changing the sets so that they would exhaust evenly. On account of the entire 18-cell battery being used to control outside circuits, the polarity of which could not be changed, it was found to be necessary to go into the use of a four pole switch in order to interchange the batteries, without moving the cells around on the shelves or to change the connections; either of which would be impracticable. This switch would introduce additional resistance into the operating circuits, and due to the fact that it would be necessary to operate it quite frequently, if the full life of the battery was to be obtained, it was decided to abandon this feature. From actual experience no real objections have developed to having the two sets of battery exhaust unevenly. The maintainer soon learns that the sets will have to be renewed at different times and consequently keeps a separate record for each.

The scheme has now been in service for several years, prior to and during which accurate records have been kept of the life of all operating batteries used. From these records it has been established that the life of the average signal operating battery is increased approximately 33⅓ per cent. A nominal expense is involved at each signal in connection with providing the additional wire, circuit controller, and for rearranging the circuits, but this is offset by the large saving that results from the use of the scheme.

It is now planned to make a further saving in energy consumption by applying push buttons to all switch indicators. These indicators at present are normally energized and stand at clear except when a train is approaching. Through the use of the push buttons the indicators will be de-energized at all times except when the push buttons are operated by the trainmen. It is calculated that on approximately 1,100 indicators in service the saving in current consumption will amount to about $2,500 annually.

# Automatic Train Control in Use On American Railroads

THE notice of the Interstate Commerce Commission, calling upon prominent railroads to install automatic train stops, which was published in the *Railway Signal Engineer* of January, page 24, has revived interest in the general subject of automatic stops, and many inquirers are calling for information concerning it. Apparatus of this character is already in use on 11 railroads in this country, of which four run both passenger and freight trains, and it will be of interest at this time to note briefly the situation on these railroads. The list below, "List A," gives the names of these roads, with some data concerning the kinds of apparatus and the extent of the installations:

LIST A—AUTOMATIC STOPS IN USE

*a* Boston Elevated.—Stops in use over 20 years. Simple mechanical trip. Described in Signal Dictionary, pages 122-124.

*b* Interborough Rapid Transit Co., New York—Subway and elevated lines. Simple mechanical trip. Described in Signal Dictionary, page 117.

*c* Hudson & Manhattan (Subway).—New York and Jersey City. Same general type as above. Signal Dictionary, page 108.

*d* Pennsylvania, New York City Terminal. Tunnels; also in unprotected situations. The Hill mechanical trip. Described in Bulletin No. 63 of the Union Switch & Signal Co., and in the *Signal Engineer* of January, 1912.

*e* Brooklyn Rapid Transit Co. (N. Y.) Subway and elevated lines.

*f* Chicago & Eastern Illinois.—Used on both passenger and freight trains over about 100 miles of line. Miller Train Control Corporation; apparatus described in the *Railway Signal Engineer*, page 329, November, 1914; page 61, February, 1916.

*g* Chesapeake & Ohio.—American Train Control Company; in use on about 20 miles, single track. Apparatus described in *Railway Signal Engineer*, page 131, April, 1919. Ramp type.

*h* Chicago, Rock Island & Pacific.—Regan Safety Device Co. Described in *Railway Signal Engineer*, page 204, May, 1920. Ramp type, with speed control.

NOTE—The three last preceding installations have been under inspection during the past year by the Bureau of Safety of the Interstate Commerce Commission and the Train Stop Committee of the American Railway Association.

*i* Cincinnati, Indianapolis & Western.—The Shadle automatic train control—intermittent electric contact type. *Railway Signal Engineer*, page 405, October, 1920.

*j* Washington Water Power Company. This is a trolley road; Overhead automatic stops in use on 22 miles. Described in Signal Dictionary, page 112.

*k* San Francisco-Oakland. Double track line, overhead trip. Signal Dictionary, page 113.

The list begins with elevated and subway intramural railroads, the situations of which are so different from those of ordinary railroads that must students of the problem have paid little heed to the question of adapting the simple mechanical trips of these city railroads to the needs of heavy and mixed trunk-line service; but it is proper to include the city lines in this list, for two reasons: First, the main reason for classing the simple trip as available only on the city roads is that it is particularly susceptible to being interfered with by snow and frost; but the government now calls for installations where snow and frost do not make much trouble; and the adaptation of the principles of these trips to apparatus usable in cold climates has not as yet been thoroughly studied.

