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THE

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## Present Status and Tendencies of Railway Electrification.

*By F. Darlington.*

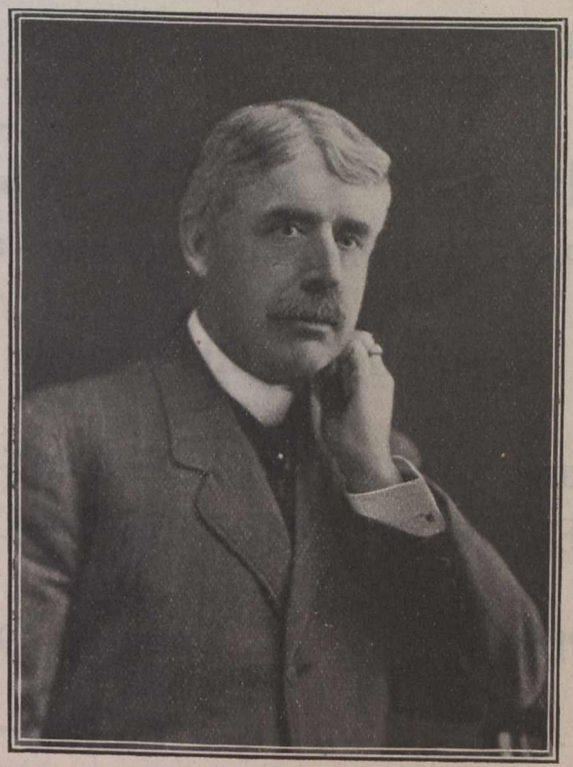
In the opening paragraph of a paper on railway electrification, recently read before the Engineering Society of Columbia University, L. R. Pomeroy wrote: "From a physical and mechanical view point, electric traction can meet all of the demands and requirements of railway service" and he added, "Whether electricity will replace steam traction or not, is entirely a commercial problem."

These two statements exactly describe the present situation regarding railway electrification. Electric power is capable of doing all of the work of railways. Will it pay to adopt it? We all appreciate that there can be no complete and comprehensive answer to this question at present; although during the recent period of financial depression, when no large improvements and extensions were undertaken by railways, splendid progress was made in the development of electric railway appliances, so that in many places where the application of electric power to railways would have been unprofitable a few years ago, it will now show a profit because of these improvements.

With the return of prosperity when business increases we have a right to expect that these improvements which have been both in the direction of reducing the cost of construction, and of increasing the power and efficiency of electric railway apparatus, will lead to new and extended applications of electric power to railways. Meanwhile independent interurban electric roads have grown extensively in the same territory with steam roads and often parallel to them, where the logical and economical course would have been for the steam railways to extend and increase their facilities and use electric power where it was advantageous. But electric motive power apparatus as it was first developed and used by trolley roads was not advantageous for steam railway work. It was excellent for single car operation, as is proven by its success, but it was too costly to install and was too inefficient for operating heavy railway trains. For steam railways to have adopted it under such circumstances would have meant electrical equipment for light local work only, while steam locomotives would have remained in use for heavy work, but today economical and efficient electrical apparatus is available for all railway requirements.

Improvements in the power and efficiency of electric railway appliances are making electric roads more and more on a par with steam roads for heavy transportation business, and it is more true every day that the best economy in any locality can be secured by a single line of railways rather than by separating the work and management. The separation of railways therefore into two classes, steam and electric, according to the kind of motive power they use, will soon become impossible, because modern electric railway apparatus is suitable for heavy as well as for light work and the advantages of combined management and operation of heavy railways and interurban roads, will be secured by utilizing improved electrical appliances for heavy traffic as well as for light traffic, and by combining both classes of work on one system and under one management. To whatever extent the conditions have been improved by the development of more economical and effective electric railway apparatus, to just that extent is the tendency of present times towards electrification of steam railways, since in the long run electrification will be carried as far as it will pay.

A short review of the various old and new electric railway systems comparing their first cost and efficiency will indicate the probable future course of electric railroads better than any opinion of mine would do. The first use of electric motors on railways was on city street cars where electric power replaced horses. The motors were of small size and the total power used per car was in the neighborhood of 15 h.p. and the motors were necessarily all of the direct current type, because in the early days of electric traction alternating current motors had not been developed. As a result of improvements in electric motive power appliances, street car lines were extended and the weight of their cars and the power of their motors were so increased that they became profitable for long runs, and interurban trolley roads resulted. At the same time direct current electric locomotives were developed chiefly for use where smoke from steam locomotives was objectionable, and, direct current motors have been improved and increased in power and are now thoroughly reliable for all classes of railway operation.



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Complete direct current railway electrifications include an electric power generating plant, and trolleys or third rails and sub-stations, etc., for transmitting and distributing the electric power from the generating plant to moving trains, and motive power apparatus on the trains for converting the electric power into mechanical power for train propulsion. Improvements in the power and efficiency of electric generating plants kept pace with the advancement in direct current motor construction, and the apparatus for conducting electric power from the power house and distributing it by direct currents to moving trains was also improved.

The introduction of the so-called commutating poles or inter-poles is the most valuable improvement that was made in the last few years in direct current railway apparatus, because it enables the use of higher voltages on the motors and consequently on direct current distribution systems than were formerly possible; but with all that has been done to improve direct current appliances the minimum cost of direct current railway electrification prevents the general substitution of electric power for steam when large units of power are used per train and it does not seem possible with direct current apparatus to further materially reduce the cost of electric equipment. With the increasing power of electric trains third rails were substituted for overhead trolley wires and were increased in size and weight and supplemented by copper feeder cables, and protected by insulated covers, and the capacity of sub-