

cago on July 17, 1913, the company is omitted, for no date of sale has been selected by the receiver.

In addition to the properties mentioned in the foregoing lists other companies have undergone various forms

	Mileage	Outstanding	
		Stock	Funded Debt
Bowling Green Ry.....	7.50	\$50,000	\$20,000
Cassville & Western Ry.....	5.00	100,000	.....
Columbus, Marlon & Bucyrus R. R.	17.18	500,000	510,000
Dedham & Franklin Street Ry....	9.50	75,000	100,000
Erie & Central Pennsylvania Ry....	.....	1,000,000	40,000
Fayetteville Street Railway & Power Co. ....	4.00	.....	.....
Fort Dodge, Des Moines & Southern R. R. ....	106.00	3,200,000	6,600,000
Geneva & Auburn Ry.....	17.85	450,000	400,000
Goldsboro Traction Co.....	6.00	200,000	12,500
Highland Park & Lake Burien R. R.	9.00	.....	.....
Lackawanna & Wyoming Valley Rapid Transit Co.....	.....	6,500,000	7,683,000
Medfield & Medway Street Ry.....	11.25	100,000	100,000
Mexico, Santa Fé & Perry Trac. Co.	27.00	850,000	1,600,000†
Nebraska Traction & Power Co....	20.00	248,700	214,000
Pittsburgh, McKeesport & Westmoreland Ry. ....	9.00	500,000	431,500
South Shore Traction Co.....	9.00	600,000	435,000
Springfield, Clear Lake & Rochester Interurban Ry. ....	11.00	120,000	60,000
Toledo & Chicago Interurban Ry.	42.00	1,250,000	1,320,000
	311.28	\$15,743,700	\$19,526,000

†Authorized amount; outstanding amount not known.

of reorganizations, readjustments and change of ownership, but they have been omitted because of a lack of formal receiverships and foreclosure sales.

### ILLINOIS TRACTION SCHOOL FOR STEAM BOILER OPERATORS

The Illinois Traction System has made an arrangement whereby it will conduct a school of instruction in boiler-room operation at its Peoria (Ill.) generating station for its superintendents, stationary engineers and boiler-room foremen. This is probably the first school of the kind to be established in a street railway power plant. It is planned to equip one boiler in the Peoria plant with a full set of both indicating and recording instruments to show and record all draft and temperature changes which take place under different methods of firing, and both the coal and the water consumed by the boiler will be measured continuously, so that a test of considerable refinement may be conducted at a moment's notice. It is planned to have large-scale diagrams of the boiler on which the actual draft instruments will be shown. This will permit the draft changes throughout the entire boiler to be observed at a glance, and the effect of damper and fuel bed changes may be noted immediately. The following recording instruments will be installed: A recording Venturi meter; a coal weigher; a recording steam-flow meter; a recording gas analysis instrument; recording thermometers for the feed water, flue temperature and steam temperature; recording gages for the furnace and damper drafts, and a thermo-electric pyrometer for furnace temperatures.

The management believes that this course of instruction will indicate to engineers and firemen the value of different parts of the boiler, the most efficient methods of firing, the use of the various instruments necessary in detecting heat losses, the possibility of smokeless combustion, the effect of soot and scale accumulations, the results obtained from various sizes and kinds of coal, and the influence of various percentages of CO<sub>2</sub> in the flue gases. When a condition of high efficiency is obtained, the attendant methods of firing will be immediately duplicated in the operation of the rest of the plant as a practical demonstration of the possibilities in applying improved methods. The school will be established by Harrington & Peebles, advisory engineers on boiler-room economy.

### ELECTRICAL EQUIPMENT FOR THE CHICAGO, MILWAUKEE & PUGET SOUND ELECTRIFICATION

As announced last week, the Chicago, Milwaukee & St. Paul Railway, after careful consideration, has decided to use the 2400-volt d.c. catenary system for the proposed electrification of its Rocky Mountain division between Three Forks and Deer Lodge, Mont., a distance of 113 miles, corresponding to approximately 168 miles of single track. This covers one freight division.

