Electric Tramways Generally

by Arthur Beavan

HISTORY OF TRAMWAYS

Nearly fifty years ago there arrived in this country an enterprising citizen of the United States bearing the name of George Francis Train, with whom will always be associated the first attempt to introduce tramways into Great Britain.

Like many other innovators, Train was ahead of his time, and after vainly struggling against indifference, and, in London, against the strongest opposition voiced by the Chief Commissioner of Works, he returned home a wiser and a sadder man, having failed to launch his great enterprise.

Not unreasonably he complained that his system had not been given a fair trial, and that his nationality was against him, pointing out that in Ireland he had, on the contrary, received sympathy and encouragement from the fact that he was an American.

The truth was, his ideas were immature, and his tram-lines utterly unsuited to the street traffic of great cities.

His first attempt was at Birkenhead, in 1860; and three years later he laid down a line, four miles long, from Hanley to Burslem, in Staffordshire, and also a short one at Darlington. In the year 1861 he constructed a line from the Marble Arch along the Uxbridge Road, and another from Westminster Bridge to Kennington Park. The track was ballasted, not paved, and the macadam very soon "rutted" on each side of the rail; but the worst feature was that the tread of the rail being an inch below the road surface, the wheels of vehicles were seriously injured and sometimes wrenched clean off as they endeavoured to leave the lines.

A tremendous agitation ensued against the tramway system. Train's rails were compulsorily taken up, and his ideas were dismissed as impracticable.

Yet the bread had been cast upon the waters, destined to be found much later on, but not by George Francis Train. For ten years after the Birkenhead line was laid down, tramways remained in a very primitive condition, the sole aim being to obtain a smooth track, and so lessen the wear and tear caused by the uneven macadam. The rolling-stock was crude in the extreme, and the rails were fastened down to longitudinal sleepers, so that the spikes invariably worked up, but this defect was remedied when steel girders came into use. The trams were, of course, drawn by horses, for until 1880 no better means of traction appears to have been thought of. Nobody was a bit interested in the tramways, and carriage-folk detested them, so they were banished to the outskirts of the City and "over the water."

The West End recognised them not, except to sign petitions against their introduction. The "poor man's street railway," it affirmed, must keep its proper place in the south, the far north, and the far east of London.

It was left to private enterprise to run the lines, and practically four companies—the North Metropolitan, the London Street Tramways, the South London Company, and the London Tramways Company—monopolised the business, there being no enterprising London County Council to compete

with.

VARIOUS METHODS OF HAULAGE

For a decade—up to 1890—all kinds of improved methods of haulage were tried: compressed air, coiled springs, underground cables (a well-known example of which was the Highgate line, which was always breaking down), and, lastly, gas traction and steam traction.

To all these methods there are serious objections. Horse traction is expensive, besides being distressingly trying to the animals themselves. It is necessary to keep up a large stud for each car, and the horses when idle are eating their heads off. Their fullest speed with the heavy cars is necessarily low. Starting is a slow process, and at the best the rate of progress (including stoppages) does not exceed four miles an hour.

Compressed air and coiled springs may both be consigned to pigeon-holes, labelled respectively "doubtful" and "impossible," there being of the former scarcely half a dozen examples in Great Britain, though in America it is said to have worked well and on an extensive scale.

Cable traction has many advantages, and for a long time was successfully adopted in America, but is now abandoned. With the funicular system, in vogue in Edinburgh, Birmingham, Paris, and Melbourne, travellers have long been familiar. Where a large number of cars are employed, it has the advantage of cheapness in working, and the machinery does not easily get out of order. But the initial cost is very heavy, and it is not suitable for complicated lines, or for tramways with several branches; and therefore extensions, unless straight, are almost impracticable, though it is superior to all others, save that of electricity, for very severe gradients. As the cable moves at a uniform rate, a car can neither vary its speed nor reverse its course. Then there is a difficulty in dealing with the gas and water-pipes during construction (that is, if they are near the surface), and the conduit forms a receptacle for street refuse, and becomes insanitary. But the chief defect is that three-fourths of the total power required to haul the cars is absorbed in driving the cable.

On a small scale, and with but little success, gas traction has been recently tried. There is a difficulty in starting the engines, therefore they have to work continuously, which causes the unpleasant noise familiarised to us by petrol-driven motor-cars when standing still. There is a decided smell from the "exhaust" of the engine; the vibration is considerable; and, as at present designed, the cars cannot mount a moderately steep hill.

Steam traction has been in use for some time, but has not improved, and is not popular. Great wear and tear of the track is caused by the weight of the locomotive, and the public object to the long intervals of service, consequent upon the necessity, for economical reasons, of using large cars. Steam involves sulphurous gases and general dirtiness, besides the apprehension, fanciful or real, of an occasional "blow up."

