and is now in successful operation. The possibilities for the future use of this signal are very great on account of its having no moving element and its peculiar adaptability to roads using alternating current for signal operation.

Single-track automatic signaling is receiving an increasing amount of attention and the mileage installed during the year greatly exceeds that on double track. It has been only a few years since railway officers believed that automatic signals on single track would hinder instead of facilitate movements. Particularly since the so-called "absolute permissive block" has been developed has this idea given way to a realization of the safety and aid that the system affords. In the A. P. B. system for single-track signaling the trains are given an absolute block from passing siding to passing siding for opposing trains and a permissive block for following trains. This system has been almost exclusively installed during the past year.

There has been a substantial decrease in the miles of track protected by manual block owing to the substitution of automatic block signals in its stead. This was also true in 1914 and can reasonably be expected for a number of years to come unless a law should be passed requiring the immediate installation of block signaling on all lines, in which case the manual system would be the only one that could be installed in a short time.

The use of electro-mechanical interlocking, that is, interlocking where the power for operating switches and derails is manual and for the signals, electric, shows continual growth due to the satisfactory operation of such plants. The use of switch and lock movements and the elimination of separate levers for facing point locks is a development of the year. Such plants reduce the size of machines necessary and with switch indication circuits, concrete foundations and heavier construction now used in signaling, no element of safety has been sacrificed.

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President, Railway Signal Association

On railways where white is used as a proceed signal there is always the possibility of a false proceed indication due to a broken lens or roundel in a stop signal. This possibility, though very rarely causing an accident, is always present and each year sees the gradual adoption of green as the color indication for proceed on some railroads. This year has been no exception, one prominent road in the south having completed the change from white to green in the past few weeks.

The Division of Safety of the Interstate Commerce Commission has secured the services of an experienced and well-known signal engineer during the year. His advice and counsel will, it is believed, do much to prevent hasty and unconsidered legislation affecting railway operation and, particularly, block signaling and automatic train control. The appointment of an experienced man to this position was of peculiar interest to the railways just at this time when Congress has before it a bill to expand the jurisdiction of the Interstate Commerce Commission to cover operating matters.

Valuation of the signal appliances on a number of railways has been started during the year in connection with the federal valuation. This work has required the services of many signalmen both by the government and the railroads. It is only because of the general depression in construction work that the railways have not been required to materially increase the signal engineers' forces to take care of this work on roads where it is now under way. This work is generally handled under the supervision of the signal engineer, his forces making the detailed inventory and obtaining the required records. The Presidents' Conference Committee on Valuation has appointed a subcommittee of signal engineers to prepare data and to handle such signal matters as are assigned to it. The committee has been quite active throughout the year.

An interesting development during 1915 has been the extensive introduction of American signal devices and American signalmen on Australian railways, a field which has heretofore been occupied exclusively by the products of Great Britain, and this, with the American signaling appliances that have been put in service on English railways, where signaling was born, says much for the state of the art in this country.

Except for a few small installations for experimental purposes there has been no installation of automatic stops or cab signals on steam roads. The Brooklyn Rapid Transit, an electric subway line, is installing an automatic stop and cab signal system with speed control features which is of interest on account of the control being continuous, the brakes being applied whenever the speed at any point exceeds a predetermined amount as obtained from a braking chart. A speed control of this character prevents much of the serious decrease in capacity which will result from a simple automatic stopping device.

The Railway Signal Association has continued its work of standardization during the year, so that a majority of the parts used in signaling and interlocking are now standard. The uniformity established by the association has resulted in material savings to the railways and it has had much influence for good in the advancemnet of the signaling art generally.

The coming year promises to be the most active in the volume of signaling installed ever experienced on American railways.

PROGRESS IN ELECTRIFICATION DURING 1915

BY GEORGE GIBBS*
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During a year of great disturbance in all business conditions little has been done in the way of initiating new railway projects, but the period has witnessed the completion of two very important electric traction installations and the partial completion of a third on steam railways. All three represent departures in important details from previous installations and practical results will be watched with interest.

On the Norfolk & Western a freight haulage installation was undertaken to relieve the congestion by an increase in train speed and also to produce operating savings on the main line heavy grade division over the Alleghany mountains; it is conducted under unprecedented conditions as to density of traffic and train weight.

The suburban passenger train electrification of the Pennsylvania at Philadelphia is an application under complicated terminal conditions of an electric system which is designed to be adapted for future extension over long distance main lines and to then handle all classes of service.

The Chicago, Milwaukee & St. Paul electrification in Montana and Idaho applies electric traction to heavy train units, both freight and passenger, on a line having heavy traffic and over the longest distance yet attempted; it is being carried out by an electric system quite different in detail from that employed on the two railways first mentioned.

These installations, added to others already in operation, furnish examples representing practically all conditions and kinds of railway service. Their purposes are various. Electric traction has been employed to make underground terminals in large cities practicable; to facilitate safe operation in long tunnels; to increase the capacity of lines or of passenger terminals; and to increase the operating capacity on heavy grades. In certain of these cases increased economy of operation is an important and perhaps a controlling consideration. The reasons, therefore,

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have been either compelling ones from an operating standpoint, or those connected with expected economies.

The success of this form of traction may be viewed from different standpoints, accordingly as the inquirer sets the problem for himself. Technically, it has been amply demonstrated that electricity can propel trains of any weight at any speed, not limited by other considerations, and that the apparatus required will function reliably; in fact, notwithstanding the complicated mechanism involved and the circumstance that an electric system is tied together from the power house to the trains, thus requiring that all links must operate to secure service, operation has been found remarkably reliable, and, in this respect, an advance on steam operation which it superseded.

