MINISTRY OF TRANSPORT & CIVIL AVIATION

RAILWAY ACCIDENTS

REPORT ON THE COLLISION

which occurred on

2nd December 1955

near

BARNES STATION

in the

SOUTHERN REGION

BRITISH RAILWAYS

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1956

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MINISTRY OF TRANSPORT AND CIVIL AVIATION,
Berkeley Square House,
London, W.1.

27th June 1956.

SIR,

I have the honour to report for the information of the Minister of Transport and Civil Aviation, in accordance with the Order dated 5th December 1955, the result of my Inquiry into the collision which occurred at approximately 11.28 p.m. on Friday, 2nd December 1955 near Barnes station on the electrified four-track "Windsor" line in the Western Section of the Southern Region, British Railways.

The 11.12 p.m. four-coach electric passenger train from Waterloo to Windsor and Chertsey, which was not booked to stop at Barnes, was approaching the station at about 35 m.p.h. on the Down Local line when it collided with the rear of the 10.55 p.m. 42-wagon steam freight train from Battersea to Brent, which was drawing slowly forward after a stop at the Barnes Junction Down Local home signal. The electric train had entered the two mile section from Point Pleasant Junction under clear signals, and the accident was caused by irregular operation of the Sykes lock and block apparatus by the Barnes Junction signalman.

The steel underframe of the leading coach of the electric train overrode the underframe of the goods brake van, destroying the van body and smashing a container loaded on the next freight wagon, and the coach then turned over to the right on to the adjacent Down Through line. A fire which was started in the wooden bodywork by electrical arcing rapidly developed into a blaze. The coach was practically burnt out, and I much regret to state that eleven of the 30–40 passengers in it, together with the motorman and the freight train guard, lost their lives. In addition 20 passengers were detained in hospital with serious injuries, and 21 others sustained minor injuries or shock.

The collision took place close to Bridge No. 21, which carries a road named Queens Ride over the line, 360 yards from Barnes Junction signal box. So far as could be ascertained, severe damage to the leading coach by the impact was confined to the motorman's and the leading passenger compartments, and the rapid onset of the fire was therefore most unfortunate. The current was removed immediately from the Down Local line by the opening of the circuit breakers at the Barnes Junction substation (½ mile) close by and at the Clapham Junction substation (3 miles). The Down Through circuit breaker at Barnes Junction also came out at once, but this line continued to be fed from Clapham Junction, and in all probability the fire was started by the arcing which persisted for four or five minutes when metal parts of the overturned coach came into contact with the conductor rail. The flow of current in this short circuit was insufficient to open the Down Through circuit breaker at Clapham Junction, and it remained closed until a short circuiting bar was applied at 11.34 p.m. by the prompt action of Motorman G. Peters who was travelling on duty in the 3rd coach of the electric train. The fact that the current was not removed from the two Up lines until 11.49 p.m. played no part in the fire.

Two calls for emergency assistance were made at 11.33 and 11.34 p.m. by the Barnes Junction signalman who dialled 999 from a public call box on the Down Local platform, and the first of these calls was connected at once by the exchange to the Barnes fire station, 1¼ miles from the site. A call was also received by the Information Room at Scotland Yard from an unknown source at 11.35 p.m. At about the same time Sergeant C. Jackson of the Metropolitan Police, who was on duty nearby with his bicycle and had seen some electrical flashing, telephoned to the Putney police station from a police call box. Ambulances and the London Fire Brigade were then called by the Putney Police.

As a result of these calls the brigade from the Wandsworth fire station 2½ miles away turned out at 11.37 p.m. and reached the site at 11.44 p.m. Owing to a misunderstanding, the 11.33 p.m. call from the signalman reached the Barnes fire station as a call for an ambulance only, and this station, which was the nearest to the site, did not receive a definite fire call until 11.40 p.m. (from a lineside resident). Their appliances then turned out very promptly and also reached the site at 11.44 p.m. These two fire brigades came into action at once with a plentiful supply of water and they were followed quickly by five others, but the fire had taken such a hold that all they could do was to prevent it from spreading to the leading three coaches.

Some passengers managed to make their way out of the leading coach in the first few minutes, and others were helped out of the three rear coaches by railwaymen in the train. Owing to the rapid spread of the fire it soon became impossible to rescue anyone from the leading coach, though Sergeant N. Loxley and Constable T. Oliver of the Metropolitan Police together with Station Foreman S. N. Rogers, who was travelling in the train, persisted very courageously in extricating one severely injured passenger ; Sergeant Loxley and Constable Oliver received injuries which kept them from duty for several days. Surrey and London ambulances and

doctors and nurses began to arrive from 11.39 p.m. onwards. There was no lack of first aid attention, and the more serious cases were conveyed very promptly to hospital. Many local residents were generous in their care for the injured in very distressing circumstances, and I should mention the good work done by Mr. R. H. R. Bartlett, who was one of the first on the scene.

The two Up lines were not blocked by the collision, but they were kept clear of traffic for the breakdown operations, and the interruption of the route was therefore complete. The few remaining night passenger services in both directions were terminated at stations short of the obstruction and some special connecting road services were provided by London Transport. During the morning of the following day, Saturday 3rd December, many improvised passenger services were run, making full use of alternative routes, and further help was given by London Transport emergency road services. The wreckage was finally cleared from all the lines by 10.30 a.m. and the Up Local and Down Through lines were reopened to traffic at 11.12 a.m. The normal passenger service was restored during the early afternoon, but it was subject to some delays until the Down Local line became available at 5.48 p.m., after the damage to the track had been repaired.

This is a busy freight route during the early morning hours, and many freight trains had to be cancelled or terminated short of their destinations. The accumulation of traffic was, however, cleared by special working during the week end, and the freight situation was normal on Monday morning, 5th December.

The weather at the time of the collision was fine and clear, and the rails were dry. There was a moderate south westerly wind.

I. Description of Trains and Effects of Collision

1. The electric train was formed of two identical two-coach suburban units, Nos. 1853 and 1877. It was to be divided at Staines for the front unit to proceed to Chertsey and the rear unit to Windsor. Each unit consisted of a driving trailer third with a tare weight of 30 tons in front as the train was running, and a motor third brake in rear with a tare weight of 42 tons. The total tare weight of the train was thus 144 tons, and its total length was 86 yards. There were ordinary screw couplings and side buffers at the ends of the units, and the two coaches of each unit were close coupled with a single central buffer. The Westinghouse air brake was in operation on all the wheels, with non-ferrous brake blocks acting with a force of 56% of the load on the six non-motored bogies, and cast iron blocks acting with a force of 85% of the load on the two motored bogies.

These two units were introduced into service in 1935 and 1936. Their steel underframes, bogies and electrical equipment were then new, but their bodies were originally constructed between 1895 and 1900 for steam-hauled stock and they were adapted for mounting on the new underframes with comparatively little alteration. The main body frame work and side panels were of hard wood, except that sheet steel panelling was fitted to the driving and electrical equipment compartments when the conversion took place ; the roofs and compartment partitions were of soft wood. The exterior and interior finishes were of ordinary paint and varnish mixtures, and thorough tests which were subsequently carried out on the surfaces with a blow lamp showed little tendency for the paint or varnish to spread the flame.

2. The freight train was conveying exchange traffic between the Southern and London Midland Regions. It consisted of 13 loaded and 29 empty four-wheeled wagons and a 20-ton brake van, all loose coupled, weighing approximately 490 tons. It was hauled by a 2–8–0 type engine of the London Midland Region, Class 8F, weighing 127 tons in working order with its tender. The total weight of the freight train was thus approximately 617 tons, and its total length was about 320 yards.

3. With reference to Fig. 2 of the attached plans, the freight train had re-started when the Barnes Junction Down Local home signal No. 49 was cleared with Barnes East box out of circuit. It was moving very slowly towards the starting signals at danger at the far end of the station platform, and the engine was about 20 yards from these signals when the collision took place. The van was about 90 yards ahead of the home signal, which was still in the clear position, and had nearly reached the steel girder bridge No. 21. The electric train had passed the Barnes Junction distant signal at caution, and was travelling at about 35 m.p.h. instead of the usual speed of about 45 m.p.h. at this point for a train which is not booked to stop at Barnes Station.

4. As has been stated, the leading coach mounted the underframe of the brake van, leaving its derailed and badly damaged bogies jammed together against the wheels of the van, which was also derailed. The wooden van body was swept away and the end of a container loaded on the low-sided wagon next to the van was smashed. The coach then turned over to the right clear of the freight train and came to rest on its side on the alignment of the Down Through line under the bridge, and alongside the van and the two rearmost wagons, which had been driven forward for a few yards.

The coach underframe was severely crumpled in front of the main bogie pivot cross member, which is approximately 10 ft. from the headstock, and it is probable that the motorman's and the first passenger compartment were destroyed by the impact. The underframe had retained its general shape behind this cross member, though there was some buckling of the solebars, and it is probable that the eight passenger compartments over this length were not very seriously damaged at this stage, though some doors may have been jammed. Damage to the 2nd coach of the leading (Chertsey) unit was mainly superficial, and it came to rest upright in close contact with the underframe of the brake van, with both its bogies derailed. The two coaches of the rear (Windsor) unit were undamaged and remained on the rails. There was very little structural damage to the massive steel underframe of the freight train brake van, or to the steel frames of the next two wagons. The rest of the freight train was undamaged and was drawn away later by its own engine.

5. The immediate effects of the collision were thus not very severe, probably because the freight train was just on the move, but they were greatly aggravated by the subsequent fire which burnt out the leading coach and the debris of the brake van, together with the container and its contents ; the body of the next empty cattle wagon was also destroyed by fire. By all accounts there was no arcing for a minute or two after

the collision and it is possible that it was started by the settling down of the wreckage on to the Down Through conductor rail. Some light explosions continued to be heard after the arcing had ceased, and they were probably caused by the explosion of the detonators which were being carried, as usual, in the motorman's compartment and in the brake van ; there were also five oil lamps in the wreckage, namely one tail and two side lamps from the brake van, and the motorman's and guard's hand lamps.

While the hard wood framing of the coach would have been relatively slow to ignite by itself, the paraffin oil in the lamps and the soft wood debris of the van body may well have contributed to the rapid onset of the fire, and there were probably some live embers from the brake van stove ; furthermore, the container was loaded with aircraft wireless aerials which were wrapped in waxed paper and packed in cardboard cartons. In its later stages the fire was probably intensified by melted drippings from the bitumen coating which had been applied to the bridge girders two days before, and its rapid spread from the front to the rear of the coach was no doubt assisted by the wind which was blowing in this direction in the confined space under the bridge.

6. With the combination of all these adverse conditions the greater part of the coach was ablaze, with flames mounting high above the bridge girders, when the Fire Brigades arrived at about 11.44 p.m., 16 minutes after the collision. Although they brought their jets to bear very quickly with an ample supply of water, disregarding the risk of shock from the live conductor rails of the two Up lines, they were unable to prevent the destruction of the leading coach ; they were, however, successful in preventing the fire from spreading to the next coach, the front end of which was only scorched.

7. I refer later to the reasons for the delay in removing the current from the Down Through line, and to the circumstances in which the Barnes fire station did not receive a call for their services until 11.40 p.m., 12 minutes after the accident.

II. Description of Route

8. With reference to Figs. 1 and 3, the Main and Windsor lines from Waterloo run together in a south westerly direction for the four miles to Clapham Junction, and there are eight running tracks for most of this distance, with the Main line tracks on the left and the Windsor line tracks on the right.

At Clapham Junction the Windsor line diverges to the right from the Main line. It then continues westward for 3 miles as a four track line through Wandsworth Town and Putney stations to Barnes station and junction, 7 miles from Waterloo. The four tracks are named from North to South, Up Local, Up Through, Down Through, Down Local. The gradients between Clapham Junction and Barnes are slight, and there is no sharp curvature. There is deep cutting through the high ground around Putney, but in the neighbourhood of Barnes station the line is practically level with the flat ground of Barnes Common.

9. The four tracks continue through the Barnes station platforms (two single and one middle island), and they divide at the ends of the platforms, close to Barnes Junction signal box, into two double lines for the Chiswick (right hand) and Richmond (left hand) directions. The freight train, which was running on the Down Local line, instead of on the Down Through as booked, was destined for the right hand route across the junction, and the electric train which collided with it was to proceed along the left hand route via Richmond.

10. All the four Windsor line tracks are electrified on the standard third rail system (650 volts D.C.) of the Southern Region, and they carry a concentrated service of multiple unit trains for the inner and outer suburban routes in the Thames valley and for the Ascot and Reading line. During the heaviest hour of the evening peak, 14 Up and 19 Down passenger trains are booked through Barnes Junction, in the proportion of about three to one on the Richmond and Chiswick routes. There is also considerable freight movement, particularly during the early hours of the morning, as this is an important route for exchange traffic between the Southern and the London Midland and Eastern Regions via Kew and for traffic to and from Feltham marshalling yard.

III. General Description of Signalling

11. The signalling arrangements for Down traffic between Clapham Junction and Barnes Junction, together with the relevant distances, are shown by the general diagram, Fig. 3.

12. The running tracks from Waterloo to Clapham Junction are equipped with multi-aspect colour light signals with continuous track circuiting and no manual block, and the same applies to the four Main line tracks thenceforward to Hampton Court Junction, 13 miles from Waterloo. Manual block is, however, in force on the four Windsor line tracks beyond Clapham Junction 'A'.

Clapham Junction 'A' is a power box and is situated at the London end of the station. It was manned by two signalmen, one controlling the Main line and the other the Windsor line traffic, and the train register was being kept by a booking lad. The signalmen at this box have some responsibility for the regulation of traffic, and when trains are running out of course they have discretion to vary the booked routing as between the Through and Local lines.

13. The next box on the Windsor line is *Clapham Junction 'E'* (*WBB*), at the country end of the platforms. It has a power frame, and the standard three-position "closed" block of the Southern Region is in operation through the short section from Clapham Junction 'A'.

14. Sykes lock and block is in use through all the sections from Clapham Junction 'E' to Barnes Junction and beyond, and its working is described by Sections IV and V of this report, and by Appendices A–D.

The continuous track circuiting is, however, extended from Clapham Junction 'A' past Clapham Junction 'E' to Point Pleasant Junction. The track circuits exercise the usual control on the three and four-aspect colour light signals shown on the diagram, the last of which are the Point Pleasant Junction Down homes (with junction indicators) at the country end of the Wandsworth Town station platform.

Thenceforward all the signals are upper quadrant semaphores.

15. *Point Pleasant Junction* box has a manual frame of 34 working levers and the 11 track circuits are indicated by an illuminated diagram. This box controls the junctions with Wimbledon branch via East Putney and two pairs of facing crossovers, but none of these junctions was used during the period concerned in this case.

There are no Down semaphore distants at this box. No. 43 is the lever of the Down Local colour light home for straight running, and with this lever pulled the aspect clears to G if the Down Local semaphore starter No. 42 is "off". The aspects of the Clapham Junction 'E' signals in rear follow the usual sequence.

16. *Putney* is a "block box" only, with no points and crossings, and there are 8 track circuits, including "berth" track circuits in rear of the Down home signals. It had been switched out of circuit in the ordinary way at about 11.8 p.m. while the freight train was running on the Down Local between Clapham 'E' and Point Pleasant Junction, and all the signal levers had been reversed. In these circumstances the Putney Down distant arms followed the movement of the arms of the Point Pleasant Junction starters, slotted with them on the same posts.

The Putney Down advanced starters are slotted with the Barnes Junction electrically worked Down splitting distants.

17. *Barnes East* box controls two facing crossovers and some siding connections. It has only one group of Down signals, the through running arms of which are slotted by Barnes Junction box. The Barnes Junction Down distants are also controlled by Barnes East.

Barnes East had been switched out of circuit at about 9.45 p.m. and was not therefore concerned in the accident. All its signal levers for through running had been reversed, *and its Down Local and Through signals were acting as the Down homes for Barnes Junction box, under the full control of the latter* ; the same applied to the Down distant signals.

18. *Barnes Junction* box is situated close to the ramp at the country end of the island platform between the Up and Down Through lines. It is of brick and timber construction, and the working floor, 9 ft. 9 ins. above rail level, is roomy and well arranged. There is an excellent view through the windows over the junction and its approaches from the West, but the eastward view of the lines through the station is not so good. It is possible to see the front of a train on the Down Local line when it reaches the London end of the platform about 230 yards from the box, though there is some obstruction to this view by the arms and posts of the Down Through starting signals. Trains standing at the Down homes are out of sight.

The manual frame contains 48 working levers and there are three short track circuits, separately indicated, which take the place of lock bars on the facing connections close to the box. There are no track circuits in rear of the Down home signals, as are provided at Point Pleasant Junction and Putney.

I refer later to the working of the Sykes lock and block apparatus at this box and at Point Pleasant Junction.

19. With Putney and Barnes East boxes switched out, the block section concerned was from Point Pleasant Junction to Barnes Junction, approximately two miles in length. The next block posts beyond Barnes Junction in the Richmond and Chiswick directions respectively were White Hart Crossing (¼ mile) and Grove Park (1¾ miles). There are "gate boxes" at the two level crossings (see Fig. 3) and their levers are released from Barnes Junction.

20. The following is a summary of the more important distances with reference to Barnes Junction signal box :—

Waterloo station	7¼	miles	East
Clapham Junction	*Miles*	*Yards*	
'A' signal box	3	624	,,
'E' signal box	3	299	,,
Point Pleasant Junction			
Colour light Down homes (No. 43 Down Local)	2	620	,,
Signal box	2	82	,,
Down starters (No. 42 Down Local) ... ... (No. 32 Down Through)	1	1,352	,,
Putney signal box	1	266	,,
Barnes Junction			
Down distants (Nos. 50 and 52 Down Local)	–	1,723	,,
Down homes (No. 49 Down Local)	–	471	,,
Approximate point of collision	–	380	,,
Overbridge No. 21	–	363	,,
Train on Down Local first visible from signal box	–	232	,,
Front of freight train at moment of collision (approx.)	–	60	,,
Down starters (Nos. 48 and 51 Down Local)	–	40	,,
Signal box		—	
Electrical substation	–	286	West
White Hart Crossing signal box (Richmond line)	–	888	,,
Grove Park signal box (Chiswick line)	1	1,414	,,

21. I viewed the signals after dark from the motorman's compartment of an electric train, travelling on the Down Local line, and I noted that their oil lights were remarkably good. The view of all the signals left little to be desired, with the possible exception of the Barnes Junction Down Local home signal No. 49. I first saw its green light at a range of about 930 yards ; it remained in view for about 150 yards and then was obscured

intermittently by the superstructures of two footbridges for 410 yards, after which it could be seen continuously for the remaining 370 yards. The motormen whom I interviewed said that there was no real difficulty in observing this signal.

22. With the slight reverse curvature at the approach to Bridge No. 21, the rear lights of the freight train brake van should have been visible to the motorman of the electric train over a range of about 250 yards.

