that, in a great many cases, a study would indicate that the use of power-operated switches is well warranted at some of the sidings, but that, at other sidings or junction points, power-operated switches would be used so seldom that their installation would not be warranted. At these latter locations, signals should be provided, with some sort of indication so as to indicate that trains should enter or leave these sidings or junction points in order to avoid the delays which would be caused by calling the operator at the control point, for instructions. There are, of course, outlying switches which are used by locals or switch engines for setting out or picking up cars, and I do not think that any protection, other than that afforded by automatic signals, is necessary for such layouts.

In regard to the use of an electric lock, I can not see where the fact that a territory is under centralized control, makes any difference; if it is felt that a switch is of sufficient hazard to warrant an electric lock, it is just as necessary to have this electric lock in signal territory regardless of whether the operation is by train order or centralized traffic control. If the switch governs train movements into a track of sufficient length that the train may get entirely in the clear, I think it is quite important that a telephone be installed at this point so that the trainmen can release the track and later secure permission before re-entering the main line.

Oil or Electric Switch Lamps?

"What does it cost per year to operate a switch lamp electrically from primary battery as compared with oil lamps? Is constant or approach control used and how is the control circuit arranged?"

Approach Control Makes Electric Lighting Economical

By G. K. Thomas
Assistant Signal Engineer System, Atchison, Topeka & Santa Fe, Topeka, Kan.

The cost of operating oil-lighted switch lamps depends very largely upon local conditions. Where a large number of lamps are located close together, as in yards, they can be maintained at a lower cost than the same number of lamps scattered over a longer territory, as on the main line. Investigation seems to indicate that the average cost ranges from $10 to $20 per year. Where reasonably efficient methods are used, perhaps an average cost of $12 may be used as a conservative figure for comparison purposes.

On the Santa Fe, electric switch lights using energy from primary battery are provided with approach-lighting control. The total running cost, including interest on the investment, varies from $6 to $9 per year, depending chiefly upon the method of installation and control necessary in each case. Four cells of potash battery are used, generally installed in a small concrete battery box near the switch. The lamps are rated at 3.5 volts, 1.05 watts. Parkway cable or flexible conduit connections extend from the battery box to the lamp. Approach control is accomplished by means of a back contact on the switch indicator where a switch indicator is available. At points where switch indicators are not installed, approach control is accomplished by the use of DNL-type series relays in the line control circuit of automatic signals. In a-c. territory it is generally found that 110-volt 10-watt lamps, continuously lighting, may be operated at approximately the same cost as primary battery with approach control.

Oil Operation Cheaper

By W. L. Dayton
Superintendent of Signals, Grand Trunk Western, Detroit, Mich.

We figure the cost of operating an oil lamp for one year as follows:

Fortnite oil, 1½ pt. each week—10 gal. at $0.76	$0.76
Matches and wicks	.03
Labor, 10 min. each week—9 hr. at $0.70	6.30
	$7.09

The labor item includes time for the operation of the motor car and for handling the oil. This is for continuous burning and for cleaning lamps once each week.

The cost of operating an electric lamp with a battery, for one year is as follows:

Primary battery renewal, 500-a.h., 6 at $1.16 each	$6.96
One lamp bubl 2.5-volt, 0.15-amp, at $0.54	.54
Labor, changing bulb and inspecting, 2 hr. at $0.70	1.40
	$8.90
Credit for exhausted elements at $0.14 each	.84
	$8.06

The above assumes that a set of four renewals will operate a lamp for eight months. This is a very good average, although we have a few lamps where the battery will last one year.

In all cases we use a sun relay for controlling the lighting circuits. The life of the battery is governed by the operation of the sun relay, some of the relays are very sensitive to light and dark and can be set for very close operation, while others are not so sensitive and they have to be set to operate accordingly.

Approach Electric Lighting Is Cheaper

By P. A. Garrity
Western Sales Manager, Thomas A. Edison, Inc., Chicago, Ill.

The oil switch lamp seems to be an "orphan" among railroad men, with every one trying to dodge his responsibility and trying to put over its maintenance on the other fellow. The electric lighting of switch lamps, especially on the railroads that use them in automatic territory, seems to be the inevitable development when there is a practical and economical means of so doing. We believe that primary batteries provide this means from both a practical standpoint as well as an economical one, as illustrated in the figures.

Primary-battery electric lighting of switch lamps is accomplished either by burning a 3½-volt 0.150-amp. lamp continuously from four primary cells, or, where the railroad uses switch indicators, by burning the lamp through the back contact of the indicator only on the approach of a train.

A recent development has brought about a 3½-volt 0.150-amp. lamp which just seems to fit in nicely with a desired method of lighting signals, in that it gives a cheap installation cost and in that maintenance is brought to a very low figure. The operating details are as follows:

Average current 0.110 amp.
$24 \times 0.11 = 2.64$ a.h. per day

$$\frac{500}{2.64} = 190 \text{ days from four renewals}$$

CONSTRUCTION COST

4 Edison type S-504 cells	$ 9.74
1 Edison adapter	2.50
1 3.5-volt 0.150-amp. lamp	.40
1 wood battery box (4 cell)	5.00
35′ No. 14 R.S.A. wire	1.05
Labor	5.00
	$23.69

OPERATION COST

4 S-500 renewals (net)	$ 3.73
1 3½-volt 0.150-amp. lamp	.40
Cost for 190 days	$ 4.13
Cost per day—$0.02	
Cost per year— 7.30	
6% on $23.69	$ 1.42
Operating cost	7.30
Cost per year	$ 8.72

The total maintenance cost per year, including interest charge on the investment, is $8.72 per lamp, with a minimum of labor, as the four renewals will give 190 days' continuous service without attention, other than perhaps cleaning the dust from the surface of the switch lamp lens.

