MINISTRY OF TRANSPORT & CIVIL AVIATION

RAILWAY ACCIDENTS

REPORT ON THE DERAILMENT

which occurred on

20th January 1954 at

THIRSK

in the

NORTH EASTERN REGION

BRITISH RAILWAYS

LONDON : HER MAJESTY'S STATIONERY OFFICE

1954

TWO SHILLINGS NET

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

21*st July*, 1954.

SIR,

I have the honour to report for the information of the Minister of Transport and Civil Aviation, in accordance with the Order dated 22nd January 1954, the result of my Inquiry into the derailment which occurred at 6.15 p.m. on 20th January 1954 at Thirsk, on the East Coast main line in the North Eastern Region, British Railways.

The train was the 2.0 p.m. "Heart of Midlothian" express from King's Cross to Edinburgh and it comprised 13 bogie coaches hauled by a Pacific type locomotive. The engine and the first four coaches were derailed at the facing points in the Down Main, opposite the signal box at the north end of the station.

The express had been approaching Thirsk under clear signals at about 75 m.p.h. when a signal just outside the station suddenly changed from green to yellow and the next one – 187 yards in rear of the points – went from green to red. The driver was alert and promptly applied the brakes but he was unable to stop the train before it reached the points, which had partially opened owing to faults in the electrical signalling installation. Fortunately the speed had been reduced by then to about 20 m.p.h. and the derailed coaches, which remained upright, were not badly damaged. There were no casualties.

The 5.0 p.m. passenger train Leeds to Newcastle, which was following close behind the express, was stopped south of Thirsk. Later it was brought forward to the station, where its passengers and those from the express were detrained and went on by bus to join a relief train at Northallerton.

The Up and Down Main lines and the Down Slow were blocked. Down traffic was diverted via Starbeck, Ripon and Northallerton, and all Up traffic was taken over the Up Slow line. The Down Slow was re-opened at 4.0 a.m. the next morning and the Up and Down Main lines were cleared by 3.15 p.m. and 3.50 p.m. respectively, after an interruption of 21½ hours.

It had been raining continuously for several hours and the track and formation were thoroughly saturated. The visibility, however, was good.

DESCRIPTION OF SITE

1. The main line from York runs almost due North through Thirsk (22 miles from York) and Northallerton (30 miles), as shown on the site plan of the accompanying drawing. There are four running tracks for practically the whole of the way and they are one of the straightest and flattest stretches of line in the country, with maximum permissible speeds of 90 m.p.h. on the Main and 60 m.p.h. on the Slow lines. At Thirsk, apart from a very slight curve half a mile to the South, the lines are straight and level. All running tracks are equipped with complete track circuiting and three and four-aspect colour-light signals, except for one or two semaphores on the Slow lines. The general layout and details of the signalling at Thirsk are shown on the main plan.

2. No. 223 points, where the train was derailed, formed the southern end of a crossover from the Down Main to the Down Slow. They were laid with standard 95 lbs bull-headed rails and cast iron chairs on wooden sleepers and crossing timbers in stone ballast.

3. Distances from the point of derailment (south end of No. 223 crossover) are:—

Pilmoor	6½ miles	South
Sessay	4¼ ,,	,,
Signal D.20 (automatic)	2,896 yards	,,
Signal D.21	1,681 ,,	,,
South end of T.C.101	1,263 ,,	,,
Bridge No. 45	1,047 ,,	,,
Signal D.22	681 ,,	,,
Signal D.22B	187 ,,	,,
Point of derailment	–	–
Front end of derailed engine	100 yards	North
Point where test train engine stopped	260 ,,	,, (*see* paragraph 28).

THE TRAIN

4. The engine was one of the A-1 class with 3 cylinders and 4–6–2 wheel arrangement; it weighed, with its 8-wheeled tender, 164¼ tons in full working order. The steam brake operated on the coupled wheels of the engine and on all wheels of the tender. All except two of the 13 coaches were of the latest British Railways standard all-steel stock; the eighth and ninth were older vehicles with bodies of composite construction on steel underframes. The vacuum brake operated on all wheels and direct admission valves were fitted to the standard coaches. The combined brake power of the engine and coaches was 477·3 tons, equivalent to 78·6% of their total weight of 607¼ tons. The overall length of the train was 308 yards.

