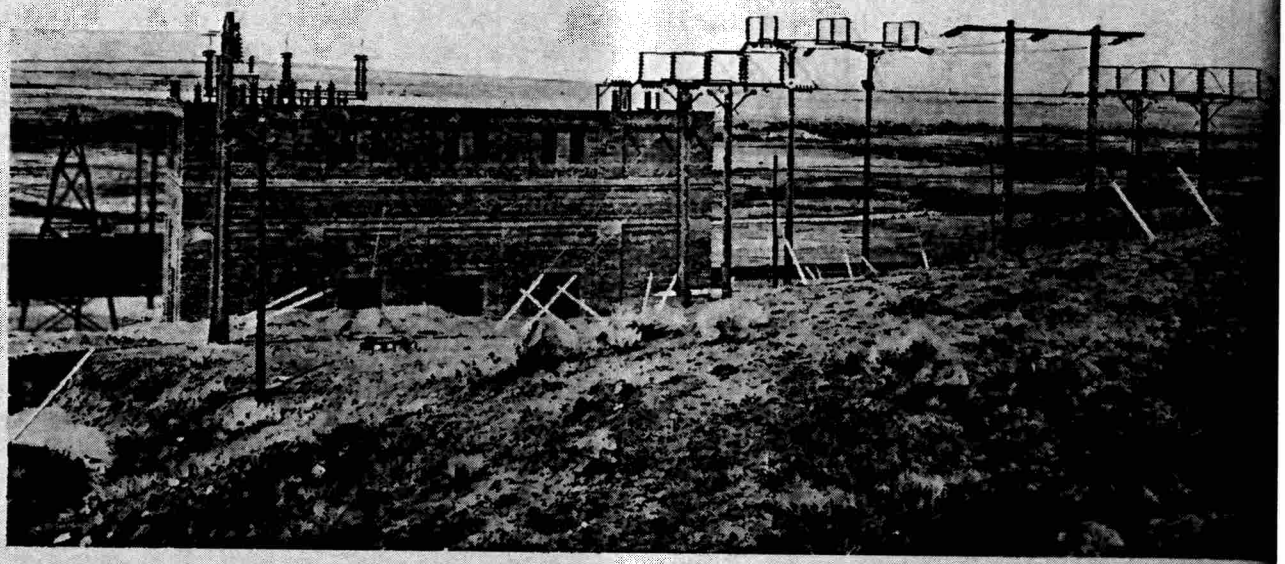


SUBSTATION AND TRANSMISSION-LINE EQUIPMENT TYPICAL OF NEW INSTALLATION

Equipment for St. Paul's New Electrified Division

Details of Power Supply, Substation Location and Capacity, and Line Construction for 2 Route-Miles of Electrified Track as Planned for the Seattle-Othello Division of the Chicago, Milwaukee & St. Paul Railway

As recently announced in the ELECTRIC RAILWAY JOURNAL, the Chicago, Milwaukee & St. Paul Railway has undertaken the electrification of a new division at the western end of its transcontinental line. The new work comprises 98.7 route-miles between Othello and Cle Elum, 89.9 route-miles between Cle Elum and Seattle, and 28.3 route-miles between Black River Junction (about 10 miles south of Seattle) and Tacoma.

The total route mileage of 216.9 as given above consists mainly of single track, and the figures do not include any track mileage for yards and sidings. Because of the greater efficiency of yard and siding tracks when electrical operation is in force, the railway company has not yet decided how much of this class of trackage should be electrified. At present, therefore, only route mileages can be given.

The coming electrification of 216.9 miles, plus the 437.6 miles at present electrified between Harlowton and Avery, makes an imposing total of 654.5 route-miles electrically operated by the St. Paul. This is not only the longest electric route in the world, but will be also the longest in single-track mileage, undoubtedly, since the original electrification has 149.4 miles of yard and siding track alone and the electrified trackage in the Seattle and Tacoma yards may bring the grand total close to 1000 miles.