IV. Sykes Lock and Block

23. It was appreciated towards the end of the last century that something more than the simple methods of block telegraph working was desirable for the safe operation of dense traffic. Track circuits were then in their infancy, and the Sykes lock and block and other similar systems were developed to interlock the block instruments with the outdoor signals. The Sykes system is designed to ensure so far as possible :—

(*a*) that a signal controlling the entrance to a block section (the section signal) cannot be cleared for a train unless the train has been accepted by the box in advance ;

(*b*) that once a train has been accepted, a second train cannot be accepted until the first train has passed clear of the section ; and

(*c*) that the signals at any one box are worked in their proper sequence for every train movement past them.

24. Appendix A describes the main working principles of Sykes Lock and Block as it is used in the Western Section of the Southern Region. The detailed application of these principles is subject to considerable variation, depending on the local conditions at each signal box, but it should be noted that a common feature at all Sykes boxes is the provision of a key by which the signalman may release the special Sykes locking in certain circumstances defined by the Regulations.

25. Appendices B and C are relevant extracts from the standard Regulations of the Southern Region for train signalling by the Lock and Block system. They do not differ in principle from the ordinary double line block regulations, and the sequence of block operations and bell signals is much the same, but it will be noted from Appendix B that a very careful procedure is required before a signalman makes use of the releasing key.

26. It will also be noted from (*a*) of Appendix C that under the Sykes Lock and Block Regulations, as indeed under the regulations for ordinary block working, a signalman is not allowed to offer a train forward until he has received "Train Out of Section" for the previous train. In the Western Section, however, (see also (3) of Appendix A) the raised position of the block indicator at the box in rear, with the switch hook over the plunger at the forward box, may mean *either* that no train has been accepted, *or* that a train has entered and is still occupying the section ahead. As with ordinary two-position block, therefore, there is no visual indication to the signalman at the box in rear of the true state of the forward section, and he can only rely on the 2 pause 1 bell signal to tell him that he has received "Train Out of Section".

The arrangement is different in the Eastern and Central Sections, where the block indicator arm stands normally lowered. It is raised by the operation of the plunger at the box in advance, and is lowered again automatically when the plunger is re-set by the pulling and replacing of the relevant signal levers. The switch hook, however, exercises an overriding control of the block indicator at the box in rear, and the forward signalman is required by the regulations to turn the switch hook over the plunger on receiving "Train Entering Section" and to remove it from the plunger when he sends "Train Out of Section". Under this arrangement, therefore, the rear signalman should have a positive visual indication at all times of the state of the forward section, as with ordinary three-position block.

27. As Putney box was switched out of circuit while the freight train was approaching Point Pleasant Junction about 20 minutes before the accident, I should mention that the switching out procedure with lock and block is special in that a "plunge" has to be given from the boxes on either side to enable the signalman at the switching out box to clear his starting signal, and the signalmen at either side then have to re-set their plungers by using their releasing keys. The full procedure is given in Appendix D.

28. On lines signalled by lock and block, enginemen are not required to carry out the full provisions of Rule 55 by going to the box when they are detained at signals. They must, however, sound the engine whistle directly they are brought to a stand.

V. Working of Sykes Lock and Block at Point Pleasant Junction and Barnes Junction

Point Pleasant Junction

29. The Sykes instruments concerned are shown by Fig. 4. The *Down Local "plunging" instrument* to Clapham Junction 'E' is associated with No. 43 lever, which controls the Down Local home for straight running. (It is also associated with levers 41 and 45 which control this signal for divergence to the Down Through or to the branch and with lever 36 controlling the Down Through home for divergence to the Down Local.) The upper of the two indicators on the face of the instrument indicates the Sykes locks on lever No. 43 and others, and displays LOCKED in black letters on a red ground or FREE in white letters on a green ground.

30. The lower indicator works with the plunger. It normally displays a blank white ground, changing to TRAIN ON in black letters on a white ground when the plunger has been operated to accept a train.

With the indicator showing TRAIN ON the plunger is locked. It is freed for a second acceptance by the pulling and replacing of any of the three levers Nos. 41, 43 or 45 controlling the Down Local home. None of these levers can be fully replaced to re-set the plunger until the first train has occupied track circuits AD *and* AV (instead of the more usual treadle).

The operation of the plunger proves through an independent lock that track circuit AD is clear, and that levers 41, 43 and 45 are normal in the frame with the signal aspect at red.

31. I have mentioned that No. 43 lever is locked against full replacement until track circuits AD and AV are occupied. There is also rotation locking between 43 lever and 42 lever which controls the Down Local section signal, and it is indicated by the upper indicator of the plunging instrument. Thus, once lever 43 has been replaced it cannot be pulled again until lever 42 has been pulled and fully replaced, and this cannot be done until the train has operated treadle B beyond 42 signal.

32. The signalman is able to re-set the plunger when TRAIN ON is showing by use of the key in the right hand keyhole of the instrument. The key is ineffective if lever 41, 43, 45 or 42 is out of its normal position and in any case the plunger remains locked unless track circuit AD is clear.

Similarly, he can release the rotation front lock on lever 43 by use of the key in the left hand keyhole, *but only if lever 42 is normal.*

33. The *Down Local section signal instrument* is above No. 42 lever. The one indicator on its face displays LOCKED or FREE in accordance with the state of the Sykes lock (front or back) on 42 lever. The front lock can only be released by a "plunge" from the box in advance ; this is normally Putney, but the releasing circuit is transferred to the Down Local plunger at Barnes East when Putney is switched out, or to Barnes Junction when Putney *and* Barnes East are switched out, as was the situation at the time of the accident. As has been stated, the back lock of 42 lever is normally released by treadle B, but, in the event of a failure of the treadle to release, the back lock can be released by the key. *There is no key release on the front lock.*

The block indicator miniature semaphore arm, which is controlled by the switch hook of the plunging instrument of the next forward box in circuit, is mounted above the main instrument in a separate circular case.

Barnes Junction

34. Fig. 5 shows the Down Sykes instruments at Barnes Junction, and their working follows the same principles. The *Down Local plunging instrument* is the one mainly concerned, and the signals associated with the re-setting of its plunger for a second acceptance are Nos. 48 *and* 47, *or* No. 51.

Once the plunger has been operated to accept a train from Barnes East, Putney or Point Pleasant Junction (which causes the lower indicator of the instrument to go from "blank" to TRAIN ON), it becomes locked *either* until the starting signal 48 *and* the advanced starter 47 have been pulled and replaced, *or*, with the junction set right handed, until the starter 51 has been pulled and replaced. Release of the back lock on 47 is effected by treadle E, and the back lock on 51 is released by the occupation of track circuits A and B.

35. There is the usual rotation locking between signals 48 and 47 (indicated by the upper indicator on the plunging instrument) ; also between signal 51 and signal 40, the back lock of which is released by treadle H.

There is no rotation locking on the Down Local home No. 49, but operation of the Down Local plunger proves No. 49 lever normal, and that the arms of the distant signals 50 and 52 are properly at caution. The arms of signals 50 and 52 and the slot worked by lever 49 are repeated in the box.

36. As at Point Pleasant Junction, the signalman is able to unlock the plunger when TRAIN ON is showing by use of the key in the right hand keyhole, but the key is not effective unless levers 47, 48, 49 and 51 are normal. It can be used in the left hand keyhole to free the front rotation lock of lever 48, but only if 47 is normal.

37. In addition to the special Sykes locking there is the usual mechanical interlocking between the levers at all the boxes, and it follows conventional practice.

VI. Summary of Train Running

38. The account which follows has been compiled from an analysis of all the verbal evidence, including the statements of the motormen of passenger trains which were running on the Down Through line before the accident, and overtook the freight train at different points during its progress on the Down Local line between Clapham Junction and Barnes. These statements, which I am satisfied are reliable, have been considered in conjunction with some times recorded in the guards' journals and in the train register at Clapham Junction 'A' box, which had evidently been kept with much care by the booking lad.

The only other box at which a full train register was being kept at the time of the accident was Grove Park. "Occurrence books" only were being kept at Clapham Junction 'E', Point Pleasant Junction, Barnes Junction and White Hart Crossing.

Running tests to ascertain typical point to point times were also made on the Down Local line with a representative freight train and with a four-coach electric passenger train. The test with the freight train was carried out at night, and it was hauled by the same engine as the train concerned in the accident ; the same driver was in charge, and he was told to work the train just as he had done on the night in question. All the signals were clear for him at Clapham Junction 'E', Point Pleasant Junction and Putney boxes, and the train was brought to a stand at the Barnes Junction home signal 49. This signal was then cleared, and the train was drawn slowly forward to signals 48–51 at danger.

The electric train used for the test was the 11.12 p.m. from Waterloo to Windsor and Chertsey. It was run under clear signals from the booked stop at Clapham Junction as far as the Barnes Junction distant which was kept at caution. The home signal 49 was clear, as it was for the train which was concerned in the accident.

39. On the night of the accident, the services on the Windsor line through Barnes Junction were running a few minutes late in both directions owing to a temporary power failure between 9.30 p.m. and 10.0 p.m. During the half hour or so before the accident occurred, the following Down trains were signalled :—

	Train	*Line from Clapham Junction*	*Approximate time at Barnes Junction*	*Route from Barnes Junction*
A	10.42 p.m. Waterloo–Windsor and Chertsey ...	Local	10.57	Richmond
B	10.38 p.m. Waterloo–Hounslow	Through	10.58	Richmond
C	10.54 p.m. Waterloo–Reading	Through	11.6½	Richmond
D	10.50 p.m. Waterloo–Teddington	Through	11.15½	Richmond
E	10.56 p.m. Waterloo–Hounslow	Through	11.21½	Chiswick
F	11.3 p.m. Waterloo–Kingston	Through	11.27	Richmond
G	11.8 p.m. Waterloo–Hounslow	Through	Stopped at Point Pleasant signal 32 at about 11.25½ p.m.	
H	10.55 p.m. freight Battersea–Brent	Local	In collision at about 11.28 p.m.	
K	11.12 p.m. Waterloo–Windsor and Chertsey ...	Local		

During this period, four Up trains passed through Barnes Junction, two from the Chiswick direction, and two from the Richmond direction, the last of which was a steam-hauled special empty stock train which passed Barnes at approximately 11.22 p.m.

40. The freight train came on to the Windsor line at Clapham Junction 'A' box, where there is a trailing connection with the line from Battersea Yard, and it passed the box at 11.4 p.m., one minute before time. It was booked to run on the Through line thenceforward, but the signalman at Clapham Junction 'A' ran it forward on the Down Local as he had only a short margin behind it on the Down Through on account of the late running. The next train on the Down Local was the 11.12 p.m. from Waterloo to Windsor and Chertsey which collided with the freight train, and it was due to leave Clapham Junction at 11.19 p.m. There was thus a comfortable margin of 15 minutes on the Down Local behind the freight train, and the signalman was fully justified in taking advantage of it in the exercise of his responsibility for traffic regulation. In actual fact the Windsor train stopped at Clapham Junction at about 11.23 p.m., 4 minutes late ; the two trains were therefore 19 minutes apart at Clapham Junction.

41. "Train Entering Section" for the freight train was sent forward from Clapham Junction 'E' to Point Pleasant Junction at approximately 11.7 p.m., on which the signalman there, J. W. G. Davis, offered it forward to Signalman A. T. Blundy at Putney. At this time Blundy was about to switch his box out of circuit so he refused the freight train. The authorised time for him to leave the box was not until 11.45 p.m., and I refer to this point later.

After carrying through his part of the switching out procedure, which established the block section from Point Pleasant Junction to Barnes Junction, Davis again offered the freight train forward ; it was accepted at once by a plunge from Signalman B. C. Parish at Barnes Junction which enabled Davis to clear his Down Local starting signal No. 42. This acceptance was not in dispute.

42. Train D (paragraph 39) ran under clear signals between Clapham Junction and Barnes. It overtook the freight train just beyond Wandsworth Town station, and the motorman stated that it was travelling at "normal goods train speed". This was probably at about 11.10 p.m., and it is likely that "Train Entering Section" was sent by Point Pleasant to Barnes Junction when the train passed the box at about 11.11 p.m. The motorman of Train D also noticed that all the Point Pleasant and Putney Down Local signals were clear for the freight train. The Down Through and Local distant signals of Barnes Junction were, however, at caution. A lengthman, who was "looking out" for a man engaged in drilling rails close to Point Pleasant Junction signal 42, noticed that this signal and the Putney Down Local distant were clear for the freight train, and he saw the two arms fall back after this train had passed.

43. Train E was checked by signals between Clapham Junction and Point Pleasant Junction and was nearly stopped at the Point Pleasant Down Through starter 32 (on account of Train D ahead in the longer block section to Barnes Junction with Putney switched out). The motorman noticed that the Point Pleasant Down Local starter 42 was at danger, and he recollected that he passed the freight train as it was standing at the Barnes Junction Down Local home 49. The guard of Train E recorded 11.21½ as the departure time from Barnes station, so that his train probably passed the standing freight train at about 11.20½ p.m. Assuming that the freight train was just beyond Wandsworth Town station at 11.10 p.m. and adding the running time recorded in the test from that point to the stop at Barnes Junction signal 49, *it seems probable that the freight train concerned in the accident arrived at signal 49 at approximately 11.18 p.m.*

44. Train F was also checked by signals between Clapham Junction and Point Pleasant Junction and was stopped for a short time at the Down Through starter 32 until Train E had cleared the section to Barnes Junction. While this train was standing, the motorman noticed that the Point Pleasant Down Local starter 42 was at danger. All the Barnes Junction Down distants were at caution, but the Down Through home 41 was clear. The motorman recollected that the brake van of the freight train was opposite to this signal when he passed it, also that the Down Local home 49 on the same gantry was clear.

As Train F ran into the Down Through platform at Barnes, the motorman noticed that the engine of the freight train was somewhere about half way along the platform, moving very slowly towards signals 48–51 at danger. The guard booked 11.27 in his journal for the departure time from the station, and on reaching the level crossing about 350 yards beyond the platforms, the train lost the current as the substation circuit breakers were brought out at the instant of the collision. Allowing for the time of 45 seconds recorded in another test for a similar train to reach the level crossing from a standing start from the station, *it seems probable that the collision took place at about 11.28 p.m.*

45. The motormen of trains D and F stated that the brake van of the freight train was carrying three good red lights (i.e. a red tail light and two red side lights) when they passed it at Wandsworth Town and Barnes respectively, and the motorman of Train E referred to "proper three lights". In accordance with Rule 121 the right hand side light should have been changed to white while the train was running on the Local line.

46. I have mentioned in paragraph 43 that in all probability the freight train arrived at signal 49 at about 11.18 p.m., and it is reasonable to assume that the train re-started directly signal 49 was cleared, as its driver, A. R. Nield, stated. In the freight train test (paragraph 38) a time of 3½ minutes was recorded for the engine to reach the point half way along the platform after re-starting from signal 49, and by working back from the time of 11.27 p.m. (paragraph 44) it can be deduced that signal 49 was cleared at approximately 11.23½ p.m. *It is probable, therefore, that the freight train had been standing at signal 49 for 5 or 6 minutes.*

This however was denied by Driver Nield who said that he had been standing at the signal for 1–1½ minutes only ; also by Signalman Parish of Barnes Junction, who stated that he cleared the signal a minute or two after receiving "Train Entering Section" for the freight train from Point Pleasant Junction—i.e. at about 11.13 p.m.

I should mention that it is not usual for trains to be held at signal 49 to await Line Clear ahead or a path across the junction. The usual practice is to hold them at signals 48–51, and with no track circuit at signal 49 it is next to impossible for the Barnes Junction signalman to comply with Rule 39 (a).

47. The 11.12 p.m. train from Waterloo to Windsor and Chertsey was booked to stop at Clapham Junction, running thenceforward on the Down Local line and taking the left hand route at Barnes Junction to Richmond which was the next booked stop.

The train stopped at Clapham Junction at about 11.23 p.m., four minutes late, and the 'A' box register recorded that "Train Out of Section" was received from 'E' box at 11.24 p.m. It is probable that "Train Entering Section" was sent from Clapham Junction 'E' to Point Pleasant Junction between 11.23 and 11.24 p.m.

48. Signalman Davis at Point Pleasant stated that he offered the train forward to Barnes Junction directly he received "Train Entering Section" from Clapham Junction 'E' (this, however, was against the Regulations, as he had not received "Train Out of Section" on the bell from Barnes Junction for the freight train). According to Davis, the train was accepted at once, on which the instrument of his section signal 42 dropped to FREE, and he then cleared the signal. He stated that he sent "Train Entering Section" in the ordinary way as the train passed his box.

At about this time, Train G, which left Clapham Junction at 11.21 or 11.22 p.m., and stopped at Wandsworth Town, was brought to a stand at Point Pleasant signal 32 (Train F ahead). The motorman noticed that the Down Local starter 42 and the Putney distant arm below it were "off", and just as he was stopping at signal 32 the Windsor train passed him at a speed which he estimated was about 45 m.p.h ; the lengthman mentioned in paragraph 42 confirmed that signal 42 was clear for the Windsor train. The motorman of Train G also said that the lights in his train began to flicker soon after he had stopped, and finally went out. Train G was eventually drawn back by a steam engine.

49. From an analysis of the running of Train G, and the point to point times recorded with a representative electric train (paragraph 38), it seems probable that on the night in question the Windsor train passed Point Pleasant Junction box at about 11.25½ p.m. The running time recorded in the test from Point Pleasant box to the site of the collision was 2 minutes 20 seconds, which gives some confirmation to the probability of 11.28 p.m. as the approximate time of the collision. Nor is this time inconsistent with the statement of the motorman of Train G with regard to the failure of the current.

50. As will be seen later, Signalman Parish denied that he received any bell signals from Point Pleasant for the Windsor train. It is known that he did not offer this train forward to White Hart Crossing, but it was established that he offered the freight train to Grove Park and that it was accepted at once. The time of this acceptance was recorded in the Grove Park register as 11.28 p.m.

51. The following is a summary of the more important times mentioned in the foregoing paragraphs. They are probably correct to the nearest ½ minute in either direction :—

FREIGHT TRAIN offered by Point Pleasant to Putney and refused	11.7 p.m.
Putney box switched out	11.8 p.m.
FREIGHT TRAIN accepted from Point Pleasant by Barnes Junction	11.9 p.m.
FREIGHT TRAIN passed Point Pleasant	11.11 p.m.
T.E.S. sent forward to Barnes Junction	
FREIGHT TRAIN arrived at Barnes Junction Down home 49	11.18 p.m.
T.E.S. for WINDSOR TRAIN Clapham Junction 'E' to Point Pleasant	11.23½ p.m.
*WINDSOR TRAIN accepted by Barnes Junction	
Barnes Junction home 49 cleared	
FREIGHT TRAIN re-started	
WINDSOR TRAIN passed Point Pleasant at about 45 m.p.h.	11.25½ p.m.
*T.E.S. sent forward to Barnes Junction	
COLLISION	11.28 p.m.

* Stated by Signalman Davis, Point Pleasant Junction box.

