MAIN-LINE ELECTRIFICATION OF THE CHICAGO, MILWAUKEE & ST. PAUL IN MONTANA

Probably by Jan. 1, 1914, the Chicago, Milwaukee & St. Paul Railway will have reached a decision as to the type of equipment to be employed for its main-line electrification over the mountains in Montana. It is practically certain that either a 14,000-volt, twenty-five-cycle a.c. system or a 2400-volt d.c. system will be used. The plans of the General Electric Company and the Westinghouse Electric & Manufacturing Company are now under consideration. For the railroad company the entire matter of electrification has been placed in the hands of C. A. Goodnow, vice-president in charge of operation and construction. Previous articles on this proposed electrification have been published in this paper.*

The company first expects to electrify a division of the railroad 113 miles long, extending over the Rocky Mountains between Three Forks and Deer Lodge, Mont. This work will be begun early in 1914. Ultimately the electrification will be extended to that portion of the main line between Harlowton, Mont., and Avery, Idaho, a main-line distance of 440 miles and, including sidings, a total of 450 miles of track. This plan will mean an outlay on the part of the railroad company of perhaps $6,000,000 or $8,000,000, with an annual expenditure of say $1,500,000 or $2,000,000. This work foreshadows the probable electrification of the entire line from Harlowton to the Pacific Coast, a main-line distance of 865 miles, including the line to Tacoma.

Electrical energy will be obtained from the Montana Power Company of Butte, Mont., and the Thompson Falls Power Company, with which the railroad company has entered into long-term contracts, as previously noted in these columns. The length of transmission will vary from about 15 miles to about 140 miles.

In the zone of the proposed electrification the railroad crosses three separate mountain ranges, namely, the Bitter Root Mountains, the Rocky Mountains and the Belt Mountains. The elevations attained by the railroad are respectively 4170 ft., 6322 ft. and 5788 ft. above sea level. The grades range from 1 per cent to 2 per cent in the mountains with many miles of from 0.3 to 0.6 per cent grades between the ranges. Across this profile it is proposed to haul all passenger and freight trains by electric locomotives at speeds of from 25 m.p.h. to 30 m.p.h. in the case of the former, and from 15 m.p.h. to 18 m.p.h. for the freight trains. All switching service will also be performed by electric locomotives. One electric freight locomotive will be capable of hauling a train as heavy as 2500 tons on 1 per cent grades and two will handle the same tonnage on 2 per cent grades. The electric locomotive units will consist of coupled halves.

One interesting feature of the electrification in connection with train dispatching is pointed out by Mr. Goodnow. At the outset but 20,000 kw-hr. will be available for railroad operation under the contract. The dispatcher will have this amount of energy to move his traffic, and he must not use electricity in excess of that amount. To this end he not only must have the entire situation clearly before him so that trains will not be started from terminals at hours when they will be unreasonably delayed on the line waiting for energy, but he must supervise the speed of the trains on ascending gradients. In order to push an important train across a mountain range at maximum speed it may be necessary for the dispatcher to slow down other trains, or he may order one or more trains to move at maximum speed to provide for the prompt movement of subsequent trains. These considerations would seem to add to the complexities of the duties of the train dispatcher, but there are compensations, as Mr. Goodnow points out, in the knowledge that under electric propulsion a train when ordered forward may be made to move at the precise speed calculated, that the meeting and passing points may be figured to the minute, that there will be no delays for coal and water and for cleaning fires, and that the electric locomotive will be ready for service at terminals as soon as a new crew can be provided. The working conditions of the engineman and assistants under electric locomotive operation should also be greatly improved.

*See ELECTRIC RAILWAY JOURNAL, Jan. 11, Feb. 1, Feb. 15, May 24, and June 7, 1913.

MEETING OF NEW ENGLAND STREET RAILWAY CLUB

At the regular monthly meeting of the New England Street Railway Club at Boston on Nov. 20 Carl F. Woods, secretary Arthur D. Little, Inc., Boston, presented a paper upon the "Relation of the Chemist to the Electric Railway." The author pointed out the increasing importance of scientific investigation in relation to the economical operation of railways and cited a considerable number of ways in which the industrial chemist can be of assistance to transportation companies, including fuel analyses, the study of flue gases, feed water, lubricants, cables, wire for trolley service, steel, equipment and supplies in general. An abstract of the paper is given below.

COAL

A glance at the log sheets of any station shows that the item of coal represents about 50 per cent of the total cost of producing power. Many a purchaser buys coal by the ton with no accurate knowledge of its heating value or suitability for his particular conditions. Purchase on the basis of an analysis including the heat units, coupled with intelligent selection under existing conditions, would prevent the need of explaining log sheets showing the consumption of 4 lb. or 5 lb. of coal per kw-hr. or the attempt to burn coal having a fusing temperature of its ash of 2300 deg. Fahr. in a furnace whose temperature over the grates was close to 2800 deg Fahr.

An analysis should show the percentage of moisture, fixed carbon, volatile matter and ash. High moisture means the purchase of so much water at the price of coal, and a proportional amount of heat must be wasted in evaporating it. The volatile matter is of importance as indicating the probable difficulty with which the coal may be burned completely without smoke. All coals having the same amount of volatile matter do not behave alike in the furnace, and it is, therefore, necessary to know both the chemical composition and the actual heating value. The ash is not only valueless but offers greater resistance to free and even distribution of air through the coal on the grates. Excessive quantities of ash increase the labor and cost of firing and of handling ashes.

FLUE GASES

An analysis of the flue gases at once affords a direct measure of efficiency. Under proper conditions of combustion flue gases should contain not less than 12 per cent of carbon dioxide, but they frequently contain as low as 3 per cent. This means that more than 50 tons of excess air are heated to a high temperature for every ton of coal burned. Similarly, fuel losses occur by incomplete combustion. For each pound of coal which is burned to carbon monoxide instead of to carbon dioxide about two-thirds of the available heat is lost. The object of flue gas analysis is therefore to prevent excess of air and at the same time to insure the complete combustion of the coal. The determination of the combustible matter in the ashes at once shows the percentage of unburned coal which is lost through the grates into the ash pits and which represents a direct waste of fuel.

FEED WATER

The formation of scale and the softening of water are due to the simplest of chemical reactions, and by an analysis of proposed feed water a competent chemist can