

7. In order that proper contact pressure be had, a contact opening of from .040 in. to .045 in. must be maintained.
8. The maintainer should always be sure that roller is free of cam, otherwise roller in time will develop a flat spot and then proper adjustment cannot be maintained.
9. When cap is removed from contact fingers and they are free, tension should be such as to insure good contact pressure.

GALVANOMETER RELAYS

The question of the best method of avoiding chattering of galvanometer relays under service conditions, brought out the fact that several methods have been tried. Some endeavor to accomplish this result through electrical means and some through mechanical means. The method of applying weight to the rotor concentric with the shaft has been tried at several places and those present agreed that is the most satisfactory method yet devised for minimizing this trouble.

COST OF LIGHTING SIGNAL LAMPS

One report on the cost of lighting signal lamps indicated that 196 signals were lighted with oil lamps one year for \$1,233. Another report stated that the cost per signal per month for lighting with oil was \$1.70 and for electric light from storage battery 76 cents per month. A statement as to the cost of lighting with gas showed \$10.50 per light per year.

A letter from A. H. McKeen, Signal Engineer, Oregon-Washington Railroad & Navigation Company, included the following costs of maintaining 180 miles of signals with oil and electric lights. Electric lights were installed on this district during 1914:

Cost per year of operating signals with Exide storage batteries and oil lights:	Cost per year of operating signals with Edison storage batteries and electric lights:
Interest on cost of Exide storage batteries 5% on \$3,794.\$ 189.70	Interest on cost of Edison storage battery, 5% on \$13,265.28\$ 663.26
Depreciation on cost of Exide batteries 25% on \$3,794.... 948.50	Depreciation on cost of Edison storage battery, 5% on \$13,265.00 663.26
Cost of oil for 341 signals, 1 gal. per lamp per month at 24c 982.08	Cost of electric lamp renewals 47.00
Cost of wicks, burners, etc. 35.00	Store Dept. expense 4.70
Store Dept. expense. 102.00	Wages of 9 maintainers 8,640.00
Wages of 10 maintainers 9,600.00	
\$11,857.28	\$10,018.22

Saving per year with electric lights, \$1,839.06.

Note: No freight charges are included for System line transportation of oil or batteries. No charge is shown for current used for electric lighting, as this is a small proportion of discharge of battery, and is more than compensated for by other savings. Exide batteries were charged and changed out each 28 days. Edison batteries are charged and changed out each 50 days.

LIGHT SIGNAL PERFORMANCE RECORD

A statement was submitted by S. R. Florence of the Pacific Electric, showing the results obtained by that company with its installation of light signals. On the Pasadena Short Line, with 31 three-position and 4 two-position light signals, placed in service April 23, 1914, and having an average number of signal functions per day of 16,800, the failures recorded in the year 1916 were as follows:

Dark signals	10
Failure of insulated rail joints.....	3
Blown fuse on main feed wire	2
Switchpoints out of adjustment	5
Total	20

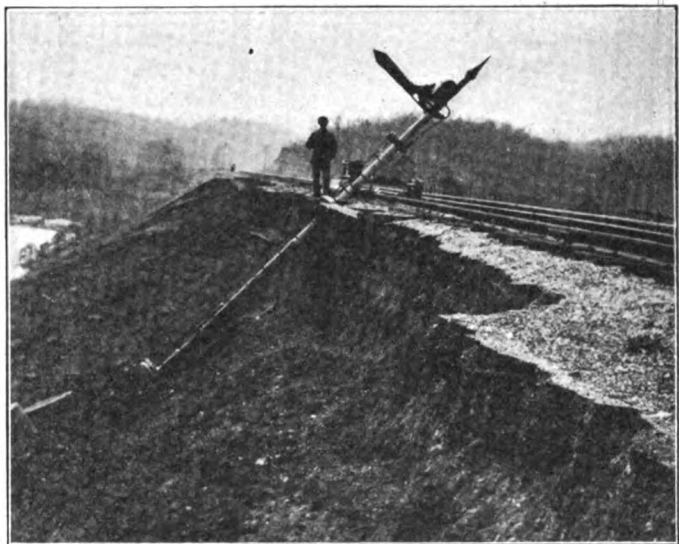
On the Venice Short Line, with 60 three-position light signals placed in service January 14, 1914, having an average number of signal functions per day of 5,655, the failures for the year 1916 were as follows:

Dark signals	13
Shorted impedance bonds	2
Defective insulated joints	1
Broken track wire	2
Broken line wire	1
Blown fuse on main feed wire.....	1
Blown fuse on relay	1
Transformer failure (defective material).....	1
Open track grid	1
Open switchpoint	1
Broken rail	1
Total	25

The cost of maintenance labor per signal per year on this line is \$15. The cost of material per signal per year is \$12, and the cost of power per signal per year \$6, giving a total cost for maintenance and operation of \$33 per signal per year.

SIGNAL PROTECTION FOR WASHOUTS

A PRACTICAL demonstration of the protection which automatic signals give for washouts was recently reported from East Chattanooga, Tenn., on the Southern. Heavy rains and high water caused a fill on the eastbound main line just east of an interlocking plant



Washed Out Signal Doing Its Best to Protect the Track

to give way for a distance of about 500 ft. Automatic signal No. 2362, located at the scene of the trouble, slid half-way down the fill. This movement of the signal caused the home signal in the interlocking plant to indicate "stop." Two eastbound passenger trains were due at this point shortly after the fill gave way, and when the operator of the interlocking plant notified J. T. Brown, signal maintainer, that the home signal had been thrown to danger by some unknown cause, he refused to permit trains to be carded by the home signal until he could go over the track to locate the trouble. He went forward promptly and found signal 2362 in the position indicated in the illustration. In spite of the washout, it was still standing guard over the tracks, the upper portion of the pole inclining over the tracks with the signal blade in the stop position. The part played by these signals and the judgment shown by the maintainer very probably averted an accident in this case.