52. The engine of the freight train was jerked forward by the collision. For a minute or so Driver Nield and his fireman apparently did not realise that a serious accident had occurred, but on looking back they saw electrical flashing and fire, on which Driver Nield went to the box and told Signalman Parish what he had seen. Parish then sent "Obstruction Danger" to Point Pleasant, the time of which was recorded in the occurrence books at both boxes as 11.30 p.m. After that Parish went out of the box and made two calls for emergency assistance by dialling 999 from the public telephone box on the Down Local platform. The times of these calls were recorded by the PROSPECT exchange as 11.33 and 11.34 p.m.

VII. Evidence

Trainmen

53. The driver of the freight train was A. R. Nield of Cricklewood Motive Power Depot in the London Midland Region, and he had been working regularly over this route with freight trains since 1939. The fireman was A. W. Feltham, also of Cricklewood.

Nield stated that he had a clear run on the Down Local line from Clapham Junction until he found the Barnes Junction distant at caution and he stopped at the home signal No. 49 at danger. He sounded the whistle very soon after he had stopped and "within a short space of time the signal came off"; he then started the train and "rolled slowly into the station" on the slight falling gradient towards the platform starters 48–51 at danger. He said that he was three or four engine lengths from these signals when the collision occurred; he was in his seat at the time on the left hand side of the footplate and his head was bruised.

Nield went on to say that the fireman, who had been "stunned", looked back from the right hand side and told him that the train was on fire, so he went to the signal box at once and told the signalman what had occurred and to block all roads. He then went to the site of the collision, but owing to the fierceness of the fire he could not get through the bridge, so he returned to the box to get the current cut off, but someone told him that a message about this had already been sent. He then decided to uncouple his train as far back as possible and he drew the front portion forward by arrangement with the signalman.

Nield did not think that he had been standing at signal 49 for more than 1½ minutes, and he said that the signal had been cleared about ½ minute after he had whistled; he could not recollect that any train had passed him on the Down Through while he was stopped. He thought that he had been moving forward very slowly from signal 49 for perhaps three or four minutes, and was still just moving when the collision occurred. He added that it was very unusual to be stopped at the home signal though he had often been stopped at the platform starters to wait for a path across the junction.

It seemed to Nield that the fireman had told him almost at once that the train was on fire. He got down immediately and shouted up to the box from the ground, but he said that he could not get the signalman's attention, so he went into the box. So far as he could recollect the signalman was writing at the time and did not appear to think that there was anything wrong until he was told that the train had been hit from behind and that the van and an electric train were on fire; the signalman then seemed almost "dumbfounded" and immediately put signals to danger and "started ringing his instruments". He stayed in the box for about two minutes and did not think that the signalman had used the telephone during that time.

He looked at the engine headlights after the accident and was satisfied that they were properly alight.

54. Fireman Feltham said that the train was stopped at signal 49 for approximately two minutes, and that an electric train had passed on the Down Through line at somewhere about this place (this was Train E). He said that the signal came off almost at once after Driver Nield had whistled, and the train then drew very slowly forward into the station. He remembered that Driver Nield had told him that it was unusual to be stopped at signal 49.

He confirmed that the engine was still moving very slowly when the collision occurred, and he "knocked his head". On looking back, he saw flames and white and vivid sparks which made him think that his train had been hit by an electric train. At first he said that he saw the flames within a few seconds of the collision. On being questioned on this point he said "not quite immediately" but he was certain that the time was less than 2 or 3 minutes.

55. The guard of the Windsor train, W. E. Jeffery, was travelling in the rearmost brake compartment. He did not see any of the Point Pleasant or Putney signals or the Barnes Junction distant, but he said that he saw through his side lookout window that the Barnes Junction home signal No. 49 was showing a green light. He did not think that the speed had varied much between Clapham Junction and Barnes and it seemed to him that the train was coasting at 30–35 m.p.h. at the time of the collision. He did not notice any application of the brake and he heard no whistle.

He was thrown across the brake compartment and dazed; on recovering himself after "a minute or two" he re-lit his hand lamp and went back to protect the train, but he said he did not get far, perhaps 300 yards, because he was anxious to summon help. After telephoning to "somebody" from Barnes East box to request emergency assistance he helped some people out of the rear coaches, but he said he could not get near the front unit because of the intensity of the flames. He noticed a small fire when he first got out of the train, and said that "it soon became a big fire". He heard a loud explosion as he was going back to protect the train.

56. Motorman G. Peters, who was booked to take the rear two-coach unit forward to Windsor from Staines, was travelling in the second passenger compartment of the third coach in company with Station Foreman S. N. Rogers, who was on his way home after duty at Waterloo. Peters said that the journey seemed normal as far as Barnes and, like Guard Jeffery, thought that the train was running at 30–35 m.p.h. at the time of the collision, but he referred to a trembling or shuddering in the instant before the collision, which suggested to him that the motorman might have braked at the last moment, possibly by letting go the dead man's handle.

He and Rogers then went forward and tried to extricate a man who was pinned under the leading coach, and they were engaged in this task when violent arcing commenced, so he fetched a short circuiting bar from

the motorman's compartment at the rear of the second coach, and he tried to get it across the Down Through conductor rail and the adjacent running rail. It was burnt through at once so he got another short circuiting bar from the rear unit and this time managed to connect it firmly across. As has been mentioned, this action succeeded in opening the Down Through circuit breaker at Clapham Junction substation to remove the current finally from the Down Through line and stop the arcing. The time at which this circuit breaker came out was recorded in the substation log as 11.34 p.m.

Marks of burning on the rails suggested that an unsuccessful attempt had been made to apply a short circuiting bar to the Up Through line, and Peters said that someone whom he did not know had tried to use a burnt out part of his "first" short circuiting bar in this way.

57. Station Foreman Rogers also said that there was no fire or arcing until he got to the bridge. He helped the police to get a passenger out of the burning wreckage and then ran forward to the signal box and asked Parish if he had called for the emergency services and for the current to be cut off. Parish had replied that he had already done so. Rogers then returned to the site and on his way heard some explosions which sounded as if they were caused by detonators.

Signalmen

58. The statements of the signalmen at Clapham Junction 'A' and Clapham Junction 'E' boxes were of service to establish some of the facts and times recorded in paragraphs 39–51, but otherwise they had no bearing on the accident. Barnes East had been switched out at or about the authorised time of 9.45 p.m., nearly two hours before the collision, and does not come into the story. Putney box, however, had been switched out by Signalman Blundy about 20 minutes before the collision and well before the authorised time, and the freight train concerned was the first to enter the lengthened block section on the Down Local line from Point Pleasant Junction to Barnes Junction. Blundy's evidence, therefore, has some relevance.

59. Signalman A. T. Blundy, who is 50 years of age, became a Special Class relief signalman in 1951. He knew Putney box well, and had been booked for duty there at 3.45 p.m. on the day of the accident (Friday), also on the Monday, Tuesday and Wednesday of that week. The authorised time for him to leave duty was 11.45 p.m., but on busy lines such as this a latitude of ½ hour or so on either side is allowed to enable the signalman to seize an opportunity for switching out when all the sections are clear—see Appendix D.

Blundy said that he had closed on the Through lines at about 11.7 p.m., after the 10.54 p.m. train from Waterloo to Reading (Train C) and the 9.58 p.m. train from Reading to Waterloo had cleared the forward sections to Barnes Junction and Point Pleasant respectively. He had closed on the Local lines at about 11.9 p.m., directly after the 10.40 p.m. Up train from Teddington to Waterloo had cleared the section to Point Pleasant ; the last train on the Down Local line had been the 10.42 p.m. from Waterloo to Windsor (Train A) which cleared Barnes Junction at about 10.57 p.m. He added that in order to keep the Down Local line clear for switching out he had refused the freight train when it was offered to him from Point Pleasant at about 11.7 p.m., and as will be seen later this was confirmed by Signalman Davis. He was sure that he had followed the correct switching out procedure including verification by telephone that the block and bell communication had been established between Point Pleasant Junction and Barnes Junction.

After switching out he left the box and eventually took Train F on the Down Through to go home to Twickenham ; this train stopped at Putney at about 11.24 p.m. He recollected having seen the freight train pass through Putney on the Down Local line, he thought after he had left the box, and he noticed it moving into the Down Local platform as Train F entered Barnes station. On passing Barnes substation he saw a flash which suggested that a circuit breaker had come out, and shortly after that his train lost the current.

60. In an attempt to conceal the fact that he had closed the box before time, Blundy made the false entry of 11.28 p.m. in his occurrence book. The time at which Putney box closed was not entered in the Point Pleasant occurrence book until after the accident, and Signalman Davis then recorded 11.5 p.m., but he subsequently altered this entry to 11.12 p.m.—see below. Signalman Parish at Barnes Junction did not enter the Putney closing time in his occurrence book until Blundy telephoned to him from Twickenham, having heard of the accident on his arrival there. By agreement with Blundy, Parish then recorded the time of 11.12 p.m. On being asked the reason for this conversation, Blundy stated that it was obvious that he was "in the wrong place" at Twickenham at 11.39 or 11.40 p.m. and that when he heard of the accident he knew very well that the truth would have to come out.

He admitted that he had closed Putney before time on the Monday, Tuesday and Wednesday, he thought at about 11.18 p.m., and he had persuaded Signalman Davis to record the false time of 11.28 p.m. on each occasion. The only record at the other end was 11.28 p.m. on the Wednesday at Barnes East, which was in circuit at the time.

After the telephone conversation with Parish, Blundy went by road from Twickenham to Barnes with an Inspector, and opened Barnes East box. Later on he telephoned from there to Signalman Davis and asked him to record 11.12 p.m. as the Putney closing time so as to agree with the record at Barnes Junction. It was for this reason that Davis altered the entry in the Point Pleasant occurrence book from 11.5 p.m. to 11.12 p.m.

As a reason for leaving the box early all that week, Blundy said that he had been accustomed to working in power boxes, and referred to the "harder physical conditions" with the manual frame at Putney. He thought that there was no great harm in what he had done, and did not think that traffic should have been delayed by the longer block section even though trains were running out of course. In actual fact two trains on the Down Through (E and F) were severely checked or stopped from this cause at the Point Pleasant Down starter No. 32.

61. *Point Pleasant Junction box* is double manned during the traffic peaks, one man signalling the Up and the other the Down lines. Signalman J. W. G. Davis, who is 42 years of age and has been in the Special A Class since 1951, had taken duty in sole charge at 10.0 p.m., and he was due to work until 6.0 a.m. He had worked in this box for about three years.

Davis referred to the current failure (paragraph 39) which had caused some delay to traffic before he took charge, but he said that after that there were no delays or failures up to the time of the accident, and that all his instruments and levers were working normally. At about 11.0 p.m. Blundy asked him to divert Train D from the Through to the Local line to enable Putney to switch out. He assented at first, but "immediately" afterwards he was offered, and accepted, the freight train from Clapham Junction 'E' on the Down Local, and realised that traffic would be delayed if Train D was diverted to the Local line behind the freight train. He therefore told Blundy that he could not make the diversion.

On receiving "Train Entering Section" for the freight train he offered it to Putney but it was refused, from which Davis assumed that Blundy was just going to switch out. He thought that the switching out procedure had taken 1-1½ minutes, and he was satisfied that it was carried out correctly, though he stated later that he did not test the operation of the switch hook-block indicator circuit with Barnes Junction, also that he took a "short cut" with the testing of the bells, by exchanging the "Train Out of Section" signal (2 pause 1) instead of 16 beats consecutively as laid down.

Directly Putney had switched out he offered the freight train to Barnes Junction and he said that it was approaching the box at the time. It was accepted at once, on which the instrument of No. 42 lever dropped to FREE, and he then cleared the signal. He could not specifically remember having seen the block indicator semaphore move in response to his "Train Entering Section" signal, but he said that it was his duty to watch for this, and he thought, therefore, that the semaphore must have gone up.

62. With regard to the Windsor train, Davis said that he offered it forward to Barnes Junction directly he received "Train Entering Section" from Clapham Junction 'E'. It was accepted without any delay by the usual repetition of the "Is Line Clear" bell signal, on which the instrument of No. 42 lever again dropped to FREE and he again cleared the signals. He agreed that, as things had turned out, he must have offered the train forward without having received "Train Out-of Section" for the freight train. He realised that it was his duty under the Regulations to wait for "Train Out of Section" before offering another train forward, and he said that he would normally follow this course, but he added "if a certain time elapses I would offer the train forward and rely on the signalman at the other end to refuse to accept it if he was not in a position to do so".

Davis thought that even in a busy box such as this he could be certain of picking out the right "Train Out of Section" bell signal and he added "there are a number of bells ringing, sometimes we can hear bells ringing in all directions, but we are there to pick them out and after a certain time elapsing I assumed that I had got that one as well". The following is a further extract from his evidence at my Inquiry :—

"Q. So really not having received that signal you should not have warned the Windsor train forward ?

A. That way you put it, I should not have done.

Q. But it does not seem to lie very heavily on your conscience ?

A. Well, I offered the train, I got the clear and I was working normally, I had not the faintest idea that anything was wrong".

Thus the main burden of Davis' evidence was that the Windsor train was accepted by Barnes Junction in the ordinary course of the Sykes block working and that his instruments and levers were working normally. He stated that he sent "Train Entering Section" as the train passed his box at the usual speed of 40–45 m.p.h., and that he did not know that anything was wrong until he received the "Obstruction Danger" signal from Barnes Junction at 11.30 p.m. Soon after that he saw some electrical flashing from the Barnes direction.

63. At the Regional Inquiry Davis said that just after he received "Obstruction Danger" Signalman Parish rang him from Barnes Junction and that the following conversation took place, so far as he could remember:—

"Parish : What is down the Local line ?

Davis : You have got a Windsor going down the Local.

Parish : No I have not, I have got a goods.

Davis : You have got a Windsor."

Davis said that "the 'phone then stopped" and he recollected that at the time of this conversation Train G was standing at the Down Through starter No. 32, awaiting "Line Clear".

At my Inquiry, ten days later, Davis said that he thought that this conversation took place *before* the "Obstruction Danger" signal, though he could not be absolutely certain of his memory after the lapse of time. He also referred to another telephone conversation a short time before the " Obstruction Danger " in which Parish had said that he had "heard a bang and was going out to look ", and Davis judged that the "Obstruction Danger" signal was sent after Parish had returned to the box. He recollected a third conversation "some time after" in which Parish had said "the Windsor is into the back of the goods" ; Davis thought that he himself had probably initiated this last conversation in order to find out what was the cause of the "Obstruction Danger" signal, and he added that this was the first time "he realised how things were". He had not thought from the first conversation that there was any dangerous confusion in Parish's mind, and the possibility that there were two trains in the section had not occurred to him, since "everything was normal" at Point Pleasant and he was in no difficulty himself. He said, however, that it was unusual to receive a query of this kind, especially from Parish.

64. Signalman Davis said that he had always had every confidence in the working of the Sykes apparatus at Point Pleasant Junction. He had had to report failures from time to time, but they had always been attended to by the lineman.

65. *Barnes Junction box* is double manned from 7.10 a.m. to 11.0 a.m. and from 4.10 p.m. to 8.0 p.m. on Mondays to Fridays inclusive, and a full train register is kept by a booking lad from 6.30 a.m. to 9.10 p.m. On the night in question, Signalman B. C. Parish had taken duty in sole charge at 10.0 p.m. and was due to work until 6 a.m. He is 31 years of age, and was first appointed to signal box duty in 1949, twelve months after he had joined the service ; he made rapid progress and reached the Special 'A' Class in November 1952. He had worked at Barnes Junction box since July 1952 and before that he had worked for a time at Barnes East.

66. Parish stated that traffic was running fairly normally in spite of the power failure just before 10.0 p.m. He was, however, working under more pressure than usual as the trains were running through the junction out of their regular order, and he had to improvise the crossing movements on the spot. It will be noted from paragraph 39 that during the half hour before the accident he had dealt with four Up and seven Down trains including the freight train. As will be seen later he denied that the Windsor train was ever offered to him from Point Pleasant Junction.

67. He was satisfied that the closing of Putney box was carried out correctly. On receiving the closing signal (7-5-5) he gave a "Free" on the Down lines to Putney by operating the plungers, and after giving time for Blundy to clear his signals and pull out his switches, he exchanged "Train Out of Section" with Point Pleasant to test the bells (instead of the 16 consecutive beats on the bell laid down—see also paragraph 61). He then used the releasing key to restore the Down plunging instruments from TRAIN ON to "blank".

Parish thought that Putney had switched out at about 11.12 p.m., but he could not be certain to a minute or two, and he did not record the time in the occurrence book until after the accident—see also paragraph 60.

68. He said that the freight train was offered to him from Point Pleasant on the Down Local at about the same time as Train D on the Down Through (this was probably at about 11.9 p.m.). He also said that he received "Train Entering Section" for Train D almost at once and for the freight train 1–1½ minutes later, and he thought that he must have turned the switch hooks over the plungers as usual.

After receiving "Train Entering Section" for the freight train he went to another part of the frame as he was busy with Up traffic. He did not, therefore, clear signal 49 at once to let the train into the station to wait for a path across the junction as he would ordinarily have done. So far as he could remember he had cleared the signals for Train D to go through to the Richmond direction, and he had cleared signal 49 for the freight train "a few minutes" after receiving "Train Entering Section". He did not think that the train had been stopped at signal 49, and he heard no whistle from the engine. I should mention in this connection that a test was made with the whistle of the same engine standing in a siding close to signal 49, and I found it very difficult to hear the sound from inside Barnes Junction box with the windows closed.

Parish stated that the freight train was coming to a stand in the station when Train F arrived at about 11.25 p.m. (Train F actually stopped at the station at about 11.27 p.m.). He also said that he offered the freight train to Grove Park directly he received "Train Out of Section" for Train E, and that it was accepted at once, but he could not let it go across the junction until Train F had gone by on the Down Through to the Richmond direction.

Signalman A. Ketchell at *Grove Park*, however, recorded 11.25 p.m. in his register for "Train Out of Section" for Train E, and 11.28 p.m. for the acceptance of the freight train, and he was certain that there was an interval of 2½–3 minutes between these two block signals. On this point Parish said that he would not question the accuracy of Ketchell's booking.

69. Parish strongly denied that he had received any block signals for the Windsor train, neither "Is Line Clear" nor "Train Entering Section", and he said that his first intimation that anything was wrong was when Driver Nield shouted up to him "I have had a bang in the back", and he denied that Nield had failed to gain his attention from the ground.

He stated that he did not realise at this stage that anything serious had happened, but before "he could do anything else" the driver came into the box and told him that he had been knocked across the cab, and at the same time a porter from the station shouted that there was a fire, on which the driver had said "That is my van on fire". He then realised that something more serious had occurred than he had first understood, and telephoned to Point Pleasant to say that he was going down "to see what was wrong with the train". Signalman Davis had asked "Which train ?", and he replied "The goods" on which Davis had answered "Righto!".

He then went out of the box and had not gone far when he met a passenger who said "Get an ambulance, someone is injured", so he dialled 999 from the public call box on the Down Local platform and asked for an ambulance. He said that on coming out of the telephone box he looked up the line and saw "one mass of flames", so he returned to the telephone and again dialled 999 asking for Fire Brigades and the Police and repeating his request for ambulances. It was established (see later) that these two calls were made at 11.33 and 11.34 p.m.

