

BOURNEMOUTH CORPORATION TRAMWAYS.

Board of Trade (Railway Department),
8, Richmond Terrace,
Whitehall, S.W.,
29th June, 1908.

Sir.

I have the honour to report, for the information of the Board of Trade, in accordance with your Order of the 2nd May, the result of my enquiry into the cause of the accident which occurred on the Bournemouth Corporation Tramways about 6.50p.m. on the 1st May.

In this case, car No. 72 was descending the incline from St. Michael's Church, Poole Road into Bournemouth Square, via Poole Hill, The Triangle, and Avenue Road, when the driver (Wilton) lost control. The car attained a dangerously high speed and eventually left the rails at the right-hand curve in Avenue Road near the School of Cookery. It crossed the left-hand footpath and plunged down a bank into the private garden of Fairlight Glen House, where it came to rest on the steep wooded slope, lying on its right side.

I regret to say that the casualty list was long and serious.

There were at the time from 35 to 40 passengers on the car—ten inside and the remainder on the upper deck. Of these, seven were killed, or died very shortly afterwards, and 26 were injured, some of them very seriously. The driver, who remained at his post, sustained a fractured rib and other injuries.

Car No. 72 was a double deck (without top cover) bogie car, with eight wheels, and maximum traction trucks (large wheels leading). It weighed about 12 tons unloaded, and I understand, about 75 per cent, of the load was carried on the large wheels. There was seating accommodation for 30 inside and 34 outside passengers. The principal dimensions were as follows :—

	Ft.	Ins.		Ft.	Ins.
Length over all	35	6	Wheel base of bogies ...	4	0
Length over body	23	6	Diameter of driving wheels	2	7 ³ / ₄
Width over all	6	6	Diameter of pony wheels	1	8

The braking equipment included:—

1. Hand wheel brake working cast-iron blocks on all eight (steel) wheels. The gear is of the usual type, an upright staff carrying a cranked handle with a ratchet head. A chain connected with the rigging is wound up on the lower end of the staff, under the platform, when the handle is revolved, and the blocks thereby pressed against the wheels.
2. Electro-magnetic, track brake, with four shoes, two on each rail. Each shoe has two steel blocks placed in line over the rail, and acts as a powerful electro-magnet when excited by current supplied by the motors acting as generators. The drag of the shoes on the rails, caused by their magnetic adhesion, brings pressure to bear upon the wheel brake blocks by a system of levers. The brake acts, therefore, both upon the track and upon the wheels. It is also similar to the ordinary rheostatic electric brake in the retardation of the motors themselves due to their acting as generators.
3. In addition there, was available the braking effect obtained by reversing the motors and using power either in series or on the highest (parallel) notch.

The car was fitted with four sand boxes, one at each corner, of the non-automatic type. The sand valves, operated by pedal or foot tramp from the driver's platform, were intermittent in action. The sand was discharged through india-rubber pipes at a distance of 24 inches from the wheel contacts.

The tramways in Bournemouth have the 3 feet 6 inches gauge. Through the centre of the town, the lines are worked by electric traction on the underground conduit (side slot) system; outside the centre, overhead conductors with trolley arm connection are used. On the west the change from trolley to conduit is made in Poole Road, about 100 yards east of St. Michaels Church. All cars travelling from Poole to Bournemouth have, therefore, to come to rest at this spot, in order that the conduit plough, for making contact with the underground conductor, may be fixed.

The track is double in Poole Road and Poole Hill. At Par's Corner the tracks diverge. The descending track, with which we are concerned, traverses The Triangle and Avenue Road, and was authorized as Tramway No. 1 of the Bournemouth Corporation Act, 1901. The lines from St. Michael's Church to the square were constructed in 1902, and I inspected them on behalf of the Board of Trade in January, 1903.

From the conduit pit in Poole Road to the scene of the accident is a distance of 460 yards. The route winds considerably and has continuous falling gradients.

