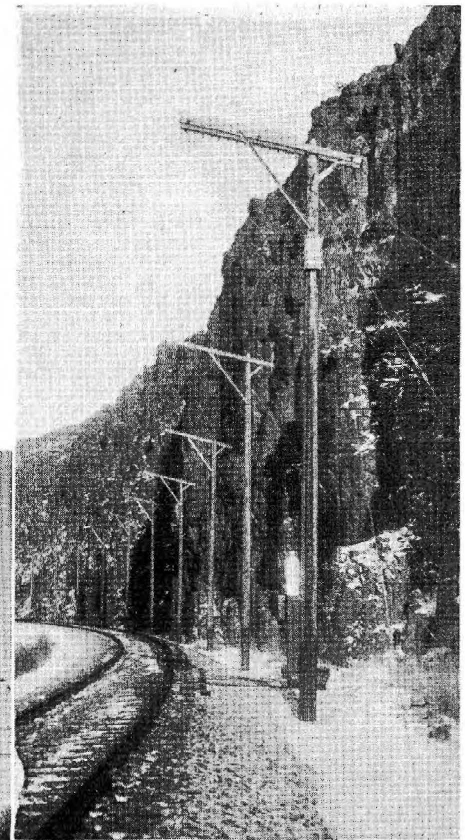
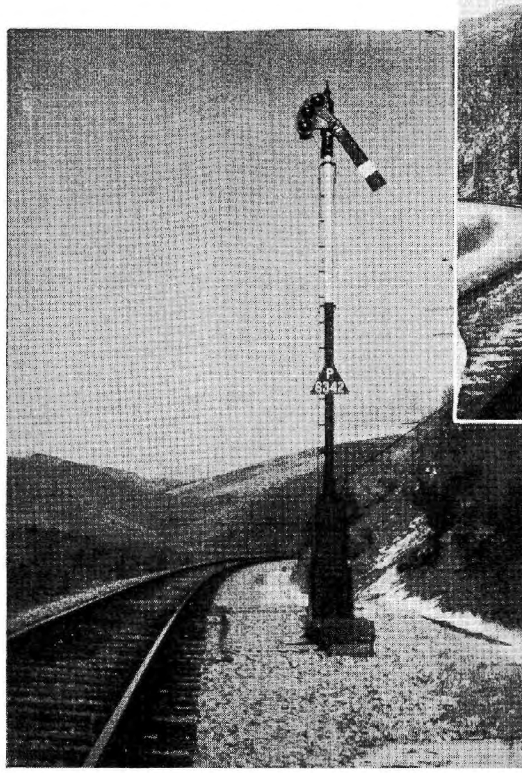
Rock Detector Protection

on the Western Pacific





Above — Crossarm type falling-rock detector. Left—Automatic signal equipped with special triangular shaped plate

Two types used, one for sliding or rolling rocks, and the other for falling rocks

On certain sections through Nevada, the main line of the Western Pacific is located close to rock bluffs, on which the formations are such that large rocks, affected by erosion, freezing and thawing, are loosened and sometimes roll down on the track. At several such locations, protection has been installed to detect rolling or falling rocks, and to set signals at restrictive indications, as warning to enginemen of approaching trains. At locations where the hillside slopes down to a point near the track, a fence is constructed parallel with the track, and in some instances, a second fence is installed farther up the hillside so that any rock rolling down would strike one or both of the fences.

At some locations, the track is located along bluffs which rise almost vertical, so that loosened rocks fall in practically a straight line. Under such conditions, a fence would not serve as protection, and, therefore, at these locations, protection is afforded by the equivalent of a fence, constructed in a horizontal plane and placed near the top of regular line poles in a form similar to a regular crossarm construction.