He then returned to the box and again spoke to Point Pleasant Junction. He told Davis that something had hit the freight train, on which Davis had replied "You have got the Windsor down there somewhere", and Parish had answered "Well, I did not clear you for the Windsor" or words to that effect.

Parish said that he put signal 49 to danger and sent "Obstruction Danger" to Point Pleasant directly he heard there was a fire (recorded in both boxes as 11.30 p.m.) and to White Hart Lane when he returned to the box after calling for the emergency services. He did not send "Obstruction Danger" to Grove Park.

On returning to the box he also tried to telephone to the Barnes electrical substation, and was answered eventually by the signalman in the Windsor line crossing box. He said that this was at about 11.35 p.m., and he told the signalman that he wanted the current cut off from all roads immediately.

With regard to the two telephone conversations with Davis, Parish stated at the Regional Inquiry that he told Davis he was going down to see what was wrong with the freight train, after the porter and Driver Nield had told him there was a fire. At my Inquiry, however, he said that this conversation took place just after Nield had come into the box and before he had been told that anything serious had happened. He said on both occasions that the second conversation had taken place when he returned to the box after calling the emergency services, i.e. some time after the "Obstruction Danger" signal to Point Pleasant, and he made no reference to a third conversation with Davis.

70. In reply to questions, Parish repeated that he had cleared signal 49 "one or two minutes at most" after receiving "Train Entering Section" for the freight train (i.e. at about 11.13 p.m. at the latest) and he therefore did not think that the train could possibly have been stopped at the signal. On being informed that it was known that the freight train had been stopped at signal 49, he stated that the lever was over at the frame

and that the slot repeater was showing "off", and he could only suggest that the signal arm had failed to respond to the action of the slot, and had eventually been jerked "off", either when he replaced the Down Through home 41 on the same gantry behind Train E, or cleared it again for Train F (this would have been at 11.20 or 11.21 p.m.). He said that this had happened on previous occasions when Barnes East was out of circuit, but not while he was acting as signalman, and that he had been called out as flagman two or three months ago in connection with a slot failure on this gantry.

He was confident that he had not at any time overlooked the freight train under pressure of traffic, and that he had not used the releasing key to plunge for the Windsor train on an offer from Davis at Point Pleasant. He also said that he could not have cleared signal 49 with the intention of bringing the Windsor train forward "because I saw the freight train before the 11.3 p.m. (Train F) ran into the station. The accident was some minutes afterwards ". (In actual fact Train F ran into the station at about 11.27 p.m. and the accident occurred 1–1½ minutes later.)

He thought that the freight train had been standing in the platform for a couple of minutes before the accident, and on being asked why he had left 49 signal off during this time he replied that there was no immediate hurry and he had other things to do. As the freight train was still moving when the collision occurred, Parish could not have seen it for very long before, and when this point was put to him he replied "I should only have needed to see it for a fraction of a second. The head lamps would have woken me up straight away".

71. In order to show that he had never at any time forgotten the presence of the goods train he mentioned that, on offering Train F to White Hart Lane, the signalman there had rung him to clarify the offer as he was expecting the Windsor train, and Parish said that he had told him "He would not get the Windsor yet as he had a goods to cross behind the 11.3 p.m." He thought that Train F was in the platform (11.27 p.m.) when he offered it forward to White Hart Lane, but he corrected himself later and said that the offer should have been made at about 11.20 p.m. or 11.21 p.m., i.e. when he received "Train Entering Section" for the train from Point Pleasant Junction. He therefore considered that this conversation proved that he was aware of the presence of the freight train at least eight minutes before the accident.

72. Notwithstanding Signalman Davis' evidence about the offer and acceptance of the Windsor train, Parish could only account for its presence in the section by suggesting that the lever of the Point Pleasant Down Local starter had been freed falsely by some defect in the equipment, although he said that the instruments and levers were working properly at the time to the best of his knowledge. He was not, however, satisfied with the tests which were subsequently made by the Signal and Telecommunications staff; he said that they had not tested the bells and he referred to previous troubles of various kinds with the instruments. "So far as he knew" he had reported them and they had been put right.

73. Signalman Parish was pressed further on the matter of Signalman Davis' evidence. He was asked whether it was possible that he might have overlooked the freight train momentarily under pressure of traffic when the Windsor train was offered to him, and have assumed from the TRAIN ON indication that he had forgotten to "key out" the instrument after Putney had switched out—and that he might then have used the key to unlock the plunger and accept the Windsor train. Parish replied that this "was of course a possibility", but he was confident that he had not made such a mistake, and he added that if he had received "Train Entering Section" for the Windsor train he could have avoided the accident by placing signal 49 to danger and running back with detonators and a hand lamp before the train "could have been there".

74. Signalman D. T. Maher was on duty at *White Hart Lane* (no train register). He said that Train D passed him on the Down line at 11.17 or 11.18 p.m. A little later a train (F) was offered to him from Barnes Junction by the 3 pause 1 stopping train bell code. He was expecting the Windsor train at that time (1 pause 3), so he telephoned to Parish to verify the offer, and he noted at that moment that his clock was exactly at 11.25 p.m. Parish had told him that the offer was correct, and had added "You will have the Windsor after, I have a goods waiting, but I cannot stop as I have still got the empties on the Up Local". (This must have been the 10.46 p.m. steam hauled special empty stock train from Strawberry Hill to Clapham Junction, and according to the guard's journal it passed Barnes at 11.22 p.m.).

The next thing Maher noticed was a train going by on the Down line with no lights just as he was having a conversation with the Mortlake signalman about train running. At first he thought that it might be an empty train, but he saw the lights come on again and he realised it was Train F. He gave "Train Out of Section" to Barnes Junction, and after that no more Down trains were offered to him.

At about 11.29 p.m. Maher offered an Up Windsor train to Barnes Junction, but received no acknowledgment. He offered it again about two minutes later and again received no acknowledgment, so he telephoned to Parish "I have got the Up Windsor here", on which Parish had replied "You will have to hold it for a while, I have got a blow out". According to Maher nothing more was said and he received "Obstruction Danger" from Barnes Junction at 11.32 or 11.33 p.m.

Signalman A. C. Noke, who was on duty at *Mortlake* box, said that after he received " Train Entering Section" for Train F Maher rang him to say that "the train looked more like empties than a passenger". Noke said that Maher had told him at the same time of the conversation he had had with Parish.

75. Area Inspector G. Brant is responsible for the supervision of 115 signalmen in 42 boxes in the Twickenham area, and he said that he would in the ordinary course visit Barnes Junction and Point Pleasant Junction about twice a week. He spoke highly of Signalman Parish's capabilities which had enabled him to be recommended for quick promotion to the Special 'A' Class, and he mentioned that Parish was in the habit of attending the block signalling and rules and regulations classes in his spare time. Mr. Brant stated that Parish had last been examined in the rules and regulations on 22nd July 1955 by the Relief Area Inspector with satisfactory results.

Mr. Brant also spoke well of Signalman Davis. He had taught him his first signal box many years ago and had followed his career ever since. He did not think Davis had the same opportunities as Parish for attending classes in his spare time on account of family ties, but he was entirely satisfied with his work. He had last examined him in the rules and regulations on 25th April 1955.

He did not know Signalman Blundy so well, as he was a relief signalman and had done most of his work in the London Inspector's area. With regard to the switching out of Putney box before time, Mr. Brant said that he had no means of detecting this if false entries were made in the books.

Mr. Brant said that he had had some troubles with failures of the equipment in the 30 Sykes boxes in his area, including Barnes Junction and Point Pleasant Junction, but he was entirely satisfied with the prompt attention which had been given to failures by the signal maintenance staff.

Signalling Equipment

76. Tests of the signalling equipment were carried out after the accident by Inspector S. A. Attle, Sub-Inspector J. W. D. Burden and Chief Lineman R. McGovern under the general direction of Mr. L. J. Boucher, the Signal Engineer of the Southern Region.

It so happened that Chief Lineman McGovern arrived at Point Pleasant Junction box two or three minutes after the accident, having gone there to make some routine cable tests. Davis told him that he had just received "Obstruction Danger" from Barnes Junction, and that "The Windsor had run into the back of a goods train". McGovern asked him if he had received "Train Out of Section", and Davis had replied "Well, I received a clear".

McGovern noted that all the levers were normal in the frame and that the Down Local starter (42) instrument was showing LOCKED with the semaphore arm up. He then went to the site of the accident by car where he met Sub-Inspector Burden, and they decided to send for Inspector Attle. Later on McGovern went into Barnes Junction box where Parish told him that he had accepted the freight train just after Putney box had been switched out, but they had no conversation about the cause of the accident. McGovern subsequently assisted Inspector Attle and Sub-Inspector Burden with tests at Point Pleasant and at Barnes Junction.

77. Sub-Inspector Burden arrived at Barnes at 12.45 a.m. He first went to the scene of the accident and then came back to the box. He found levers 48, 49, 50 and 52 normal in the frame with their repeaters showing "on". The upper tablet of the Down Local plunging instrument over 48 lever was showing LOCKED and the lower tablet was "blank" (this position had been brought about by 48 lever having been used after the accident to draw the freight train forward, but not 47 lever). He found that the Down Local plunger was locked.

Mr. Burden said that he had no conversation with Signalman Parish, and he then went to Point Pleasant Junction box by car, leaving McGovern at Barnes Junction. On arrival at Point Pleasant he found the instrument of the Down Local starter 42 at LOCKED, with the lever normal. He tried to pull the lever, forcing it against the lock, but was unable to do so. He then asked for Barnes East and Putney boxes to be switched out (they had been opened in the meantime) and asked McGovern at Barnes Junction to give him a "plunge" for the Down Local. This plunge dropped the Point Pleasant section instrument to FREE, as it should have done, on which Mr. Burden pulled 42 lever. On trying to replace it he found it correctly back locked, so he released the "treadle" back lock with the key, and he replaced the lever fully to normal, on which the instrument went to LOCKED ; he tried to pull lever 42 again, but could not do so. He had slammed the lever back hard to see if the jerk would drop the instrument to FREE but it did not do so. He said that this might possibly happen with "misuse of the equipment" but he had never known the front lock of a section signal to be freed in this way. Mr. Burden added that the only way in which he thought a section instrument could be freed falsely was by accidental contact between line wires if one was broken during a severe storm "or other mishap".

78. Inspector Attle arrived at Barnes Junction with Mr. Boucher at 2.45 a.m. They did no testing there at the time, and went on to join Mr. Burden at Point Pleasant. Mr. Attle said that he had found all the instrument cases at Point Pleasant securely padlocked. He obtained a plunge from Barnes Junction several times, and made several tests of the front and back locks on 42 lever, just as Mr. Burden had done, and he examined the condition of the tappet locks under the frame.

He then tested the "hold up" strength of the permanent magnet of the section instrument No. 42, though he had never known a "false clear" to be caused by a weak magnet ; he also verified the armature clearance, and tested the releasing coils for continuity and insulation. He then gave his attention to the block line wires, which are in a fairly new cable between Point Pleasant and Barnes East, and on poles for the 400 yards thence-forward to Barnes Junction. The block circuits are metallic throughout with no earth return, and Mr. Attle used a megger to test the insulation resistance between the wires and between each wire and earth. He was assisted by Mr. Burden in all of the tests and examinations at Point Pleasant, and both men said that they proved entirely satisfactory, with a minimum insulation resistance of 600,000 ohms on the line wires and all their associated apparatus.

Mr. Attle also verified that the Down Local switch hook-block indicator circuit was working properly, but he did not make any specific test of the bells because he considered that they had already been well tested by the switching in and out of Barnes East and Putney boxes.

79. Examinations and tests at Barnes Junction were made by Sub-Inspector Burden at first daylight on Saturday 3rd December, and again on the Sunday morning. He found the Down Local plunging instrument in good order, with no possibility that a false contact could have occurred to energise the "plunge" line to Point Pleasant. The independent plunger lock circuit which proves lever 49 normal and the distant arms 50 and 52 at caution was in order, also the lever tappet locks. Mr. Burden also verified that the plunger became locked after use, and was properly re-set by the pulling and replacing of the relevant signal levers (paragraph 34).

80. Mr. Boucher was present at most of these tests, and he was fully satisfied that the Point Pleasant Down Local starting signal lever No. 42 could only have been freed of its lock by the closing of the line contacts at Barnes Junction by manual depression of the plunger. He was sure that the release could not have been brought about by a stray current, and at my subsequent examination of typical Sykes instruments and lever locks, he demonstrated to me that the circuits are specially arranged to ensure that current from the line battery only can be applied to the magnet releasing coils when the section signal lever is normal, and treadle battery current

only (to release the back lock) when the lever is reversed. A vertically sliding changeover switch, worked by a second rod connecting the lever to the instrument is used for the purpose and, as a further precaution, the line and treadle circuits are taken through lever contacts, which are "made" in the normal and reversed positions respectively.

81. In view of the complaints about the unreliability of the Sykes apparatus which were made by Signalman Parish, and by Signalman Blundy, I asked for the failure records in the Barnes area to be reviewed, and a detailed statement was furnished by Mr. Boucher of all the failures of signalling equipment which had been reported at Barnes Junction, Barnes East, Putney and Point Pleasant Junction boxes during the 25 months from November 1953 to November 1955 inclusive. The total number of failures recorded during this period was 238 for the four boxes, or 2·38 failures per box per month, and of this total 171 had nothing to do with the Sykes apparatus and were typical of all mechanical signalling installations.

The remaining 67 failures affected the Sykes instruments and lever locks and the block bells (·67 per box per month). There were 32 instances of failure of the plunger to free the section instrument of the box in rear, and most of the remaining 35 Sykes locking failures were failures of the rotation locking succession to free the front locks of signal levers, and failures of the treadles to free the back locks ; the main causes were faulty contacts, disconnections, weak batteries and maladjustment of the Sykes mechanical linkage. In 13 cases the signalman would have had to use the releasing key to overcome the failure, but no record is kept of the many more occasions on which the signalmen have to use the key in connection with train operation or switching out—see Appendices A and B.

82. Six of the 67 failures of the Sykes apparatus were, however, on the wrong or danger side, and were in consequence investigated with special care by the Signal Department. The following are some details :—

	Signalman reported	*Summary of Signal Department record*
BARNES EAST		
(1) 21.12.54	Backlock of Up Through Advanced Starter wrongly freed with lever reversed.	Failure verified. Water in treadle. Drain hole choked.
PUTNEY		
(2) 29.10.54	Backlock of Down Local Advanced Starter wrongly freed with lever reversed.	Failure not repeated on test, but treadle line insulation bad. Line renewed.
(3) 29.10.54	Backlock of Down Through Starter wrongly freed with lever reversed.	Failure verified. Broken arm in treadle. Made good.
(4) 31.10.54	Instrument of Down Through Advanced Starter "dropped to free".	Failure verified. A broken cotter pin had allowed a fork screw to work out, so disconnecting the vertical rod between the lever and the instrument.
POINT PLEASANT JUNCTION		
(5) 26.10.54	Instrument of Down Local Starter (No. 42) "dropped to free" on slamming the lever hard back.	Failure not repeated on test. Considered possible that armature might have failed to "latch up". Armature slightly "slack" and armature bedplate slightly worn. Instrument changed as a precaution.
(6) 26.10.54	Backlock of Down Through home (No. 33) failed to hold up on "pulling off" for 7.8 a.m. train Waterloo–Windsor.	Failure not repeated on test. Signal Dept. fitter could find no fault with the instrument, but it was changed as a precaution.

No wrong side failure was recorded during the 25 months at Barnes Junction.

It will be noted that (1) and (3) above were due to false energisation of the treadle line which released the back locks, and (2) was probably an intermittent failure by a similar cause. No. (4) was a simple mechanical disconnection in an exposed position which should have been immediately obvious to the signalman. Failures (5) and (6) at Point Pleasant Junction were not repeated at very careful tests by the Signal Department, but it was considered that both might possibly have been due to slight mechanical slackness in the instrument.

83. Mr. Boucher would not say that he could be satisfied with this two year record, but he considered that the number of failures of all kinds reported from the four boxes was not excessive having regard to the intensive use of the apparatus on this densely occupied line, and he added that the treadles and their circuits had always been a weak point in the Sykes equipment. He also considered that Sykes apparatus as a whole was inclined to be more troublesome to maintain than modern electrical signalling on account of its mechanical complexity. Long experience had not, however, shown that there was any serious risk of false energisation of the circuits by stray traction currents ; he had never known a block (plunger) line to be affected in this way, but he thought it just possible that a stray earth current might get on to a treadle line to release a back lock if good insulation was not maintained.

84. On account of Signalman Parish's suggestion that the arm of the Down Local home signal might not have responded at once to the pulling of his slot lever No. 49 (paragraph 70), Mr. Boucher arranged for thorough tests of the slot mechanism (which was renewed about two years ago), and he said that the arm had responded correctly at the tests to the lever movements at Barnes Junction box. He added that a failure of this kind was not impossible, but that it could only happen during severe frost or after a long period of neglect,

and he was satisfied that regular attention had been given to cleaning and oiling of the mechanism. There was no record that a slot failure had occurred on the gantry two or three months before the accident, as Signalman Parish alleged.

Electric Current

85. For the supply of current, the electrically separated section of four track line concerned was between the Clapham Junction and Barnes rotary converter substations. These two substations are nearly 3½ miles apart, and the site of the collision was approximately 3 miles from the former and ½ mile from the latter. Each substation feeds direct current at 650 volts towards the other along the conductor rails, and there is a separate feeder connected through a circuit breaker to the D.C. bus bars for each of the four tracks. There is no intermediate set of track paralleling circuit breakers (track paralleling hut).

These substations were built in 1915, and the D.C. circuit breakers are of relatively slow speed type. Owing to the heavy traffic on this route they have to be set to trip out at a current value which is very near to that which would be passed through the resistance of the conductor rails by a short circuit at the distant end of the section.

The substations in this area are under continual supervision, by means of direct telephone lines, from the electrical control centre at Raynes Park.

86. In order to minimise delays to traffic by transient short circuits, which are fairly frequent on conductor rail systems, the substation attendants are required by the standing instructions to carry out the following procedure when a track feeder circuit breaker is opened automatically :—

(*a*) Close circuit breaker immediately.

(*b*) If circuit breaker re-opens, re-close after one minute.

(*c*) If circuit breaker re-opens, re-close after two minutes.

(*d*) If circuit breaker re-opens, leave open and communicate with the adjacent substation and ascertain if the corresponding circuit breaker has opened there. If not, ask for it to be opened.

This form of procedure, with variations, is generally adopted at railway substations.

I was informed that during the four weeks 23rd October to 19th November 1955 track feeder circuit breakers had been tripped out automatically on short circuit on 187 occasions on the whole of the electrified lines of the Southern Region. Of these short circuits, only ten had persisted after the three attempts to re-close the circuit breaker in accordance with the routine.