The principal curves and gradients are as follows:--

Yards from Conduit Pit.	Gradients.	Name of Thoroughfare.	Yards.	Direction of Curve.	Radius in Feet.	Remarks.				
0-17	1 in 108	Poole Road	0-176	Left	Very easy					
17-33	1 in 45									
(a) 33-67	1 in 24	Poole Hill								
67-83	1 in 19									
83-133	1 in 14.5									
133-183	1 in 19	The Triangle					176-206	Left	100 and 150	Par's Corner.
183-233	1 in 14.6						206-261	Left	350	
233-300	1 in 17						261-293	Left	150	
300-333	1 in 13						293-345	Right	100	Robson's Corner.
333-366	1 in 18	Avenue Road					345-426	Left	400	
(b) 366-466	1 in 22		426-448	Right	300					
			448-458	Right	150					
			458-464	Right	120	Derailment at 460 yards.				

The average gradient on the incline between (a) and (b) is about 1 in 18. The steepest actual gradient (as measured) is between yards 300 and 317, where the inclination is 1 in 12.25. The route as a whole is not one which, from the point of view of either curvature or gradient, can be described as exceptional for tramway working.

The superelevation on the sharper curves was as follows:—

- Curve at Par's Corner—100 feet radius..... From 1 to 2¼ inches.
- Curve at Robson's Corner—100 feet radius ... From ¼ to ½ inch.
- Curve at derailment—150 feet radius From ¼ to ¾ inch.
- Curve at derailment—120 feet radius From ½ to ⅝ inch.

The Board of Trade Regulations governing the traffic on the down hill route are as follows:—

1. Speed limited to six miles an hour in Poole Hill, The Triangle, and Avenue Road as far as Fairlight Glen House, just above which the derailment took place.
2. All cars have to be brought to a standstill at the top of Poole Hill.
3. The track brake must be applied on all falling gradients of 1 in 15 or steeper.

In addition to the above, the Corporation had imposed the following compulsory stops :—

- On Poole Hill at Par's Corner.
- In Avenue Road at Robson's Corner.

My enquiry was held in public in the Council Chamber, and lasted several days. In addition, I acted as assessor to the coroner at his inquest.

Judged by the number of fatalities, this accident is the most serious which has occurred on tramways in the United Kingdom. The general circumstances, however, are not peculiar. A long steep incline, a car out of control attaining a dangerous velocity, and consequent derailment on a curve at the foot of the hill—these are features common to most tramway accidents. The deplorably long list of killed and injured in this case was due, firstly, to the large number of passengers who happened, by reason of the warm weather, to be travelling on the upper deck of the car, and, secondly, to the unfortunate contingency that, just at the point of derailment, there was nothing more substantial than the kerb of the footpath and a light iron railing to prevent the car from plunging down the embankment and overturning. The car in question (No. 72) together with the maximum traction (Brill) trucks, was built by the Brush Electrical Company, Loughborough, and was delivered in May, 1905. It was first taken into service in May, 1906. The controllers (series-parallel, No. 90 M type) were made by the British Westinghouse Electrical Company, and the same Company supplied the electro-magnetic track brakes. These, together with all the electrical equipment, were fitted to the car in Bournemouth. Between May 21st, 1906, and November 2nd, 1907, the car ran 34,348 miles. In August, 1906, it got out of control on Poole Hill, but the driver eventually regained control by using the reversing power. On this occasion there was a dirty contact found in the leading controller. The car was in the shops for general overhaul and repair in November and December, 1907. Between December 14th, 1907, and May 1st, 1908, the mileage worked by the car was 10,302. On three days in April, 1908, complaints were registered regarding the working of the controllers. No. 2 controller fired on the 2nd April owing to fingers requiring cleaning. On the 6th there was trouble owing to the catch of the reversing barrel (No. 1) being stiff and out of position. On the 28th the magnetic brake (No. 2) failed to work on the journey down Boscombe Hill owing to dirty contact at the bottom of the controller. On the night of 29th April the controllers were examined and tested by assistant fitter Grimwood in the Central Depot; and brakesman Fry examined the brake equipment, as regards clearances and mechanical details, in Parkstone Depot on the night of 30th April.

On the day of the accident (1st May) No. 72 car was driven by six different men, and travelled 99.4 miles. From 4.56 a.m. until 1.14 p.m. it was in charge of driver Bartlett, who made three descents of Poole Hill, and found all the brakes efficient. Driver Copelin took charge at 1.14 p.m., and at 3 p.m., in trying to reverse from No. 1 end, he locked the controller, and was unable to drive any further from that end. Eventually, by cutting out one of the motors, he was able to drive the car from the rear (No. 2) end into Parkstone Depot. He reported that No. 1 controller was out of gear, and he could not use power from that end. Inspector Rushton examined the controller, and found the motor barrel out of position. He threw it out of gear, re-adjusted the barrel, and replaced the pinion gear which had over-ridden. He then tested the controller by means of the handles, and found it worked properly.

