

THE LONDON ELECTRIC TRAIN

by Piers Connor

4 – DEVELOPMENTS

TRAIN SERVICES

The original plans for each of the LER lines were based on estimated traffic levels that suggested a 3-minute all-day service, with long trains in peak hours and short trains in off-peak times. The companies allowed for a lot of spare trains, up to 25% of the total, according to the board minutes. However, the service pattern, as originally proposed, didn't last long and, although traffic did not reach the expected levels initially, it gradually built up. Peak hour headways were then shortened, reaching 27 trains an hour on the Bakerloo, 30 on the Piccadilly and 40 trains an hour on the trunk section of the Hampstead between Camden Town and Charing Cross in February 1909. For a period in 1908, the whole Piccadilly service was provided by 3-car trains, even during peak hours. Generally, over the LER, you might get anything from a 2-car M-CT train up to a full 6-car formation, depending on availability and the time of day. The variations of the train service at this time were described in some detail in the excellent "Rails Through the Clay" by Jackson & Croome.

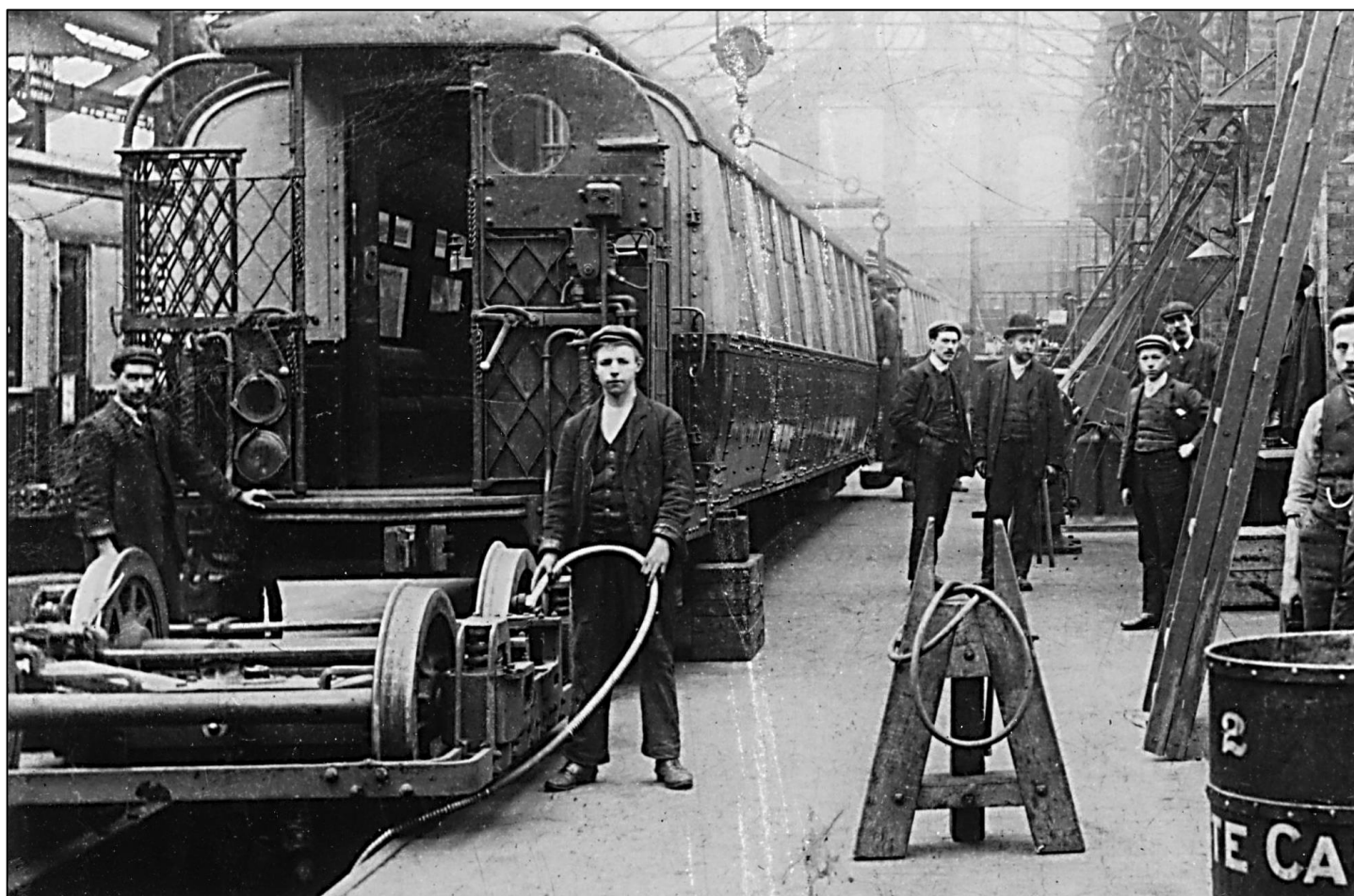


Figure 1: The interior of the lifting shop at London Road depot on the Bakerloo. The car in the foreground is a control trailer. The driving controls were behind the screen with the small viewing porthole. The photo is most likely from before the First World War as work began in 1913 on providing full width screens with gangway doors on control trailers and this one is still in original condition. Note also that this car has folding gates. In front of the car is the leading trailer bogie. Photo: Collection B.R. Hardy.

OPERATIONS

The operation of a full-length 6-car train required a crew of six: Driver, guard, and four gatemen. The guard was located on the leading pair of entrance platforms and a gateman of each of the other four. When passengers were loaded, the rear gateman began the starting sequence by pulling a bell wire on the leading platform of his pair of platforms. This rang the bell at the front end of the car, alerting the next gateman to do the same and so on down the train to the guard, who rang the bell in the driver's cab as the driver's signal to start.

Although a gateman was supposed to be provided for each pair of intermediate entrance platforms on a train, sometimes a pair of gates would be left unattended if the full complement of staff wasn't available. In these cases, it was normal to leave the rear platforms unattended. At peak times, closed entrances caused problems with extended dwell times and, during the First World War of 1914-1918, the call-up of men for the armed forces caused considerable difficulties in this respect. Towards the end of the war, women began to be employed as gatemen.

BAKERLOO EXTENSIONS