The following data is for lamps which are approach lighted:

35 trains per day occupying approach lighting circuit 3 minutes each or 1¾ hours

1—¾ hours at 0.250 amp. = 0.436 a.h. per day

4—500 a.h. cells will give 1,146 days' life

INSTALLATION COST

1 D.N.L. relay	$16.50
4 cells primary battery (permanent parts)	6.00
1 Edison adapter	2.50
1 3½-volt 0.3-amp. lamp (precision filament)	.65
Wire, etc.	2.35
Labor	7.00
	$35.00

OPERATING COST

6% on installation cost of $35	$ 2.10
4 primary battery renewals (net)	4.00
1 3½-volt 0.3-amp. lamp	.65
Labor renewing 4 cells at 20 cents each	.80
Total cost for 1,146 days	$ 7.55
Cost per day	$ 0.0066
Cost per year	2.41

The average *materials* cost (oil, wicks, etc.) is given by eight railroads as ..... $5.43 per year

A saving of $5.43—$2.41= ..... $3.02 per lamp per year for material only in favor of the electric-lighted signal lamp

The approach electric lighting as outlined for signals, which includes an interest charge on the investment and a labor charge covering the setting up of batteries, will save $3.02 per lamp per year over the cost of oil wicks, etc., for the oil lamps.

We believe the approach electric lighting of switch lamps controlled by a D.N.L. line relay operated in series with the signal control circuit will appeal to many. Electric lighting of signals and switch lamps not only saves a lot of money but would give the benefit of more dependable and better night indications. The average cost shown, covering oil lamp supplies, was given us by 10 railroads and, therefore, we feel that the figures of $5.43 per year is a good average.

The care of oil lamps by signal maintainers is one of the dreaded jobs and one that cannot be delayed. In other words, the lamp day must be given preference over other maintenance work regardless of weather conditions. The electric-lighted lamp can be set up for long periods relieving the maintainer so that he can use his time to better advantage in actual maintenance and repair work.

Continous Electric Lighting Cheaper

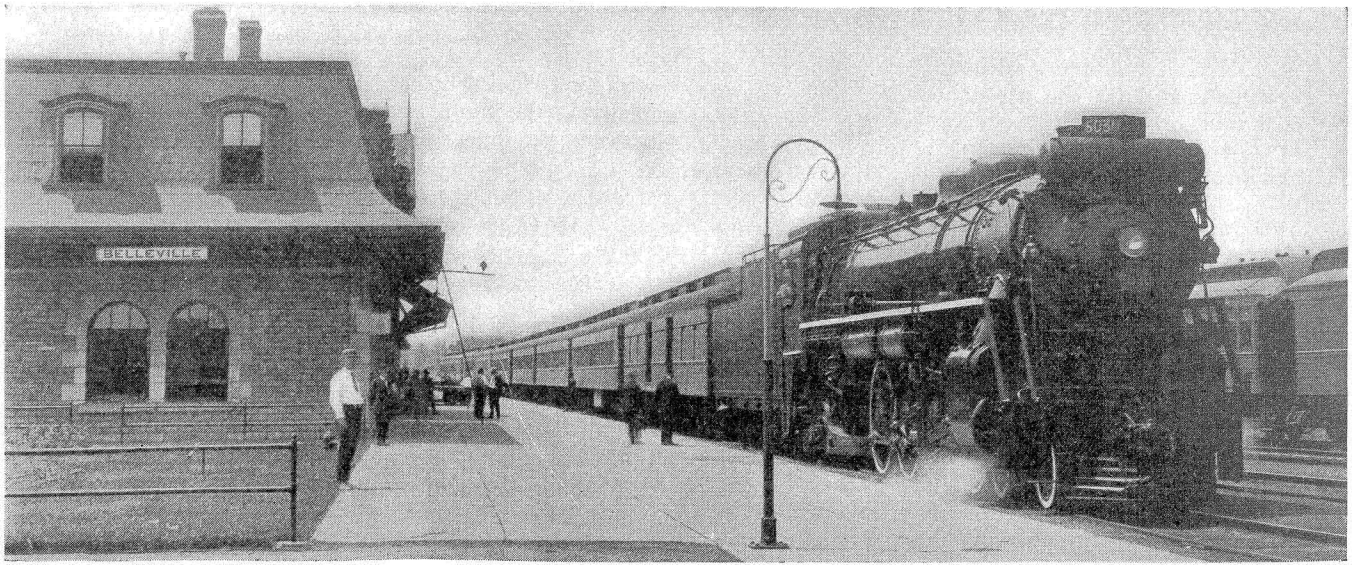
By C. O. Ryberg

Supervisor of Telegraph and Signals, Pennsylvania, Toledo, Ohio

We estimate the comparative cost of oil and electric operation of switch lamps as follows:

Cost of maintaining one oil lamp per year:		
Labor	$22.74	
Oil	3.50	
Material	1.60	
		$27.84
Cost of maintaining one electric lamp per year:		
Labor	$ 9.84	
12 lamps at 30 cents	3.60	
3 battery renewals at $1.50	4.50	
		17.94
Saving per year effected with electric lamp		$ 9.90

We do not use approach control; the lamps are burned constantly.



One of the Canadian National trains on the six-hour 334-mile run from Montreal to Toronto