cally to 15 per cent of the entire payroll. It is estimated that the payroll for the next year will be increased approximately $360,000 for the same hours of labor. The present price which the company is obliged to pay for coal, including marine and war insurance, is now in excess of $7.79 a ton. In spite of a constant effort to keep the supply up, the storage pile on Oct. 6, 1917, had been reduced to 15,004 tons, with only 2150 tons available from the overhead pocket of the station. Moreover, the company, in order to keep its lines in a safe condition, has been obliged to hire outside track labor at a higher rate than it is paying its own force.

For the nine months ended Sept. 30, 1917, after paying its operating expenses and fixed charges, the company had an actual deficit of $119,743. From present indications, said Mr. Potter, this deficit by the end of the calendar year will amount to at least $300,000, even without allowing for any depreciation reserve as recommended by Ford, Bacon & Davis. And for the fiscal year ending June 30, 1918, with the present prices of labor and material continuing, the company will fall short at least $600,000 of the amount necessary to meet its operating expenses and fixed charges, unless some relief is granted.

St. Paul Orders Equipment for the Cascade Electrification

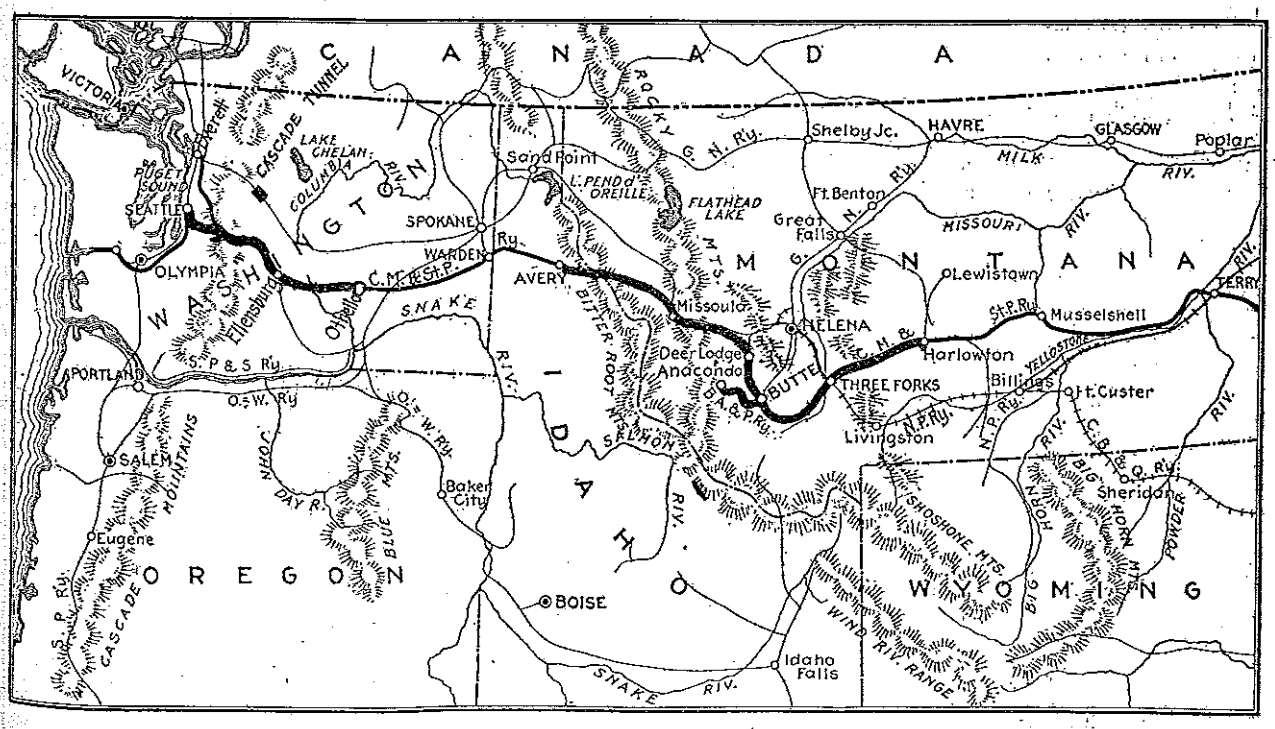
New Types of Locomotives Especially Designed for Passenger Service Will Be Used—Delivery Specified to Begin About the Close of the Year 1918