The Bakerloo line was built in bits. The first section opened between Baker Street and Kennington Road (now Lambeth North) on 10 March 1906. The bit south to Elephant & Castle was opened on 5 August and a northern extension to Marylebone (then called Great Central, after the railway company that built the Marylebone terminus) went public on 27 March 1907, followed by another section to Edgware Road on 15 June. All these extensions were planned before or during the construction stages of the original line and the rolling stock ordered was sufficient to service the line as far as Edgware Road.

Some six years passed before another extension to Paddington was opened on 1 December 1913. To cover this length of route, the fleet was becoming stretched. If we look at this in detail, we can assume that, if they had a 3-minute headway and a 20-minute trip time each way with a 5-minute turnround at Elephant & Castle and a reversal time of 6 minutes for the shunt at Paddington, they would need 17 trains out of a fleet of 18 x 6-car trains. This was not tenable because they needed at least 15% of their cars for maintenance at any one time. As a result, train lengths were limited. In the years 1908-09 for example, trains, even during peak times, were all limited to 3-car sets. If they wanted to run longer trains, they would need two motor cars per train and they would soon get close to the limits for motor car availability, so they were, at best, restricted to 15 trains of 4-car length or more – do-able, but tight. They did have an extra 3-car train transferred from the Piccadilly Line in 1911. Each of the three cars were transferred between 30 July and 1 August by road.

When a further extension to Queen's Park was authorised and the vision of Bakerloo trains running over the London & North Western Railway (LNWR) to Watford became a reality, was there a real need for more trains. The new line to Queen's Park was opened to the public in two stages. Trains started running through to Queen's Park on January 31 1915 but passengers were only carried as far as Kilburn Park because Queen's Park station wasn't ready. It opened on 11 February. To provide the extra trains, a mixture of old and new cars was cobbled together as follows:

- 10 new motor cars were ordered from Brush of Loughborough.
- A 4-car (M-T-T-M) train was ordered from Leeds Forge.
- 7 motor cars were built at Golders Green from the bodies of seven of the Piccadilly's 20 Hungarian control trailers stored there, by cutting off one end and 'pasting' a motor car end on in its place.
- 10 of the control trailers still stored at Golders Green were cleaned up and put into service as trailers on the Bakerloo.

All the additional cars were given fleet numbers in the Bakerloo series. The line now had 36 (original) motor cars +1 (ex-Piccadilly) +10+2+7 (listed above) = 56 motor cars and 72 (original) +2+2+10 (listed above) = 86 trailers, including the original control trailers. Again, assuming a 3-minute headway between Queen's Park and Elephant, they needed 23 trains.

