

having a smaller cross section, a reduction in maintenance expenses; better insulation of electric conductors in connection with switches and signals and a better track alignment. In most cases screw spikes are used.

The hardwood tie plate is really necessary to secure the advantages of longer life coming from chemical treatment of sleepers, and this is the real reason for its general use.

System as Applied to Shop Repairs to Locomotives.

MR. A. K. KENDALL, foreman of the erecting shop of the Canadian Pacific Railroad at Montreal, read an interesting paper at the April meeting of the Canadian Railway Club on "System as Applied to Shop Repairs to Locomotives." He pointed out that the efficiency of repair shops depended directly upon the regularity with which the locomotives came into the shops. If the equipment is shopped spasmodically, say 5 per cent one month and 20 per cent the following month, additional cost is bound to result. Economical shop methods depend upon the co-operation of the operating department so that the equipment is shopped in even amounts.

The Canadian Pacific shop has worked out thoroughly the standardization of work, the application of the principles of scientific management to machine operation through the use of time studies, and other scientific methods. Wherever possible a straight piece work system is used as a stimulus to the workman, enabling the efficient workman to increase his earning capacity considerably above his former day rate. This is done without any additional strain upon him, for he is taught how to use his energy in the most economical manner. One of the problems to which much attention has been devoted concerns the apportionment of the compensation on piece work where more than one operator is employed. The end which is sought is to prevent the efficient man from losing because of his less efficient coworker. Much attention has also been given to the routing of work in the shop, testing of machines, and careful inspection.

Air Brake Problems.

THE April meeting of the New England Railroad Club was devoted to the consideration and discussion of a paper presented by Mr. Charles U. Joy, general air brake inspector of the New York, New Haven and Hartford Company. The paper, which was largely descriptive and historical in character, contained some interesting points concerning present practices and probable future developments. Mr. Joy reported that his company had had most excellent results

with the use of Westinghouse high brake equipment (Schedule P. C.) in connection with high speed passenger work. Using as a basis of comparison the months of November and December, 1911, and January and February, 1912, his company had been forced to remove 77 pairs of slid-flat wheels. The total passenger car mileage for these months was 25,142,828, which gives an average of 326,530 passenger car miles to one pair of slid-flat wheels removed. Over 50 per cent of the amount were removed from cars using 70 pounds pressure, which hardly supports the general impression that high brake power causes slid-flat wheels.

Concerning the question as to what changes will have to be made in truck design in order to permit of greater break-shoe pressure, which will be necessary in case any large increase is made in the weight of trains, Mr. Joy stated that in his opinion it would be impossible to much increase the brake-shoe pressure without forcing the journals from their bearings. He believed that it would be necessary, when an increase in pressure must be made, through the use of still heavier equipment to apply a clasp brake or one using two shoes per wheel. This would give more bearing surface and eliminate the journal pressure resulting from the brake-shoe load, as at present applied.

In the discussion which followed the presentation of Mr. Joy's paper, Mr. R. D. Smith stated that he had had some experience with the use of clasp brakes on locomotives and found that they were open to the objection that they heated the tires and were very hard on the wheels, which "are showing a great deal of distress."

Selecting Explosives for Engineering Operations.

MESSRS. CLARENCE HALL and Spencer P. Howell, of the Bureau of Mines, Department of the Interior, have prepared a bulletin (No. 48), representing the results of much study and experimentation, on "The Selection of Explosives Used in Engineering and Mining Operations." The report deals exhaustively with the power and range of usefulness of each of the various classes of explosives ordinarily used in blasting operations. The reasons for the difference in the performance of each class is explained both practically and theoretically. What explosives are safe for use in gaseous or dusty tunnels or coal mines; those which can be used for neutralizing poisonous gases in tunnels or mine work; the merits of different classes of electric detonators, and the relative efficiency of each class of explosives when thawed or in a frozen condition, are exhaustively considered. The report will be of great interest and value to civil engineers and others having charge of railroad construction work.

Electrical

The Problem of Steam Railroad Electrification.

THE annual meeting of the American Institute of Electrical Engineers, held on May 20th, was given over largely to the discussion of a paper entitled "Trunk Line Electrifica-

tion," prepared by Mr. Charles P. Kahler, in which some of the most distinguished men in the field participated.