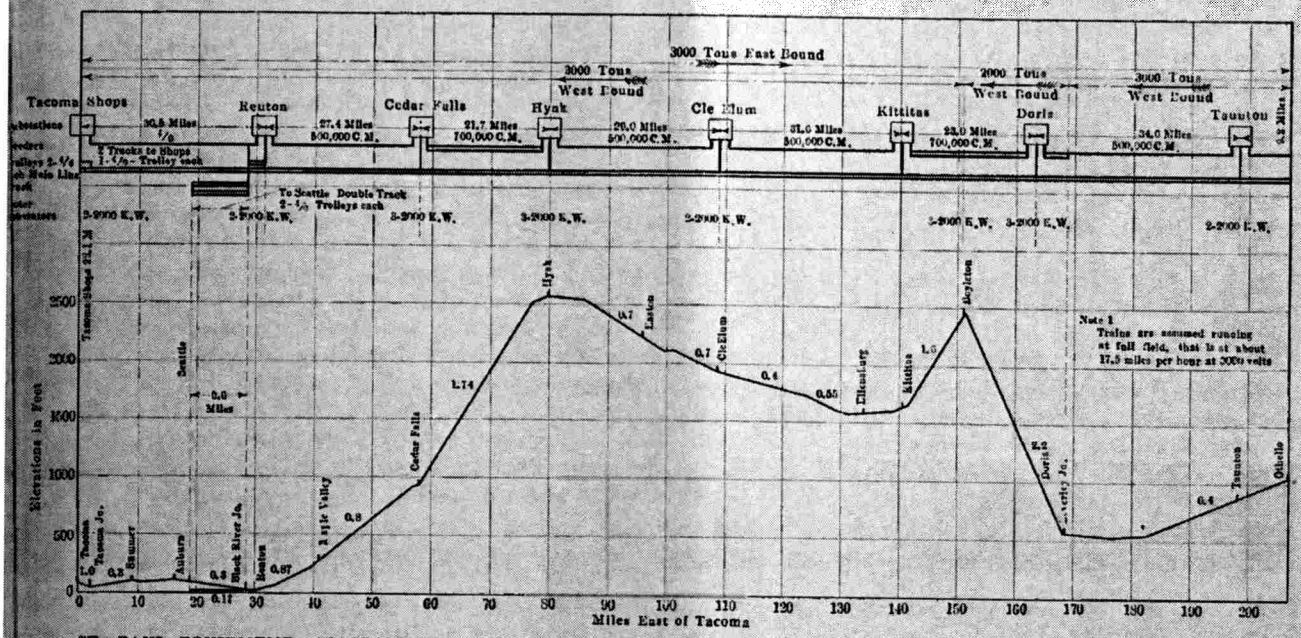
About half of the coming electrification covers heavy mountain grades, including a number of tunnels. The physical characteristics of the new electrically-operated division will, therefore, closely approximate those obtaining on the four electrically-operated divisions in Montana and Idaho.

Arrangements have been made with the Inter-mou tain Power Company to supply power required for new electrification from Othello to Seattle and Taco This power will be generated principally in the Wa ington Water Power Company's plant on the Spok River, some thirty miles northwest of the city of S kane, and at the Snoqualmie and other plants belong to the Stone & Webster system of western Washingt

The railway company's own transmission line al the right-of-way will be 100,000 volts, 60-cycles, th phase, built to about the same standards as its pres lines in Montana and Idaho. The transmission wi will be No. 00, six-strand copper with hemp core, the aerial ground wire and individual pole grounds 3/8-in., seven-strand, Siemens-Martin galvanized wi This transmission system will extend from Taun near Othello, to Cedar Falls, a distance of 140 mil This will serve the eastern end of the new electrifi tion. The extreme western end, or the section ly west of Cedar Falls, will have its substations tied with a network of hydroelectric lines operated by companies supplying the energy to the railway.

SUBSTATIONS, FEEDERS AND BONDS

Substation locations are as tabulated below. The pacities that are given correspond to the known abil of motor-generators of like rating on the Harlow Avery electrification to handle certain loads. All s station and feeder capacities are based on a trail train load of 3000 tons eastbound and westbound, cept for an 18-mile westbound grade of 2.2 per ce just west of the Columbia River, where the train load reduced to 2000 tons, this ruling westbound grade e



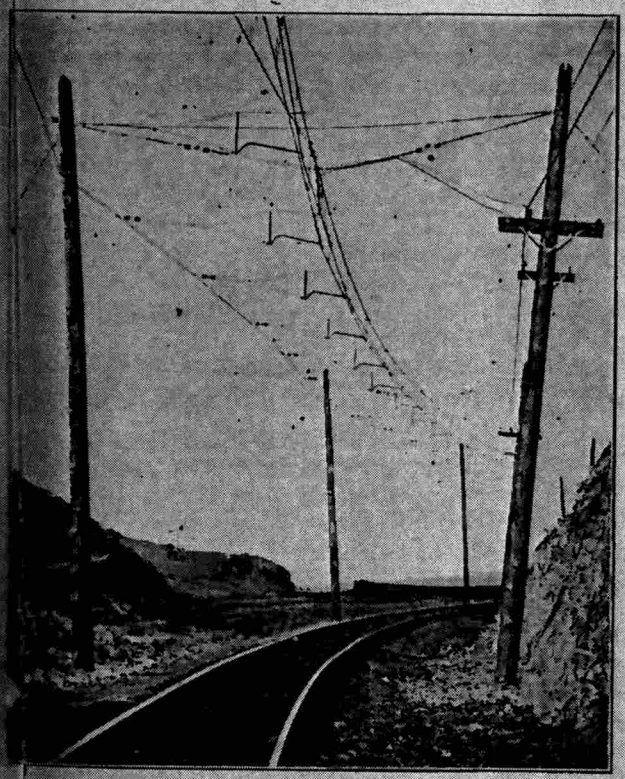
ST. PAUL EQUIPMENT—DIAGRAM SHOWING PROFILE OF SEATTLE-OTHELLO DIVISION TOGETHER WITH SUBSTATION LOCATIONS AND FEEDER CAPACITIES