The trolley will be fed from five substations containing synchronous motor-generator sets, step-down transformers and necessary switching apparatus installed at the following sites: Morel, 17 miles east of Deer Lodge; Newcomb, 46 miles east of Deer Lodge; Grace, 63 miles east of Deer Lodge; Piedmont, 78 miles east of Deer Lodge, and one at Three Forks. The sites of these substations may be varied slightly if later investigation shows such changes desirable. These stations will receive energy from the 100,000-volt transmission line of the Great Falls (Mont.) Power Company, as mentioned in the preliminary description of the line which follows.

#### LOCOMOTIVES

No decision has been reached with regard to the type of either the passenger or the freight locomotives. It is probable that twelve locomotives will be needed for freight service. The freight locomotives will be required to haul a trailing load of 2500 tons up a 1 per cent grade at a speed of approximately 15 m.p.h. The passenger locomotives will be required to handle a trailing load of 800 tons on level track at approximately 50 m.p.h. and on a 2 per cent grade at approximately 24 m.p.h. The current will be taken by means of roller pantograph collectors. Heat for trains will be obtained by means of oil-burning steam boilers, for which ample room will be provided. All the locomotives, both freight and passenger, will have regenerative control. The air brakes will be used only for making stops and in emergencies.

#### SUBSTATIONS

Based upon the investigation of the locomotive performance on the ruling grades in the electrified zone, it has been decided to install in each substation supplying gradients of more than 1 per cent a capacity of three 1500-kw units, two being in operation and the third held in reserve. Although the starting of a train calls for practically 100 per cent overload upon the two units in operation, a 200 per cent overload for five minutes' guarantee will furnish ample capacity to start a train of maximum tonnage on a maximum grade.

For gradients up to 1 per cent energy will be furnished from a two-unit substation containing two 1500-kw motor-generator sets, each having a maximum load capacity of 4500 kw for a period of five minutes. It is the intention to use one 1500-kw unit in operation with the second as reserve, to be used in emergencies such as disablement of the operating unit or a congestion of trains requiring them to be operated in fleets.

Basing the substation capacity and location on the foregoing limitations, it is proposed to install three three-unit and two two-unit substations on the 113-mile division between Deer Lodge and Three Forks, Mont. In each case the substation building will be designed to accommodate an additional unit which may be installed when future traffic conditions make it desirable.

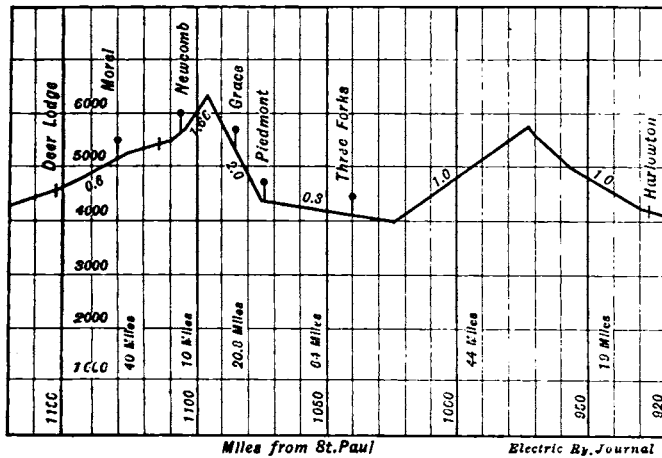
All of the substation units are to be of the same size and will comprise a sixty-cycle synchronous

motor direct-connected to two 750-kw, 1200-volt d.c. generators connected in series for 2400 volts. Each motor-generator set will be fed from three single-phase step-down transformers reducing from a transmission potential of 100,000 volts to 2300 volts at the synchronous-motor terminals. Each motor-generator set will be equipped with two exciters, one for the synchronous motor and the other for the fields of the generators, thus making the motor-generator set, step-down transformer and exciting generators, together with the controlling switchboard, a complete unit in itself.

It is proposed to erect the substation buildings of brick on concrete foundations with a concrete roof supported on steel girders which will provide a foundation for the overhead high-voltage busbars. Each building will be equipped with a crane of sufficient capacity to move the heaviest part of the substation apparatus. The transformers will be of the self-oil-cooled type, placed in a roofed transformer room with tracks, to facilitate installation and repairs. An accompanying table presents the equipment and capacity of each substation.

