

Conclusion.

This accident cannot be attributed to any defect in the switch gear or its position, nor to any rash attempt to tighten the bolts, nor to disobedience to the rules, nor to misjudgment by Bone of the distance between his finger and the switch, but merely to absent-mindedness. Bone had been engaged on such work for ten months and in this sub-station for six months. He was fully aware of the danger. He had been a leading torpedoman and was familiar with dangerous work in magazines.

Having regard to the economy of space necessary in this sub-station which in several respects resembles an engine room on board ship, I do not consider the space behind the switchboard is too narrow. There is sufficient room for inspection while the apparatus is "alive," and for repair when it is shut down. The bare iron floor contributed no doubt, to the fatal shock, and I understand that a teak grating is to be provided. This will reduce the risk of slipping. Wooden gratings or india-rubber mats are useful to prevent slipping, but they are a treacherous safeguard against high pressure electric shocks. The kind of switch used here is open to the objection that sparks may fall on the man who opens it. Oil switches present some advantages, but they have to be provided with isolating switches which would present more bare metal than those in use at this sub-station, and such isolating switches are not always placed in safe positions. These observations are of a general character and do not relate directly to the accident. Three sub-stations of this type have been at work for nearly six years without any accident from electric shock.

This accident was due to absent-mindedness or momentary aberration of a competent man.

I have the honour to be,

Sir,

Your obedient Servant,

A. P. TROTTER.

The Assistant Secretary,
Railway Department, Board of Trade.

Printed copies of the above Report were sent to the Company on the 25th April.

GREAT CENTRAL RAILWAY.

Board of Trade (Railway Department),
8, Richmond Terrace, Whitehall, London, S.W.,
30th January, 1906.

Sir,
I HAVE the honour to report, for the information of the Board of Trade, in compliance with your Order of the 8th January, the result of my inquiry into the circumstances under which a passenger train was derailed at about 4.50 p.m. on the 4th January in Catesby tunnel, between Charwelton and Willoughby, on the Great Central Railway.

In this case, as the 3.25 p.m. down passenger train from London to Manchester, consisting of an engine, tender, and five vehicles, was passing through Catesby tunnel at a high rate of speed, the whole of the train, with the exception of the engine and tender, was derailed. The line appears to have been burst, each rail being forced outwards, and the five vehicles of the train were all derailed on the permanent way between the rails. The driver of the engine noticed that something had gone wrong with his train, so he promptly turned off steam and applied the brakes, and the train was brought to a stand, with the engine at a spot 450 yards ahead of where the first marks of the derailment were found. When the train came to rest, it was found that the coupling of the rear vehicle, a slip coach, had broken; and that this coach had come to rest at a point only 160 yards ahead of the first marks, and that it was standing foul of the up main line. The remaining vehicles of the train were all attached to the engine, and they were all standing upright clear of the up main line. A goods train was, at the time, approaching the spot on the up main line, but very prompt measures were taken by the driver and guard of the passenger train and by some railway officials who were also travelling in that train, to block that line, with the result that the goods train was stopped just in time to prevent its colliding with the slip coach.

There were between 50 and 60 passengers travelling in the train, but none of these

appeared to have suffered any bodily injury, though the Company has since received two notifications from passengers, complaining that they are suffering from shock.

All the vehicles of the train were considerably damaged, and the line was completely wrecked for about 450 yards.

Details of the damage to rolling stock and to the permanent way are given in the appendix.

The engine of the train was a four-wheels-coupled tender engine with a leading bogie and a trailing carrier; it was fitted with a steam brake working blocks on the four coupled wheels, on the carrier wheels, and on the tender wheels, and with a hand brake working the blocks on the tender wheels; it was also fitted with the vacuum brake apparatus for working blocks on the wheels of the coaches.

The train consisted of the following vehicles attached to the engine in the order given:—

	Wheels.
One composite corridor brake	8
One buffet car	8
One composite	8
One first-class brake	8
One slip composite brake	8

All these vehicles were fitted with the vacuum automatic brake, working blocks on all their wheels. The brakes are all reported as having been in first rate order.