Second, the experience of the subways and the elevated lines should be availed of by all railroads in the matter of discipline of runners. One of the persistent arguments against the use of automatic train stops is that they will make, or tend to make, all enginemen careless. But officers of roads using the stops give strong testimony that the actual effect is exactly the other way; the stops make the men more careful. Testimony on this point on the Boston Elevated covers a period of over 20 years. The Chicago & Eastern Illinois, with its more varied traffic and different conditions, confirms the story of the Boston Elevated. An important element in the successful operation of automatic stops on a busy line is the success with which the enginemen maintain smooth and regular operation; and no road can afford to ignore the records of the years of successful operation on these city railroads, with their many hundreds of motormen.

In a second list, "List B," there are shown the names of roads in which experimental installations have been made. Of the 16 items in this list, five—Nos. 1, 6, 7, 13 and 15—have been the subject of recent published descriptions or news notes, as shown in the list. Item 12 refers to a recently reported contract, concerning which we have no detailed information. The other 10 refer to experiments which have been closed, or which have lain dormant for a considerable length of time.

LIST B—AUTOMATIC TRAIN-STOP EXPERIMENTS

1 Buffalo, Rochester & Pittsburgh—General Railway Signal

Co., Induction apparatus. *Railway Signal Engineer,* page 431, November, 1921.
2 Canadian Pacific.—Prentice "wireless" apparatus. Railway Age, June 23, 1911.
3 Chicago, Burlington & Quincy.—Gollos automatic stop. *Railway Signal Engineer,* page 160, May, 1916.
4 Delaware, Lackawanna & Western.—Wooding's train control. *Railway Signal Engineer,* page 311, October, 1917.
5 Interborough Rapid Transit Co.—G. P. Finnigan's induction apparatus. Described by J. M. Waldron in the Railway Age, June 16, 1911.
6 Erie.—International Signal Company's apparatus; Webb system. Current issue *Railway Signal Engineer.*
7 New York Central.—Sprague induction system. *Railway Signal Engineer,* page 263, July, 1921.
8 New York Municipal Railways (Brooklyn Rapid Transit Co.) Elaborate speed control system, made by the General Railway Signal Co.; subjected to elaborate tests in 1916. Description in the *Signal Engineer,* August, 1915.
9 New York, New Haven & Hartford.—The Webb apparatus, noticed above, was subjected to extensive tests in 1917.
10 Pennsylvania (Western Lines).—Gray-Thurber system; tested by the Division of Safety, Interstate Commerce Commission, in 1914. Report submitted to Congress on January 9, 1915.
11 Philadelphia & Reading.—Schweyer's induction system. *Railway Signal Engineer,* page 224, July, 1918, and page 353, November, 1918.
12 Pittsburgh & Lake Erie.—Union Switch & Signal Co.
13 Raritan River.—M-V All-weather train control. Current issue *Railway Signal Engineer.*
14 Southern (C. N. O. & T. P.)—Julian-Beggs automatic speed control. *Railway Signal Engineer,* page 128, April, 1916.
15 Southern Pacific.—National Safety Appliance Co. Experimental plant is now being installed between Hayward, Cal., and Halvern.
16 Western Pacific.—National Safety Appliance Company's induction apparatus subjected to extensive tests near Oroville, Cal. *Railway Signal Engineer,* page 347, November, 1915.

"List C" is a rearrangement of the items given in "List B."

LIST C—INDEX TO NAMES OF PROPRIETORS IN LISTS A AND B

NOTE—The numbers at the left refer to the position of the items in Table B, and the letters to Table A.