THE Chicago, Milwaukee & St. Paul Railway on Oct. 29 placed orders for the substation equipment of the 216.9 (route) mile Othello, Seattle and Tacoma division, and also for seventeen locomotives to be used on either the first or second electrifications as hereinafter detailed. To hasten delivery dates on account of the high cost of fuel oil the orders were divided between the Westinghouse and General Electric companies as follows: To the Westinghouse Electric and Manufacturing Company, ten locomotives and three substations, namely those at Kittitas, Doris and Taunton. To the General Electric Company, seven locomotives and five substations, located at Tacoma Junction (formerly Tacoma Shops), Renton (including former Black River Junction), Cedar Falls, Hyak and Cle Elum. Each substation includes one or more 2000-kw. motor-generator sets and corresponding high-tension apparatus.

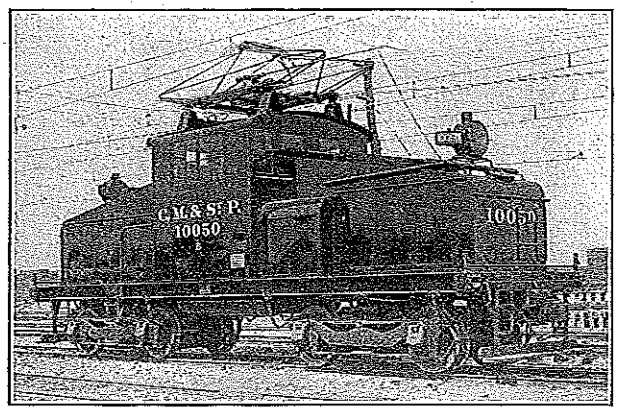
The passenger locomotives were guaranteed by the manufacturers to provide a capacity sufficient to haul twelve all-steel cars at 25 m.p.h. on a 2 per cent grade.

The locations of the substations, the numbers of units per station, and the mileage between stations are given in the table on page 820.

The general features of the extension of the St. Paul



ST. PAUL ELECTRIFICATION EXTENSION—MAP OF PRESENT AND PROSPECTIVE ELECTRIFICATIONS.
Heavy line east of Avery shows present electrification, heavy line west of Othello shows electrification under way for which locomotives have just been authorized



ST. PAUL ELECTRIFICATION EXTENSION—75-TON SWITCHING LOCOMOTIVE

electrification of which this new equipment will form a part were covered in an article in the issue of the ELECTRIC RAILWAY JOURNAL for July 21, 1917, page 92. The present electrified section, that now in process of electrification, and the relation of these two to the company's trackage in Montana and Washington, are indicated on the accompanying map. The route mileage of electrified road between Harlowton and Avery is 437.6, and this added to the new mileage makes a total of 654.5 route-miles.

SUBSTATION APPARATUS

The 3000-volt d.c. motor-generator sets to be supplied will be similar to those previously furnished by the General Electric Company, namely, the combination of a 2500-kva., 2300-volt, 60-cycle motor and two 1000-kw., 1500-volt d.c. generators connected in series. These sets will carry three times their rated load, *i.e.*, 200 per cent overload, for five minutes. The efficiencies of the General Electric sets are to be: at 50 per cent overload, 92.6 per cent; at full load, 92.4 per cent; at one-half load, 88.8 per cent. The Westinghouse sets will be substantially the same in regard to capacity and efficiency.

LOCATION OF SUBSTATIONS, NUMBERS OF UNITS AND MILEAGE BETWEEN STATIONS

Substation	No. of 2000-kw. Motor-Generator Sets	Mileage Between Stations
Tacoma Junction	2	
Renton	1 (room for 2)	28.7
Cedar Falls (foot of 20-mile, 1.7 per cent grade)	2 (room for 3)	27.2
Hyak (other side of grade)	2 (room for 3)	21.7
Cle Elum	1 (room for 2)	29.0
Kittitas	2 (room for 3)	31.6
Doris (on 2.2 per cent grade)	2 (room for 3)	23.0
Taunton (end of line)	2	34.9