At 3.30 p.m. Copelin again took out No. 72 car, and, accompanied by a conductor who was learning to drive, drove it to Christchurch Station. Copelin took the car twice down Poole Hill, once before 3 p.m. and once after. On both occasions he found the magnetic brake working properly. Drivers Sackley and Dewar, who were in charge from 4.30 p.m. until 5 p.m., had no occasion to use the magnetic brake, and cannot speak as to its efficiency. Driver Allen drove the car from 5 until 5.20 p.m., and used the magnetic brake in descending Boscombe Hill, and on several other occasions. He found it worked perfectly, and had the usual retarding effect.

At 5.20 p.m. driver Wilton took charge of the car at Lansdown. He was not informed by Allen that anything was amiss. Copelin, who alone of the drivers was aware of No. 1 controller having got out of order at 3 p.m., did not hand on the information to Sackley, who succeeded him in charge of the car. Indeed, as the car was sent out again at 3.30 p.m. by

Inspector Rushton as being in working order, there seems no reason why Copelin should have reported the occurrence to his successor.

Wilton drove the car from No. 1 end westward to the terminus at Poole, where he arrived about 6.8 p.m. He used the magnetic brake on this journey in descending Constitution Hill, and found it worked perfectly. About 50 yards from the terminus he shut off power, by moving the large controller handle into the "off" or neutral position. After coming to a standstill he brought his small handle or reversing key at No. 1 end from the forward into the "off" position. He then removed both handles, and took them to No. 2 end. He had no difficulty in doing this, and noticed nothing unusual in the movement of the handles. It is not possible, owing to the interlocking, to remove either of the handles until the pointers of both have been brought round into the "off" position as indicated on their respective dials. Wilton left the terminus at Poole, on his eastward journey to Bournemouth about 6.10 p.m., driving from No. 2 end. As far as the conduit pit in Poole Road, about 4½ miles from the terminus, the journey was uneventful. No emergency stops were made, and there is no steep decline, so that Wilton is perfectly certain that he did not use the magnetic brake on this return journey. The hand brake was sufficient for all purposes, and acted well. The car was brought to rest at the conduit pit, and the plough attached to the underground conductor. Wilton restarted the car, by using one or two notches of power until a speed of three or four miles an hour was attained. Power was then shut off, and the car allowed to run a little distance without power. He applied three notches of magnetic brake opposite the Pembroke Hotel, in the vicinity of an arc lamp post on the left of the roadway, which is situated about 65 yards from the conduit pit. There was no effect, and Wilton's first impression was that he had missed making contact on the notches. He worked further notches, on the brake side, and used sand, but there was still no effect. By this time the car was close to the usual stopping place at Par's Corner, and had attained a speed of ten or twelve miles an hour. He realized that the brake had failed; but was so confident that it was only a temporary failure, that he brought his controller handle from the brake into the "off" position and allowed the car to run freely round Par's corner. He then reapplied the magnetic brake in the same manner notch by notch, but again without effect. A little more than halfway between Par's and Robson's corners i.e., about 280 yards from the top of the hill, Wilton applied his reversing power, by bringing his controller handle into the "off" position, moving the reversing key into the backward position, and then using power, notch by notch, as far as the 5th. This had no retarding effect, although the automatic canopy switch was blown, and the car had attained a speed of twenty to twenty-five miles an hour at Robson's corner. Wilton then used his handbrake, which he held in position ready, to apply it all down the hill, but the speed was so great there was little or no retardation, and the car left the rails on the curve above Fairlight Glen House, as has been described, about 460 yards from the starting point at the top of the hill. Wilton's explanation for relying so long upon his magnetic brake was that on another occasion, about a year previous, the magnetic brake failed the first time he tried it, but worked beautifully on the second attempt. If he had known that the magnetic brake was not to be relied on, he could not have taken the car down the hill in safety with the hand brake only.