Course of Derailment and Damage to Stock

5. As already mentioned, the train was only travelling at about 20 m.p.h. by the time it reached No. 223 facing points, almost opposite Thirsk signal box. These points were lying in the mid-position and in consequence the engine, the first three coaches and the leading pair of wheels of the fourth coach were derailed before the train came to a stand. The engine stopped 100 yards beyond the points, and the track in the Down Main was destroyed for 93 yards from the switches onwards. Some signalling equipment was also damaged but No. 223 point machine was not touched.

There were no marks on the switch blades nor on the stretcher rods to suggest that the points had been hit by any object; the track in rear of the points was undamaged, and none of the train's equipment was defective or missing except as a direct result of the accident.

6. The derailed stock remained upright but the rear of the second and the front of the third coach veered to the left and completely blocked the Down Slow line. The opposite ends of these vehicles also obstructed the Up Main.

The damage to the stock was slight. Some of the undergear of the engine was bent and twisted, and one tender axle box and a buffer were broken. The brakework of the three leading coaches was damaged and their bodies were twisted slightly but none of the window or door lights were broken and all the interior fittings were intact.

The Signalling Equipment

General.

7. The signalling at Thirsk was brought into use in November 1933 in connection with the initial widening of the lines between York and Northallerton. The signal box is alongside the Down Slow line about 200 yards north of the Down platform and it is equipped with one of the first route relay interlocking systems to be installed in this country. This system is similar to that at Bethnal Green, which is described in my Report dated 14th April 1954, on the derailment which occurred there on the 4th September 1953, though there are some differences in detail which are mentioned later.

The route relay panel.

8. Separate switches for each route are mounted on the illuminated diagram alongside the signal indications to which they refer. There are also individual point switches at the top of the panel. The set of each pair of points is indicated on the diagram so as to show whether they are lying in the normal or reverse position. These indications are illuminated so long as the points are correctly detected. Thus when the points are operated the lights go out and do not re-appear until the movement has been completed and the detection proved.

The controlled signals extend from D.21 to D.23 on the Down Main and from U.23 to U.21 on the Up Main. In addition, the panel shows all signals and track circuits on the Down line from Pilmoor, 6½ miles to the South, and on the Up line from the outskirts of Northallerton, 7½ miles to the North. Thus the signalman has a pre-view of traffic for many miles as it approaches Thirsk.

The signals.

9. All the running signals, including the automatics, are of the three and four-aspect type with 6 volt double filament A.C. lamps taking power direct from the main supply through their own individual transformers. When a running signal has been cleared approach locking holds the route until the train has passed the junctions ahead. The majority of the automatics are also approach lit.

10. The running signals, both automatic and controlled, between Skelton (just north of York) and Northallerton are given serial numbers prefixed by the letters D for the Down and U for the Up lines. At Thirsk the signals are controlled by the route switches which are numbered consecutively beginning with the Down lines; these numbers, as well as the serial numbers, are shown beside the signals on the diagram. Those which are relevant to this report, together with the route switches that control them are given below:—

Signals.	*Controlled by Route Switch No:*
Down Main.	
D.21	1 Down Main.
	6 Down Main to Down Slow.
D.22	2 Down Main.
D.22B	3 Down Main.
	8–11 Down Main to Down Slow and three Reception Lines.
D.22C	4 Down Main.
	12 Down Main to Down Slow.
D.23	5 Down Main.
Up Main.	
U.22	109 Up Main to Up Slow.
	133 Up Main.
U.22B	132 Up Main.
Shunting.	
90–92	90 Down Main to Coal Depot.
99–100	99 Down Reception Line No. 2 to Down Main.
105–107	107 Up Reception Lines to Up Main.

Points.

11. The only points to which reference need be made are:—

220. Facing crossover Up Slow to Up Main.
221. „ „ Up Reception Lines to Up Slow.
223. „ „ Down Main to Down Slow.

Relevant interlocking and controls.

12. All signals and points are fully interlocked and controlled in accordance with modern signalling practice. The distance between the automatic signals varies slightly according to local conditions, and approaching Thirsk the Down signals are about 1,350 yards apart though the spacing through the station is reduced on account of additional signals needed to meet traffic requirements. The provision of four-aspect colour-lights, with delayed clearance where necessary, has enabled ample braking distance to be available at all running signals.

