ELECTRIC RAILWAY DEPARTMENT.

MECHANICAL TRACTION BY ELECTRICITY.*

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In the installation of mechanical traction by electricity on tramway systems, the point to be considered is how this form of traction compares in cost of construction and working with that it displaces, and what are the conditions that make for a high or low cost of working. It will doubtless be admitted that unless such form of traction were financially superior to other forms it would not be adopted; but it will be useful to inquire wherein this particular superiority lies, as this indicates the direction in which the skill and resource of the engineer should chiefly be turned. The cost of constructing and equipping an electric tramway system is very much greater than the cost of a horse system. The receipts per car-mile may not be much greater, and with the largely increased mileage run may possibly be even less; therefore, unless the expenses per car-mile of the electric system are very much less than the expenses of the horse system, whence can be obtained the large additional net revenue required to pay interest and sinking fund on the greatly increased capital invested? It is accordingly to this lowering of the cost of electrical working that the attention of the engineer should be chiefly directed, and the best results in this respect can be obtained only by care in construction.

In the first place, on what item in working cost may a saving be looked for?

In the matter of wages of men on the car no saving can be effected, two men would be needed on the electric as on the horse car, and the electric employees may even be expected to require higher wages. The maintenance of car-body-painting, repairs, etc.—would be practically the same in either case; the maintenance of the electric equipment of the car is an addition to any expense of the horse system; so also is the overhead wire and feeder system; the maintenance of the track would be greater for the electric system, including therein the bonding. In all thesee items the cost in the total would be greater for the electric than for the horse system. There would be some advantage to the electric system in being able to run at a higher speed, thus distributing the wages of motormen and conductors over a larger mileage in a day and reducing the amount of that item per car-mile. But this is not a large amount and would not compensate for the increase in the other items mentioned.

The only item remaining to be considered is the power used in the service, and it in in this item also that the saving can be effected. For this reason the power house on an electric system is the point to which the intelligence and skill of the engineer should be mainly devoted. It is upon this that the financial success of the undertaking depends. If it is carelessly constructed, with engines, boilers and appliances that do not insure a low cost of working, then it is certain that but a small profit—and perhaps no profit at all—will be realized. It is certain that no great financial success will be secured. Everything that will reduce the cost of producing the electric current should be sought out and applied in the construction of the power house.

The cost of horse traction—and by this is meant the cost of horse-keep, wages of grooms, shoeing, veterinary expenses, but exclusive of drivers' wages—may be taken as varying from 3½d. per car-mile in an easily-worked town such as Glasgow, to 5d. per car-mile in a hilly and more difficult town, such as Liverpool. This is the cost of horse traction arrived at from the working of fairly large systems showing 7,000,000 car-miles annually in Glasgow and over 4,000,000 in Liverpool. The cost of electric power for traction on the overhead trolley wire system should, with enonomical engines, boilers and heat-saving appliances, be under ¼d. per car mile for an easily-worked level town, and for a more hilly town with steep gradients slightly over ½d. per car-mile. The cost nere meant is the cost of all wages, fuel, water, oil, etc., in the power house, together with the cost of maintenance, repairs and up-keep of the plant. The cars driven by this power are those weighing about 6½ tons when empty and capable of seating 26 passengers inside. In order to insure this low cost of working every care must be taken in the power house. In choosing its site it should be placed close to a plentiful supply of water, where all that is requisite for condensing purposes may be had at a nominal charge, or merely for the cost of pumping. A river, canal, pond or the sea would afford what is needed. It should be conveniently situated for the supply of coal from railway line, canal or wharf, so as to save the charges of handling fuel. One shilling per ton saved in cartage would amount to a very considerable sum in a year in a large traction station.

But, needless to say, the most important matter is the type of engines, boilers and heat-savers to be used. The writer favors low-speed (70 revolutions) compound condensing engines, such as are built by numerous English firms, boilers of the Lancashire or Galloway type, with Green's economizers. A plant of this character was constructed and worked under the writer's charge on the Montreal Electric Street Railway, with the result that the cost of producing current was a little under one farthing per kilowatt-hour, and the cost per car-mile less than half-penny in the open months of the year, when coal could be obtained for 9s. per ton. The consumption of coal was 3.48 lbs. per kilowatt-hour, or 2.60 lbs. per e.h.p.-hour, and this was maintained during the months of working. The average for a whole year was only 2.75 lbs. per ehp.-hour. It is not pretended that this is a phenomenally low rate of consumption. On board many of the large ocean-going steamers as low as 1.50 lbs. of coal per h.p.-hour has been reached with triple expansion engines; but the writer believes that few electrical power-houses have been able to show better results than those mentioned. Nor is the result to be attributed to a very large output; precisely similar results can be obtained by using similar appliances on a smaller scale. In the Montreal house there were six 800-h.p. engines, and the daily output of current averaged 43,000 units. But the author has recently obtained similar results with a small cable plant on the Birmingham cable system. In 1897 this plant consisted of a pair of single cylinder engines running at 53 revolutions of 287 maximum h.p., with Galloway boilers, and no special heat-saving appliances. It was necessary to increase the engine-power to meet increased traffic. The author put in a pair of superposed compound condensing engines of 400 h.p. running at same speed as before, and obtained condensing water from a well in conjunction with a tank and cooling tower. The result was that the consumption of fuel was reduced from about 325 tons per month, or 8.9 lbs. per car-mile, to 6.5 lbs. per car-mile; and the introduction of Green's economizers has further reduced the consumption to 4.7 lbs. per car-mile, or to about 3 lbs. per h.p. hour. On the Birmingham small cable system, the saving does not amount in money to a large sum, but on a great electric system running, say, 7,000,000 car-miles in the year, 4 lbs. of coal saved per car-mile, at 9s. per ton, amounts to £5,625 per annum; and it is this consideration that gives emphasis to the plea for an economical power-house plant.

To return to the previous argument. Note what a large saving is effected when a cost of ¼d. per car-mile for power is substituted for 5d.; on a car-mileage of 7,000,000 it means no less a sum than £131,250 per annum! and indicates the source whence the increase of net earnings may be obtained to pay for the heavy cost of electrical installation. The whole cost of working a large electric system, including working charges of all kinds, should be under 5d. per car-mile; but this can only be obtained with a carefully constructed power-house, where the works-cost of the current is cut down to a minimum.

The limits to which this note had to be confined prevent the introduction of any more elaborate figures or statistics than those given; but enough has been said to indicate that, in the writer's judgment, it is to the power-house that the chief attention should be directed in order to ensure the financial success of an electric system. Other parts of the system claim attention, but it is on this that success or failure mainly turns. More money can be lost on the one item of power than would pay all the other working charges, and whether the high potential system with transformers or the multiple unit system be adopted, the successful working ultimately depends upon having engines and boilers that will do their work with a low consumption of fuel.

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It is believed that the council of the town of Woodstock, Ont., will accept the proposition made by Messrs. Ickes & Armstrong, of Harrisburg, Pa., for the construction of an electric railway in that town.