All of these could now be 4 cars or longer as they had enough motor cars to do this and still leave 10 spare for maintenance, a little over 15%. With the trailers they had, the maximum they could do in terms of train lengths would have been 16 x 5-car trains, plus 7 x 6-car trains. This left 10 spare trailers, a bit over 11%, plenty for the maintainers. These maintenance percentages were to become a sort of de-facto standard for the Underground for the next 50 years, with 10% minimum for trailer cars and 15% for motor cars.

MIDDLE DOORS

It quickly became apparent that the original car body design with end entrances only was totally inadequate to allow the standard 20-second station stop time planned for peak operation. To get an idea of what it was like, imagine a 1973 Stock train on the Piccadilly Line today with end doors only – no double doors anywhere along the train. Perhaps the number of people would be less but the time taken to alight and board would be considerably longer than you would wish for on a rapid transit railway and it would be a scramble through the gates. More entrances were needed.

The District Railway had adopted middle doors for its new electric cars of 1903-05 but the body shape and height of a tube car conspired to prevent a sensible middle door design, initially anyway. Despite this, much effort seems to have been put into finding a solution and, possibly as early as 1911 but certainly by 1914, a Hungarian Piccadilly Line motor car, No.68, was modified to have sliding centre doors (Figure 2). Also, its end platforms were enclosed and sliding side doors provided there too. This car was one of the last cars to be commissioned and I suspect it probably never ran in service in its original condition.



Figure 2: Piccadilly Line motor car No.148 (formerly No.68) waiting to be scrapped in the yard at Acton Works. This car entered service in 1911. Sometime later it was modified and fitted with capstan-operated sliding doors. The end platform was enclosed and fitted with doors and a double doorway was cut into the middle area of the car. The car was fitted with driving controls at the trailing end so that it could be used on the Holborn – Aldwych shuttle service. The car was officially written off on 30 July 1930. The scrapping work had already started when this photo was taken on 8 September 1930. The coupler and tripcock are missing from the front end, having been removed for spares. Photo: LT Museum.

Car No.68 may have been part of an experimental train. In 1914, it was recorded in the LER Board meeting minutes of 5 February that a 4-car Piccadilly train was involved in “end and middle door experiments” and that the doors had been converted from electro-pneumatic operation to hand operation. It is reasonable to assume that this work probably started at least two years earlier. Whether No.68 was part of this isn’t clear. My supposition about these experiments is that the four cars involved were originally proposed to be a complete train working in service as a 4-car set. This may have happened briefly and it may have involved different middle door arrangements on the different cars. We don’t know now. I suspect No.68 was involved with the middle door trials because of its late commissioning date. It was also, at some time, probably shortly after the door experiments, fitted with driving controls at the trailing end to allow it to be used as a single car operating the Holborn – Aldwych shuttle service.

The fact that the doors on the experimental train were converted from air operation to hand operation suggests that compressed air door engines were still not developed sufficiently to give safe and reliable operation and that hand operation was considered, for a while anyway, a viable solution. There had been serious problems with the pneumatic system adopted by the District for its new electric stock in 1905. The doors there were operated by slim cylinders mounted at the top of the doors. This would have been very difficult to fit on a tube car and, anyway, the system was fairly crude and there was no protection against slamming, often a feature of air operated doors unless controlled carefully by anti-

slam valves or a suitable door driving arrangement. The door edges were lined with brass so, if you got hit by one, you'd know all about it. The problems with the operation plus a very high maintenance requirement led to the District abandoning it after only three years in service¹.

Hand operation on the doors of the experimental Piccadilly cars didn't last long either. The issues would have included safety and practicability. In practical terms, the hand-worked doors of the District and Metropolitan trains had to have a balance-weight system on each door leaf to counteract the mass of the door when it was opened by a passenger. They were quite heavy and otherwise might have defeated the efforts of a lighter-built person trying to open a door. Double doors were linked to each other as well as having balancing weights, so that one door being opened caused the other to open. Balancing gear would have been very difficult to fit on tube car doors because of the curved roof.

From a safety point of view, doors would have had to be kept closed while the train was moving. Despite the fact that there was no door locking system on the hand-worked doors of the District and Metropolitan Railways and that they often ran with open doors, it was considered necessary to lock doors between stations on the tube lines. This was, I think, due to the tight fit of the tube tunnel round the cars and the height problem in particular.