When D.22B, the signal protecting No. 223 points, is at R, D.22 remains at R also until T.C.101 is occupied. Thus the sequence of aspects in these circumstances is:—

D.20 YY
D.21 Y
D.22 R (until T.C.101 occupied).
D.22B R.

Route switch No. 3 of signal D.22B detects and locks No. 223 points in the normal position. If the detection fails, the aspect changes at once to R with consequent alterations of the other signal aspects in rear.

Shunt signal 99 sets, locks and detects No. 223 points in the reverse position.

Shunt signal 107 sets, locks and detects Nos. 220 and 221 points in the reverse position.

The relay room.

13. The relay room is on the ground floor of the signal box, with the battery room adjoining it at the south end. It houses the interlocking, detection and track circuit relays. The two last named are of the 110 volt A.C. type, but the route relay interlocking system, including the interlocking relays, is energised by 25 volts D.C. The working of the point machines in this installation is, however, controlled by A.C. point controllers placed in boxes alongside their respective machines instead of in the relay room. The motors themselves are operated by 120 volts D.C. from the battery in the signal cabin. The leads from this battery are taken to a bus bar in the relay room, where there are five negative and five positive feed cables leading out to location boxes on the Up and Down side of the line. Each of these boxes feeds a number of point machines and each box houses distribution boards, fuses, etc., not only for the D.C. supply to the point motors but also for the A.C. circuits to the track circuit and detection relays.

The point machines.

14. The point machines are of the combined type incorporating the facing point lock and detector. Each motor is series wound with two sets of field coils connected in series for operation from the 120 volts supply. Two pole changer coils, one for normal and one for reverse operation, are provided so as to reverse the motor connections when necessary.

To prevent damage to the machine, the motor is made regenerative by the pole changer contact gear bringing a snubbing circuit into effect after each complete operation. Shortly after the new equipment was brought into use it was thought that too high a current was passing through the circuit and a variable resistance of 10 ohms maximum was therefore inserted.

The power needed by one machine to work a crossover is approximately 4 amperes at 120 volts.

Report

Evidence of the train crews.

15. Driver A. Salmon took charge of the express engine on its arrival at York. The train left six minutes late and ran the whole way to Thirsk under clear signals. The engine was steaming well and the vacuum brake gauge was registering 21 inches. As the express was approaching Thirsk at a speed of 70–80 m.p.h. Salmon saw the signals D.21 and D.22 both showing green aspects. He passed D.21 at clear, after which his vision of D.22 was temporarily obscured by smoke and steam from an Up train. He did not see this signal again until he had passed under No. 45 bridge, when to his surprise he saw the light had changed to yellow. He made an immediate brake application and a moment or so later he saw the next signal, D.22B, at red.

Although the train began to slow down, there was not sufficient distance in which to stop, and it was derailed on the crossover just opposite the signal box. The speed by this time was very much reduced, and the engine stopped quickly and remained upright. Salmon immediately went to the box, where he was told by the signalman that all signals had already been placed to Danger. Fireman K. Carry generally confirmed his driver's evidence.

16. Guard E. M. Bradley was in charge of the express from King's Cross, and he was travelling in the 11th coach. He said that the brakes had been working satisfactorily throughout the journey, which had been uneventful as far as Thirsk. But as they were approaching the station Bradley felt a jerk, followed by a full emergency brake application, and on looking out of the window he saw signal D.22B at Danger. He estimated that the speed of the train was between 70 and 80 m.p.h. when the brakes were applied, but it had dropped to between 20 and 30 m.p.h. at the time of the derailment.

17. Driver A. N. Rutter of the Leeds train, which was following closely behind the express, had no difficulty in stopping at signal D.21 having received a double yellow warning at D.19B followed by a yellow at D.20.

Signalman's evidence.

18. Signalman F. Brown, who was on duty at Thirsk signal box from 2.0 p.m. to 10.0 p.m., said he had worked in it ever since it was opened 20 years ago and he was thoroughly acquainted with all the features of the signalling. Shortly before the accident occurred there were altogether seven trains either at or approaching the station. Their positions were shown by the illumination of the track circuit lights on the panel. The King's Cross to Edinburgh express was on the Down Main at Sessay with the Leeds train behind it near Pilmoor. There was an H Class Goods on the Down Slow. On the Up side the 5.3 p.m. Newcastle to King's Cross express was on the Up Main near Ottrington and a D class Goods was on the Up Slow proceeding to Sessay, with another H class Goods between Northallerton and Thirsk. An E class Goods was standing in No. 2 Up Reception Line ready to follow the Newcastle train on the Up Main.