Mr. Kahler brought out in his paper the facts that the electric locomotive in proportion to its weight could haul heavier loads than its steam

rival; that unlike the steam locomotive, which must spend the larger part of its time in the shops, it was capable of giving a very large daily service which, in most cases, is double that performed by the older type; that it was possible to haul a larger tonnage with a smaller number of locomotives and that the economies of operation were considerable. A paper was also read by Mr. H. M. Hobart, of the General Electric Company on 2400-volt railway electrification. This paper consisted largely of a comparison of costs of steam and electric equipment for a hypothetical case of a mountain division 96 miles in length. The cost per one hundred ton miles with steam was given as 18.1 and with electricity as 11.6 cents.

The discussion was in many ways the most valuable feature of the meeting, for it brought out the views held by some of the most prominent engineers in this field. Mr. A. H. Armstrong, of the General Electric Company, contended that the plans for electrification should be made not with regard to present requirements but to those of the future; that if the work is in the end to prove economical it must consider "the traffic of five, ten or even fifty years from the present time."

Mr. F. E. Wynne, of the Westinghouse Electric and Manufacturing Company, took exception to some of the figures contained in the papers which had been presented, contending that the over-all figures given for efficiency between power house and line—namely, 89 per cent for general train service and 78 per cent for express train service—should be decreased from seven to ten per cent.

Mr. E. R. Hill, of Gibbs and Hill, expressed his gratification at the logical manner in which electrifications are being carried out. He stated that his firm had had occasion to figure on a number of mountain grade electrifications and that, in general, the results of the substitution of electricity for steam had been very satisfactory both as regards economy and an increase of speed and reliability of service.

Mr. A. H. Babcock, of the Southern Pacific Railway, in a written communication pointed out that generalizations with reference to trunk line electrification were extremely dangerous; he had found on the Pacific Coast that the savings due to electrification were by no means enormous and would not defray, except after the expiration of many years, the cost of the substitution. Power companies were not prepared to furnish electric current at sufficiently low prices to offer effective competition with fuel oil at the ordinary market rates on the Coast of 70 to 80 cents a barrel. Energy at the rate of five mills per Kw-hr. was prohibitive. He criticised the statements in one of the papers concerning the annual load factor given as sixty per cent as a minimum. Mr. Babcock believes that it would seldom rise above 20 per cent as a matter of fact. He was of the opinion that as a rule the total energy charge could be wiped out of the annual financial statement without making a material difference in the result, so small a part did it play in the total operating cost and in comparison with the fixed charges and other expenses.

In written discussions over the signatures of H. Y. Hall and G. W. Welch the statement was made that an insufficient allowance for first cost and maintenance was made as a rule under Western conditions. They believed that the figures submitted in the papers under discussion were much

more favorable than would be found in actual practice.

New Haven Electrification Delayed.

BECAUSE of strikes of electrical workers the completion of the electrification of the portion of the New Haven's line between Stamford and New Haven has been somewhat delayed, with the result that it is not anticipated that regular service will be offered before August 1st. The structural work for the suspension of wires is largely concluded and the wiring is practically complete as far as Norwalk and will soon be finished to Bridgeport.

Additional Details Concerning St. Paul Electrification.

IT is known that both the General Electric and the Westinghouse Electric Companies are preparing estimates on the electrification work to be done of the Puget Sound Division of the Chicago, Milwaukee and St. Paul system. It is believed from the work thus far done that the cost of this electrification will be considerably less than the \$8,000,000 originally estimated. It is roughly calculated that the cost will not exceed \$8,000 per mile and as there are 450 miles to be electrified the total expenditure will be between \$3,600,000 and \$4,000,000. These figures include only the electrification work proper and do not include the cost of locomotives or any allowance for generating apparatus. As the power is to be purchased from hydro-electric companies no allowance must be made for the latter item.

Third Rail and Overhead Clearances.

AT the meeting of the American Railway Association held on May 21st, the Committee on Electrical Working submitted a report concerning third rail and overhead clearances. This Committee was composed of some of the most eminent men in the industry. The Committee reported in brief in favor of a minimum clearance of 15 inches from the track gage line, continued horizontally to a point within six inches of the track gage line and two and one-half inches above the track rail. The Committee reported that it intended to take up the various technical questions concerning overhead working conductors with the electrical working committees of the American Railway Engineering Association and the American Electrical Engineering Association. In advance, however, of the final conclusion the Committee desired to make a tentative report in which it was recommended in brief that a distance of 9 feet 11½ inches be allowed for overhead conductors above the top of the car making a clearance of twenty-five feet between the top of track rails and permanent way structures. This minimum applies to those conditions where trainmen are likely to give signals with a lantern; where such is not the case a minimum height of permanent way structure of twenty-four feet is provided for freight work; where no freight is handled, or if so handled in such a way that brakemen will not be required to pass over the tops of cars, a minimum height ranging from 15 to 18 feet is suggested.