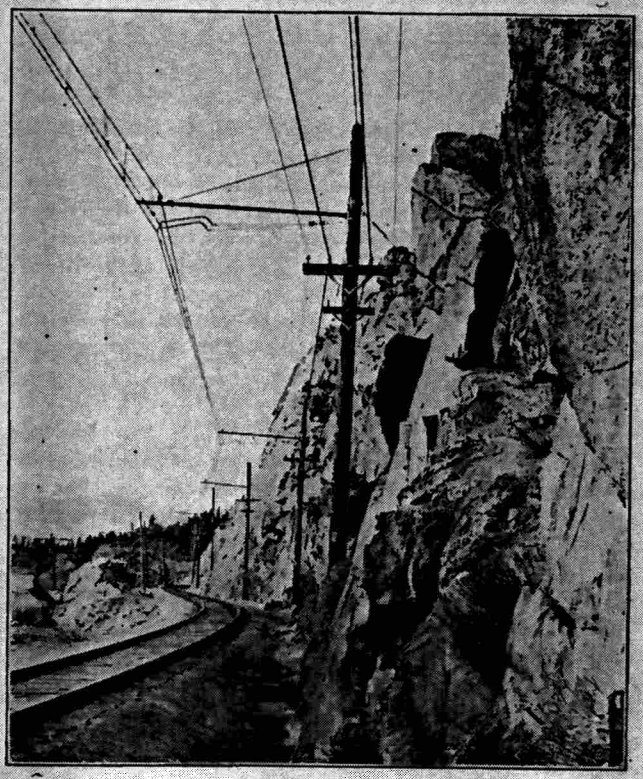
ending between the stations of Beverly Junction and oylston on the eastern slope of the abrupt divide be-ween the Columbia and Yakima Rivers. The ruling rade eastbound is 1.74 per cent, and it extends for 20 iles east of Cedar Falls to the summit of the Cascade ountains.

The order and capacity of substations beginning at e east end are given in the following table:

Substations	Motor-Generators
Taunton, 9.2 miles from Othello	Two 2000-kw.
Doris, 34.9 miles from Taunton	Three 2000-kw.
Kittitas, 23 miles from Doris	Three 2000-kw.
Cle Elum, 31.6 miles from Kittipas	Two 2000-kw.
Hyak, 29.0 miles from Cle Elum	Three 2000-kw.
Cedar Falls, 21.7 miles from Hyak	Three 2000-kw.
Renton, 27.4 miles from Cedar Falls	Three 2000-kw.
Tacoma, 30.5 miles from Renton	Two 2000-kw.

The Renton station serves the 10-mile, double-track ne that extends from Black River Junction west to eattle. There is a distance of 2.4 miles between Ren-n and Black River Junction, and this is included in the section listed in the run to the Tacoma substation. The foregoing substation ratings are based upon 150 per cent load for the motor-generator sets for a period of two hours, and 300 per cent load for a period of five minutes. All substation buildings will be of brick,





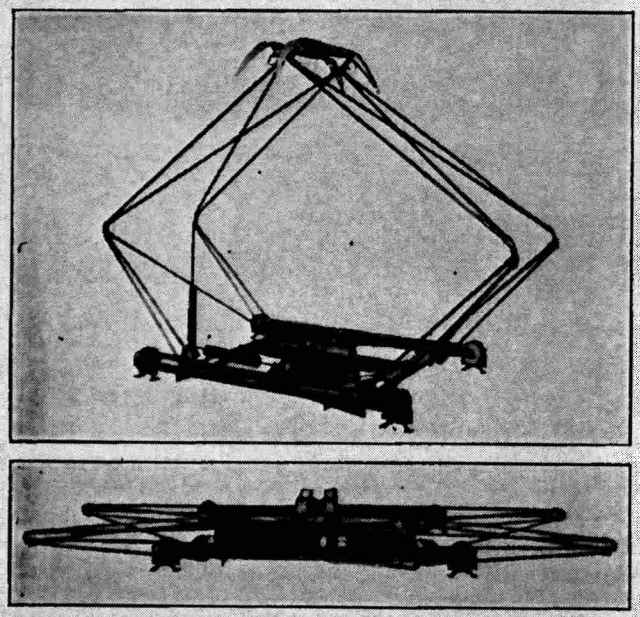
PAUL EQUIPMENT—TYPICAL ARRANGEMENT OF OVERHEAD CONTACT SYSTEM ON SHARP CURVE AND ON MODERATE CURVE

with concrete foundations. At Hyak the machines will be set considerably above the track level to avoid the extraordinarily deep snows that are common in the locality.