This train passed through Thirsk at 6.13 p.m. and as soon as it had cleared the overlap track circuit (255T) of signal U.22B at the south end of the station, Brown reversed No. 107 switch so as to allow the E class Goods to depart from the Up Reception Line to the Up Main. (The operation of this switch reverses Nos. 221 and 220 crossovers provided all the controls are clear). Brown said he made this movement at 6.14 p.m. and as he did so the normal detection lights of the two crossovers went out on the panel but the reverse lights did not show up. The detection of No. 223 crossover leading from the Down Main to the Down Slow was also lost at the same time.

Brown said he thought a fuse had blown and he called down to the linemen who were working in the relay room to find out what they were doing. Lineman Brayshaw came running up the stairs to look at the panel and then dashed out again. The King's Cross express passed signal D.21 about the same time and as it did so Brown noticed that the panel indications of both D.22 and D.22B had gone to red but almost immediately D.22 changed to yellow (this would occur as soon as the express occupied track circuit 101T—*see* paragraph 12). Brown went to the window to see what was happening and he watched the express approaching at about 25 m.p.h. He was powerless to do anything and the derailment took place just below him. He immediately put all signals to Danger and told the signalmen at Pilmoor and Northallerton, the two boxes open on either side, to stop all traffic.

Brown explained that at about 4.0 p.m. Brayshaw had told him that there was an earth on the point circuit, and at 5.40 p.m. he came to him again and asked him whether he was going to work any points at that particular time so that he could make a test.

Brown said he had last worked No. 223 points at about 4.30 p.m. when he made a shunt from No. 2 Down Reception Line across to the coal depot. To do this he had turned Nos. 99 and 90 switches. He had not experienced any difficulty in the detection, which "came up" as soon as the points had been operated. The previous train on the Down Main before the King's Cross express was a C.1 Goods which passed at 5.48 p.m. when the signals were working perfectly normally.

Linemen's evidence.

19. On the day of the accident a number of linemen were attending to faults in the signalling and telecommunications system. These were due primarily to damage caused by a gale a few days earlier, though the heavy rain which had been falling continuously for many hours had also contributed to the difficulties.

20. Chief Lineman J. K. E. Piggin, who had recently taken charge of the signal and telegraph equipment from Skelton to Northallerton, had been working throughout the day clearing faults on the signal post telephone system. He was aware of the difficulties at Thirsk and he arrived there at 5.40 p.m. with Chief Lineman C. H. Pearce, of York, who had come out to help him. They were met in the relay room by Lineman T. Brayshaw and Assistant Lineman G. H. Kirby. These two men had also been attending to telephone line faults at Northallerton earlier in the afternoon but were then engaged in looking for an earth on the 120 volt D.C. point motor circuits in the Thirsk relay room.

Piggin discussed the problem with them and decided to leave Brayshaw looking for the D.C. earth while his assistant, Kirby, helped the two Chief Linemen repair the telephone circuits. The three men were engaged on this work for the next 20 minutes or so. First Kirby, then Piggin and finally Pearce went to the telephone location boxes on the Up side but they all returned together to the relay room just before the accident occurred.

Piggin said that on their return Brayshaw told him that the detection on some of the points was lost but this did not register immediately in his mind because he was still thinking about the telephone faults. A moment or two later Piggin heard a noise and saw through the window the reflection of sparks from the wheels of the derailed express. He immediately connected the accident with trouble at the points

outside the signal box so he cleared everyone out of the relay room and locked it up. As soon as he had done this he went up to examine the panel and saw there was no detection on No. 223 points. Signalman Brown told him how the detection on these points had failed when he turned No. 107 switch, and Piggin noted that the switch was now normal with No. 221 points indication in the reverse position.

He next inspected No. 223 facing points in the Down Main and found the switches lying half open; they did not appear to have been damaged. After this he undid the point lock cover and found that the lock was released. He put the cover back and decided to await his Inspector's arrival before examining the rest of the equipment.

21. Chief Lineman C. H. Pearce said that on his arrival at Thirsk he stayed first of all in the relay room taking volt meter readings while Piggin and Kirby went out to attend the telephone location boxes. Pearce was just about to leave the relay room and join the others when Brayshaw, who was looking for the earth on the 120 volt D.C. circuit, told him that it would not clear until he disconnected two of the cables. Pearce replied that he would come and help him on his return, but the accident occurred shortly after they got back to the signal cabin.