.. Bostwick—See National Safety Appliance Company.
5 Finnigan—Interborough Rapid Transit Co.
1 General Railway Signal Co.—B. R. & P Ry.
8 General Railway Signal Co.—B. R. T. Co. (N. Y. Municipal Railways).
3 Gollos—C., B. & Q. R. R.
10 Gray-Thurber—Pennsylvania.
6 International Signal Co.—Erie and N. Y., N. H. & H.
14—Julian-Beggs—Southern.
13 M-V All-weather train control—Raritan River.
*f* Miller—Chicago & Eastern Illinois.
16 National Safety Appliance Co.—Western Pacific.
15 National Safety Appliance Co.—Southern Pacific.
2 Prentice—Canadian Pacific.
*h* Regan—Chicago, Rock Island & Pacific.
11 Schweyer—Philadelphia & Reading.
*i* Shadle—Cincinnati, Indianapolis & Western.
7 Sprague—New York Central.
12 Union Switch & Signal Co.—Pittsburgh & Lake Erie.
6 Webb (See International Signal Co.),
4 Wooding—Delaware, Lackawanna & Western.

The most recent comprehensive publication relating to automatic train stops is the report of the Automatic Train Control Committee (A. M. Burt, chairman) of the United States Railroad Administration, which report was transmitted to the director-general of railroads on December 31, 1919, and abstracted in the *Railway Signal Engineer,* page 31, January, 1920. This report gave the results of a thorough and intimate study made by a committee of seven, including six railroad officers and engineers, and W. P. Borland, chief of the Bureau of Safety of the Interstate Commerce Commission.

Besides analyzing and describing the different types of apparatus and giving brief descriptions of devices examined, the report, following its general conclusions, gives a comprehensive bibliography of the subject; and a list of 17 devices, more or less fully developed, which were deemed worthy of further tests. Eleven of these devices are noted in the tables which are printed herewith as reference.

The report of this committee was extremely cautious, the most progressive paragraph being that to the effect that, on lines of heavy traffic, fully equipped with automatic block signals, the use of train control devices "is desirable." The committee recommended that after the termination of federal control of the railroads, its work should be continued by a committee of the American Railway Association; and such a committee was established. Of this committee, C. E. Denney, vice-president of the New York, Chicago & St. Louis, is chairman, and G. E. Ellis, Chicago, is secretary.

This last named committee, in conjunction with the Bureau of Safety of the Interstate Commerce Commission, issued a list of requisites for automatic train control which was noticed in the *Railway Signal Engineer,* page 91, March, 1921.

The devices named by the Automatic Train Control Committee, December, 1919, as available for test, were as follows: In table A, items f, g, h, i; in Table B, items 1, 4, 6, 7, 11, 12, 15.

The following references to the *Railway Signal Engineer* will be of interest to those who may wish to examine the subject of cab signals, some of the details of which are of value in connection with the automatic stop problem:

1. *Railway Signal Engineer,* page 247, June, 1920. Description of Augereau's wireless cab signal, as installed in France.
2. *Railway Signal Engineer,* page 159, April, 1921. Report of New York State Public Service Commission on automatic stops.
3. *Railway Signal Engineer,* page 91, March, 1921. J. B. Latimer on automatic stops and audible signals.

Matter supplementary to the above mentioned article by Mr. Weissenbruch may be found in a paper by F. Maison, in the Bulletin of the International Railway Association for November, 1921. Mr. Maison's paper has been prepared for the International Railway Congress, which is to be held in Rome next April. It fills about ninety pages of the Bulletin. Like Mr. Weissenbruch's paper, it covers experiences terminating about 1914; and the author promises a second paper dealing with developments in this field since 1914.

## Reclamation of Motor Car Engine Shafts

As the new crank-shafts for gasoline motor cars could not be supplied promptly, the signal department, Portland division, of the Southern Pacific experimented on reclaiming these shafts by building them up with the electric welding process.

The labor and the material for welding, together with the lathe work, made the cost of reclaiming each of these shafts $22.15, as against the cost of a new shaft of $39.44, a net saving of $17.29. About a dozen reclaimed shafts are now in service and are giving entire satisfaction.

Another reclamation feature which is being practiced by the signal department of the Portland division is in the reclaiming of cylinders for motor cars by shrinking and lapping. These cylinders are sent to a local welding firm which has a secret process by which they are not only reclaimed, but improved, since after being reclaimed the cylinder does not heat. The cost of this work is $4.50 each, plus 50c for three new rings, making the total cost of reclaiming $6.00. From the manufacturer these cylinders cost $14.12 each. The Portland division has had 52 cylinders reclaimed, all of which have given excellent service, and the result to date is a net saving of $422.24 —(*Southern Pacific Bulletin.*)