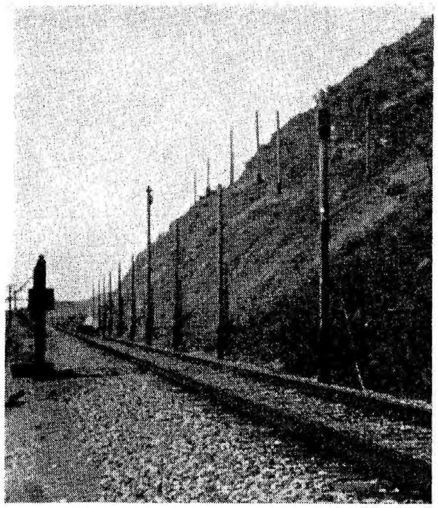
Slide Fence Construction

When constructing a rock slide fence, regular poles, ranging from 20 to 25 ft. long, are set about 30 ft. to 50 ft. apart, according to conditions, in a line parallel with the track. The operative part of the fence, designed to detect rocks rolling toward the track, consists of 20 wires strung at 5¾-in. spacing on 10-ft. crossarm attached to the poles. At the end of each section, which may be as much as 1,000 ft. long, the crossarm is equipped with 20 dead-end type insulators attached by bolts through the arm. The arm is attached, in a vertical position, to the side of the pole by four ⅝-in. through bolts 20 in. long. For each of the intermediate poles of a section, the crossarm is equipped with 20 No. 4½ porcelain knob type insulators, each attached by a ¼-in. by 6½-in. bolt. A leather washer is used, between the head of the bolt and the insulator, to reduce chances of breakage. By means of four ⅝-in. through bolts, the arm is attached in a vertical position to the field side of the pole, with the insulators on the pole side of the arm, a space of 3 in. being allowed between the arm and the pole.

The end poles of each section are guyed to concrete anchors, using 5/16-in. stranded guy wires, one guy being attached at a point on the pole just above the top of the fence, and another being attached near the top of the pole; in addition, every alternate pole is side guyed.

When all the arms and guys are in place, the No. 9 weatherproof iron wire is strung on the insulators. The wires on the two top rows of insulators are connected as part of the signal line control circuits. Jumpers are installed between the remaining wires on the arms to form one continuous series circuit for the entire fence installation as a whole. The theory of operation of this type of fence is that a rock, large enough to cause damage to the track, will break one or more of the wires when it strikes the fence. The bottom of the fence is purposely set 18 in. from the ground level, so that small rocks can roll under without operating the fence.

For each section of fence, up to 1,000 ft. in length, a separate circuit arrangement is used. A battery of 10 Edison 500-a.h. primary cells is connected in series with the series con-



Rolling rock detector fence

nection of the wire on the fence and a 500-ohm relay, normally energized by a stick circuit through its own front contact. Signal line control circuits are taken through contacts of this relay. When any wire of the series fence connection is broken, the relay is released and the signal line circuits are opened, thus causing the signals to display their most restrictive aspect. The detector relay remains de-energized until the maintainer repairs the fence wire, and then pushes a push button which energizes the relay; it then sticks up through its own front contact. The entire arrangement operates on the fundamental closed-circuit principle.

Falling-Rock Protection

At locations where sheer bluffs are located close to the track so that rocks fall in practically a straight line, the protection consists of the equivalent of a fence, but in a horizontal plane at or near the top of line poles somewhat similar to regular crossarm construction. Regular wood poles, 35 ft. to 40 ft. high, are set 25 to 50 ft. apart. In some instances, the bluffs are so close to the track that the crossarms have to be set off center and supported by bracket arms. In special types of locations, the poles themselves are set at an angle in order to position the arms in places where falling rocks will most likely be intercepted. Two or more rows of poles may be required up the face of a bluff. In some instances, fences are also constructed on the same poles where falling rock protection is constructed. With a few exceptions, the design of the falling rock protection is similar to that for the fences explained previously.