Pearce accompanied Piggin on his inspection of No. 223 points and confirmed that they were standing half open. About a quarter of an hour later, after discussing the matter with Piggin, Pearce re-entered the relay room and examined the point lock relay, which was latched normal with the glass cover in place. He did not touch anything and relocked the relay room on leaving it.

22. Lineman T. Brayshaw said that at about 3.0 p.m. on the afternoon of the accident he made the daily routine test of the 120 volt D.C. circuit and found that there was an earth on the negative side. He could not attend to it at that moment because he had received a message from Chief Lineman Piggin to locate a signal post telephone fault at Northallerton. He got back to Thirsk about 5.0 o'clock and had another talk on the telephone with Piggin who told him that he would come out to help them.

On the arrival of the Chief Lineman it was decided that Kirby should help them while Brayshaw tried to find the D.C. fault. Brayshaw therefore began his testing after first ascertaining from the signalman that he did not require to move any points. He began at the D.C. bus bar by removing in turn each of the five outgoing negative cables. He did not, however, locate the fault and he concluded there must be two earths on separate cables. Finally he found one on the lead to the A.B.C. and D. location boxes, which feed Nos. 216, 217, 219, 220 and 221 points, and the other on the lead to the E.F. and G location boxes, which feed Nos. 213, 214, 218, 222, 223 and 224 points.

Brayshaw said that the discovery of two faults on the D.C. circuit was rather a shock to him because he had never known such a thing happen before, but Chief Lineman Pearce had said he would help him when he came back from attending to the telephone lines. Brayshaw was still wondering what to do next when Signalman Brown shouted down to him that there was no detection on No. 223 points. Brayshaw ran up to the cabin to find out what had happened but he only checked the detection on these points and did not notice the position or indication on any of the other points or switches. He did not connect this trouble with the two earths on the D.C. circuits but he thought it was just a case of normal detection failure. He did not have time to do anything about this fresh trouble before the Down Express was derailed outside the cabin.

Testing of the signal equipment.

23. Signal and Telecommunications Inspector H. Richardson, of the York District, arrived at Thirsk at 7.45 p.m. and went at once to the signal cabin where he met all the linemen who had been working there, but none of them could explain the cause of the accident. Piggin unlocked the relay room so that the Inspector could examine No. 223 lock relay, which he found set in the normal position with the glass cover protecting it as Pearce had stated. The point indication relay was in the neutral position.

Inspector Richardson then went to the point machine and first examined the point control relay, which was normal. On removing the cover of the machine he found the lock withdrawn and the points in the mid-position. He examined the circuits to the signal box but he could not find any cross-connection such as might have caused a fault and he came to the conclusion that the fault must have been in the point machine itself. He next examined the 120 volt D.C. bus bar and repeated the tests which Brayshaw had made, and with the same results, namely the earth was not removed until the cables to locations A.B.C.D. and to E.F.G. had both been removed.

He then began examining No. 223 point machine in more detail. First of all he found the reverse pole changer coil was earthed, and then he discovered there was a break inside the normal pole changer coil but he could not locate it exactly. He worked all night on these examinations and it was 8.0 a.m. before he had completed them.

24. Signal and Telecommunications Inspector J. Anderson had arrived by this time and he continued the investigations. He said that he decided to concentrate on No. 220 points because it appeared to him that the trouble had occurred when the signalman had operated these points by turning No. 107 route switch. The insulation of the motor wiring and the cables was satisfactory but finally he found the armature was fully earthed. Later examination in the workshops showed there was a contact between one of the conductors and the armature, probably due to defective impregnation in the manufacture of the coils. The motor was a wartime product and it had been installed in 1941.

Having traced the faults on the two point machines, Inspector Anderson's next action was to reproduce the conditions at the time of the accident. He therefore kept the earth on the armature of No. 220 motor and put back the earth on to the negative pole changer coil of No. 223 point machine. He then went into the cabin and turned No. 220 point switch. These points were reversed and bolted correctly but at the same time No. 223 points opened to just over midway. This test was repeated several times with the same results. The weather was still very bad with the ground saturated as it was at the time of the derailment.