Increased capacity has been obtained from electric operation, both as the result of its ability to concentrate almost unlimited power at the train, and thus increase speed and hauling capacity under adverse conditions, and because in certain kinds of service, such as suburban passenger, multiple unit motor car operation is substituted for head end locomotive operation, thus reducing shifting and idle movements in congested terminals.

As regards the aspect of economy, this is not yet as clearly defined as might be expected, considering the number and variety of installations already made. Some of these installations are as yet too new to furnish comparison, but a factor of more importance is that in nearly every case new conditions have been introduced with the new form of traction, and thus the same things cannot be compared. Another fact is that the actual cost of an existing steam service is frequently as much in doubt as the probable cost of electric operation which is to replace it. This peculiar condition exists because railway accounts are not thoroughly segregated for the cost of each part of the equipment or for each operating division as a whole, much less for a particular service on part of a division, as is often required.

Generally speaking, the most attractive fields for electric operation from the standpoint of increased direct net money return on the investment are: (1) where traffic is dense over an entire division and where the train loads, or speeds, or both, may be increased by electric operation, thus utilizing motive power more effectively than with steam; (2) for traffic having a high load factor, i. e., a fair degree of uniformity throughout the day, so that trains may be operated with reduced power and labor costs. Long lines with thin traffic and terminal station operations do not generally furnish an attractive field for electric traction from the standpoint of operating savings, although in some cases such installations may prove profitable where the cost of energy can be largely reduced by obtaining it from cheaper sources.

The indirect benefits of electric operation are, however, often controlling in any installation, and among these may be mentioned smoke elimination in tunnels and underground terminals, increased comfort, speed and attractiveness in passenger service, and the increased line capacity referred to above.

It is, therefore, to be expected that electric traction will continue to develop as regards methods of application, and will be used in the many cases where it is well suited to or is required by surrounding conditions. Electric traction apparently cannot supersede steam traction for all, or for even a very large part of the railway mileage of the country, unless some radically new type of apparatus should be developed, a contingency which, unfortunately, does not seem at present to be pending.

A word may be said regarding the technical developments which have occurred or have become realized during the past year. Electric traction has for several years been tending towards extension to long distance or, rather, to entire divisional operation; this is in many cases almost essential for proper railway operation, as intradivisional transfer of power or train is costly and inconvenient. Long distance and heavy train-unit traction has made a change desirable from the expensive method of distribution of low tension direct current power to the trains by third rail conductors, which requires large capacity of feeders and sub-station machinery. The three installations completed this year all illustrate the present tendency to use an overhead trolley wire of small size, but large power capacity, by reason of the high potential of the current carried. The Norfolk & Western and Pennsylvania installations use an alternating current system throughout and distribute current at very high potential; the St. Paul's installation uses direct current in the trolley wire at a potention which is high compared with that used in a third rail, but low compared with the practice in alternating current systems. Standardization, therefore, of electric systems as a whole cannot be said to be complete, but progress has been made towards the use of overhead conductors as a standard, and, in the case of the alternating current systems, towards uniform characteristics of the current used in the working conductors.

We may, therefore, as regards further deevlopments, properly await experience with the two overhead systems now on trial. The relative first cost of these two systems does not appear, from present information, to differ greatly and the further development of both will doubtless proceed for some time. It may well be that both will find a place in heavy railway work unless one of them is shown to be greatly superior as regards simplicity, reliability and cost of operation. It is especially important, therefore, that each new installation undertaken should be based upon a competent examination, not only of the railway operating features, but of the complex technical developments now taking place, in order to clarify the problem for the future.

ENDING THE FISCAL YEAR ON DECEMBER 31 INSTEAD OF JUNE 30

By Frank Nay

Controller, Chicago, Rock Island & Pacific

The Interstate Commerce Commission was created by an act of Congress in 1887. The act required annual reports from railroads to the Interstate Commerce Commission for the years ending on June 30,—that being date for closing the governmental fiscal year. Prior to that time the railroads closed their fiscal years on various dates, according to their own convenience. Later on, when the various states required annual reports from railroads similar to those to the Interstate Commerce Commission, they also adopted June 30 as the close of the report year.

Under these conditions a large majority of the railroads closed their books two times each year and rendered two separate annual reports covering different periods, one covering their own fiscal year to their stockholders and directors, and the other for the year ended June 30 to the Interstate Commerce Commission and to the various state commissions. This caused a duplication of work, and, owing to the fluctuations of traffic and operating conditions in different seasons of the year, the annual reports to the stockholders frequently appeared to be out of harmony with the annual reports to the Interstate Commerce Commission and the various state commissions. Consequently, nearly all the railroads in the United States changed their own fiscal years to agree with those of the Interstate Commerce Commission.

As the years went on, serious objections developed to June 30 as the date for closing the fiscal year, among which were the following :

1.—On the majority of the railways of the United States the programs of maintenance and improvement work conform naturally to the calendar year, and in reporting the details of such work, a year ending December 31 has decided advantages over a year ending June 30. The maintenance and improvement forces are at the maximum and the heavy work is in progress on June 30, while December 31 is the natural close of the year for maintenance and improvements.

2.—Annual reports, the compilation of which is so much work added to the daily routine, can be more easily prepared during the winter than during the summer season, on account of vacations in general offices, and the slowing up, as a rule, of accounting work.

3.—December 31, coming at the close of the season for main-