87. *At Barnes substation*, only one of the three rotary converter machines was on load at the time. Substation Attendant C. A. Clark said that at 11.29 p.m., as recorded in his log, the Down Local and Down Through circuit breakers Nos. 20 and 18, which feed towards Clapham Junction, opened on heavy short circuit. The surge of current also tripped out the circuit breakers on the A.C. side of the machine, causing it to shut down. Clark then attempted to close the two D.C. circuit breakers in accordance with the standing instructions, but they came out again at once, and he noticed that the Down Through "pilot light" was flickering, indicating that the Down Through circuit breaker at Clapham Junction was still closed. He realised from the flickering pilot light that something was seriously wrong, but he knew nothing of the cause (he was unable to see the flashing at the site from inside the substation).

He then closed the A.C. circuit breakers and "ran up" the machine again to maintain the feed on the unaffected lines to the westward, and reported the position to the Raynes Park Control, recording the time of this report as 11.31 p.m. At 11.32 p.m. a Porter Palfrey arrived and told him to take the current off as there was a bad crash and fire at the station. He then went to telephone to Clapham Junction substation just as Clapham Junction was ringing him, and in reference to this conversation he stated "When Clapham Junction rang me whilst Porter Palfrey was in the substation, I suddenly realised that the pilot light flickering I had previously seen indicated something was wrong, and I got on to Clapham Junction. As I went to get to the 'phone he was ringing me. He said 'I have just come out on short circuit on the Down Through, and on Down Local—I had to open by hand' ". Clark said that the time was then 11.34 or 11.35 p.m.

On being asked if he did not think of telling the Clapham Junction attendant to pull out his Down Through circuit breaker when he saw the pilot light on his own Down Through breaker was flickering, he replied "I did not have much time. By the time I had initially closed the circuit breakers and they had opened again the time had elapsed". He could not remember getting a ring from Clapham Junction at about this time, but he was sure that he had reported the position at Barnes to the Raynes Park Control at 11.31 p.m.

He did not understand from Porter Palfrey that it was necessary to open the two Up line circuit breakers, and he said that there was no indication in the substation of interference with Up line current. At 11.49 p.m., however, he received a telephone call from Clapham Junction substation telling him to cut off the current from the Up lines, at the same time as Relief Signalman Barnes came in from the Windsor line gate box and told him to take the current off all roads. He then opened the Up line circuit breakers by hand and again informed the Raynes Park Control of the position.

88. Porter L. R. H. Palfrey was on duty on the island platform at Barnes station. At about 11.30 p.m. he heard "a bang" while a freight train was standing in the Down Local platform, but "he did not think much of it" until the signalman shouted to him to go and call the stationmaster, without however saying why. As he went to the stationmaster's house Palfrey saw a fire, and after calling the stationmaster he went to the substation, and he said that on arrival there he told the attendant to take the current off all lines. The attendant had said something about Clapham Junction which he could not follow. Palfrey did not see Signalman Barnes at the substation.

Relief Signalman C. W. Barnes said that he saw some flashing in the London direction through the gate box window, but he did not think that it meant anything serious until it developed gradually into "a solid mass of fire". The electrical flashing had stopped when he received a telephone call from Signalman Parish, who told him that "The Windsor had run into the back of the goods" and to get the current off, so he went

to the substation (40 yards from his box) ; he found the attendant on the telephone, speaking, he thought, to Clapham Junction, and told him to take the current off all the roads. Signalman Barnes said that his watch was then at 11.45 p.m., but that it was 9 or 10 minutes fast, so that the time must have been 11.35 or 11.36 p.m.

89. *At Clapham Junction substation* only one of the five machines was on load at the time. The attendant on duty, B. Duffy, said that at about 11.29 p.m. he was watching his ammeters, and noted that the ammeter needle of the Down Local feeder towards Barnes was hard over to the right against its stop at the 5,000 ampère mark. He therefore decided "not to take any chances" and pulled out the circuit breaker by hand. He said that it obviously broke a very heavy current, and that the pilot lamp went out, indicating that the corresponding circuit breaker at Barnes was open. He then telephoned to Barnes substation and received confirmation from Clark that the Barnes Down Local circuit breaker had opened. Clark had also told him that his machine had shut down as well, but he said that Clark did not make any mention of his Down Through circuit breaker.

At 11.31 p.m. Duffy noticed that the ammeters of the Down Through, Up Through and Up Local feeders were showing an unusual varying load from zero to 3,000 ampères, but he did not take any action on this as there seemed to be no serious trouble except on the Down Local, and his machine was still "on the line" ; he thought that the cause might have been an intermittent short circuit, as sometimes happened when a "faulty freight train" was crossing all the lines.

At 11.34 p.m., as recorded in the substation log, the Down Through circuit breaker came out automatically on heavy short circuit (on the successful application of the short circuiting bar by Motorman Peters) ; the pilot light also went out so he left the circuit breaker open. Duffy then telephoned again to Barnes substation and learned that both the Down line circuit breakers were out, and that there had been a crash and a fire at Barnes station. He advised Clark to call for the track lineman and report to Raynes Park Control what had occurred.

Duffy said that he took no action to take the current off the Up lines until he was told to do so at 11.49 p.m. by the Raynes Park Control. The two pilot lights remained alight, so he telephoned once more to Clark requesting him to open his Up line breakers, and the pilot lights then went out.

As has been mentioned, Clark referred to telephone conversations with Duffy at 11.34–35 p.m. and at 11.49 p.m., but he could not recollect the first conversation which Duffy said had taken place at about 11.31 p.m.

90. Control Operator C. C. F. Martin was in charge of the control room at Raynes Park. He said that at 11.31 p.m. Clark reported from Barnes substation that his Down Local and Down Through circuit breakers towards Clapham Junction had tripped out on heavy short circuit at 11.29 p.m., also that he had got his machine going again but was unable to re-charge the tracks. Clark had also said that the Down Local circuit breaker at Clapham Junction was "out". Martin then asked the Woking Traffic Control (11.32 p.m.) whether there had been any trouble at Barnes and was told that they had had no reports (this conversation was confirmed by the Traffic Controller). At 11.35 p.m. he received a report from Duffy at Clapham Junction that the Down Through circuit breaker had tripped out and that he had been unable to re-charge.

Martin said that the next report which he received was at 11.39 p.m. when Clark rang from Barnes substation to say that Relief Signalman Barnes had told him that there was a fire, and at 11.48 p.m. he was informed of the collision by the Woking Traffic Control and was asked to take the current off all the roads at Barnes. He telephoned at once to Clapham Junction and Barnes substations telling them to discharge the current from both the Up lines.

The Woking Traffic Control log recorded a message from Martin at 11.35 p.m. that "the current was gone", but the Traffic Control knew nothing of the collision until Signalman Parish reported it to them at 11.37 p.m., and their log also recorded a message at 11.45 p.m. from Guard Jeffery of the Windsor train asking for the current to be cut off from all roads.

91. The Down Through circuit breaker at Clapham Junction was renewed in 1948 and the Down Local breaker (which was pulled out by hand) was reconstructed in 1949. All substation track feeder circuit breakers are examined and cleaned and oiled every three months. This attention was given to all the circuit breakers at Clapham Junction on 2nd October, and the Down Local and Down Through circuit breakers there were specially examined and tested three days after the accident. The fitter reported that the Down Local breaker was slightly stiff in operation when tested on overload, but that after cleaning and oiling it operated correctly. He had no fault to find with the Down Through breaker.

92. In a written review of the circumstances in which the Down Local (No. 20) and Down Through (No. 18) circuit breakers at Clapham Junction substation did not trip out automatically, Mr. H. H. Swift, Chief Mechanical and Electrical Engineer, Southern Region, made the following comments :—

> "I would first like to refer to the circumstances at the time of the incident when the sections of conductor rail concerned were supplied through old slow speed circuit breakers in Barnes and Clapham Junction Substations 3·31 miles apart. The calculated current on each line from Clapham Junction Substation with a dead short circuit at the site of the incident was 5,700 amps, the circuit breakers being set to trip at a nominal 5,000 amps. It will be recalled that there was a very solid short circuit on the Down Local (No. 20 circuit breaker) and that the circuit breaker did not trip automatically and was opened by hand by the Substation Attendant. This circuit breaker was examined on the 5th December when it was found that the tripping mechanism was slightly stiff, which was corrected by cleaning and oiling. The circuit breaker had previously received attention on the 8th October. There was no suggestion of any arcing on this line, which would, in fact, have been impossible owing to the solid nature of the short circuit.
>
> On the Down Through line No. 18 circuit breaker at Clapham Junction Substation did trip automatically as soon as a good solid short circuit had been applied with the short circuiting bar by Motorman Peters. When examined on the 5th December, the tripping mechanism was found to be in order ; it had been previously overhauled on the 8th October.

I am of the opinion that one or more of the following circumstances prevented satisfactory operation of the circuit breakers :—

(1) The prospective short circuit current being only slightly above the setting of the breakers.

(2) The difficulty of accurately setting the tripping point of circuit breakers of this type.

(3) Slow response preventing No. 18 circuit breaker tripping on the momentary rush of current which must have preceded the arcing.

(4) The subsequent limitation of the current on this line by the arcing itself.

(5) Stiffness in the tripping mechanism of No. 20 circuit breaker."

Emergency Calls

93. It was established without any doubt that two calls for emergency assistance were made at 11.33 p.m. and 11.34 p.m. by Signalman Parish, who dialled 999 to the PROSPECT automatic telephone exchange from a public call box on the station platform, and the 11.33 p.m. call was connected at once to the Barnes fire station of the Surrey Fire Brigade which was the nearest to the site (1¼ miles). It was stated, however, that this call reached the Barnes fire station as a call for an ambulance only, and the station did not turn out until a lineside resident telephoned (also by dialling 999) at 11.40 p.m., 12 minutes after the accident. In a detailed investigation of this failure of the emergency communication to achieve its purpose, I received the full co-operation of the London South West Area Telephone Manager of the General Post Office, Mr. C. Turner, and of the Clerk of the Surrey County Council, Mr. W. W. Ruff, and the Council's Chief Fire and Ambulance Officers, Mr. A. H. Johnstone and Mr. T. G. Mullen. Mr. Turner and the officers of the Council had already reviewed the actions of their respective services in the emergency.

94. Brief instructions on the "999" public emergency telephone procedure for calling the fire, police and ambulance services are boldly displayed in all telephone directories. They instruct the caller firstly to ask for the service or services required directly the exchange telephonist answers the 999 dialling, and to give the number from which he is speaking ; and secondly, when the emergency authority answers (or if the telephonist asks) to give the precise address where help is needed and other details if necessary. The standard G.P.O. notice which is exhibited in all public telephone call boxes reads :—

"EMERGENCY CALLS

DO NOT INSERT ANY COINS

Lift Receiver and Listen for Dialling
Tone (A Continuous Purring Sound)

DIAL 999

Ask Operator For
FIRE, POLICE or AMBULANCE"

On the Railway side, the following notice is exhibited in every signal box, level crossing gate box, station ticket office and station foreman's office :—

"In case of emergency requiring the following services : dial 999 on the nearest Post Office telephone and ask for the service required :—

Fire Brigade : Police : Ambulance"

95. The handling of emergency calls in telephone exchanges is governed by the Exchange Service Regulations of the General Post Office. Among many other detailed provisions, they require operators to answer the special 999 signal with the words "Emergency ; Which Service please ?", and then to set up the call immediately to the service requested without delaying to ask for further information unless this is essential. Such emergency calls must receive special supervision and the operator must remain in circuit until particulars have been passed to and accepted by the called subscriber. The operator is also required to write down the particulars of an emergency call as early as can be done without delaying the connection, for subsequent record by himself on a "ticket" and by the section supervisor on a "docket".

At all fire stations, one of the firemen is in continual attendance on the telephone, and can "turn out" the appliances when required by sounding the alarm bells. He has no other task during a particular turn of duty.

96. On the resumption of my Inquiry to investigate this matter, Signalman Parish stated in amplification of his evidence recorded in paragraph 69 that it was not his intention at first to call for emergency assistance when he left the signal box after sending "Obstruction Danger" at 11.30 p.m., but only to find out what was wrong with the freight train. He said that he was unaware of any fire at that time (notwithstanding his earlier evidence and the statements of Driver Nield), and that he went to the call box to ask for an ambulance only because a passenger came running along and said someone was hurt.

He vaguely recollected that on dialling 999, someone whom he thought might be at Scotland Yard, had asked which service he wanted and had said "Just a minute, what shall we have first ?". Immediately after that someone else spoke to him, whom he agreed might have been speaking from the Barnes fire station, and Signalman Parish then asked for an ambulance to be sent to "an accident" at Barnes railway station. He said that he could not be more specific because he did not then know just what had happened.

On coming out of the call box he saw the fire, and Porter Palfrey had also shouted to him something about a fire, so he went back and dialled 999 again (11.34 p.m.), asking for all the three services, Fire Brigade, Ambulance and the Police. He recollected that he was then connected to the ambulance service, and he asked for ambulances to be sent to Queens Ride Bridge as there had been a train accident and people were badly hurt. Signalman Parish said that he was then under the impression that he had already called the fire brigade.

97. At the Prospect automatic telephone exchange, Telephonist (Mr.) F. J. E. Parish, who has long experience of night telephone duty at this exchange, was taking the emergency calls, several of which are received during every 24 hours. Assistant Supervisor C. M. Webb, who also had served in the Prospect Exchange for many years, was in charge. The exchange was "quiet" at the time.

These two men did not confirm Signalman Parish's account. Telephonist Parish stated that at 11.33 p.m. the 999 lamp was lit and the buzzer sounded. He asked at once which service was required on which "a very agitated man gasped out 'Fire, Ambulance, Police'." He asked for the caller's number (Prospect 7088) and immediately connected him to the Barnes fire station, No. 2222, remarking at the same time to Mr. Webb who was standing close to him, "There is a chap here asking for the lot".

On connecting the call to the Barnes fire station, he was answered by "Fire Brigade" and then heard the caller say "Crash at Barnes, Signalman speaking". Telephonist Parish then "went out of circuit" (by moving a switch) to make out the "ticket" recording the time and particulars of the call. He thought that the preparation of the ticket took only a few seconds, and on switching into circuit again he heard a man, whom he assumed to be the fireman, saying "All right—I will send an ambulance along". Both the caller and the fire station then cleared the line, and he took no further action for the time being.

Parish, however, made an earlier statement to Mr. Turner, in which he had not mentioned having heard the caller say "Crash at Barnes" to the fireman, and he had said in this statement that he had left the circuit temporarily after telling the caller that he was through to the Fire Brigade and to "speak up please".

At 11.34 p.m. he received another 999 call, also from Prospect 7088, but he did not recognise that the caller was the same man. He had seemed less agitated and had asked for an ambulance only, and Telephonist Parish was absolutely certain that no other service was requested at this call. He therefore made a connection to the Surrey Ambulance headquarters at New Malden (Kingston 7494). He again just heard the conversation start before he went out of circuit to prepare another ticket, and recollected that the caller had begun by saying something about a crash at Barnes station, but he did not hear what was said after that. He was not surprised at being asked for an ambulance twice, because he said that on one accident there were sometimes as many as 20 calls for an ambulance in quick succession.

It was evident that Telephonist Parish felt that he had fulfilled his duty on Signalman Parish's request for the fire and ambulance services at the 11.33 p.m. call, because he had made an immediate connection to the Barnes fire station, and had also overheard that an ambulance would be sent. He had not made the Police connection because the caller had cleared the line, but he said that if he had recognised that the second call was from the same man as the first he would have asked him if he still wanted to be connected to the police. At 11.35 p.m. he received a third 999 call, from a lineside resident, requesting police attendance at the site of the accident, and he connected it at once to Scotland Yard, in accordance with the Regulations.

The exchange record showed that three further 999 calls for ambulances and police were then received in quick succession and duly connected. At 11.40 p.m. a 999 fire call from a Dr. Scott, who lives close to the site, was connected to the Barnes fire station.

98. Mr. C. M. Webb said that when the 999 call was received at 11.33 p.m. Telephonist Parish had told him that the caller had seemed agitated and out of breath and had said "Quick, I want the lot—Fire, Police and Ambulance", on which Parish had replied "All right I will give you the fire service". Parish had then gone out of circuit for what Mr. Webb said was a matter of seconds to make out the ticket and that he then told him that he had heard the fireman say he would send an ambulance along. Parish had asked him whether this was in order and he had assented, observing that the fire station had facilities for calling ambulances; Parish had also told him that there had been a railway crash at Barnes station.

Mr. Webb went on to say that the Barnes fire station had rung back, as usual, between 11.33 and 11.34 p.m. to verify the source of the call. He himself had answered, and had told the fire station that it had come from Barnes railway station (Prospect 7088) but the fireman did not tell him that the call was for an ambulance only and had merely asked for its source. He had been very surprised to hear subsequently from Mr. Turner that the Barnes fire station did not receive a fire attendance call until 11.40 p.m. He had been entirely confident in the meantime that the fire station had accepted the 11.33 p.m. call as a call *for both the fire and ambulance services*.

Mr. Webb added that if the fireman had said in verifying the call that he had received it as a call for an ambulance only he would certainly have told him that there was a crash and fire at Barnes station. He said that normally the fire station would be the first to tell him if a request for another service was put on to them, as might possibly happen when he had a relief man on duty in the exchange.

Speaking of his responsibilities generally, Mr. Webb said that if a person dialled 999 and asked for a service it was the duty of the exchange to connect him, and he reiterated that he was entirely satisfied at the time that the ambulance *and* fire stations had received a request for their services at 11.33 p.m.

99. Barnes fire station was described by the Chief Fire Officer of the Surrey C.C., Mr. Johnstone, as a fairly busy one with an average of 250 to 300 calls a year. Fireman R. G. Milton, who had served at this station for seven years, was on telephone duty from 11.0 p.m. and during the first half hour he received no calls. He stated that at 11.33 p.m. the telephone bell rang and the "emergency" flap dropped. On picking up the receiver, he used the usual salutation "Fire Brigade speaking", on which the caller had said "Can you send an ambulance, there has been an accident at Barnes station". He replied that there was no ambulance at the fire station but that he would get one sent, and telephoned the request at once to the Surrey ambulance headquarters at New Malden (Kingston 7494). The fire station log recorded that the source of the call was verified with the Prospect exchange at approximately 11.34 p.m., as Mr. Webb had stated.

Milton said that nothing more happened until 11.40 p.m., when he received another 999 call through the Prospect exchange, this time to a railway accident and fire at Barnes station (this was from Dr. Scott), so he "put the bells down" at once and the two appliances turned out (as has been mentioned they reached the site at 11.44 p.m.). Almost immediately afterwards he was told of the accident and fire by the Surrey Fire Brigade Divisional Headquarters at Wimbledon (by direct telephone line), but he could not take any further action as the appliances had already gone. He then received several more calls through the Prospect exchange for fire attendance in quick succession, and informed the Divisional Headquarters as each one came through. These calls were from various sources, including lineside residents and the Police. He was so busy that he was unable to verify the sources with the exchange until 11.48 p.m.