25. These experiments were repeated in my presence on 2nd February but on this occasion the weather was dry and Nos. 213 and 214 point machines were used. The armature of No. 214 motor was earthed, a disconnection was made in the normal operating pole changer coil of No. 213 machine and its reverse pole changer coil was earthed, thus setting up the conditions as found on point machines Nos. 220 and 223 respectively. No. 214 machine was operated but No. 213 did not move at first because the insulation of the ground was too high. No. 213 reverse pole changer coil was therefore connected directly to the same earth circuit as the other machine and this time No. 213 points moved to the mid-position when No. 214 machine was reversed. The same results were obtained when the test was repeated. These experiments not only confirmed those carried out by Inspector Anderson but they also showed how the resistance of dry ground was sufficient to prevent serious circuit leakages from affecting other nearby equipment.

The normal operating pole changer circuit of No. 213 machine was next made good and the test was repeated; this time No. 213 bolt was withdrawn and the points began to move, but as soon as the normal pole changer coil reached the mid-position the current was reversed, so that the motor returned the points to normal and bolted them. Finally the resistance on the snubbing circuit of No. 213 motor was short circuited and No. 214 points were again operated. No. 213 motor did not move but the fuse in the 120 volt circuit was blown.

26. Mr. A. F. Wigram, the Signal and Telecommunications Engineer, North Eastern Region, had arrived at Thirsk on the evening of the accident and he supervised the tests which have already been described. As a result of his investigations he was able to trace the cause of the irregular operation of No. 223 points to the following sequence of events.

The turning of No. 107 switch operated Nos. 220 and 221 point lock relays in the normal way, thereby energising their respective point controllers, which reversed and so allowed current to operate the motors and throw the points. The reversal of No. 220 points controller put the positive side of the 120 volt battery to earth through the fault in the armature of that machine as indicated diagrammatically on the drawing. The earth current was picked up at the reverse operating pole changer coil (R.W.) of No. 223 points which, as already explained, was also earthed, and the current returned through the motor to the negative side of the battery. When No. 220 points completed their movement the pole changer contacts reversed, thus cutting off the 120 volt feed from the armature. This in turn cut off the feed to No. 223 points, causing them to stop in mid-position.

Two other factors contributed to this irregular operation:—

(*a*) The disconnection in the normal operating pole changer coil (N.W.) of No. 223 points threw this coil out of action. If it had been working correctly it would have been connected in circuit by the initial movement of the facing points bolt throwing the cut-out contacts to the mid-position. This would in all probability have restored the points to normal, since the full operating voltage across the normal operating coil would have overcome the stray earth voltage across the reverse coil and thereby reversed the pole-changer contacts, as was confirmed by the tests on 2nd February.

(*b*) The presence of a snubbing resistance in the circuit between the normally de-energised operating line and the negative return. This resistance was sufficient to divert a proportion of the false earth feed through the motor to the negative side of the battery; if the resistance had not been there the current would have returned direct through the de-energised (in this case the reverse) operating line to the snubbing contacts, thereby blowing the fuse for No. 220 point machine if the current had been sufficiently high (15 amps.). The blowing of this fuse would have cut off the current not only to No. 220 point machine but also to No. 223, as was demonstrated by the tests on 2nd February.

Previous point operating circuit failures.

27. Inspectors Richardson and Anderson, Chief Lineman Pearce and Lineman Brayshaw, all of whom had had considerable experience in the maintenance of the Thirsk installation, were asked about previous failures of the point operating circuits which were tested daily. None of them had ever remembered a case of two earths on separate circuits at the same time and all of them stated that earth faults only occurred about once every six months.

Signalman Brown was also questioned about his experience since the new signalling was introduced 20 years ago and he confirmed that faults on the point machines were rare. Fuses were sometimes blown when linemen were testing but this seldom happened. Taken by and large there had been little trouble since the installation was first brought into use.

Examination of the linemen's records for the last four years showed that a total of 10 faults on the point machines were reported, of which six were due to earths on pole changer coils and four to disconnections in the coils.

Test run

28. A trial run was made on 2nd February to check the stopping distance of a train approaching Thirsk at high speed. On this occasion the train was travelling at 80 m.p.h. with all signals at clear. As soon as the engine occupied T.C.101, signal D.22B was returned to Danger, thus changing the aspect of D.22 from G. to Y. A full brake application was made at a point about 50 yards south of the No. 45 overbridge, *i.e.* about 100 yards before the point where Driver Salmon made his emergency application. Although the train decelerated rapidly, D.22B was over-run and the engine finally stopped 260 yards beyond No. 223 facing points, having travelled a distance of approximately 1,355 yards from the point of brake application. This compares with a distance of approximately 1,000 yards between No. 223 facing points and the point where the brakes of the express were applied.