HEIGHT

The big issue for side doors on tube cars is, of course, the height². The height of the cant rail, where the roof joins the top of the bodyside, is about 5ft 4ins (1,626mm) above floor level on a tube car. Anyone over that height would have to duck unless the doorway opening is cut into the curve of the roof. This is why the end entrance platforms were open, apart from a narrow section of roof over the centre where there was 6ft 4in (1,930mm) clearance. Thus the only way to get enough height along the body side for a doorway was to cut into the roof.

This was done for the sliding door solution on Car No.68 (Figure 2); the doors were curved at the top in a shape matching the roof profile, more or less. For us, looking at it today, it seems obvious that this was the way to go but it was a novel solution in 1911. On car No.68, the doors were operated by a capstan, which was used to pull them open or closed with cables when manipulated by the guard. It is also worth noting that there are handles on the outside of the doors, presumably to provide "hand operation" as mentioned in the Board minute description of the modifications to the 4-car train.

There must have been some problems with the capstan system. We do not have a description of it but it is easy to see that the real issue would have been how do you keep the doors closed and locked if there is no one on the car that can watch the capstan or find a way to lock it. Door locking could also have been a problem with a wire rope for the drive system. I suspect it was difficult to maintain the tension.

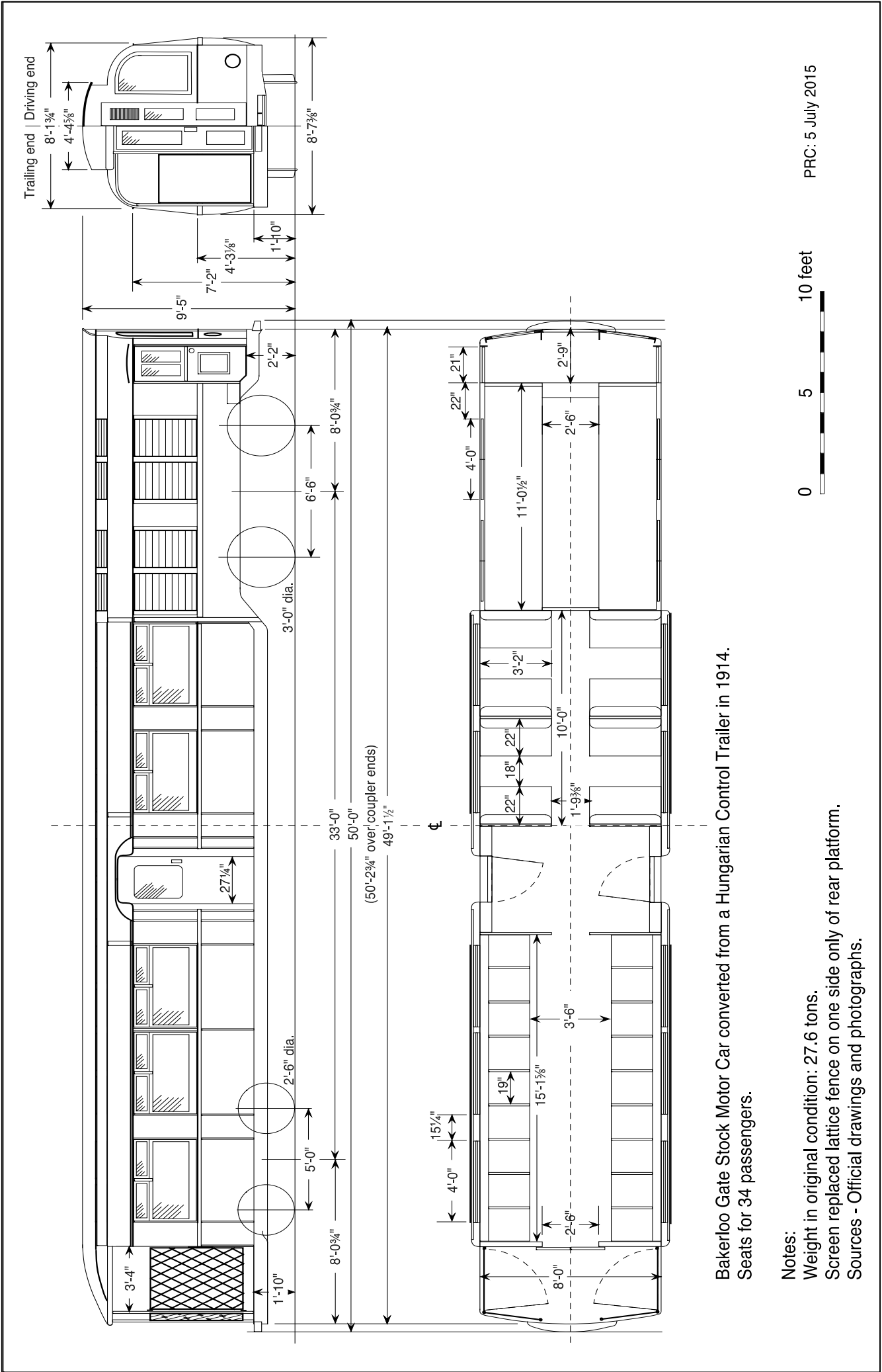
SLIDING OR SWING

One of the questions that taxed the engineers working on the middle door question was whether to have swing or sliding doors. My supposition is that they chose sliding doors first and that No.68, having sliding doors, was part of the 4-car train trial of 1912-13 that I mentioned above. Taking this line of thought further then, what happened to the other three cars? It was probably a M-T-T-M formation but it does not appear as specially mentioned in any surviving literature or records that I've seen and none of the original vehicles are recorded as scrapped before the late 1920s, so what happened to it? Did it remain on the Piccadilly Line in service, was it stored out of service or was it transferred to another line?

Well, apart from the 3-car set mentioned above that was transferred from the Piccadilly Line to the Bakerloo in 1911, there were no transfers until 1915, when cars were moved to the Bakerloo for the Queen's Park extension. There is no evidence that the 3-car set was modified in any way but it is unusual in being the only one to go prior to that time and that only one car with middle doors appears to have survived on the Piccadilly from this period. So, did the 3-cars sent to the Bakerloo come from the 4-car middle door experimental set? Were they sent there to test middle doors on the Bakerloo