Milton said that the caller at 11.33 p.m. did not seem "unduly" agitated though perhaps not perfectly calm, and he got his words out properly. He was positive that the caller had made no mention of a railway accident or crash as Telephonist Parish had stated, and had not said "Signalman speaking". He was equally certain that no mention had been made of a fire. He had no idea what sort of accident had occurred but merely that an ambulance (in the singular) was requested. He said that if he had had the slightest suspicion that anything of a serious nature such as a railway collision or derailment had occurred, whether there was a fire or not, he would have turned out the appliances at once in accordance with the uncompromising instructions on this point and the fire brigade traditions. He appreciated that he would never be criticised if it transpired that the station had made an unnecessary attendance. He thought that if the caller had asked for ambulances (in the plural) he would probably have turned out the station or at least asked for more details. As things were, he thought that the call was quite an ordinary request for an ambulance and when one of the firemen had come in to ask what it was all about he had said "Don't trouble, it is only an ambulance call", or words to that effect.

Milton was not surprised that an ambulance call had been connected to the fire station because an ambulance had been kept there at one time. He had also received ambulance calls from time to time and he referred to one on 12th October 1955 from Barnes or Barnes Bridge railway station. This had puzzled him because the Prospect exchange said that they had not put a call through to the fire brigade at all. He actually went down to the exchange later and asked if he could see the docket, but they could not find one, so he rang up the stationmaster and learnt that an inexperienced porter had telephoned direct to the fire station (Prospect 2222) because a woman porter had been injured.

100. Control Driver W. H. Roberts was on telephone duty at the Surrey C.C. Ambulance Control Centre at New Malden from 11.0 p.m. onwards. He stated that at 11.33 p.m. (as recorded in his log at the time), he received a call to the effect "This is Barnes fire station, can you send an ambulance to Barnes railway station, there has been an accident". Roberts asked the caller (Fireman Milton) what had happened, and received the reply "I don't know"; the caller than rang off. He immediately telephoned by private line to Richmond ambulance station, which is the nearest to the site, and ordered an ambulance out.

At 11.34 p.m., just as Roberts was completing the record of the 11.33 p.m. call, he received a second (999) call which he assumed to be from a member of the public (this was Signalman Parish), and the following was his description of the conversation. "I cannot now remember the exact words which were used, but the caller was very agitated and I had some difficulty in getting the information which I required. He started by asking if I could send ambulances to Queens Ride Bridge where there had been an accident. I asked if this was near Barnes railway station and with some impatience he answered that it was, and that he had already told the Fire Brigade. To try and calm him down I told him that there was an ambulance already on the way and asked what sort of accident it was and how many people were injured. He just repeated that there had been a train accident and added that a lot of people were screaming, and rang off".

Roberts then felt certain that a serious accident had occurred and that it was his duty to implement the "Ambulance Crash Plan". He first of all re-directed the Richmond ambulance to Queens Ride Bridge by radio telephone, and then turned to the task of concentrating ambulances to the site from the various out-stations and warning the Kingston Hospital. For this purpose, Roberts had to initiate many telephone calls by private and post office lines, and at the same time he was inundated by incoming telephone calls and radio messages, which included enquiries from the London Ambulance Service and various police stations; he dealt with them as best he could. Roberts said that under the standing orders it would have been his duty to call the police and fire services if he considered it necessary. He said that he did not take this action, or even consider it, because he was so confident that the police and the fire service had already been informed.

In actual fact the *London* Fire Brigade had been informed through the London Ambulance Service and the Metropolitan Police, with the result that the Wandsworth fire station turned out at 11.37 p.m. as has been stated. The London Fire Brigade in turn warned the Surrey Fire Brigade Divisional Headquarters at Wimbledon, who telephoned to the Barnes fire station at approximately 11.40 p.m., just after the station had turned out on receiving the fire call from Dr. Scott.

Signalman Parish agreed that Roberts' description of the conversation with him at 11.34 p.m. was "reasonably fair". He did remember having been "a little sharp" with the ambulance man because he suddenly realised he was in a hurry and "these people" seemed to be taking their time. On being told of the evidence from the telephone exchange that he had asked for all three services at the *first* call at 11.33 p.m., Signalman Parish reiterated that he had not done so because he did not know of any fire at that time, and added that if he had there would have been no object in calling for assistance twice. His subsequent statements in cross-questioning on this point were contradictory, but his impression that the Fire Brigade had already been called when he spoke to Control Driver Roberts appeared to be genuine. He thought that he had "had the Fire Brigade" at the first call, and he also appeared to think that on dialling 999 he was automatically connected to Scotland Yard, and that it was their responsibility to summon the services requested.

101. In commenting on the statements of Telephonist Parish and Assistant Supervisor Webb, Mr. Turner said that it was most important that the telephonist should record the particulars at the time of an emergency call in writing at the earliest possible moment; he said that such a record was specially valuable if a caller cleared the line before he was connected to all the services he had requested.

He considered that the staff of the exchange were fully justified in assuming that the fire and ambulance services had duly accepted a call at 11.33 p.m., because Telephonist Parish had connected the caller at once to the Barnes fire station and had also overheard the fireman say that an ambulance would be sent along. He added that the telephonist must remain in circuit to give all possible assistance to a caller, but he did not consider that Parish could be criticised for leaving the circuit for a few seconds (keeping his headphones on) as he still had the call under supervision, with lights to indicate that the caller and the fire station were still connected.

Mr. Turner said that there were no specific instructions on what should be done if a caller asked the exchange for all three services at once, as on this occasion, though the methods of calling each individual emergency service were laid down in considerable detail, generally and locally. It was not part of the telephonist's duty to inform callers who asked for all three services at once that three separate connections would be required, but he would be told not to leave the line. If a distressed caller were to ask for all three services and then put the receiver down, thinking he had done his duty, a telephonist would have to use his discretion. Mr. Turner said that he would probably have the call traced by the engineer, and would then inform the Police and leave them to take charge of the situation.

The Chief Operating Superintendent of the Southern Region, British Railways, Mr. S. A. Fitch, felt that in these circumstances he might have to revise and amplify the instructions to the railway staff on the matter of emergency calls.

102. Mr. Johnstone said that the instructions which were common to all fire brigades were emphatic that an attendance must invariably be made on doubtful calls ("When in doubt—turn out"). He added that no man would be in trouble if an unnecessary attendance were made, whatever the circumstances, but if a station failed to turn out in a doubtful case severe disciplinary action would follow ; he could not, however, recollect a single instance, because this tradition of the fire service was "so ingrained and so established" all over the country.

VIII. Conclusions

Cause of the Collision

103. The statement of Signalman Davis of Point Pleasant Junction that his Down Local starting signal No. 42 was clear for the Windsor train was confirmed by the motorman of Train G who saw the Windsor train pass him while he was stopped at the Down Through starter No. 32, and by the lengthman who was acting as "look out" man on the track close by. I am confident that this evidence was reliable, and I conclude that the Windsor train entered the section from Point Pleasant Junction to Barnes Junction under clear signals, including the Putney Down Local distant. I am also sure that the Barnes Junction Down Local home No. 49 was clear as the Windsor train approached and passed it, probably at about 35 m.p.h. with power shut off, in obedience to the distant signal at caution ; the nature and extent of the collision damage was consistent with speed of this order.

Motorman W. G. Flanders, who was killed at his post at the controls of the train, therefore had a clear signal in view just before the collision, and in all probability he was taken by surprise by the tail lamp and two side lamps of the freight train brake van ahead of him. As has been stated, these lights should have come into his view at a range of about 250 yards, but the line at this point is not straight, and I do not think that he could have been expected to realise in the dark, at any rate until the very last moment, that the freight train was in his path on the Down Local line, and not on the Down Through on which it was booked to run ; it also seems possible from the statements of the motormen of Trains D, E and F that Guard E. A. Hinman, who also lost his life, had not changed the right hand side lamp of the brake van from red to white in accordance with Rule 121 to indicate that the train was travelling on the Local line. The evidence of Motorman Peters, who was travelling in the train, suggested that an emergency application of the brake was in fact made at the last moment, and in all the circumstances which I have mentioned I consider that Motorman Flanders should be relieved of any responsibility whatever for the accident.

The fault, therefore, lay in the signalling of the Windsor train, in that the section signal No. 42 was clear for it while the section was still occupied by the freight train.

104. I should first of all mention that I am satisfied that signal No. 42 was properly restored to danger behind the freight train by Signalman Davis. It is probable that the lengthman whom I have mentioned was watching the signals closely to guide him in his look out duty, and he was certain that he saw the arms of signal No. 42 and of the Putney distant on the same post fall to danger after the freight train had passed ; the motormen of Trains E and F also stated that this signal was at danger when they were checked or stopped shortly afterwards at the adjacent signal No. 32. Moreover if Signalman Davis had failed to replace signal No. 42 behind the freight train, the Sykes rotation locking would have prevented him from clearing the colour light home No. 43, and he would have been unable to release this locking by the key with lever No. 42 over in the frame.

There remain two possible ways in which the accident could have occurred : either (a) that Signalman Davis transgressed the elementary principles of block working by allowing the Windsor train to go forward without obtaining an acceptance for it from Barnes Junction *in coincidence with* a danger side failure of the apparatus which wrongly freed the instrument of lever No. 42 to enable him to clear the signal : or (b) that Davis offered the Windsor train forward and that it was accepted by a plunge from Signalman Parish after the latter had used the key irregularly to re-set his plunging instrument while the freight train was still in the section.

105. I consider that (a) is most unlikely. For one thing there was nothing to disturb Signalman Davis' balance when he received "Train Entering Section" for the Windsor train from Clapham Junction 'E'. The switching out of Putney box had been completed about 15 minutes before, and I am satisfied that the procedure had been carried through in the main correctly by the three signalmen concerned to establish a clear block section on the Down Local line from Point Pleasant Junction to Barnes Junction before the freight train was offered and accepted in the ordinary course at approximately 11.9 p.m ; as I have stated, this acceptance was not in dispute, and I have no reason to doubt that the block indicator semaphore at Point Pleasant went up when Signalman Parish turned the switch hook over the plunger in response to the "Train Entering Section" signal. Furthermore there was no junction working at Point Pleasant to complicate the situation during the period concerned, and the trains were following each other in sequence on the main through route.

Signalman Davis' account of his actions was a simple one. His evidence impressed me as straightforward and truthful throughout, without undue emphasis of points on which his recollection could not be sure, and I do not disbelieve that he obtained what seemed to him to be a normal acceptance for the Windsor train when he received "Train Entering Section" for it from Clapham Junction 'E' at approximately 11.23½ p.m., just as he had done for the preceding freight train ; I also accept that he sent "Train Entering Section" for the Windsor train as it passed his box at about 11.25½ p.m. There appeared to be no reason why he should have broken the regular sequence of block working, and if he had done so he could only have cleared signal No. 42 without a plunge from Barnes Junction if a sudden wrong side failure of the equipment had coincided with an unusual type of signalman's mistake.

106. Apart from the improbability of such a coincidence after the instruments and levers had been working normally as both the signalmen stated, I am satisfied from the very thorough tests by the Signal Department and my own inspections in company with Mr. Boucher that there was no fault in the Sykes equipment during the critical period, though I have not disregarded that it was reported by a signalman (not Davis) that the instrument of No. 42 signal at Point Pleasant Junction had dropped irregularly to FREE on one occasion 13 months before ; as I have mentioned, the instrument was then changed as a precaution, though the failure could not be repeated on test by the Signal Department. I have also no doubt that the bells and their circuits between Point Pleasant Junction and Barnes Junction were in order.

I consider, therefore, that there was no foundation for Signalman Parish's suggestion that the Windsor train entered the section as the result of a "false clear" failure without an acceptance by him, and *I can only conclude that the collision occurred in the circumstances of (b) above, i.e. that Parish plunged for the Windsor train on receipt of the "Is Line Clear" signal from Davis which the latter had sent forward without having received "Train Out of Section" for the freight train, as he admitted. As Parish's Down Local plunging instrument was then standing at TRAIN ON after his normal acceptance of the freight train, he could not have accepted the Windsor train without using the releasing key to re-set the instrument and unlock the plunger.*

107. In contrast with the situation at Point Pleasant, Signalman Parish was working under some pressure at a junction box where out of course crossing movements had to be arranged owing to the late running. It was difficult to make any connected sense of his account of the events, and it was obvious that he had no clear idea of the position and movements of the freight train after he received "Train Entering Section" for it at approximately 11.11 p.m. His statement that he cleared his Down Local home signal No. 49 for this train not more than two minutes later, to allow it forward to the platform starting signals, was in conflict by a wide margin with the train running times summarised in paragraph 51 ; I am confident that these times were correct or nearly so, and I am satisfied that signal No. 49 was cleared at approximately 11.23½ p.m., ten minutes later than Parish stated. It is significant that this was also the approximate time at which the Windsor train would have been offered forward from Point Pleasant Junction.

It will be noted from paragraph 51 that the freight train must have been standing at signal No. 49, out of sight of Barnes Junction box, for 5 or 6 minutes, notwithstanding the statement of Driver Nield that he had been stopped for 1½ minutes at the most ; I do not consider that Nield was a very reliable witness, and it is possible that he was anticipating some criticism for failing to sound the whistle directly the train came to a stand. There was thus no truth in Parish's contention that the freight train could not have been stopped at signal No. 49, and when this was put to him as an established fact he could only suggest that the response of the arm to the lever had been delayed by yet another failure of the equipment, i.e. of the action of the slot, and he made a vague reference to a similar failure two or three months before of which no record could be traced.

In my opinion the slot failure was most improbable, and after reviewing the whole of the evidence, I have little doubt that when the Windsor train was offered to Parish at about 11.23½ p.m., the freight train, for which he had received "Train Entering Section" as long as ten minutes before and which was running on the Local line instead of on the Through line as booked, had passed completely out of his mind. That being so, he may have assumed hastily that the Down Local plunging instrument was at TRAIN ON not because he had accepted a train, but because he had forgotten to re-set it with the key after Putney box had switched out, or possibly that the instrument had failed in some way. These I think are the circumstances in which Parish must have used the key to plunge for the Windsor train, in thoughtless disregard of the very careful procedure required by the Regulations before the key is used to cancel a TRAIN ON indication.

The freight train re-started when signal No. 49 was cleared, also at about 11.23½ p.m. and I think it is very probable that Parish cleared the signal directly after he had accepted the Windsor train, with the intention of bringing this train forward to signal No. 48 to await "Line Clear" until Train F had cleared the section to White Hart Crossing. I have also no doubt that Parish received "Train Entering Section" for the Windsor train at approximately 11.25½ p.m., and that he then placed the switch hook over the plunger.

108. In arriving at these conclusions, I have not overlooked the conversation with Signalman Maher at White Hart Crossing to which I have referred in paragraphs 71 and 74. I have no doubt that some such conversation did take place, but I have considerable suspicion with regard to the time of 11.25 p.m. on which Maher's statement was so precise. The freight train was still moving slowly towards the platform starters when the collision took place at approximately 11.28 p.m., and could not have been seen from the box three minutes earlier even with the most careful observation. Parish suggested, contrary to the established facts, that the freight train had been waiting in the platform for about two minutes when the collision occurred, and I consider that his less guarded statement "the head lamps would have woken me up straight away" (paragraph 70) was nearer to the truth.

Parish also said that he got the freight train accepted by Grove Park at 11.25 p.m. directly he received "Train Out of Section" for Train E, and I think this may well have been another attempt to suggest that the freight train was in his mind at that time. It is much more likely, however, that this acceptance was given at about 11.28 p.m., as recorded by Signalman Ketchell in the Grove Park train register, three minutes after he had sent "Train Out of Section" for Train E. This was also the approximate time of the collision, and Parish may then have been reminded of the presence of the freight train for the first time since he received "Train

Entering Section" for it from Davis at approximately 11.11 p.m., and realised that he had made a serious mistake. I think it is quite possible that Parish then had his first conversation with Davis to ask what train was on the Local line, although Davis' memory on this point was uncertain.

In all these circumstances I reject the evidence of the conversation with Maher as proof that Parish had not at any time overlooked the presence of the freight train in the rear section. Though this evidence may seem plausible if it is regarded in isolation, the proof could only have been valid if the whole of Signalman Davis' evidence had been false, which I do not for one moment believe.

109. Signalman Parish must therefore bear the full responsibility for the accident, and it is to be regretted that he went to such pains to put the blame elsewhere. His record of successes in the block signalling written examinations left no doubt as to his considerable ability, but the record also confirmed that his ability was not matched by the steadiness of character which is equally essential in a railway signalman ; in one disciplinary case he displayed considerable ingenuity in an unsuccessful attempt to conceal a block working irregularity.

110. Parish, however, should not have been put in a position to fail as he did on this occasion, for the reason that Davis should not have offered the Windsor train to him without having first received "Train Out of Section" for the freight train. This was contrary to the fundamental principles of block working, as codified by the Regulations, but I do not consider that Davis should be too severely criticised for his error, which he did not attempt to excuse ; the Western Section arrangements for the working of the block indicator semaphore gave him no visual indication that the forward section was still occupied, and he had to depend on the 2 pause 1 bell signal alone in a very busy box controlling four lines of way. Signalman Davis' record over the years is very good, with no disciplinary entries, and I am sorry that he allowed himself to be persuaded by Relief Signalman Blundy to make false entries in his occurrence book of the times at which Putney box was switched out during the week.

111. The fact, however, that Blundy switched out Putney box before the due time had no more than an indirect bearing on the course of events, as the lengthened block section was properly established as clear before the freight train was accepted from Barnes Junction. It cannot, therefore, be said that any responsibility for the accident rests with him, although his standard of self discipline and his lack of honesty were out of keeping with his position as a senior signalman and were a very bad example to the younger men. His past record indicated that he was a capable railwayman and included some commendations for initiative.

112. I do not think that Driver Nield, of the freight train, lost much time in going to Barnes Junction box to inform Signalman Parish that an accident had occurred. His statement that he had been standing at signal No. 49 for 1½ minutes only was not in accordance with the facts, but in view of the test mentioned in paragraph 68 it is very doubtful if the engine whistle could have been heard from inside the box and I see no reason to disbelieve that he sounded it very soon after he was stopped. I consider, therefore, that Driver Nield is free from responsibility.

Electric Current

113. With the very high temperature of the intense electric arc, which persisted for approximately five minutes, it is understandable that under the conditions described in paragraphs 5 and 6 a fierce fire developed with great rapidity in the surrounding wreckage, and it was not long before the whole of the wooden body of the leading coach was ablaze, under the influence of the prevailing wind. The paint and varnish of the coach body were quite ordinary, and I am satisfied that they made no special contribution to the spread of the flames.

114. The persistence of the arcing until 11.34 p.m., when Motorman Peters was successful in applying a short circuiting bar at his second attempt, was due solely to the continued feed to the Down Through line from Clapham Junction substation, because the Down Local and Through circuit breakers at the nearby Barnes substation had opened automatically at the instant of the collision, and the Down Local circuit breaker at Clapham Junction had been pulled out by Substation Attendant Duffy very soon after it, directly he noticed the ammeter needle was hard over at the 5,000 ampère mark.

The reasons for the failure of the old type circuit breakers at Clapham Junction to cut off the current automatically from the Down Local and Down Through lines have been well summarised in paragraph 92.