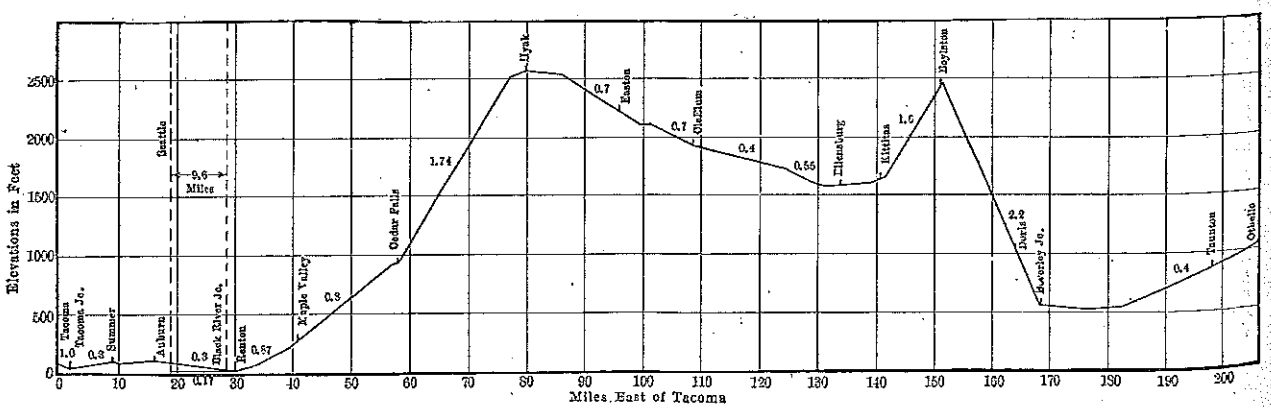
At Tacoma and Renton, 55,000-volt power covering about one-third of the requirements will be received from Stone & Webster plants, while the remainder, at 102,000 volts, will come from the Washington Water Power Company. There will be installed one 2500-kva. transformer for every 2000-kw. motor-generator set.

LOCOMOTIVES

Of the seven locomotives ordered from the General Electric Company, two are switching locomotives of the steeple-cab type illustrated. These are duplicates of two already in use, the details of which appeared in the issue of this paper for March 4, 1916, page 465. Each weighs 75 tons, and has a tractive effort of 22,000 lb. and a rating of 200 amp. at 3000 volts, corresponding to about 550 hp. The heavily braced and reinforced underframe is mounted on swivel trucks, each carrying two GE-225 motors, nose suspended. The endeavor has been to use parts of the switching locomotive equipment which would be interchangeable with the corresponding parts on the road locomotives. Thus, for example, a compressor much larger than necessary is installed in order to obviate the necessity for carrying extra parts.

The passenger locomotives will be the first St. Paul machines designed especially for passenger service. While the details of design are not yet ripe for disclosure, it may be stated that the drive on the General Electric locomotives will resemble in many respects the bi-polar gearless design of the New York Central locomotives. The St. Paul locomotives, however, will have twelve motors instead of eight. They will be capable of hauling a 960-ton train at 25 m.p.h. over a ruling grade of 2.2 per cent and at 60 m.p.h. over level track. The continuous output rating, 860 amp. at 3000 volts, is equivalent to 3100 hp. The Westinghouse locomotive drive will be of the quill type.

The General Electric passenger locomotives will go directly into service on the new Cascade electrification, but the ten Westinghouse locomotives will probably replace ten out of twelve General Electric locomotives on the present electrification. The latter locomotives will enter freight service, as they can be made similar to the regular freight engines merely by changing the gear ratio. They were really designed for freight service but were geared for passenger service as it was not certain as to the use to which the locomotives would be put. This brings to mind the fact that the only important differences between the locomotives for the two services heretofore were the gear ratio and the pro-



ST. PAUL ELECTRIFICATION EXTENSION—PROFILE OF OTHELLO, SEATTLE AND TACOMA DIVISION

vision of a heater for passenger trains. In the future, however, freight and passenger machines will be widely different. The passenger locomotives must not only provide for heating equipment but must also be capable of operating at the highest speeds without regard to water, snow and other weather conditions. For local passenger service the company will continue to operate the split halves of two existing locomotives.