Wilton's tour of duty on 1st May was from 10.40 a.m. until 12.4 p.m., and from 4.40 p.m. until 11.32 p.m.---a total of 8 hours 36 minutes. He had been employed by the Corporation from December, 1902, and had been a permanent driver for over four years, after serving as cleaner, conductor, and spare driver. Although more frequently employed driving on other routes, he was fully conversant with the route *via* Poole Hill and Avenue Road, and stated he had driven cars down the incline in question many hundreds of times. The evidence given by Dr. Spinks, who saw him after the accident, by Chief Inspector Palmer, and other witnesses, proves that Wilton was absolutely sober on the 1st May; and he bears an excellent

character for general sobriety and carefulness. This is vouched for by his record, which shows no entries during the last 2¼ years.

Two other tramway employes were on the car during the descent of the hill, inspector Sellars and conductor Finch. Sellars was engaged in checking the tickets on the first portion of the journey. Both these men agree that the car started from the conduit pit as slowly as usual, and that they did not observe the speed was unusually high until close to the stopping place at Par's Corner. Sellars was on the back platform, and Finch on the upper deck, and as Wilton did not signal on the bell for assistance, they neither of them, in accordance with the rules, interfered with the hand brake at the rear end of the car. Sellars was of opinion that the wheels were not skidding down the incline, and Finch estimates that the speed at the moment of derailment was 25 miles an hour. There is evidence to show that the car tilted outwards considerably in rounding Robson's Corner, and that several people expected the car to leave the rails or overturn at that point. Mr. White, who was one of the passengers on the car, jumped off it just before reaching Robson's Corner. He estimated that the speed of the car was then 18 miles an hour. Dr. Spinks' estimate of the speed at the moment of derailment was 12 to 15 miles an hour; in Mr. Salomon's judgment it was 30 miles an hour.

I examined the permanent way on the route on several occasions during the course of the inquiry. The rails are the same as were originally laid in 1902 the width of groove was then 1 inch, and considerable wear has since taken place. At Par's Corner, from measurements taken in my presence, the width of the groove varied from 1¼ inches to 1¾ inches, at Robson's Corner from 1¼ inches to 1⁷/₁₆. Guard or check rails have been added at various places to reduce the wear of the outer rail. On the curve where derailment took place, the original rails were taken up and relaid two or three years ago after the derailment of another car at the same place. The outer rail was then raised so as to provide some superelevation, and to prevent the continuance of the heavy wear on the head and running edge of the outside (left) rail a check rail was fitted to the inner rail in such a position that the groove was reduced to ⁷/₈ inch. The top of this check rail was about ¼ inch above the level of the running rail. When I measured the grooves at this curve, that of the left-hand rail varied in width from 1¼ inches to 1⁵/₈ inches, whilst the right-hand rail showed the groove have widened to 1¼ inches, the increase in width from ⁷/₈ of an inch being due to wear on the check rail by the backs of the flanges. There was a clearly marked score on the wood block paving between the rails, showing where the flange of one of the right-hand wheels had left the groove. I had sections prepared of the rails at the point of derailment. These show that the wear on the running edge of the left-hand rail amounted to about one-half of the original vertical distance between the head of the rail and the bottom of the groove. There were clear indications also that the flanges of the left-hand wheels, owing to the check on the inner rails and the wearing down of the head of the outer rail, were riding on the bottom of the groove, two very clear scores being apparent.

On the 14th May certain trials were made on this particular curve, and speeds up to 12 to 13 miles an hour attained by different cars without derailment. These trials prove at all events that, notwithstanding the large amount of wear on the rails in proximity to the site of the accident, as regards speed, there was a considerable margin of safety beyond the authorised limit of 6 miles an hour, provided the wheel flanges were in fair condition. At the same time it is not possible, I think, to avoid the conclusion that the worn condition of the rails of the point of derailment and of the flanges was to some extent a contributing factor in the case.

I examined car No. 72 on the afternoon of 2nd May, before it had been moved from the position it occupied after the accident. It was then lying on its right side on the embankment. The hand-brake was applied---two and three-quarter turns of the chain being