The initial feeder capacities in copper are as shown in the following table:

Taunton-Beverly Junction	One 500,000 circ. mil
Beverly Junction-Dor.s	Two 500,000 circ. mil
Doris-Kittitas	Two 700,000 circ. mil
Kittipas-Cle Elum-Hyak	One 500,000 circ. mil
Hyak-Cedar Falls	Two 700,000 circ. mil
Cedar Falls-Renton	One 500,000 circ. mil
Renton-Tacoma	One No. 0000

No feeders will be installed on the double-track section between Black River Junction and Seattle, as the



ST. PAUL EQUIPMENT—VIEWS SHOWING DOUBLE-PAN PANTOGRAPH FOR LOCOMOTIVE IN RAISED AND LOWERED POSITION

four trolley wires will be ample to supply the draft of power without excessive voltage drop.

Each rail of the main-line track will have one 250,000-circ.mil expansion bond on grades of 1 per cent or less and two 250,000-circ.mil bonds for grades exceeding 1 per cent. These bonds will be tied in with an overhead negative return of No. 0000 bare copper at intervals of approximately 8000 ft. This construction is designed to protect trackmen against large differences in rail potential in case of defective bonds.

3000-Volt D.C. Distribution

The d.c. distribution system will be practically a duplicate of the present installation between Harlowton and Avery, as this has proved to be entirely satisfactory during the last year's experience with it. Cedar poles will be standard except for a limited number of steel bridges over multiple track sections and at terminals. Over the Columbia River Bridge the wooden pole construction will be replaced with a combination transmission and trolley wire structure. There will be also some center pole construction and possibly steel supports on curves over the double-track line between Seattle and Black River Junction, these tracks being owned by the Oregon-Washington Railway & Navigation Company and Pacific Coast Railway Company and leased for use by the Chicago, Milwaukee & St. Paul Railway Company's trains.

Throughout, the present catenary standards will be followed exactly. The messenger cable will be of ½-in. seven-strand, galvanized Siemens-Martin steel, with hangers of ¼-in. galvanized steel rods. As the double trolley wire has proved so successful in giving a flexible non-arcing contact, it will be used in the new construction in all cases except at sidings, where only one wire will be suspended from the catenary. The two trolley wires on the main-line tracks will be of No. 0000 copper, clipped to the closed loop hangers every 15 ft. in staggered relation, so that provision is really made for supports at intervals of 7½ ft. The hangers will vary in length from 8 in. to 27 in. Ten-inch air breaks and disconnecting switches will be installed at each side of every passing track.

Locomotives

It will be recalled that the present St. Paul electric locomotives used for passenger service are really standard freight locomotives that have been provided with passenger gearing. The manufacturers have now been asked to bid on designs specifically intended for passenger service. This passenger type will then be made standard for such service, while the present machines will be used only for freight service. No change is contemplated in the pantograph collectors.

Four Engineering Societies Form National Council

By co-operation of the four national societies of civil, mining, mechanical and electrical engineers, respectively, a representative body has been formed under the auspices of the United Engineering Society for the purpose of speaking authoritatively for all member societies on all public questions of a common interest or concern to engineers. At the organization meeting, held on June 27 in New York City, a committee was appointed to consider the best means of utilizing the inventive ability of members of the founder societies for the benefit of the government in the prosecution of the war, and the government bureaus have been informed of the desire of the council to be of assistance.

The council is composed of twenty-four members, five from each of the four founder societies and four from the United Engineering Society. The officers are I. N. Hollis, Worcester, Mass., president; H. W. Buck, New York, and George F. Swain, Cambridge, Mass, vice-presidents and Calvert Townley, New York, secretary.

Employees' Club in Buffalo

The International Railway, Buffalo, N. Y., is organizing a club for all of its employees. At a recent meeting in rooms which are being fitted up on the second floor of the package express terminal, several hundred platform employees, clerks, carhouse men and others attended. The heads of all the departments were present and the spirit of co-operation shown indicated that the club will be a success. The club is being formed so as to bring the various employees of the company into closer co-operation.