the surface of the sub-grade, but will simply form a slight surface crust which has insufficient strength to sustain heavy loads. The writer has observed standard pavements badly subsided and shattered and their life greatly decreased due entirely to the faulty preparation of the sub-grade.

Heavy rollers are so constructed that the effective rolling is accomplished by the rear two wheels and the weight is generally distributed so that approximately one-third the weight of the roller is carried by each wheel. Specifications for compacting sub-grades in general require the use of a certain weight of roller expressed in tons, or provide a minimum weight per lineal inch width of roller tires. Road rollers are manufactured with several widths of rear wheels, and by merely specifying the weight of the roller the compression per lineal inch width of tire can vary to a considerable extent, and thus a heavy roller with wide tires will not give as much actual compression as one weighing two tons less which has narrow tires. On the other hand, a heavy roller may be specified, which with narrow tires gives an excessive weight and might endanger water and other pipes if the ground be in a loose and unstable condition. The minimum and, in unfavorable soil conditions, the maximum compressive weight per lineal inch width of tire seems the more logical manner of specifying the weights, and obviates any uncertainty of the compression which will actually be used in rolling the sub-grade.

The slight increase of cost which thorough rolling entails is incomparable with the added durability and utility of the completed pavement resulting from a well compacted and solid sub-grade.

ELECTRIFICATION OF RAILWAYS.

In connection with the consideration which the Canadian Pacific Railway Company is giving to the electrification of a portion of its lines, it is interesting to note what American railways are doing in this respect. The day of electrification of steam roads is dawning. It has been stated that it costs about the same, mile for mile, to electrify as to build a new road, and the question is, therefore, almost entirely one of the advisability of heavy investment.

The Pennsylvania Railway is contemplating electrifying its line between Pittsburg and New York, a distance of over 400 miles, which will be at least double-track, and which will cost approximately $40,000 per single track mile.

In the Western States the Great Northern Railway, and the Chicago, Milwaukee and Puget Sound Railway have planned the electrification of 530 and 440 miles respectively, contracts having already been let for roadbed, power, etc. This revolutionary step is occasioned by the poor coal and water conditions with which steam locomotives have to contend in North Dakota, Montana and Idaho, and with hydro-electric power in abundance.

The Denver, Rio Grande and Western is electrifying one of its mountain divisions, 114 miles in length. Some 73 miles of mountain electrification for heavy coal haulage is a very interesting application of electricity in railroading which the Norfolk and Western Railway is planning in West Virginia. The new suburban electrified section of the Pennsylvania, extending from Philadelphia to Paoli, will comprise 70 miles of single track.

Electrifications which have already been made in the United States by steam railroads are as follows:—

	Miles of single track.
Baltimore and Ohio	7.4
The original electrification of the steam railroad. The pioneer user of heavy electric locomotives.	
New York, New Haven and Hartford	594.8
Including 22 miles on the Hoosac tunnel route of the Boston and Maine, the lines from New York to Stamford, and Providence to Warren (38.5 miles and 109.3 miles); the Harlem River Branch, 141.4 miles; the line from Stamford to New Haven, now nearing completion, 210 miles, besides more than 50 miles of short lines, including a very complete system about Hartford.	
New York Central	371.6
Two hundred and thirty-four miles out of New York City, 19 miles on the Michigan Central (Detroit River tunnel), and 118 miles on the West Shore Railroad between Utica and Syracuse.	
Pennsylvania	435.5
Comprising 186.8 miles on the Long Island Railroad, 98.4 miles on the Pennsylvania's approach into New York, and 150.3 miles between Camden and Philadelphia.	
Butte, Anaconda and Pacific	90.0
An ore-carrying mountain line	
Southern Pacific	96.0
Suburban lines at Berkeley, Oakland and Alameda, Cal., close to San Francisco Bay.	
Grand Trunk	4.0
Four miles of tunnel track (St. Clair tunnel) at Port Huron, Mich.	
Erie	40.0
In Central New York to the south of Rochester.	
Great Northern	6.0
The electrification of the Great Northern Railway's cascade tunnel, between Leavenworth and Skykomish, about 100 miles east of Seattle.	

Word comes from London that Dr. Goldschmidt, the inventor of a new system of wireless telegraph which, it is said, will revolutionize such communication, has telegraphed his London agent that he has satisfactorily established communication between Neustadt, Ruebenberg, near Hanover, Germany, and Tuckerton, N.J., for two days during the day time, when the power employed at Neustadt—namely, 150 kilowatts, was more than sufficient for the distance of 3,900 miles. In the tests the new "singing wheel" used in this invention showed itself to be capable of such delicate adjustment that secret messages can be sent inasmuch as it can be varied and adjusted instantaneously to any length of wave. The reception of messages is so delicate that an attempt to tap it would involve the necessity of another company tuning to within .0 per cent. of a Goldschmidt message in order to be able to receive anything that could be understood. An English company with a privately-subscribed capital of $5,000,000 will probably be registered shortly. Sir Oliver Lodge, the scientist, expresses the opinion that the Goldschmidt machine will rule the aerography of the future.