wound round the spindle—and the blocks were bearing on all wheels. It required special effort to turn the spindle further. The hand brake rigging, springs, &c., were intact, and apparently in good order. The cast iron wheel blocks, especially those of the pony wheels, showed very considerable wear, but appeared to be in proper adjustment. There was plenty of sand, which had been upset all over the car when it overturned. The sand valves and sand pipes were in order. At No. 2 (leading) end both handles were in position on the controller, the reversing key being in the "backward " position, and the large handle at the last (seventh) brake notch. The automatic canopy switch was "out." No. 2 controller as regards contacts, fingers, mechanism, &c., was in good condition, and the movements of the large handle, and reversing key, actuated the barrels and made contacts with the fingers in the proper manner. I found one of the leads attached to the coil of the off rear magnetic brake shoe broken, the break being of old standing; the insulation of the other lead to the same coil was damaged. Inside the car the leads to this shoe were disconnected. Only three out of the four magnetic shoes were therefore available for use. So far as I could judge, the adjustment of the shoes was correct, and the release springs were in working order. Some of the steel blocks, which form the magnet poles of the shoes, were worn away to within half an inch of the holders.

There was some indications of "flats" on the treads of some of the wheels, but the marks were all so slight that it was evident that the wheels could not have skidded for any appreciable distance on the journey down the hill. Moreover, from the Report Sheet, there were slight flats in the wheels at No. 2 end before the car was taken out on service on the 1st May. The tyres of the driving wheels showed signs of much wear. At the centre of the treads of these wheels the diameter had decreased from 31 $\frac{3}{4}$ " to a minimum, in the case of the right leading wheel, of 28 $\frac{5}{16}$ ". The thickness of the tyre in this case was worn down from about 2 $\frac{1}{2}$ " to $\frac{3}{4}$ ". The tyres of the pony wheels at the centre of the tread were only worn down to the extent of $\frac{1}{4}$ ". The flanges of all the right hand wheels were much worn at the backs, most signs of wear being visible in the leading (No.2 end) right hand wheel. But there was no actual "sharpness." The leading left hand flange was not worn at all at the back, but the thickness of the flange had been reduced from about $\frac{5}{8}$ " to $\frac{3}{8}$ " by wear at the throat.

At my request all the electrical and magnetic circuits and earth connections were tested for continuity by Mr. Bulfin, Borough Electrical Engineer. All were found correct with the following exceptions:-

1. Rear (No. 1 end) off magnetic shoe coil, the lead to which (as described above) was found broken.
2. The earth cable to the case of No. 1 motor was found torn away from its socket, the severance in this case being clearly the result of the overturning of the car.

To make these tests the cover of No. 1 controller was removed by Mr. Lait, Depot Superintendent and foreman Robinson, on the evening of 2nd May. They found the reversing or motor barrel of this controller was not in its proper "off" position, but midway between "off" and "reverse," and that there was contact made with several of the reversing fingers. It was not realized at the time what effect this position of the reversing barrel in No. 1 controller would have when the magnetic brake was applied from No. 2 controller. Nothing was therefore said at the time by these witnesses to anyone else regarding the wrong position of the barrel. They easily turned or jarred the barrel back into its proper "off" position.

But the fact, which the evidence establishes, that, when Wilton lost control of the car, the reversing barrel at No. 1 end was making contact with the reversing fingers, explains the failure of both the magnetic brake and the reversing power. The effect of this contact (with this type of controller), whilst the car was being driven from No. 2 end, will be to short-circuit the armatures of the motors, and prevent the generation of current by the motors. Consequently there would be no magnetization of the steel blocks forming the shoes, and no attraction would be set up between the shoes and the rails. Similarly there would be no

retardation when the reversing key was placed in the backward position and the controller handle used in the highest power notches.

On 5th May I was present at trials that were made in Bournemouth on a car fitted with controllers similar to those on No.72. When the reversing barrel in the controller at one end was placed in the midway position above described, so that there was contact with the fingers on the reverse side, no appreciable braking effect could be obtained, either from the magnetic brake or reversing power, when the car was driven from the opposite end. At the time No.72 car got out of control, it did not therefore matter whether there were three or four magnetic shoes available, for all would have been rendered useless by the position of the reversing barrel at No. 1 end.

There are two possible causes to account for the incorrect position of the reversing barrel of No. 1 controller:-

- (a) Ill-use or mismanagement of the handles by driver Wilton.
- (b) Wear and tear of the moving parts of the mechanism, resulting in excessive slackness and freedom of movement in the barrel itself.