As to deliveries it is provided that the Westinghouse Company is to deliver the first two locomotives in fifteen months from the signing of the contract, and the remainder thereafter at the rate of two locomotives per month, completing the entire order of ten in four months. Delivery of the General Electric equipment is specified at fourteen months. This important extension of the electrification is, like the preceding work, being carried out under the supervision of C. A. Goodnow, vice-president Chicago, Milwaukee & St. Paul Railway.

Public Utility Management*

How the Public, the Employee and the Investor Are All Concerned in a Partnership Arrangement with Mutual Responsibilities

BY C. NESBITT DUFFY
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THE management of a public utility will here be discussed from the standpoint of the public, the employee and the investor. These points are taken up in the order named not because of their respective importance or chronological precedence but simply in turn in the light of their joint relationships and mutual partnership responsibility.

MANAGEMENT FROM THE STANDPOINT OF THE PUBLIC

The public has the right to expect from a utility the best service practicable at the lowest cost possible under efficient management, taking into consideration the conditions under which the service is furnished and all of the elements of cost involved. The cost should include not only that of operating and maintaining the property used in furnishing the service, but all investment charges as well, including insurance, taxes, depreciation, provision for extraordinary contingencies and a fair return on the investment. A utility should provide and maintain reasonably adequate facilities and furnish reliable, safe and sufficient service. It should have its employees thoroughly trained in the performance of their duties, which should be done, with due regard for their responsibility to the public.

The management should conduct the business according to a wise, progressive, fair and liberal policy. The company should take part in all public movements looking to the benefit of the community served. It should cultivate and establish friendly relations with government officials, the newspapers and business interests, co-operating with them in every way possible in order to deserve, win and retain the confidence and good-will of the public. The management should not only be willing to receive but should invite fair and constructive criticism. All complaints, no matter how trivial, should be thoroughly investigated and the results explained to the complainants in a conciliatory and courteous manner, regardless of whether the complainant or the company is at fault.

The opportunity of discussing its business with the public promotes not only a better understanding between the company and the public, but a better knowledge of the mutual obligations resting on both. "Service" has been defined as "giving value received." The utility which serves the public best, all things considered, serves itself best.

The employee of a utility in return for honest, faithful and loyal service has the right to equitable wages, consistent with the conditions obtaining and the character and the importance of the work performed. He is entitled to fair and impartial treatment, with the opportunity to advance solely on merit. He has the right to expect independence in his employment without regard to political, religious, social, business or personal influence. The company should take an interest in his well-being from a moral, educational, social and economic standpoint, consistent with its obligations to the public and the investor.

FROM THE STANDPOINT OF THE INVESTOR

The investor has the right to expect that the public accord to the company fair and impartial treatment, with due consideration for the conditions obtaining and the problems involved in the conduct of the business, the protection of the investment therein and its mutual responsibility for the success or failure of the enterprise. The investor has the right to expect proper co-operation on the part of the public in the use of the facilities provided. It is the duty of the company to operate its property for the convenience and best interests of the public as a whole, but due allowance should be made for the "human equation" in the work of employees. The public is obligated to observe the rules of the company, formulated for its protection, and to do its part in order to secure good service.

The investor has a right to demand that the property be operated in the most efficient manner possible, consistent with good service, good wages and good dividends, and the safeguarding of his investment. In the investor's interest the employees should be required to render honest, faithful and loyal service in return for equitable wages and fair treatment, and they should be required to perform their duties with a full realization of their responsibility to the company and to the public. They should be made to understand that they are partners in the business, that they and the company will be judged by the manner in which they perform their duties and that the success or failure of the business depends very largely upon them.

The investor is entitled, because of the risks and hazards assumed in the investment as well as the value of the service to the public, to a fair return, with adequate provision for the maintenance and the depreciation of the property.

In the conduct of the business of a utility the public is entitled to good service; the employee to good wages; the investor to good dividends. Anyone who assumes the management of a utility is responsible for the accomplishment of these things, but they can be secured only through co-operative effort and the proper discharge of the mutual responsibility of the parties at interest. This is true of the ownership and operation of all public utilities.

*Abstract of paper recently delivered before A. E. R. A.—N. E. L. A. joint company section No. 5.