The weight of the loaded engine was $69\frac{1}{2}$ tons, and the maximum axle load was $18\frac{1}{2}$ tons on each of the two coupled wheels. The weight of the tender was 44 tons, with a maximum axle load of $15\frac{3}{4}$ tons. The weights of the vehicles varied from 31 to 25 tons, the whole weight being, in every case, braked.

Description.

Catesby tunnel, where this accident occurred, is 3,000 yards in length, and it is situated between Charwelton and Willoughby stations, on the main line of the Great Central Railway from London to Sheffield. The line through the tunnel runs approximately north and south, and it consists of up and down lines, the down line, on which this accident occurred, being on the west side of the line. The lines through the tunnel are practically straight, and for a down train the gradient is a falling one of 1 in 176.

The point where the derailment appears to have taken place is situated 1,606 yards from the south or up end of the tunnel, and after the train came to rest it was found that from that point up to the spot at which the engine was standing, a distance of 450 yards, the down line was completely wrecked, the right hand rail being forced over near to the up line, and the left hand rail being forced over towards the side of the tunnel. Over this section of the line nearly all the chairs were broken, and the sleepers were very much cut about. The right hand rail was completely broken at the point where the marks of the derailment commenced; this break occurred about five feet ahead of a rail joint; the shorter length of this broken rail was, after the accident, found to be still in its right position, but the longer length had been forced outwards towards the up road, and it bore on its broken end the mark of a very severe blow. The remainder of the right hand rails though forced out of position were unbroken, and they were held together by their fishplates. The first mark on the left hand rail was found one rail-length ahead of the first marks on the right hand rail; the left hand rails, though forced out of their position, were not broken at all, and they also were all held together by their fishplates.

The positions in which the various vehicles came to rest have been described above.

The rails in use on the line are of steel, weighing 86 lbs. to the yard, and they are connected by fishplates, weighing 32 lbs. the pair; the chairs are 53 lbs. in weight, and are fastened to the sleepers by two spikes and two wooden trenails; the sleepers are of the usual dimensions, and there are 11 to each 30 feet rail length; the top ballast is of granite chips. The drainage is carried out by means of a central culvert down the six-foot way, and owing to the tunnel being on a falling gradient, no trouble appears to be experienced in carrying the water away.

Evidence.

Harry Bailey, driver, states: I have been 24 years in the service of the Company, during 13 of which I have been a driver. I came on duty on January 4th at 2 p.m. to work until 1 a.m. on the 5th. I should have had an hour at Manchester, during which time I could have left my engine. I came off duty previously at 8 p.m. on the 3rd. I was the driver of the engine of the

3.25 p.m. train from London to Manchester. My engine was a four-wheels-coupled tender engine with a leading bogie and a trailing carrier. It was running chimney first. My engine was fitted with a steam brake working blocks on the four coupled wheels and on the carrier wheels and on the six tender wheels, and with a hand brake working blocks on the tender wheels. My engine was also fitted with a vacuum brake apparatus for working the blocks on the wheels of the vehicles on the train. My brakes were all in good order. Up to reaching Charwelton Station everything had gone right with the train, and I do not think that we were half a minute out of time when passing that station. The first thing which I noticed going wrong was that it seemed as if somebody had applied the hand brakes, which seemed to check the engine, and then a sharp snatch as if my engine was still further checked. I think my engine was about midway in the tunnel when this happened. I at once applied my brakes fully. Steam was turned on at the time, but I also turned that off, the steam with one hand and the brake with the other. We came gradually to a stand, and while coming to a stand the engine did not seem to be much jerked. As far as I could see, my brakes acted very well. When we came to rest all the wheels of my engine and tender were on the rail. I do not think any of them had been off the rail at all. I did not notice any movement of the engine which seemed due to a rail breaking under it. I could not find anything the matter with my engine. An inspector then came forward from the train and took steps to protect the up road. I then found that the train was off the road. The inspector got on my engine, and I uncoupled the engine from the train and ran forward to the next signal-box. I got hold of an empty carriage from an up train and took it back in the tunnel and brought the passengers out. The engine was running very freely indeed and I can throw no light on the cause of the accident. I estimate our speed at the time of the accident at about 60 miles per hour. This is our usual speed for running through the tunnel. While I was on the ground after examining my engine I heard a train coming on the up line, so I immediately put down a detonator almost opposite my own engine. I then called out to my mate to sound the whistle, and he did so. The detonator exploded as the train passed, and the driver appeared to take notice of it. He was not going fast when he passed me.