115. The two substation attendants, Duffy at Clapham Junction and Clark at Barnes, gave what seemed to be quite straightforward accounts of the events at their respective locations, although there were some discrepancies between their statements and the substation and control room logs. Duffy was prompt in realising from the ammeter reading that something was seriously wrong on the Down Local line, and in opening its circuit breaker by hand ; as things turned out, it is a pity that he did not follow this up by pulling out the remaining three circuit breakers, including the Down Through, when he noticed the unusual and varying readings of the ammeters about two minutes later, but he can hardly be criticised on this account, because the indication of the ammeters of serious trouble was nothing like so definite as on the first occasion, and the running of his machine was unaffected. Moreover he had no obligation to open these circuit breakers under the standing instructions mentioned in paragraph 87, and I think that his assumption that a transient short circuit was affecting all three lines was not unreasonable in the circumstances, especially as the proportion of short circuits which persist on the third rail system of the Southern Region is comparatively small.

116. Substation Attendant Clark gave me the impression that he was searching his mind on whether he could have failed in his duty. Again as things turned out, the onset of the fire might have been prevented or checked if he had asked Duffy to open his Down Through circuit breaker directly he saw that his own pilot light was flickering, but I do not think that Clark need have anything on his conscience, because the flickering of the pilot light might have been caused by quite an ordinary accidental short circuit, and he had no reason to suppose that a serious accident had occurred until he was told of it by Porter Palfrey. It was stated that Palfrey arrived at the substation at 11.32 p.m., but it is unlikely that he could have got there much before 11.34 p.m. after calling the stationmaster and making his way for about 300 yards along the track in the dark. Clark then lost no time in getting on to Clapham Junction substation, at the same moment as Duffy was ringing him after the latter's Down Through circuit breaker had been brought out by the action of Motorman Peters.

If Clark had adhered strictly to the procedure laid down in the standing instructions it is possible that he might have been in touch with Clapham Junction substation a minute or so earlier. The instructions, however, cannot provide for every eventuality which may occur at a substation, and in all the circumstances I agree with the Chief Mechanical and Electrical Engineer that Clark cannot be fairly criticised for his decision to get his machine back on load before carrying on with the trial reclosure of the Down Local and Down Through circuit breakers.

117. The current which remained on the two Up lines until it was taken off on the order of Control Operator Martin at 11.49 p.m., after he had heard of the accident from the Woking Traffic Control, presented some risk to passengers and others on the ground at the site, although it made no contribution to the fire. It seems that Clark did not gather from Porter Palfrey exactly what was required, nor from Relief Signalman Barnes who probably arrived at the substation a minute or two after Palfrey had left, and not at 11.49 p.m. as Clark stated, but I can understand that he was more concerned at the time with the direct evidence which he had of trouble on the two Down lines.

118. Control Operator Martin was sensible in telephoning to the Woking Control when he received the first report of trouble from Clark at 11.31 p.m., but the reply which he received was negative, and he could not have been expected to order the removal of current from all lines at that stage with the meagre information which was available to him. He heard nothing further until Duffy told him at 11.35 p.m. that his Down Through circuit breaker had come out. The arcing was then extinguished.

As has been stated in paragraph 90, the Woking Traffic Control had no knowledge that a collision had occurred until they received a report from Signalman Parish at 11.37 p.m.

119. Thus I do not consider that it would be fair to blame any of the electrical staff for the continuance of the Down Through feed from Clapham Junction while they had no definite knowledge of a serious accident. Porter Palfrey, who had little experience, also tried to do his best though a little time might have been saved if he had telephoned to the substation from the electrification telephone on the island platform instead of going there on foot. I am unable to form any definite conclusions on Signalman Parish's movements after Driver Nield arrived in the box very soon after the collision, but it is probable that, despite his statements, he was quick to appreciate that a serious collision had occurred. In these circumstances one of his first duties was to get the current cut off, and he should not have left the box without first telephoning to the substation or arranging for Driver Nield or Porter Palfrey to do so. As it was, he did not attempt to telephone to the substation until about 11.35 p.m. after he returned from calling for the emergency services, but I have little doubt that he was not in a condition for clear thinking at the time.

With regard to the traffic staff on the site, Guard Jeffery's first thought was for his primary duty to protect the obstruction, and Station Foreman Rogers' immediate concern was to save life if he could. I consider that neither of these men should bear any responsibility for the delay in cutting off the current, and credit is due to Motorman Peters for his promptness and persistence in applying himself to the unpleasant task of short circuiting the Down Through line.

Late Fire call

120. The evidence on the emergency calls has been summarised in paragraphs 93–102. It was established beyond any doubt that two separate 999 calls were made by Signalman Parish at 11.33 and 11.34 p.m. from the public call box (Prospect 7088) on the Down Local platform, approximately 50 yards from the foot of the signal box steps. I am satisfied that the statements of the staff at the Prospect exchange, which were supported by the exchange records, were in the main reliable, and I have no hesitation in concluding that Signalman Parish asked, in a state of considerable agitation, for all three emergency services, Fire, Ambulance and Police, at his first call at 11.33 p.m., despite his statements to the contrary ; and that at his second call at 11.34 p.m. he asked for ambulances and nothing else.

It was also established that the 11.33 p.m. call was connected at once to the Barnes fire station by Telephonist Parish, who rightly gave priority to the request for the Fire service.

121. Signalman Parish's statement that on connection to the fire station he asked for nothing more than for an ambulance to be sent to "an accident" at Barnes railway station was confirmed by Fireman Milton. I can offer no explanation for this extraordinary contrast with the agitated request for all three services which he had made to the exchange a few seconds before, but I am convinced that Fireman Milton's evidence was truthful, and I accept his statement that Signalman Parish had given him no indication whatever that anything serious had happened or that the services of the fire station were required, either for a fire or for rescue work. Control Driver Roberts confirmed that Milton lost no time in passing the request for the ambulance to the Surrey Ambulance Headquarters at New Malden, and he also stated that Milton had known nothing of the nature of the accident at the time.

I have thus disregarded the statement of Telephonist Parish that he had overheard Signalman Parish say "Crash at Barnes—Signalman speaking" when he connected him to the fire station at 11.33 p.m. It seemed that when I interviewed Telephonist Parish some weeks after the event, his recollection on details of what was said was not very clear, and it is possible that he may have been confusing the first call with the second at 11.34 p.m ; Signalman Parish did say something of this kind when his 11.34 p.m. call was connected at once by Telephonist Parish to the ambulance headquarters at New Malden. If, however, he had made any mention of a railway collision or crash at Barnes when he spoke to Fireman Milton at 11.33 p.m., I have no doubt whatever that the latter, who is an experienced fireman, would have turned out the station at once in accordance with the high standard of discipline in the fire service and its strong traditions, as he did when he received the fire call from Dr. Scott seven minutes later.

122. I conclude, therefore, that no responsibility rests with the Fire Service for the late attendance of the appliances from Barnes fire station. It is also clear that Signalman Parish's first call at 11.33 p.m. for all three services was promptly connected to the fire station by Telephonist Parish under the supervision of Mr. Webb,

and to this extent the staff at the exchange carried out their duty. For some reason, however, Signalman Parish failed to give any indication at that time to Fireman Milton that a serious accident had occurred, and it may be that he assumed that his immediate request for all three services in picking up the receiver and dialling 999 would have been dealt with automatically, possibly by the Police, and that there was no need for him to be connected to each service in turn. At any rate he seems to have been under the impression when he spoke to Ambulance Control Driver Roberts at 11.34 p.m. that he had already called for the fire brigade.

123. The mistake, however, might have been corrected if Telephonist Parish had not left the circuit to make out his ticket just after he had connected Signalman Parish to the fire station. Mr. Turner emphasised that it was necessary to make early written records of emergency calls, and I can appreciate that this is so, but I am not convinced that Parish could not have made out his ticket while still remaining in circuit in order to keep the situation under continuous control. Assistant Supervisor Webb and Telephonist Parish knew that all three services had been requested by a caller in considerable distress and apart from any question of their initiative it appears that Parish was required to remain in circuit by the Exchange Service Regulations to which I have referred in paragraph 95.

Summary

124. The following is a summary of my main conclusions :—

(i) The Windsor train entered the section from Point Pleasant Junction under clear signals. No responsibility rested with its motorman who was killed at his post.

(ii) The Windsor train was offered to and wrongly accepted from Barnes Junction while the freight train was still in the section.

(iii) There was no fault in the Sykes Lock and Block equipment, and in order to accept the Windsor train the Barnes Junction signalman made irregular use of the releasing key. He was thus responsible for the collision.

(iv) The Windsor train was offered to Barnes Junction irregularly in that the Point Pleasant Junction signalman had not received "Train Out of Section" for the freight train, but the equipment gave him no visual indication of the state of the forward section.

(v) The switching out of Putney box before the authorised time had no more than an indirect bearing on the course of events, but the action of this signalman was indisciplined.

(vi) The electrical arcing which persisted for about 5 minutes was sufficient to start an intense fire in the wooden body of the overturned coach under the conditions which were present.

(vii) The arcing was due solely to the continuation of the feed to the Down Through line from Clapham Junction substation, 3 miles from the site, until the circuit breaker there was tripped when a short circuiting bar was applied by a motorman in the Windsor train. This action was most creditable.

(viii) The old type slow speed circuit breakers at the distant Clapham Junction substation did not trip out because the current passed by the short circuits through the resistance of the conductor and running rails did not rise to the trip setting, except perhaps momentarily.

(ix) The electrical staff had no responsibility for the continuance of the feed, but the Barnes Junction signalman should have telephoned for the current to be cut off earlier than he did.

(x) No responsibility rested with the Fire Service for the late attendance from Barnes fire station. This station did not receive a fire call until 11.40 p.m., 12 minutes after the accident. There was then no delay in turning out the appliances.

(xi) The Barnes fire station should have received a fire call 7 minutes earlier. The Barnes Junction signalman asked for all three services when he dialled 999 for the first time at 11.33 p.m., and was promptly connected by the exchange to the fire station. The signalman, in his agitation, then failed to make clear that a serious accident had occurred and asked for an ambulance only which was supplied. This mistake might have been corrected if the telephonist had remained in circuit to keep the situation under control.

IX. Remarks and Recommendations

Signalling

125. The Sykes Lock and Block system has a long record of reliable service in the safe operation of dense traffic and is still in extensive though declining use in the Southern Region. It is old fashioned in design, mechanically and electrically, but if it is properly handled the signalling of more than one train into a block section is prevented absolutely. It is recognised that a less satisfactory feature of the system is the facility which has to be given to the signalman to release the locking with the key ; accidents have been caused in this way from time to time, and the circumstances of the collision at Esher on 28th January 1945, into which Inquiry was held, bore some resemblance to those of the present case. There have, however, been many more occasions on which the special Sykes locking has prevented a signalman from making a dangerous mistake.

126. On balance, therefore, the Sykes system has considerable merit, but there is a limit to the density and complexity of traffic which any manual block system can handle with efficiency and safety, and all the more so at the present day when there are so many difficulties in recruiting suitable men for training as signalmen. There must be few manual boxes in the country which are more heavily pressed than Barnes Junction and Point Pleasant Junction, especially when trains are running out of course, and I think that the time has come when the concentrated suburban traffic on this route should be controlled by modern colour light signalling coupled with the continuous track circuiting which eliminates the possibility of block working mistakes. Much has already been done in this direction in the Southern Region and elsewhere, and extensive further schemes have been prepared or are contemplated under the British Transport Commission's Modernisation Plan. As a result of this accident a scheme has been revived for the complete modernisation of the signalling between Clapham

Junction and Richmond via Barnes Junction, and I recommend that it should receive very high priority, having regard to the density of the traffic and the consequent pressure on the signalmen on this four track section of line.

127. Comprehensive modernisation of the signalling on our railways is the ultimate intention of the British Transport Commission, but it will be some years before the Sykes lock and block system disappears from all the important lines of the Southern Region even where there are four tracks. It is essential to retain the releasing facility and, although the accident might have been prevented if it had been impossible to re-set the plunging instrument without the co-operation of the rear signalman, the universal provision of this additional safeguard would involve many difficulties.

It is certain, however, that the accident would not have occurred if there had been a "berth" track circuit in rear of Barnes Junction Down Local home signal, locking the plunger, as is provided on both the Down lines at Point Pleasant Junction and Putney. Berth track circuits are not a normal feature of the lock and block system, but they are extensively used to control the ordinary block instruments on important lines throughout the country, and have proved very valuable in preventing the acceptance of a train if a preceding train standing at a home signal is overlooked. The provision of berth track circuits at the Barnes Junction Down homes has now been authorised, and I recommend that they should be installed at all Sykes boxes controlling four lines of way where there is no good view of trains standing at the home signals.

128. It is most undesirable that a train should be offered forward before "Train Out of Section" has been received for the preceding train, and this is prohibited by the block regulations in all the Regions. With Sykes lock and block there is perhaps less possibility that the forward signalman will be confused by a premature "offer", because the plunger is locked with the instrument at TRAIN ON, but even the slightest temptation to irregular use of the key must be avoided, and full compliance with the regulations is therefore important at all times. In a busy box, however, this cannot always be easy with the Western Section arrangement of the switch hook–block indicator working, because the signalman has no positive visual indication of the true state of the forward section. This arrangement has been used in the Western Section for many years, but it may have contributed to the irregular use of the key in the accident at Esher in 1945 to which I have referred, and the accident at Barnes has again drawn attention to its weakness. I have discussed this question with the officers of the Southern Region, and consideration is being given to the standardisation of the arrangement in force on the Eastern and Central Sections, whereby the block indicator stands normally lowered, and is raised when a train is accepted and is lowered again when "Train Out of Section" is sent back. A fuller description of its working has been given in paragraph 26.

Electrical Power Supply

129. As I have stated, the current was cut off from the Down Local line within a few seconds of the collision, but it remained on the Down Through line for about six minutes, and the arcing which began when the rails were short circuited by metal parts of the overturned coach was quite sufficient to set the wooden wreckage ablaze within a very short space of time. There is no doubt whatever that the current was cut off from the Down Through conductor rail at approximately 11.34 p.m. when Motorman Peters applied the short circuiting bar, despite suggestions to the contrary which I have received, and the flashes and explosions which were noticed after that time were almost certainly caused by the ignition of the detonators in the wreckage.

130. The reasons why the circuit breakers failed to clear the fault before serious damage was done have already been stated. I have, however, no recommendation on this aspect of the case, because the complete modernisation of the arrangements for power supply in the London area of the Southern Region, including the protective equipment, was already in full swing when the accident occurred, and is being pressed forward as rapidly as is possible with works on such a comprehensive scale. I would mention that a new rectifier substation at Point Pleasant Junction, equipped with modern high speed circuit breakers, was nearing completion at the time of the accident. It was brought into use two months later, and the old rotary converter substation at Clapham Junction was then closed. The substation at Barnes is also to be re-equipped, and it is expected that the scheme as a whole will be completed by the end of 1957.

The number of substations in the London area will then have been increased by 54%, and there will be more than three times as many intermediate track paralleling huts, all of them equipped with high speed circuit breakers. The sections of track between the circuit breakers will thus be considerably shortened, and in no case should the conductor and running rail resistance limit the short circuit currents to values dangerously near to the trip setting.

131. Even, however, with this much improved protection, it cannot be absolutely certain that a circuit breaker will clear a fault automatically under all conditions which may arise, and there will always be the possibility that a high resistance short circuit may give rise to arcing, in which case the current may not rise at any time to the trip setting of the circuit breaker, or even exceed the maximum current which would be drawn by a train. Although the relief of fault conditions will also be facilitated under the new scheme by the direct control, through pilot lines, of the circuit breakers from a central control station, there must always be dependence on the staff at the site of an accident to take every possible step to get the current cut off as a matter of very first urgency.

132. I have referred specifically to the London area in these remarks, because the equipment on the outer extensions of the electrification in the Southern Region which were carried out between the wars is comparatively modern, with central control of the high speed circuit breakers at the unattended rectifier substations and the track paralleling huts. I would also observe that the risk of a dangerous short circuit in the event of a collision or derailment is a great deal less under the overhead system of electrification which has been standardised for all new work on British Railways except for some extensions of the third rail system in the Southern Region in Kent.

Rolling Stock

133. It is unlikely that a modern all-steel coach would have been seriously affected by any fire which might have been caused by electrical arcing in the wooden wreckage of the goods brake van, but I have no recommendation on the matter of carriage construction because the importance of modernising the passenger rolling stock as rapidly as possible is recognised by the British Transport Commission. I need not recapitulate all the circumstances in which this has been delayed for so long, but there is no doubt that the whole of the suburban electric rolling stock in the Southern Region would have been renewed a considerable time ago but for the war and its aftermath of material shortages and restriction of capital expenditure.

In the last few years there has been a marked improvement in the rate of new carriage building. Wooden bodied coaches are rapidly disappearing from the electric trains, and it is expected that by the end of 1957 all of them will have been replaced by coaches with steel bodies of modern design in which the fire risk is very small. The replacement of wooden coaches throughout British Railways is bound to take longer, but all new construction is now in steel, and it is estimated that under the Modernisation Plan all of the 13,900 wooden vehicles which remained at the end of 1955 will have been eliminated within seven years.

134. It has been suggested to me that the risk of electric shock to passengers is greater with all-steel rolling stock in the event of a collision or derailment. This, however, is not the case because there is much more likelihood that a good "earth" will be established if any parts of a steel coach come into contact with a conductor rail, and that the resultant "solid" short circuit will trip the circuit breakers and so discharge the current.

Public Emergency Call System

135. I have already referred at some length to the circumstances in which the Barnes fire station did not receive a call for their services until 11.40 p.m., no less than 12 minutes after the accident. The appliances then turned out very promptly and reached the site at 11.44 p.m., but the fire had taken such a hold by that time that rescue work was impossible. There is every reason to suppose that the turn-out would have been equally prompt if the station had received any indication from Signalman Parish that their services were required when he was connected by the exchange at 11.33 p.m., and the appliances would probably have reached the site at about 11.37 p.m., seven minutes earlier than they did. It is at least possible that, in this way, lives might have been saved.

136. It was known in the Prospect exchange at 11.33 p.m., seven minutes before the fire station received a definite fire call, that an incident had occurred which required the urgent attendance of all three of the emergency services, and Telephonist Parish was prompt in making the fire connection at 11.33 p.m., as a matter of first priority ; he also satisfied himself that the caller was in touch with the fire station, but he then left the circuit to record the particulars of the call, and was thus unaware that Signalman Parish had failed to make himself clear to the fireman who was on telephone duty. This was the cause of the delay in getting the right message through, but it must be borne in mind that Signalman Parish was in a state of considerable agitation at the time, as was to be expected, and, in common with many members of the general public, was ignorant of the detailed working of the 999 system.

137. In the circumstances of a railway accident, or indeed of any public or private emergency, it is quite likely that a caller will be in no condition for clear thinking, and it seems that there is always a possibility of a dangerous misunderstanding unless the situation is taken in charge at some central point from the very beginning and kept under continuous control. No emergency arrangements can be proof against every possibility of failure, but I am glad to say that the General Post Office are considering what steps should be taken to prevent a repetition of the type of breakdown which occurred on this very serious occasion, and to make quite sure that a distress call from the railway or from any member of the public is promptly conveyed to *and accepted by* the service or services required. I would suggest that the British Transport Commission should be informed of any action which may be taken in this direction so that, if necessary, their instructions to the railway staff on calls for assistance in an emergency may be adjusted or amplified.