Ill-use of the handles, *i.e.*, rotating them together, instead of separately would cause overriding of the teeth in the gearing and result in locking the controller. This, no doubt, was what occurred to the same controller at 3 p.m. on the day of the accident, when driver Copelin was in charge. It was then necessary, in order to unlock the controller, to throw the barrels out of gear, and replace the pinion wheel in its proper position. On the 5th May nothing was said in the evidence given by Mr. Lait and foreman Robinson to indicate that the controller was locked with the reversing barrel in the incorrect position in which they found it after the accident. It was not necessary to throw the barrel out of gear, in order to put it into working order, and it was easily jarred or shaken back into its proper "off" position. I concluded that they had not found any overriding of the teeth. On the same morning (5th May) I examined No. 1 controller, and found there was so much slack play in the reversing barrel, that it was possible to move it by hand from the "off" into the midway position described, without using the handles. It was also possible to effect the same result by manipulating the large handle sharply. The effect in both cases could be obtained without causing the teeth to override. On the 10th June, when re-examined, the same witnesses stated that, after the accident, they had found the teeth in the pinion gear out of place. If the rack and pinion were in at all a reliable condition, it is difficult to understand how the gearing could have been put "into time" so easily as they described. Again, the displacement of the teeth must have taken place at the Poole terminus, and must have been caused by mismanagement or forcing of the handles, by driver Wilton. But his evidence is very clear on the point that he shut off power 50 yards from the terminus, and after coming to rest brought his reversing key into the "off" position. These separate actions do not indicate mismanagement or forcing of the handles, and are unlikely to have caused overriding of teeth in the pinion gear.

Mr. Turner, electrical engineer to the British Westinghouse Electric Company, gave evidence to the effect that, when he examined, at the request of the Corporation, the controllers of car No. 72, there was a marked difference in their condition. The gearing and motor barrels of No. 2 were in good order, and no slack movement was observable beyond that which is always to be found in similar gearing. The mechanism of No. 1 controller was in a very slack condition, one of the motor barrels was so loose on its spindle that contact could be made with two or three fingers on either side by moving it with the hand. Granted contact with two fingers on the reverse side at No. 1 controller, the brake effect and reversing power when applied at No. 2 controller would be neutralized. It was possible, by sharply swinging round the controller handle at No. 1 end into the off position, to make contact on the reverse side, without any overriding of the teeth in the gearing, and this could occur

without the knowledge of the driver. He thought it inconceivable for overriding to have occurred at the Poole terminus, if Wilton used the handles in the manner he described. Nor did he think it was possible if overriding had occurred for the teeth to be reset in their right position without removing the pawl spring, unless the controller was in a deplorably bad condition. The looseness in the working of No. 1 controller noticed by several other witnesses may be accounted for by the fact that the original reversing barrel, supplied with the controller in 1906, had been replaced by another and older barrel, which had seen previous service. This barrel, besides having been subject to more wear and tear, may possibly have fitted the new controller with less accuracy.

My general conclusions on the whole case are as follows :—

1. The initial cause of the car getting out of control on this occasion was the incorrect position of the reversing barrel of No. 1 controller at the rear end, which rendered useless all the electrical braking equipment whilst the car was being driven from No. 2 controller.

2. Consequently the only available means of checking the speed of the car down the hill was the hand brake with its wheel blocks. These were in good order, and if Wilton had recognised at an earlier moment—say, when he was rounding Par's Corner—that the magnetic brake and reversing power were useless, he could, by careful management of the hand brake, and the use of sand, have negotiated the remainder of the decline in safety.

3. The incorrect position of the reversing barrel was not, in my opinion, due to mismanagement of the handles by the driver, but to looseness in the mechanism of the controller, due to wear and tear and want of proper maintenance.

Wilton's failure to recognise more quickly that his electric brakes were useless does not, in my opinion, amount to more than an error of judgment; and he deserves credit for remaining at his post till the last moment.

To fairly apportion the responsibility for permitting the car to go on service in such an unreliable condition is a difficult matter. The system of stabling cars indiscriminately at any of the four depots, in order, as I understand, to suit the convenience of the traffic, is largely at fault. No particular set of men can be held wholly responsible for the maintenance of a car which goes one night to one depot, and somewhere else the next. The system weakens responsibility by distributing it over all the depots. More especially as regards controllers, which are only subject to a bi-weekly examination, is it a bad system. A man who is only occasionally and possibly at long intervals called upon, as in the case of Grimwood on the 29th April, to examine the controllers of a particular car, is likely to shirk the responsibility for putting a car out of service for renewals. The records of any particular car must also be more difficult to maintain.