¹ See "The District Electric Train" Article 4, *Underground News* No. 570, June 2009.

² The only side doors provided on tube cars up to this time were for driver's cabs. These opened inwards and did not extend into the roof. They remained like this until air-operated cab doors appeared on the 1973 Tube Stock, so drivers invariably had to stoop when entering the cab from the side.



prior to their introduction for the Queen's Park extension? We know there were some concerns over the use of middle doors on the sharp curves at Waterloo's southbound platform. The only clue we have that might suggest this is that the motor car sent over in 1911 was Piccadilly No/18 and this car was sent back to the Gloucester Railway Carriage & Wagon Company in May 1920 to become the prototype of a further conversion programme for middle door provision. Perhaps it already had middle doors and was offered to Gloucester first for that reason. This is purely speculation but it has some possibilities.

SWING FOR NOW

The sliding door experiment obviously wasn't successful because the next proposal was for swing doors. Whether these were tried on the experimental train, or anywhere else for that matter, isn't clear but, regardless, on 13 February 1913, the LER Board authorised the ordering of the 10 new motor cars, with centrally positioned hinged doors, for the Queen's Park extension. The order went to Brush of Loughborough at a price, including equipment, of just under £22,800, the equivalent of £1.6million a car today in economic terms. This is about what you would expect for a small order of comparatively sophisticated vehicles, so the price was fair.

Almost as an afterthought, an additional, complete 4-car train was ordered from Leeds Forge³. Both this train, the new Brush motor cars and the Golders Green conversions, all had hinged middle doors but they retained the usual open gated entrance platform at the car ends. A year later, it was announced in the *Daily Mirror* newspaper⁴ that new cars were to enter service on the Bakerloo with "hygienic straps" and "double middle doors" on 9 February 1914. The "hygienic straps" referred to the white plastic covers fitted over the traditional leather hand-straps provided for standing passengers. Next month, we will look at the cars in detail.

To be continued

³ Leeds Forge was a supplier new to the LER. The company was founded in 1874 by Samson Fox, an ancestor of the Fox acting family (James, Edward and Lawrence Fox amongst them). Fox developed a design for bogies using pressed steel in place of steel plate and the design was used on early Metropolitan Railway electric stock, where they were referred to as "Fox's patent". The Fox company's main business was furnaces and railway wagons and later Fox developed an operation in the US that he eventually sold. It became known as "The Pressed Steel Car Company". The UK business was taken over by Cammell Laird in 1923.

⁴ Daily Mirror, Monday, 9 February 1914.