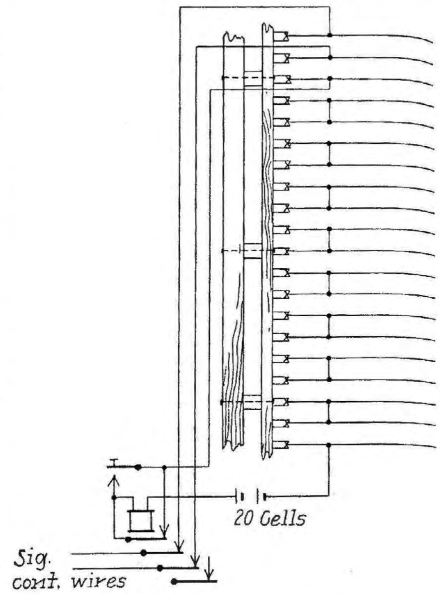
Double arm construction is provided for all end poles of falling rock detectors, 5/8-in. by 20-in. double-arming bolts being used at the ends of crossarms. Six 3/8-in. by 5-in. galvanized carriage bolts, placed vertically, are used for each crossarm to prevent splitting. Detector wires, spaced 5¾-in., are fastened to galvanized dead-end brackets at each end of falling rock detector. Galvanized eyenuts are fastened to the end of double-arming bolts to permit guy wire attachments. No. 4½ porcelain insulators are used for intermediate crossarms, as shown in the sketch. This arrangement of guying is important because the protection wires must be pulled taut so they will break readily when a rock strikes them. The double arm is required to provide adequate strength to withstand the stress set up by the guys.

Jumpers are used to connect all the wires on the arms in a series circuit. Wires, tapped off of the two outer wires, extend to Raco double-safety type lightning arresters in a box just below the crossarms, and, from there, wires extend to the relay case. The circuit arrangement, including the push button, relay and 10 cells of primary battery, is practically the same as explained previously for use with the slide type fences.

Special Signal Markers

Each automatic block signal, the control of which includes rock detector protection, is equipped with a new type of triangular number plate which has the letter "P" above the numerals, as shown in one of the illustrations. An engineman encountering such a signal, which is displaying the stop aspect, knows that he is to proceed cautiously looking for rocks on the track or for damage to the track caused by rocks. Regardless of whether any damage has been caused, the dispatcher is notified, so that the maintainer can be called to repair the fence and reset the controls.

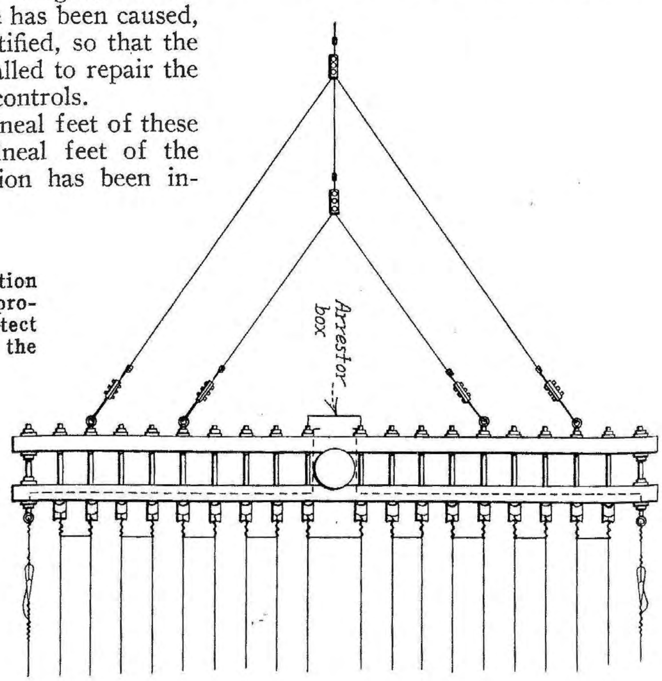
A total of 4,450 lineal feet of these fences and 2,050 lineal feet of the falling rock protection has been in-



Circuit for detector fence

stalled on the Western Pacific, and the majority of these installations have been in service since November, 1938. On several occasions, potential train accidents have been averted by the protection afforded. In one instance, a 3½-ton rock came down, breaking the fence and came to rest between the rails. This particular section of fence controls two signals for eastward trains. The first signal was at proceed and the next signal, immediately in advance of the rock fence, was at stop, which indicates that the rock came down about a minute or so before a fast passenger train reached the stop signal.

These rock detector installations were planned, installed, and are maintained by the signal department forces of the Western Pacific, under the direction of J. R. Coles, signal engineer.



Crossarm construction and guys used in the protection on poles to detect rocks that fall from the bluffs