Mr. Barber, Traffic Manager, who is responsible for this system, considers, on the other hand, that it tends to greater efficiency and public safety, as it engenders competition between the men in the discovery of faults. But the fact remains that the system is against common, if not universal, practice on tramway undertakings.

The particular controller must for some time past have been in an unreliable condition. That its condition was not discovered by any of the controllers, foremen, or Inspector Rushton, argues either insufficient examination or want of knowledge. Possibly the latter alternative may be the correct reason, as none of the subordinate staff questioned, or the Depot Superintendent, were aware what effect the incorrect position of a reversing barrel (with this type of controller) would have upon the electrical braking equipment. They would therefore be unaware of the necessity for guarding against undue looseness or slackness. More careful instruction in the method of examining controllers is necessary and more practical supervision.

There are a number of other matters to which I wish to call the attention of the Corporation. These are :—

(a) No cars should be permitted to be on service without their full brake equipment. Mr. Barber has had trials made to show that the stopping effect on a large car with four magnetic brake shoes in use is but little better than with three only. This may be admitted, but public safety demands the highest possible efficiency, and not the second best. It is only on the understanding that the full equipment is available that the Board of Trade licence working. In this particular case there were no magnet coils in store, and there was no evidence to show how long the shortage existed. But if the Corporation had given the necessary authority for keeping such necessary articles in store, the responsibility rests with the Depot Superintendent and his staff.

(b) The position of the sand pipes in the large cars can be improved. On No. 72 they were placed 24 inches from the wheel contact. Dry sand delivered at such a distance will of necessity fall clear of the rails on a curve, and even on a straight road be more liable to be blown away from the desired spot by any current of air. The distance should be reduced by one-half at least.

(c) The rails on the curve where derailment took place require to be renewed, preferably with a wider groove than that originally used. I have referred to the worn condition of these rails and recognised that there was sufficient margin of safety for the speed authorised. But all curves at the foot of long steep declines are danger points, and for this reason it is of importance that the rails on such curves should be carefully watched and replaced when they show considerable signs of wear.

(d) As regards the magnetic brake, it is now generally recognised that it should not be reserved only for emergency purposes, and for descending steep gradients, but should be in common use. When used for coasting gradients, the common practice, as set forth in the Instructions to Motormen issued by the British Westinghouse Company, is to set the controller handle immediately to the last braking notch and move it back as may be required. I see no reason why the practice in Bournemouth should be otherwise.

(e) Training of drivers is not given the attention it deserves. At most tramway centres a regular school is maintained for the training of men, which contains full scale models of all the electrical equipment wiring on a car. Batches of selected men are put through a regular course, first of technical education, and afterwards of practical driving under a qualified instructor, and the men are examined both in theory and practice. The method at Bournemouth of giving a conductor a permit to learn driving, during his spare time, from any permanent driver is not a satisfactory substitute.

(f) The organization of the tramway department is open to criticism. So far there has been no regular manager at Bournemouth. The control seems to have been divided between the Borough Engineer, the Traffic Manager and others. No one officer is responsible to the Corporation for the administration of the whole undertaking. This cannot be a satisfactory arrangement. I strongly advise the Corporation to make a change in the organization, by selecting in open competition a properly qualified General Manager, and given him control over the whole department. The critical period for tramways is not during the first three or four years, when equipment, &c. are comparatively new. It is later on, when mechanism begins to wear out and renewals have to be made. Previous experience of some length is then of first importance.

I recommend the Board of Trade to make the following alterations (1) an additions (2) and (3) to the regulations now in force :-

- (1) The compulsory stopping-place in Poole Hill on the downward journey should be at the arc. lamp-post before reaching the Pembroke Hotel.
- (2) So long as the magnetic or other track brake is not used for ordinary stops it shall be applied, to test its effectiveness, before reaching any steep gradient down which the brake is used for coasting.
- (3) All controllers at every terminus, before the handles are removed, shall be opened and the barrels examined for their proper "off" position.

In view of the fact that the whole question of braking is now under consideration by two Committees, I do not propose at this moment to make any recommendation regarding the addition of a mechanical method for applying the shoes of magnetic brakes.

I have, &c.,
J.W. PRINGLE, Major.

The Assistant Secretary,
Railway Department,
Board of Trade.