Frederick Samuel Smith, fireman, states: I have been nearly seven years in the service of the Company, during about three years of which I have been a fireman. I was employed on the 4th January with driver Bailey, and was working the same hours as he did. I was on the engine of the 3.25 p.m. train London to Manchester. Nothing went wrong with our train until we got into the tunnel past Charwelton Station. The first I noticed of anything going wrong with the train was that something seemed to be pulling on us. My driver at once shut off steam and applied the brakes. The brakes seemed to act instantly. I myself applied the sand. I did not notice any movement of the engine as if a rail had broken under it. All the engine and tender wheels were on the line when we came to rest. I do not think that any of them were ever off the line. I cannot throw any light on the cause of this accident. The brakes had been acting very well up to the time of the accident. I estimated our speed at the time at 60 miles per hour, or a little above it. It was the usual speed at which we run through the tunnel with that train.

Samuel Mellor, guard, states: I have been about 26 years in the service of the Company, during about 15 of which I have been a guard. I came on duty at 8 a.m. on January 4th to work until 7.15 p.m. I came off duty at 7.15 p.m. the previous day. I was acting as guard of the 3.25 p.m. train from London to Manchester. My train consisted of the following vehicles attached to the engine in the order given:—

	Wheels.
1 Composite corridor brake ...	8
1 Buffet carriage ...	8
1 Composite ...	8
1 First-class carriage brake ...	8
1 Slip composite brake ...	8

These vehicles were all fitted with the vacuum automatic brake working blocks on all the wheels. My brakes were in good order. I myself was riding in the fourth vehicle, the first-class brake. We left London punctually, and we were about one minute late when we passed Charwelton Station. The first I knew of the accident was hearing the noise of the vehicles in front of me bumping, and then my own vehicle began to bump, and I knew that I was off the road. About the same time that my vehicle began bumping, I noticed that the continuous brake was applied to the train. I saw that the brake was fully applied, so that there was nothing more that I could do. I myself was thrown across the van, but was not injured. The brakes appeared to me to act well. As soon as my brake came to a stand I got out, and I then found that the slip brake was not behind me. I went back to find the slip brake, and when about 20 yards from my van I met the guard of the slip van coming down to me, and he told me that his van was fouling the up road. I at once went down to the front of the train to protect the up road. When I got there I found that the driver was getting ready to go down the line. He put a detonator on the up line, and then, when he heard a goods train coming, he came back to his engine and whistled to stop the train. I then went into the train to reassure the passengers. I found that all the wheels of the train were off the line except the front bogie of the leading carriage. The guard of the slip van told me that he would go back and protect the rear of the train. When the up train came to a stand, its engine had just run past my brake van, but it did not reach the slip carriage.

John Joseph Donner, guard, states: I have been about 13 years in the service of the Company during about 3½ of which I have been a guard. I came on duty on the 4th January at about 12.30 p.m. to work until 9.30 p.m. I came off duty at 9.30 p.m. the previous day. I was riding in the slip brake at the rear of the 3.25 p.m. train from London to Manchester. My brakes and my slip apparatus were both in good order. The first thing I noticed go wrong with the train was the sudden dropping of my own carriage. We were going about 60 miles per hour at the time. I knew at once that we were off the road, and my brake ran along bumping over the sleepers. I was thrown down myself, but I looked up and managed to apply the brake while kneeling. My carriage very soon came to a stand. As soon as my carriage came to rest, I at once got out, and felt to see whether it was foul of the up road, and found that it was so. I found that my carriage had broken loose from the rest of the train. There were 13 or 14 passengers in my carriage, and I at once called to them to get out, and to walk along the tunnel so as to get as far away from the carriage as they could. I then walked forward towards the rest of the train in order to

protect the up road, and I met the guard and driver, and told them that my slip carriage was fouling the up road. They went forward at once to protect the up road, and I told them that I would go back and protect the rear of the train. I did so. My carriage was fitted with the electric light. It went out directly we stopped. I cannot throw any light on the cause of the derailment.