VARIOUS METHODS OF ELECTRIC TRAMWAY TRACTION

Dismissing all these systems, we turn to electricity, as admittedly the best agent for tramway traction, and, until some marvellous discovery displaces it as a force, likely to remain and to become universally adopted.

Blackpool was first in the field with an electric tramway in 1883. Several other provincial

districts followed suit, including Bristol and Stockton-on-Tees. London, in 1900, welcomed the completion of Mr. J. Clifton Robinson's great scheme for electrifying that portion of the London United Tramways running between Hammersmith and Kew.
The year 1903 sees metropolitan and suburban electric trams in every direction; while in the provinces they will soon cover the face of the land, so extraordinarily rapid has been their acceptance. On every hand signs are evinced of the direct influence upon the general prosperity, comfort, and pleasure of all classes of people by a cheap and rapid electric tramway service.

The electric system admits of an easy extension of routes, and is of all systems the simplest to work. The cars can be readily backed or diverted in any direction. They are roomy, clean, well lighted and ventilated, and, if necessary, can be heated; the seats are comfortable; and the speed is double that of horses, while, without any fuss, gradients of 1 in 8 can be tackled. Of its popularity none can doubt, especially in hot weather, when exhausted town-dwellers swarm on the roof of the cars for a breath of fresh air as they travel merrily along at the rate of twelve miles an hour.

Existing tramways can be adapted to this system with rapidity, and all experts bear testimony to the fact that electric haulage is comparatively so cheap, and the development of traffic on its adoption so great, that horse traction has no chance against it.

There are four kinds of electric-tramway traction which, though apparently rather puzzling, are readily explained. These are the Conduit; the Surface Contact; the Overhead (or trolley); in each of which the current is conveyed to the line—as in an electric railway—from a power house; and the Accumulator, or Self-contained Car, the motive power being obtained from storage batteries carried on the car itself, and these supply the current direct to the motor on the car.

In the conduit system the main conductors (or feed-wire), always in this country placed underground, are carried in a conduit or tube under the track, which has a narrow longitudinal slit on its upper surface level with the road. Through this slit passes a bracket carried by the car in such a manner as to make contact with the two conduit-conductors. The objections to this system are the heavy cost of construction, its liability to derangement from floods, the expense of cleaning the conduits, and its tendency to accumulate filth.

The closed conduit, or surface contact system, consists of a series of plates or studs placed along the track a few feet apart and flush with the road, and insulated from each other. Under ordinary circumstances these are disconnected with the conductor, which is laid entirely below the surface, but when a car passes over them they become, by means of switches, automatically connected with it, so that the current can be conveyed through them to the car motors. In other words, the studs are "alive" while the car is over them, and "dead" as soon as it has passed. This is a very practicable method, and in certain cases is preferable to the open conduit. Defects, however, there are, but the Dolter apparatus claims to have overcome them, and it is greatly in its favour that the system has been successfully worked in Paris for more than two years. It has the merit of readily lending itself to a combination with the overhead trolley system.

Of all systems, by far the best known to the public is that of "overhead," recognised immediately by the tall iron poles inseparable from its adoption. Ninety-five per cent. of the world's electric tramways are worked on the overhead principle. The distribution of electric energy is by means of a wire, called the trolley wire, upheld by insulated brackets on poles twenty feet above the ground, along the entire track, which is divided into sections, each section taking its current from the main

conductor-wire, which is laid underground, through the iron poles. Should any one section of the trolley wires meet with mishap, only the cars working on that section are stopped; those on the remaining divisions, having an independent source of current, continue to run without interruption. At the upper end is a small deeply grooved wheel which, by means of springs at the base of the trolley pole, is pressed against the under side of the trolley wire overhead, and in that position remains as the car proceeds. From the wire the electric current passes through the grooved wheel and down the trolley pole to the motors, of which there is one at each end of the car.

In all three systems the motor itself is suspended from the axle, which it turns; and the armature of the motor is parallel to the axle and nearest to the centre of the car. On the end of the armature is a small cogwheel which gears into the teeth of a larger wheel keyed to the axle, and this turns round the wheels of the car. A coiled spring supports the field-magnet of the motor, and when the driver turns the lever on to the top of the controller (which is a high box in front of each platform containing a series of wires connected with the motor), and switches on the current, the motor is lifted up on the first revolution of the armature, the coiled spring takes up the motion of the motor, and prevents the car starting with a jerk. The current, when done with, returns to the source of supply by the ordinary tram rails, which are specially connected at the joints for this purpose. It is maintained that for cheapness of construction, simplicity of operation, reliability in action, and flexibility in adaptation, this method is superior to all others.