**TROLLEY CONSTRUCTION**

Energy will be supplied to the locomotives by means of roller pantographs from an overhead copper trolley



C., M. & P. S. Electrification—Profile of Line Between Limits of Ultimate Electrification

wire at least 24 ft. above the rail. The trolley wire will be of No. 0000 copper and suspended from a steel catenary cable. This catenary construction will be supported by bracket arms extending from wooden poles, except on the sharper curves, where two poles

SUBSTATIONS AND THEIR EQUIPMENT		
Location	Equipment, Kw	Total Capacity, Kw
Morel	Two 1500	3000
Newcomb	Three 1500	4500
Grace	Three 1500	4500
Piedmont	Three 1500	4500
Three Forks	Two 1500	3000

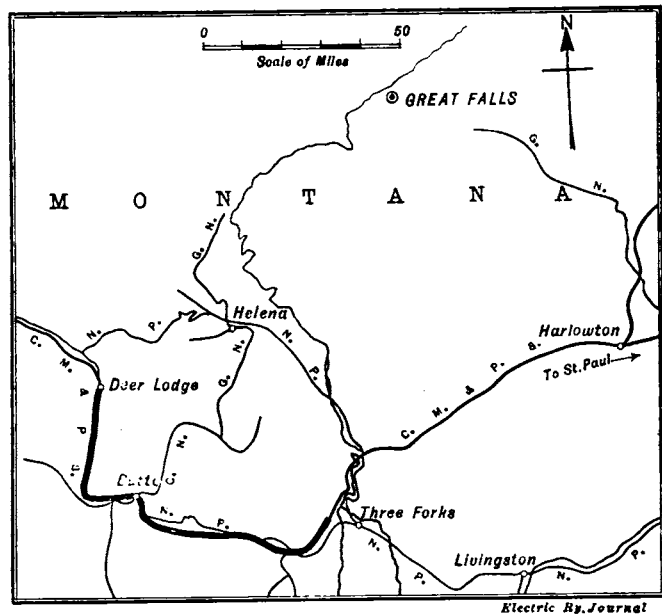
and span wire construction will be employed. The single-pole bracket construction is to be followed wherever possible, because it affords less obstruction to view and is also less expensive than span construction. Where two or more tracks are to be spanned span construction with wooden poles will be employed. Where the number of tracks exceeds four steel construction will serve.

The overhead trolley will be supplemented by feeder copper in order to restrict the energy losses in the 2400-volt conducting circuit to a reasonable amount. However, only a portion of the complete feeder system will be installed until such time as the maximum

tonnage of trains has been reached and the frequency of train service more definitely determined. For immediate installation the feeder copper will be as follows: Deer Lodge to Colorado Junction, 750,000 circ. mil; Colorado Junction to Piedmont, 1,000,000 circ. mil; Piedmont to Three Forks, 500,000 circ. mil. The details of track bonding have not yet been decided.

**TRANSMISSION LINE**

The Great Falls (Mont.) Power Company purposes to construct new transmission lines where necessary to deliver electricity to the Chicago, Milwaukee & St. Paul Railroad electrified zone. This power will be supplied in about the following capacities: Deer Lodge, 20,000 kw; Butte, 10,000 kw; Three Forks, 3000 kw. This arrangement necessitates building a new duplicate transmission line from Great Falls to Deer Lodge. As the proposed feeding-in points of the Great Falls Power Company do not coincide in all cases with the location of the substations, the railway will install a transmission line to tie in these feeding



C., M. & P. S. Electrification—Map Showing Electrified Section of Line

points to each of the several substation sites. This transmission line will follow the railway company's right-of-way, except at some points where it is possible to cut across the country and save distance.

Owing to the great distance from the right-of-way of the railway company to the source of power at Great Falls, it was found necessary to adopt a transmission potential of 100,000 volts both for the Great Falls transmission lines and for the single-circuit transmission line on the railway company's right-of-way. This high potential permits a shift in loads to different parts of the system without excessive loss. The transmission line built along the railway company's right-of-way and connecting the several substations will include the 100,000-volt line suspended upon 45-ft. wooden poles by means of a six-unit suspension-type insulator.

It has been recently reported that an engineer in Rio de Janeiro has applied to the Municipal Council for a concession to construct an underground electric railway to connect the suburb of Cascadura with the center of the city. It is stated that there will be considerable difficulties to overcome owing to the marshy and sandy nature of the subsoil.