Mr. John Williams states: I am a locomotive inspector to the Company, and have held that appointment for 5 years. I was in the train to which the accident occurred. I was riding in the front carriage of the train, in the next compartment to the brake. The first I knew of the accident was the derailment of the carriage in which I was riding. I am confident that that carriage was derailed. I noticed that the brakes were applied, and they seemed to me to act well. Another officer of the Company who was in the carriage with me, felt out of the left hand window to see where we were, and I then got out on the right hand side of the train. Before getting out of the train, I shouted to the driver and he came to me. I at once told the driver to put a detonator on the line, and just as he was doing so, I heard an up train coming. I then told the fireman to sound the whistle, which he did. The up train passed us, and I shouted to the driver as loud as I could. I think he heard me, but I am not sure. As soon as the up train came to a stand I went to the driver of it, and told him to send his fireman back to the guard to tell him to protect the up road, and he did so. I then got on the engine, and ran forward about 20 yards, and put some detonators on the line, and then ran forward on the engine to Staverton Road. I then got a carriage off an up train, and took it back on the down line and brought out the passengers from the express train. The leading carriage of the train was fitted with electric light, but the remaining carriages (with the exception of the slip carriage) were fitted with gas. The electric lights in the leading carriage did not go out, and this was of great assistance to us. The lights in the three rear coaches all went out, and I could smell that there was a great escape of gas, and I took precautions to see that all naked lights were kept away from those carriages for the time being. I do not think that any of the passengers were injured. None of them made any complaint of injury.

Mr. Conradi states: I am district engineer of the Great Central Railway, and I have charge of the tunnel in which this accident occurred. I was on the scene about an hour and a half after it occurred. When I arrived at the scene of the mishap I found that the right hand rail of the down road had broken five feet from a joint. The distance of this joint is 73 chains from the south mouth of the tunnel, and is near the 133 mile post. The chairs and sleepers up to this break were in good order. I then looked at the left rail of the down road and found a mark on the first spike beyond the next joint. The right rail ahead of the break had been burst open towards the up road, and was lying in close proximity to the up road, while the left hand rail of the down road had been forced towards the tunnel sides. The two rails formed a kind of "guard rail" in between which the derailed coaches had been running for some distance. I found the slip coach about 160 yards from the breakage, and going forward, the rest of the train was some 450 yards from the broken rail. I then went back and obtained a gauge from my inspector and had the permanent way gauged

immediately at the joint and found it quite correct. I subsequently examined the broken rail and found the marks of a blow some 12 feet from the joint. From the point where the broken rail was found, the right hand rail was forced outwards right up to where the derailed vehicles were standing, and the left hand rail suffered similarly from the point where the first mark was found on it. Both rails were held together by their fish bolts in one long line. The sleepers in between the rails were all badly marked and their ends all smashed up. The rail in use on the line is an 86-lb. rail. This rail had been down between seven and eight years at the time of the accident. It now weighs 76 lbs. to the yard. I have been four years in charge of this section. During that time there has only been one previous break of a rail in this tunnel (due to a flaw) and this took place about a fortnight ago. Our rule is not to allow an 86-lb. rail to fall in weight below 72 lbs., on the main line. The chairs are 53 lbs. in weight, and the fish plates weigh 32 lbs. the pair. The sleepers are of the usual dimensions, and there are 11 to each 30-foot rail length. The ballast is of granite chips. We do not have any trouble in the tunnel with drainage. There is a central culvert down the six-foot which carries water away, and the tunnel being on a falling gradient we do not have any trouble with it. The chairs are fastened to the sleepers by two spikes and two wooden trenails. I have inspected the rail which was broken and it appears to me that the breakage was due to a flaw. The flaw could not have been detected by inspection.

Joseph Turner, ganger, states: I am a ganger employed by the Great Central Railway, and I am in charge of the section in which the tunnel is. I have been in charge of it for about a year and a half, and previous to that I had been second in charge of the same section. About half an hour before the accident I had walked through the tunnel and inspected the down line. I had not detected any break in the rail. If there had been a break I feel confident that I should have detected it. I know now where the break was found after the accident, and I feel confident that that break did not exist when I walked through the tunnel. I have once found a broken rail in this tunnel. This was about a fortnight ago. The break was on the up line, but previous to this I had never found a broken rail. I inspect both the up and down lines separately twice a day.