There was at one time a certain objection to it on æsthetic grounds. The earlier examples, when clumsy wooden posts and festoons of wire obstructed the view and seemed to choke up the street, undoubtedly justified the protest against the "overhead"; but now that slender iron poles, ornamental rather than otherwise, and, in some cases, rosettes attached to the houses, are used for the suspension of the trolley wire, people have become reconciled to the appearance of the thoroughfares, and no longer object to the apparatus.

One more system, an ideal one, remains to be considered. It is that of the "Self-contained Car," which carries a battery of secondary cells, whence the current for working the motors is taken as required. But, for the present, there are serious obstacles against its general application. The great weight of the accumulators leads to a disproportionate consumption of power, and involves heavy expenditure on the permanent way and in rolling-stock. The batteries must be recharged at frequent intervals, and must either be removed from the car—a troublesome process—or the car must be kept idle while the cells are revivified. Accumulators as a rule do not live long, and have to be renewed.

Thus the working expenses are so heavy that, ideal as the system is, and delightful the smooth running of the cars, it does not pay commercially to adopt it, and we must wait patiently in the hope that one day a perfect and practical secondary battery will appear on the scenes. Great improvements in lightness and durability are in the air.

Tramcars have become luxurious compared with the makeshifts that did duty in George Francis Train's day, and each new line endeavours to make its rolling-stock superior to the others. Some cars are double-decked, *i.e.* have seats outside; some are single-decked, *i.e.* have no outside seats. They are roomy and comfortably upholstered, and the windows are curtained, or provided with louvre shutters to keep the sun out. Those of the London United Tramways are models of comfort, and people who recollect only the early examples, mostly of foreign construction, would be surprised at the advance made. They seat thirty inside and thirty-nine outside passengers, have spring cushions covered with plush moquette, and ceilings panelled in bird's-eye maple. There are electric push-buttons for signalling the motor-man; electric light is provided, and ventilators extend the whole length of the car,

ensuring an abundant supply of fresh air.

No cars, however, in Great Britain have reached the pitch of perfection attained in America by the palace and parlour tramcars; the former fitted up like a Pullman, with little tables and easy-chairs, and windows prettily curtained. Of this type, perhaps the most superb is in Buenos Ayres. Decorated in early French style, it is beautifully finished; while inside it resembles a drawing-room, with windows separated by carved pilasters and draperies of white silk and gold damask. A fine Wilton carpet covers the parquetry floor, whereon stand woven cane fauteuils with gold plush seats. At each end of the car is a buffet, and one of the platforms is provided with an ice chest, while an electric heater produces tea and coffee when required.

I cannot close this chapter introducing the subject of tramways, without reference to the "Rush for the Trams" that attracted so much attention last year. The rushes in the Blackfriars Bridge Road began shortly after five o'clock and continued until seven p.m., and were described in the daily journals as follows: "South London, thanks to the L.C.C., rejoices in an excellent tram service. There are many trams going everywhere within a reasonable distance—Streatham, Greenwich, Tooting, New Cross. Now, however hard or however fast you rush at a tram, it is not to be bullied into holding more than a certain number. If, however, you rush sufficiently fiercely and with sufficient violence, you may either knock or frighten out of the way a girl who has been waiting longer than you. Some genius discovered this and rushed; others, not to be beaten, rushed also. The result is that every evening the Blackfriars Road is the scene of a savage fight for the incoming trams, where men and women meet in unequal strife.... All notions of chivalry, of 'ladies first,' are thrown to the winds, apparently, on these occasions, with the result that many young girls, weak women and children, rather than share in the unequal strife, are content to walk all the way home.... Long before the trams arrive at the starting-point, they are boarded at either end, and a jovial crowd, knocking off one another's hats, poking out one another's eyes, swarms on to them. As an entertainment, this is not without merit; as an exhibition of the passions, it is undoubtedly interesting. But if you happen to be weak or a woman and want to get on one of these cars, it is possible you will fail to consider these things. Only a day or two ago a fatal accident occurred in the rush for the trams. Such a serious case is, no doubt, rare, but small injuries must be of frequent occurrence, torn clothes and bruises part of the daily round, the common talk of those who struggle for the trams. It is unpleasantly common to see women knocked off their feet and dragged in the road. Nor is the Blackfriars terminus the only battlefield. The Westminster Bridge Road is no whit better, and there, with a roadway somewhat narrower and a somewhat larger quantity of quick traffic, the danger is even greater."

The remedy for this state of affairs was thus significantly pointed out:—

"When electricity is fully adopted the service will be able to deal with a larger traffic, for, although the same number of cars will be running, they will run faster, and each will carry 50 per cent. more passengers, so that the carrying capacity of the line will be much increased. Till then there is no hope of improvement. It is impossible with horse traction to run more cars, or run them faster."

Source:

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