Acknowledgments

138. I should not end this report without mentioning the painstaking assistance which I received from the departmental officers of the Southern Region throughout the course of the Inquiry. I should also record my appreciation of the whole-hearted co-operation of the General Post Office and the Surrey County Council in the investigation of the delay in calling for the services of the Barnes fire station.

I have the honour to be,
Sir,
Your obedient Servant,
G. R. S. WILSON,
Lieutenant Colonel.

The Secretary,
Ministry of Transport and Civil Aviation.

APPENDIX A

Description of the Sykes Lock and Block System of Signalling, as used in the Western Section, Southern Region.

(1) Each signal lever is connected by rodding to a Sykes' instrument above it, which shows two indications, LOCKED or FREE. When the signalman is offered a train from the box in rear, he can accept it by pushing in a plunger which is a part of his home signal instrument. This action frees the starting signal of the box in the rear, and changes the lower tablet of his own home signal instrument from blank to TRAIN ON. The plunger then becomes locked. The upper tablet of this same instrument indicates FREE as the line is clear to the starting signal.

When the home signal lever is reversed, the upper tablet changes from FREE to LOCKED and remains in this position until the starting signal lever has been pulled and replaced following the operation of the treadle in advance of that signal. When the train has passed the home signal, the replacement of the home signal lever restores the lower tablet from TRAIN ON to blank, but the plunger may remain locked until the upper tablet changes to FREE on the replacement of the starting signal lever as described below.

(2) The instrument associated with the starting signal normally shows LOCKED, and in this position the connecting rod is raised and the signal lever locked. The rod is held in this position by a permanent magnet and detent in the instrument. When it is required to send a train into the block section, the appropriate bell signal is sent to the box in advance. If the signalman at that box is in a position to accept the train he pushes in the plunger on his home signal instrument. This action completes an electric circuit, which, by means of a coil winding in the instrument of the starting signal of the box in rear, neutralises the permanent magnet, and so allows the lock rod to drop. This frees the starting signal lever and gives the FREE indication in its instrument.

The starting signal lever is then pulled, changing the indication in the instrument from FREE to LOCKED, and the lever becomes backlocked until a treadle (or track circuit) ahead of the signal has been actuated. The depression of this treadle by a train completes a circuit to release the backlock on the lever of the starting signal and changes the indication in the instrument from LOCKED to FREE. When the starting signal lever is replaced, it again becomes frontlocked and cannot be freed until a second release is given by the plunger at the box in advance.

The effect, therefore, of this rotation locking is that each train should pass through the block section, and beyond the starting signal, before a second train can be accepted.

(3) In addition to the locking between the plunger and the signals, a block indicator, electrically controlled from the box in advance, is mounted over the starting signal instrument. This indicator takes the form of a miniature semaphore arm, which is normally in the raised position. The arm is lowered when a train is accepted, and it is raised again when the "Train Entering Section" is acknowledged.

The control of the indicator by the box in advance is effected by a switch hook associated with the plunger. The switch hook, when turned over the plunger, serves as a physical reminder that the plunger is not free to be pushed, and maintains the indicator at the box in rear in the raised position. When the signalman is offered a train which he is in a position to accept, he turns the switch hook to the right away from the plunger, so completing an electrical circuit to lower the semaphore indicator at the box in rear. When "Train Entering Section" is received, the switch hook is replaced over the plunger to raise the block indicator.

(4) A key is provided for re-setting the plunger mechanism if a train should not proceed through the section after acceptance or be shunted out of the section between signals, or again after a release has been given to the box in rear to enable it to close out ; the action of the key in the plunging instrument changes the lower indicator from TRAIN ON to "blank", and enables the plunger to be used again. The key can also be used to release the rotation locking and to release the instruments if the treadle or the pulling and replacing of the relevant signal levers should fail to do so. The key cannot be used to release the front locks of section signal instruments.

APPENDIX B

Extract from the Standard Regulations of the Southern Region for Train Signalling. Lock and Block System of Train Signalling.

1. *Electric Lock and Block System.*—The object of this System of Train Signalling is to prevent more than one Train being in the Section between two Block Signal Boxes on the same Line at the same time. This is accomplished by a Signalman not being able to lower the Signal controlling the entrance to the Block Section ahead until that Signal has been electrically released by the Signalman at the Signal Box in advance, who cannot so release the Signal until the preceding Train has passed his own Signal controlling the entrance to the Section ahead or other Signal at such Box and that Signal has been replaced at *Danger*, nor where a Treadle is provided, until the Train has reached it. As this system of working is attained by the interior portions of the Block Instrument being connected with the Signal Levers, Signalmen must work these Levers with great care.

2. *Block Telegraph Regulations.*—On Sections of the line worked under the Lock and Block System the ordinary Double Line Block Regulations (as shown on pages 3 to 28 inclusive of this publication) will apply except in so far as they are modified by the instructions appearing below and on pages 31 and 32.

3. *Description of Instruments and Mode of Signalling.*—See pages 95 to 98 inclusive, of this publication. (See Appendix C.)

4. *Failures and Defects.*—(*a*) In order to provide against the contingency of a failure of part of the Apparatus, the Bell Code is arranged to secure the working of the Block System in addition to and independently of, the Lock and Block Instruments.

(*b*) If, when the *Is Line Clear* Signal is given, the Tablet of the Block Instrument for the Section in advance should drop to *Free*, without an acknowledgment being received on the Bell, the Bell Signal must be repeated until properly answered, unless it is found that the Bell has failed, and in the meantime the Signal controlling the entrance of Trains into the Section ahead must be maintained at Danger.

(*c*) In the event of 'B' failing to free 'A' through an imperfect Plunge or a failure of the Apparatus, 'A' should call the attention of 'B' on the speaking instrument and inform him of the fact. *It must then be clearly ascertained that no Train is in the Section between the two Signal Boxes,* after which 'B' must change the Tablet of the Block Instrument from the *Train Accepted* (or *Train On*) position to the normal position by one complete turn of the Release Key in the direction of the Arrow. After withdrawing the Release Key he must again Plunge.

(*d*) If, however, it is clearly ascertained that the "Plunge" altogether fails to release the Signal in the rear, the Train must be hand Signalled by Flag or Lamp, after the Driver has been stopped, advised of the circumstances and instructed to proceed cautiously, provided that the *Is Line Clear* Signal has been sent and properly acknowledged.

(*e*) All cases of failure, from whatever cause, must be immediately reported to the Telegraph Lineman of the district, so that the failure may be rectified in the shortest possible time, and a full report of the matter, stating the nature of the failure, must be promptly sent by the Station Master to the Divisional Superintendent.

5. *Treadles.*—(*a*) At many places Treadles are provided beyond the *Home, Starting, or Advanced Starting,* Signal to prevent the Signalman fully replacing a Signal Lever or releasing the Section in the rear until the Train has passed over the Treadle. If, from any cause, a Train in passing over a Treadle does not release the back-lock on the Signal Lever, the Signalman must wait *until the Train Out of Section Signal has been received* from the Signal Box in advance before releasing the back-lock by means of the Release Key, unless he can be sure by actual observation that the whole of the Train has passed.

(*b*) Each time the Release Key is used, owing to failure of a passing Train to release the back-locked Signal, an entry of the fact must be made in the Train Register or other book provided for the purpose.

(*c*) Signalmen are specially cautioned not to put the Lever partially back before the Train reaches the Treadle, except in case of emergency, as this will in many cases prevent the Treadle releasing the back-lock. The Tablet of the Block Instrument should also be watched before attempting to move the Lever.

6. *Switch Hooks.*—The Switch Hooks must always be placed (or maintained) over the Plunger to protect the Line, when at any time the Line is obstructed, or when special protection is needed. The turning of the Switch Hook, besides locking the Plunger, puts up the Block Indicator at the Signal Box in the rear. . . . When a Signal Box is being closed, the Switch Hooks must be placed (or maintained) over the Plunger by the Signalman before going off duty ; they must be unhooked again on the Signalman re-opening the Signal Box except where the normal position of the Block Indicator is at danger in which case the Switch Hook should be maintained over the Plunger. . . .

7. *Release Key.*—(*a*) A Release Key is provided in every Signal Box for use as shown below :—

(1) To change the Tablet of the Block Instrument from the *Train Accepted* (or *Train On*) position to the normal (blank) position when the *Cancelling* Signal is given, or when the plunger fails to release.

(2) To release *Back Lock* on Signal Lever in case Treadle fails to release or is not actuated for any reason.

(3) To release *Front Lock* on Home (where Starting Signals are provided) or on Starting Signals (where Advanced Starting Signals are provided) after shunting operations.

(4) To release *Emergency Point Locks* after Plunging, provided Train has been brought to a stand at the Home Signal.

Signalmen are specially cautioned not to use the Release Key or other means of Release unless they have clearly ascertained that no Train is in the Section, and that such Release is absolutely necessary and can with safety be given.

Whenever a Signalman is offered a train and finds that his plunger is locked he must first assure himself, beyond all measure of doubt, by consultation with the Signalman at the box in the rear (even if this means delay to traffic) whether his inability to use the plunger in the normal manner is due—

(i) to a train having been accepted or being already in the section, or

(ii) to a shunt movement having been made from a siding to the main line within the area under his control, or

(iii) to some failure of the apparatus.

At the same time he must have a clear understanding with the Signalman at the box in the rear as to the description and whereabouts of the last train signalled to him, before he uses the Release Key or other means of release to free the plunger.

When in such circumstances the use of the Release Key or other means of release for accepting a train become necessary the Signalman must maintain his distant signal at caution for the next approaching train.

Should a Signalman find that a signal (other than the signal controlling the entrance to the section ahead) is "locked" when it should be "free" he must, before effecting release, satisfy himself that no train is in the section between the signal concerned and the next stop signal ahead.

A note of the circumstances must be made in the train register book or other book provided for the purpose at each box.

When the use of the Release Key or other means of release becomes necessary in connection with the *Cancelling* signal (vide Regulation 18 of the Standard Regulations for Train Signalling) the Signalman at the advance box must, after acknowledging the *Cancelling* signal and before using the Key or other means of release, confirm with the Signalman at the rear box the particular train that will not proceed and for which the *Cancelling* signal has been sent.

Release Keys either for the Treadle or other Electric Locking Apparatus must not, under any circumstances, be allowed to remain in the Instruments, or other release Key-holes, and Signalmen disregarding this Order will be severely dealt with.

(*b*) Any Signalman who improperly interferes with the Lock and Block instruments, or any part of the apparatus, or who makes any improper use of the Release Key or other means of release, will be liable to dismissal.

APPENDIX C

EXTRACT FROM THE STANDARD REGULATIONS OF THE SOUTHERN REGION FOR TRAIN SIGNALLING (page 96).
SYKES THREE-WIRE TWO-POSITION LOCK AND BLOCK INSTRUMENT.

Mode of Signalling—Western Section.—'A', 'B' and 'C' represent three consecutive Block Signal Boxes, and the process of signalling a Train is as follows :—

(*a*) Prior to the despatch of a Train from 'A', the Signalman there, provided he has received the *Train Out of Section* Signal for the previous Train and the Block Indicator is in its normal position, must call the attention of 'B', and having obtained it, must give the proper *Is Line Clear* Signal. If the Line be clear at 'B' the Signalman there must acknowledge the Signal, remove the Switch Hook from the Plunger (which will lower the Block Indicator at 'A') and press in the Plunger firmly, which will cause his own lower Tablet to change from *Blank* to *Train On*, unlock the leading signal 'A' and change the upper Tablet there from *Locked* to *Free*.

(*b*) On the Train leaving 'A', the Signalman there must send the *Train Entering Section* Signal to 'B'. 'B' must thereupon place his Switch Hook over the Plunger (which will raise the Block Indicator at 'A'), and acknowledge the Signal.

(*c*) 'B' must then, provided he has received the *Train Out of Section* Signal for the previous Train and the Block Indicator is in its normal position, call the attention of 'C', and having obtained it must give the proper *Is Line Clear* Signal to 'C'. If the Line be clear 'C' will give permission for the Train to approach which will unlock the leading Signal at 'B', change the upper Tablet there from *Locked* to *Free*, and lower the Block Indicator at 'B'. 'B' may then lower his Signals, which will change his upper Tablet from *Free* to *Locked*.

(*d*) On the Train leaving 'B', the Signalman there must send the *Train Entering Section* Signal to 'C'. 'C' will thereupon place his Switch Hook over the Plunger (which will raise the Block Indicator at 'B') and acknowledge the Signal.

(*e*) When the Train passes over the Treadle fixed beyond the Home, Starting or Advanced Starting Signal at 'B', it will change the upper Tablet there to *Free* and enable the Signalman to replace the relative signal. The action of replacing the appropriate signal lever will restore the upper Tablet to *Locked* and the lower Tablet to *Blank*. 'B' must then give the *Train Out of Section* Signal to 'A', which 'A' must acknowledge.

APPENDIX D

PROCEDURE FOR SWITCHING OUT A SIGNAL BOX WHERE SYKES LOCK AND BLOCK IS IN OPERATION.

The following is the full procedure required of the signalmen at three consecutive boxes :—

'A' 'B' 'C'

Switching out

'B' awaits T.O.S. from 'A' and 'C' for the last train through the section.

'B' then sends the "closing" bell signal (7–5–5) to 'A' and 'C'.

'A' and 'B' acknowledge the "closing" signal by repetition and each gives a plunge to 'B' to enable him to clear his section signals.

'B' then clears all his signals in both directions and then turns his closing switch to the OUT position (thus establishing the block instrument and bell circuits between 'A' and 'C').

'A' and 'C' must then exchange the "testing" bell signal (16 beats consecutively), and test the operation of the block indicator semaphores by operating their switch hooks.

After the testing bell signal has been exchanged, the signalmen at 'A' and 'C' must re-set their plunging instruments by using the releasing keys.

'B' waits for a short time after operating his closing switch, and then telephones to 'A' and 'C' to ascertain whether block and bell communication has been established through the long section.

If communication is satisfactory, the signalman at 'B' may then leave his box.

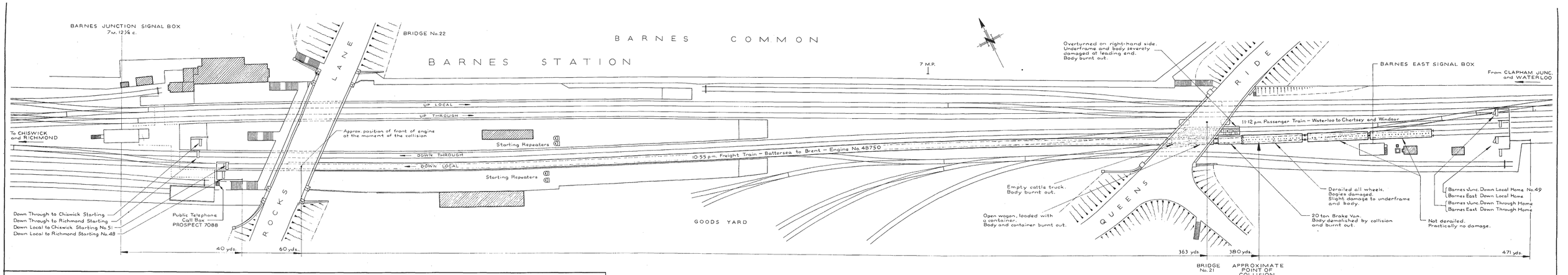


FIG. 2 GENERAL SITE PLAN

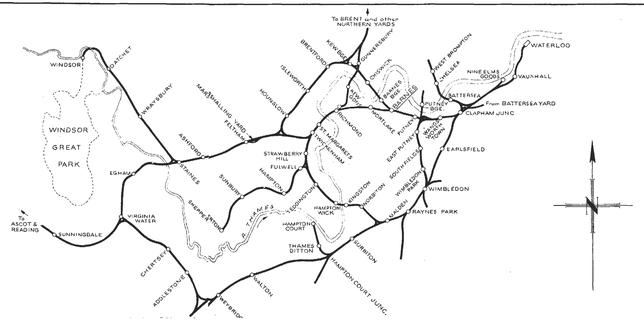
SHOWING THE APPROXIMATE POSITION OF THE TWO TRAINS AFTER THE COLLISION

SCALE: 40 FEET TO 1 INCH

FEET 100 50 0 100 200 300 400 FEET

FIG. 1
LOCATION PLAN

SCALE: 3 MILES TO 1 INCH



SOUTHERN REGION

COLLISION AT BARNES

2nd. DECEMBER, 1955

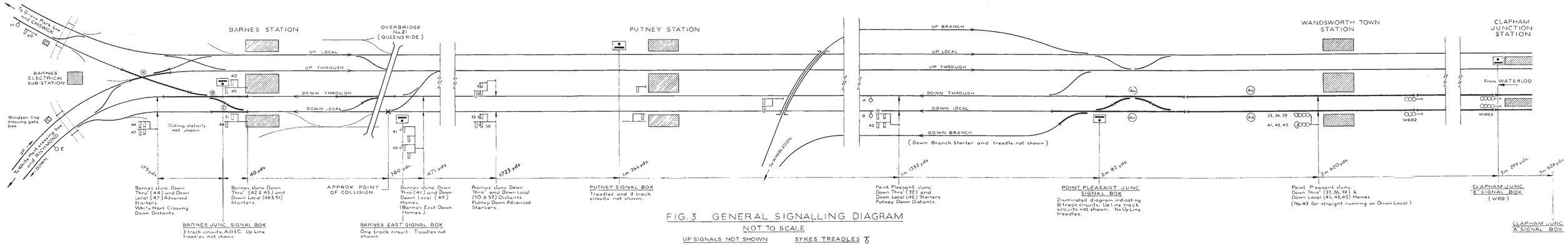


FIG. 3 GENERAL SIGNALLING DIAGRAM

NOT TO SCALE

UP SIGNALS NOT SHOWN SYKES TREADLES ℥

FIG. 5

BARNES JUNCTION

DOWN SYKES INSTRUMENTS

NOT TO SCALE

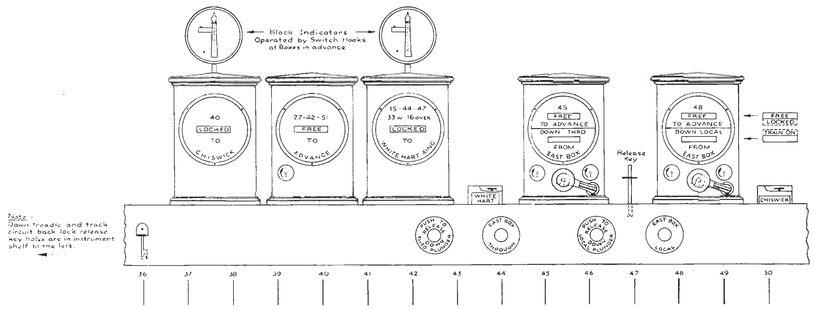


FIG. 4

POINT PLEASANT JUNCTION

DOWN LOCAL SYKES INSTRUMENTS

NOT TO SCALE