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RAILWAY ELECTRIFICATION.

By H. L. Kirker, Resident Engineer, W. E. & M. Co., St. Clair Tunnel.

This paper was written in the form of questions and answers. To save space we have omitted the questions, summarizing them where necessary to the context.

ELECTRIFICATION—WHY IT IS BEING DONE.

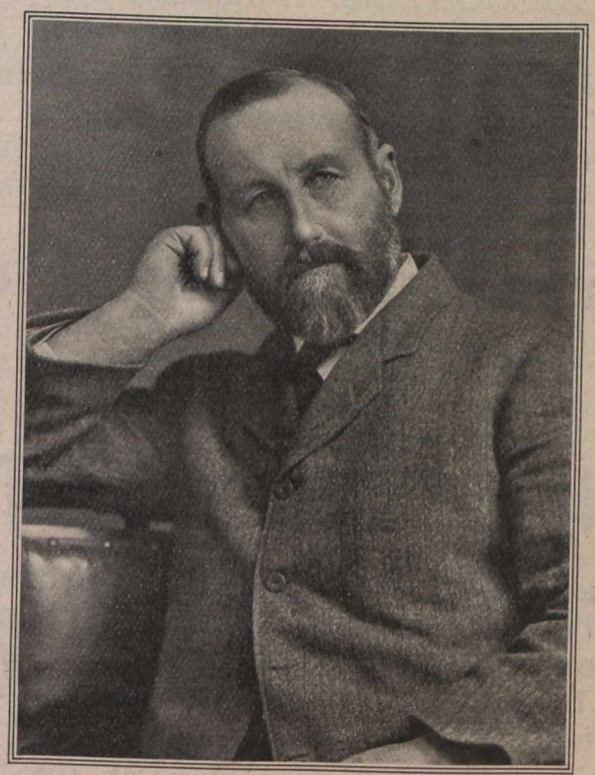
There are enthusiasts who maintain that an electric locomotive can do for a dollar what a steam locomotive does for two. There are moderates who believe that dollar for dollar is the ratio. There are pessimists who do not believe that the electric locomotive can do as much for a dollar as a steam locomotive can do for the same amount. However, as has frequently been pointed out, the primary object of electrification is not to reduce operating expenses, but to improve the service and increase the capacity. Vice-President McHenry, of the New York, New Haven & Hartford (formerly Chief Engineer of the C.P.R.), says that under general conditions it is altogether improbable that the saving resulting from the simple substitution of electric for steam power will be sufficient to justify the additional investment and financial risk.

It is the opinion of railway men that steam roads are reaching the limits of their capacity. According to J. J. Hill's estimate of a year ago, 75,000 miles of new track were then needed to relieve the traffic congestion. E. H. Harriman has gone on record to the effect that an increase of capacity is a vital necessity, that electrification is the solution, and that the increase in capacity resulting from electrification will be accompanied by a great saving. Vice-President Brown, of the New York Central, believes that at the country's present rate of growth it will be necessary to spend as much towards increasing capacity of the present railways during the next ten years as has been spent in creating these railways. With reference to the present shrinkage of business, President Delano, of the Wabash, says he believes the low water mark has been reached, and that the business of the country will improve from now on.

The limits of the capacity of the steam service are first reached in terminals, on heavy grades and in tunnels.

Assuming that terminals, grades, and tunnels have in certain cases reached the limits of their capacity under existing steam conditions, there are those who believe that the steam locomotive has reached its limits as a commercial machine. It is doubtful whether the additional weight incident to increase in boiler capacity and the additional refinement incident to mechanical stoking, feed water heating, super-heating, and compounding can justify themselves. This straining of steam locomotive design to get increased capacity merely produces a machine of half the maximum capacity, easily attained in electric locomotive design.

Assuming the steam locomotive to have reached its limits of draw bar pull and speed, and assuming a case where the terminals and tracks equipped with block signals have reached the limits of their capacity under steam conditions, the alternatives are to enlarge the terminals and lay down additional tracks or replace steam locomotives with electric locomotives that can handle heavier trains and at the same time increase the schedule speed. The cost of the new tracks and the cost of the terminal extensions, however, may easily exceed the cost of the electrification that will give an equal increase in capacity.



EDWARD A. EVANS, C.E.,
General Manager Quebec Railway, Light and Power Co., and President Canadian Street Railway Association.

The electric locomotive can give a heavier pull at high speed than the steam locomotive can give. The electric locomotive is a more powerful high speed machine than the steam locomotive. It is essentially a driving mechanism, fed from a central station of many times the capacity required to handle the train. The elimination of the generating plant from the locomotive makes room for a bigger prime mover and allows the weights to be so disposed as to increase the adhesion. The outside source of supply means that the motor can give a powerful pull through its entire range of speed. The steam locomotive is an isolated power station whose capacity is limited by the area of the heating surface of its boilers. It can exert a powerful pull at slow speed, but (to quote Mr. McHenry again) "there are few locomotives that can generate sufficient steam to use their full cylinder capacity at speeds in excess of 12 miles per hour." He adds that "an increase in speed beyond certain limits can only be attained by decrease in tonnage of train. The high cost of fast freight service is due to this."

The Mallet articulated compound built for the Baltimore and Ohio Rd. is one of the biggest steam locomotives ever built. It weighs 167 tons without tender. All the weight is on the drivers. It has a continuous capacity of 71,500 lbs. draw bar pull at 10 miles an hour (1,900 h.p.). A more recent Mallet, built for the Erie, for mountain service, weighs 205 tons, has 16 drivers, and can give a draw bar pull of 94,800 lbs., working simple. A maximum power Pacific type freight engine weighs 109 tons, exclusive of tender. Sixty-seven tons of this weight are on the drivers. The locomotive has a continuous capacity of 33,500 lbs. draw bar pull at 18 miles an hour (1,600 h.p.). A recent maximum type Pacific passenger engine has 86 tons on the drivers and can develop a draw bar pull of 32,000 lbs. A maximum power compound Atlantic type locomotive weighs 100 tons without tender. Fifty-five tons of this weight are on the drivers. The engine has a continuous capacity of 20,500 lbs. draw bar pull at 25 miles an hour (1,360 h.p.). A maximum power consolidation locomotive weighs 96.5 tons without tender. Eighty-five tons of this weight are on the drivers. The locomotive has a continuous capacity of 42,500 lbs. draw bar pull at 9 miles an hour (1,020 h.p.). The most powerful simple freight engine built in 1907 has a draw bar pull of 60,000 lbs.

The New York Central direct current third rail passenger locomotive weighs 95 tons. Of this weight 70 tons are on the drivers. It has a nominal capacity of 2,200 h.p. at 40 miles an hour. Its maximum capacity is 3,000 h.p. It can give a maximum draw bar pull of 34,000 lbs. before slipping its wheels.

The New York, New Haven & Hartford single phase passenger locomotive weighs 85 tons. All the weight is on the drivers. Its nominal capacity is 1,000 horse power. It can give a draw bar pull of 42,500 pounds.

The G.T.R. St. Clair Tunnel single phase freight locomotive (double header) weighs