Conclusion

29. There is no doubt that the derailment was due to No. 223 facing points having been moved irregularly to the mid-position while the express was approaching Thirsk at high speed. As a result of extensive tests it was proved that a false feed had been applied to No. 223 point motor when No. 220 point machine was energised. This occurred when Signalman Brown turned No. 107 switch in order to set the route for the goods train in the Up Reception sidings to follow the Newcastle train on the Up Main. Brown noticed at once that No. 223 point detection light on the panel had failed and he advised the lineman immediately, but nothing could be done before the express arrived. Brown's action in setting up No. 107 route for the goods train was quite in order and he was in no way to blame for the accident, which he was powerless to prevent. He took immediate steps to protect the obstructed lines, and all the trains approaching Thirsk were stopped either by his action or by the automatic working of the track circuit controls.

30. I am quite satisfied that the express had been travelling under clear signals as far as Thirsk and that Driver Salmon was keeping a proper lookout. I accept his statement that signals D.21 and D.22 were showing green aspects when he passed the former and that his vision was temporarily obscured by smoke and steam from an Up train. (This would have been the Newcastle–King's Cross express that had passed through Thirsk about a minute earlier.)

The false operation of No. 223 points, which must have occurred while the Down express was still on track circuit 100T (just ahead of signal D.21), broke down the detection and so threw D.22B and D.22 to R, D.21 to Y and D.20 to YY. Salmon had already passed signals D.20 and D.21 by this time and when he saw D.22 again, after passing under No. 45 overbridge, the aspect had changed to Y by the occupation of track circuit 101T. The train was now little more than 1,000 yards from No. 223 points and this distance was insufficient in which to stop the express from the speed of 75 m.p.h. Salmon's reactions in the emergency were commendably prompt and he did well to reduce the speed of the train so much.

31. Ample braking distance has been provided at all running signals at Thirsk and in normal circumstances a driver receives plenty of warning of an obstruction ahead. All the signal controls functioned correctly, so much so that Driver Salmon at least received some warning, and the Leeds train which was following close behind the express was stopped by the automatic reversion of the relevant signals to the appropriate Danger and Caution aspects.

32. A number of linemen were working in the relay room and its vicinity at the time of the accident but none of them was in any way responsible for the false operation of the points. Lineman Brayshaw had discovered a serious earth on the point motor circuit when he made the daily routine test at 3.0 p.m. that afternoon, but he had to go to Northallerton to repair some telephone circuits there and he did not get back to Thirsk until 5.0 p.m. When he resumed his testing he found a second earth but had no time to locate either of them before the accident occurred.

33. The actual cause of the false feed was a most unusual one and it required six conditions to be set up, namely:—

(*a*) A short circuit from No. 220 points motor armature to earth;
(*b*) A short circuit from No. 223 reverse operating pole changer coil to earth;
(*c*) A disconnection in No. 223 normal operating pole changer coil;
(*d*) Resistances in the snubbing circuits between the normally de-energised operating lines of the motors and the negative returns;
(*e*) A saturated ground so that earth resistance was negligible;
(*f*) Operation of No. 220 points at the critical moment when the express was approaching.

Remarks

34. Although a number of pole changer coils had given trouble in the past, I do not think it had been sufficiently serious for the staff to anticipate a failure such as occurred on this occasion, nor were the faults of a type which could have been easily detected in the course of normal maintenance of the point machines. But this accident has shown how dangerous conditions can be set up, and prompt steps have been taken to eliminate as far as practicable the chance of a recurrence.

As a precautionary measure all the pole changer coils at Thirsk were replaced immediately by new ones of the same design, but since then an improved type has been obtained and is being tested; the possibility of substituting a contactor relay in place of the pole changer mechanism is also being investigated. The snubbing resistances on all point motor circuits have been removed so as to allow any false feed to a motor to return to the battery by a direct low resistance path.