William Dinsley states: I am a carriage and waggon inspector of the Company, and have held that appointment about 14 years. On the 5th January about 11 a.m., I went to the scene of the accident. The vehicles were then still standing in the tunnel. I made a cursory examination of the vehicles in the tunnel by the help of a torchlight, but could find nothing in their condition to account for the derailment. About 5.30 p.m. on the 6th January, when the vehicles had been brought out of the tunnel, I made a further examination of them, but I could still find nothing in their condition to throw any light on the derailment. The bogies had suffered considerably, many of the axle boxes on the off side were broken, and the brake gear was damaged, but I could not detect any defect in the rolling stock which appeared to have existed previous to the accident. All the defects which I found appeared to me to be due to the accident. I examined the tyres and they appeared to be in good order.

Thomas William Male states: I am a carriage examiner to the Great Central Railway, and have held that appointment about six years. I examined the vehicles of the derailed train when they arrived at Marylebone Station on the morning of the 4th January. I made part of my examination in the station, and completed the examination in the carriage sheds. My examination was of a thorough kind. I examined each vehicle from a pit. My examination included the

axles and all the undergear; I saw that the brake work was in good condition; that the couplings were sound, and the axle-boxes; I also sounded the wheels and examined the tyres. I tested the gauge of all the wheels. I found no defects at all, and I feel confident that the train went out with its rolling stock in absolutely good order. The vehicles of this train are inspected in this way every morning, and I myself always carry it out.

Conclusion.

There can, I consider, be no doubt that this accident, which was fortunately not attended with any fatal results or even with any bodily injuries to passengers, was entirely due to a fracture of the right hand rail of the line at the point where the first marks of the derailment were found.

An examination of the entries in the books of the Charwelton, Staverton Road, and Willoughby signal-boxes shows that the average daily speed of this train between the first and last named boxes, a distance of seven miles, is close on 70 miles an hour; the speed on this occasion was probably therefore between 65 and 70 miles an hour, and this speed is only slightly higher than the estimates given of it by the various officials of the train.

From the evidence given by the driver and fireman it appears certain that the wheels of the engine and tender never left the rails at all; but from the evidence of inspector Williams, who was riding in the leading vehicle, it appears probable that it was that vehicle which was the first to be derailed, and it may be presumed that whatever caused the derailment of that vehicle similarly caused the derailment of the remainder of the train.

The vehicles of the train had been carefully examined on the morning of the day on which the accident occurred without any defect being found in them, and the train appears to have been running quite smoothly up to the time of its derailment. An examination of the rolling stock subsequent to the derailment revealed that several of the vehicles were damaged, but the damage was in every case such as might clearly have been caused by the derailment, and there are therefore no grounds for attributing this accident to a rolling stock defect.

There were no marks found on the permanent way up to the point where the broken rail was found, and it may, I consider, be regarded as certain that up to reaching that point nothing had gone wrong with the train, but it appears practically certain that it was at that spot that all the vehicles were in turn derailed.

A broken rail would fully account for such a derailment, and as a broken rail was found at this very point there can be no doubt in my opinion as to its having been the primary cause of the accident. The line had been examined by ganger Turner only half an hour previous to the occurrence, and he is confident that if the rail had then been broken he would have detected it. It is probable therefore that the rail broke under the weight of the engine or tender of the train, without derailing them, but that the end of the broken rail, being slightly displaced by these vehicles, then received a severe end-on blow from the wheel of the leading coach, which forced it outwards, and the complete derailment of the train in the four-foot way at once ensued.

The permanent way in the neighbourhood of the place where this accident occurred was in good condition; the sleepers were sound, the ballasting excellent, and the drainage arrangements quite satisfactory. The rail which was found broken had been laid down in 1898, so that it had been between seven and eight years in use; when first laid its weight had been 86 lbs. to the yard, and after the accident it was found that this had been reduced to 76 lbs. per yard; the rail had thus lost 10 lbs. per yard in weight, and its upper surface was found to have been worn away to a depth of a quarter of an inch.