35. As mentioned in my Report dated 14th April on the Bethnal Green accident, the general question of electric points operation is being examined to see whether the present safeguards can be improved. It cannot be expected, however, that every possible cause of current leakage or earth fault can be entirely eliminated and trouble may occur from time to time due to wear and tear of equipment, accidental damage, and so forth. When this affects point operating circuits the possibility of false operation of points is increased, though such incidents are very rare indeed. The two accidents under reference have emphasized the dangers which may arise from such causes, and although the speed was slow in both cases it needs little imagination to appreciate the serious consequences of a high speed derailment, which might so easily have happened at Thirsk if the points had moved a few seconds later. I recommend therefore that temporary speed restrictions should be applied whenever serious faults are discovered on circuits affecting the integrity of points or signals.

I have the honour to be,

Sir,

Your obedient Servant,

C. A. LANGLEY,

Brigadier.

The Secretary,

Ministry of Transport and Civil Aviation.

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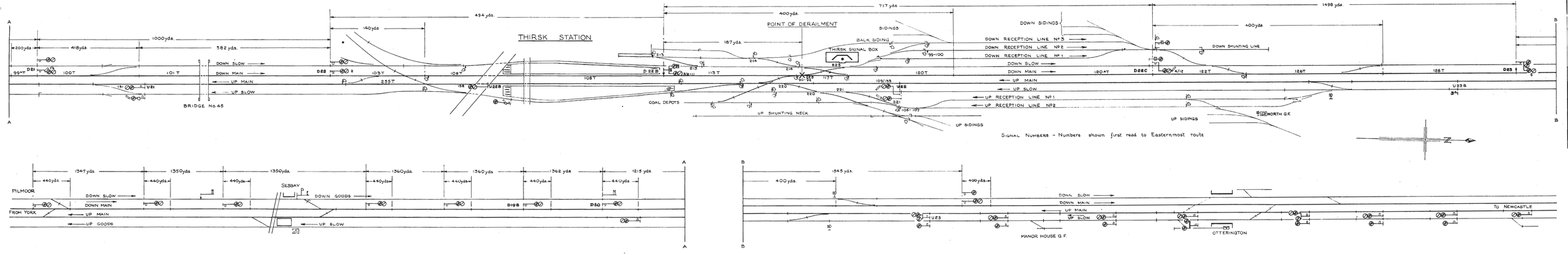


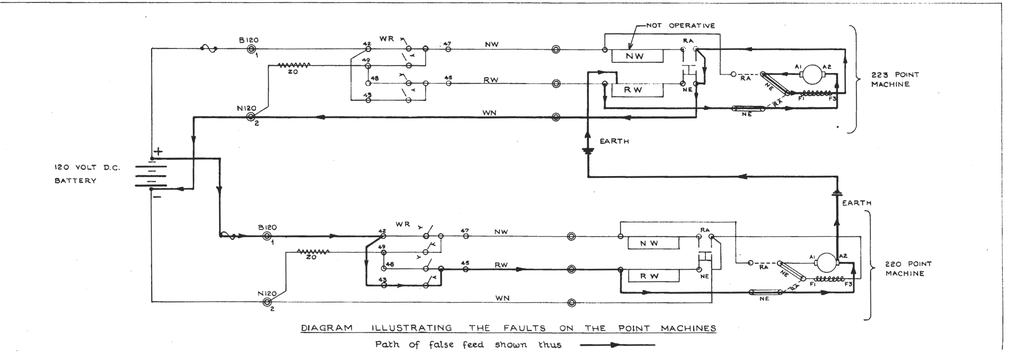


DIAGRAM ILLUSTRATING THE FAULTS ON THE POINT MACHINES

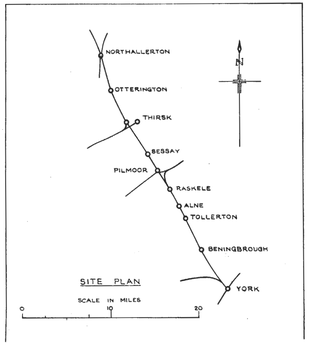
Path of false feed shown thus ⟶

THIRSK SIGNALLING DIAGRAM INCLUDING MAIN LINE AUTOMATIC SIGNALS AS SHOWN ON THE ROUTE

RELAY PANEL

Not to Scale

Only relevant signals, points and track circuits are numbered.



SITE PLAN

SCALE IN MILES

NORTH EASTERN REGION

DERAILMENT AT THIRSK

20TH. JANUARY 1954