On the broken ends of the broken rail there were distinct marks of a flaw, and it was probably the existence of this flaw, together with the wear of the rail, which had weakened it to such an extent that it failed under the weight of the engine. The flaw, it should be stated, was an internal one and it could not have been discovered by inspection.

The Company inform me that since this line has been brought into use there has been but one previous instance of a broken rail in this tunnel, and that that occurred only a fortnight previous to this accident; in that case also a flaw is stated to have been found in the rail.

The Company state that their rule is not to allow an 86-lb. rail to remain in use on a main line when its weight per yard has fallen as low as 72 lbs. Considering the weights

of the engines which are now in use, and, the high speeds at which they are habitually run on main lines, I cannot help thinking that undue risk is run by allowing rails to remain in use on main lines until they have been reduced in weight to that extent. The occurrence of this accident points, therefore, to the desirability of the Company's giving careful consideration to the question as to whether an earlier renewal of rails on their main lines is not called for.

One other point in connection with this accident calls for mention. Three of the vehicles on the train were lighted by gas; all the lights in these vehicles were at once extinguished by the derailment, and there was, in consequence, a great escape of gas. Fortunately, the officials of the Company, who were travelling in the train, noticed the smell, and they at once took prompt measures to keep all naked lights away from these vehicles; danger was thereby averted, but it is terrible to contemplate what might have been the results of this accident if an explosion had occurred or a carriage had caught fire in the tunnel. The leading and rear vehicles of the train were both lighted by electricity; the lights in the latter were extinguished, but in the former vehicle they remained alight throughout, and were of the greatest assistance in rescuing and controlling the passengers. This accident furnishes, therefore, another instance showing the undesirability of the employment of gas as an illuminant for trains, and the superiority of electricity for that purpose.

I have, &c.,
P. G. VON DONOP,
Lt.-Col. R.E.

The Assistant Secretary,
Railway Department, Board of Trade.

APPENDIX.

DAMAGE TO ROLLING STOCK.

Brake Composite, No. 1686.—One vestibule face plate, one small top quarter light broken. First Bogie.—Retaining ring bolts off one pair of wheels. Second Bogie.—One axle-guard stay minus, one axle-box broken; two swing beam bolts bent; retaining ring bolts broken; one retaining ring cut off.

Buffet Car, No. 1309.—One crest quarter light broken; one step board, and one gas cylinder stay broken. First Bogie.—One bearing spring tension bolt, three axle-boxes, two brake blocks, one nest elliptical springs and one axle-guard stay broken; one swing beam bolt and one triangle bent. Second Bogie.—One axle-guard broken; one brake block hanger angle iron broken; three axle-boxes and one box front broken; one side casting broken; one swing beam bolt bent.

Composite, No. 1294.—Two small quarter lights, one top door light, and one dynamo broken; side cornice slightly damaged. First Bogie.—Three axle-boxes and one box front broken; two swing beam safety carriers and two triangles bent. Second Bogie.—Four axle-boxes, two brake

blocks, and one triangle broken; one triangle bent.

Brake First, No. 1253.—One small quarter light, one large quarter light, one top door light, one top end light, two projection lights, one projection pillar, one side lamp, and one truss rod broken; side cornice slightly damaged. First Bogie.—Four axle-boxes, two brake blocks, two side castings, one axle-guard stay, and one triangle brake screw broken; six bearing spring tension bolts and four swing beam safety carriers bent. Second Bogie.—Four axle-boxes, two brake blocks, and one axle-guard stay broken; two swing beam safety carriers and one brake triangle bent.

Slip Brake, No. 1669.—One end light, one end panel, and one slip shackle bar broken; side cornice slightly damaged, one buffer bent. First Bogie.—Two cross stay rods, one swing beam bolt, and two bearing spring tension bolts bent. Second Bogie.—One axle-guard stay, one axle-box, one axle-box front, and one bearing spring tension bolt broken; two cross rods, and three bearing spring tension bolts bent.

DAMAGE TO PERMANENT WAY.

88 30-ft. steel rails bent.
477 sleepers crushed and broken.

954 chairs broken.
48 fishplates bent.

Printed copies of the above Report were sent to the Company on the 3rd March.
