MINISTRY OF TRANSPORT

RAILWAY ACCIDENTS

Report by

LIEUT.-COLONEL E. WOODHOUSE, R.E.

on the Collision which occurred on the

1st January, 1946

at

LICHFIELD

on the

London Midland and Scottish Railway

LONDON: HIS MAJESTY'S STATIONERY OFFICE
1946
NINEPENCE NET

MINISTRY OF TRANSPORT

RAILWAY ACCIDENTS

Report by
LIEUT.-COLONEL E. WOODHOUSE, R.E.
on the Collision which occurred on the
1st January, 1946
at
LICHFIELD
on the
London Midland and Scottish Railway

LONDON: HIS MAJESTY'S STATIONERY OFFICE
1946

LONDON MIDLAND & SCOTTISH RAILWAY

MINISTRY OF TRANSPORT,
BERKELEY SQUARE HOUSE,
W.1.

15th April, 1946

SIR,

I have the honour to report for the information of the Minister of Transport, in accordance with the Order of 3rd January 1946, the result of my Inquiry into the accident which occurred at Lichfield (Trent Valley) station, on the London Midland and Scottish Railway, at 6.58 p.m. on 1st January 1946.

While the 6.8 p.m. local passenger train from Stafford to Nuneaton was standing at the platform, on the Up Slow line, the 2.50 p.m. fish train from Fleetwood to London (Broad Street), travelling at about 35 m.p.h., was accidentally diverted to the same line at the north end of the station, instead of running through it on the Up Fast line as was intended. The resulting collision was violent, driving the passenger train forward about 100 yards and wrecking the four coaches of which it was composed; the vehicles of the fish train were undamaged and were worked forward to their destination later. All lines were blocked until the following morning when the Down lines were re-opened at 7.35 a.m. and the Up lines at 8.20 a.m.

I regret to report that 20 passengers lost their lives, 13 in the collision itself and the remainder either in hospital or on their way there; in addition, 21 passengers were injured, some seriously. The enginemen of the passenger train and its guard—who was not in his van at the time—were unhurt. The enginemen and guard of the fish train escaped with bruises or minor injuries, though the driver had to be treated for severe shock subsequently; a porter on the platform was injured by flying debris.

Prompt and valuable assistance was given by the police, N.F.S., local doctors, nurses, and residents, and by a detachment of R.A.F. from a neighbouring airfield. Ambulances arrived within ten minutes of the accident, the first of the injured reaching hospital about ten minutes later; all those injured were removed by 8.0 p.m. As the gas main supplying the station and signal boxes was broken, emergency lighting arrangements were made by the R.A.F. detachment to assist in the rescue work.

The night was fine and clear, with a few degrees of frost; there was a light to moderate south-easterly wind.

DESCRIPTION

Site and Trains

2. Lichfield (Trent Valley) station is about midway between Stafford and Nuneaton, on the main line from the North, here running roughly from North-West to South-East on a falling gradient of 1 in 330. The station, with sidings north of it, lying in a wide shallow cutting, is approached from the north through a deeper cutting over a left hand curve of one mile radius. This, and the presence of three overbridges, somewhat restricts the view of the signals at the station obtained by drivers of Up trains.

On either side of Lichfield the line is double, but through the station and for about 600 yards to the north of it there are four tracks, the Fast lines in the centre and the Slow lines on either side; the platforms are served by the Slow lines only. Immediately north of the station a chord, leading to the Walsall–Burton line, diverges towards the east, the junction with it being facing for Up trains.

Relevant distances and the layout of the Up Fast and Up Slow lines, together with the signals controlling movement over them, are shown on the accompanying diagram, from which it will be seen that there is a connection leading to the Up Slow line at Lichfield No. 2 signal box and another at Lichfield No. 1. It was by means of the latter, over points 33 and 34 reversed, that the passenger train reached the platform, the fish train later following the same path through the failure of points 33 to respond to the movement of their lever in No. 1 signal box. This connection has a 1 in 16 crossing in the Up Fast line and a 1 in 14 crossing in the Up Slow line; speed through it is restricted to 15 m.p.h.

3. The stationary passenger train consisted of four bogie coaches, electrically lit, with steel or composite underframes and wooden bodies; half of the buffers were of the shock absorbing pattern. It was drawn by 4–6–0 tender engine No. 25802 (Prince of Wales class), weighing 105½ tons in working order; the unloaded weight of the coaches was 94 tons, and the overall length of the train, including the engine, was 268 feet.

The fish train was composed of seven 4-wheeled fish vans and covered goods wagons, with a 20-ton brake van, all having steel underframes. It was drawn by 4–6–0 tender engine No. 5495 (Class 5), weighing 125¾ tons in working order. The weight of the train (empty) was 79¾ tons, and all its vehicles were fitted with the vacuum brake, working in conjunction with the steam brake on the engine and tender, the proportion of weight braked on train and engine being 96 per cent. and 64 per cent. respectively.

4. Although the passenger train was standing with brakes fully applied, which increased the violence of the collision, its engine was driven forward about 280 feet, into the sand drag at the outlet from the Up Slow line; the fish train came to rest about 400 feet ahead of the point of impact. The leading coach of the passenger train was the only one not demolished; its body and underframe were torn from the bogies, and forced to one side, with the rearmost compartment destroyed; the plating of the tender ahead of it was crushed in by this coach, but the engine was undamaged.

The three remaining coaches were completely wrecked. Half of the body of the second coach was found on the platform, about 120 feet behind the engine of the fish train, which had driven into and through the rearmost coach. The roof and body sides of this coach were found astride of the tender, and its solebars were splayed out on either side of the engine.

This engine was derailed (all wheels) but damage to it was relatively slight, and mainly confined to the front end, where the frames and buffer plate were bent and the smokebox damaged. The tender remained on the rails and, as mentioned earlier, the vehicles of the fish train were unharmed.

There was also some damage, of no great importance, to the permanent way, to signalling apparatus and connections, and to the station structure.

Signalling etc. arrangements

5. The points and signals at Lichfield No. 1 box are worked mechanically from an interlocking frame of 80 levers, of the type in use on the former L. & N.W. Railway. The point rodding is of the Company's standard channel section, 1⅝ in. × 1¼ in., weighing about 10 lbs. per yard, carried on rollers 9 feet apart; there are the usual compensators at mid-length of each line of rodding, reversing the direction of its movement and thus nullifying the effects of a change of temperature.

With regard to the connection from the Up Fast to the Up Slow line, over which the fish train was wrongly diverted, point levers 33 and 34 have to be pulled, in that order, for such a movement; pulling of lever 32 bolts the facing points (No. 33) in either position. The usual interlocking prevents the levers working the Up Fast home signals (Nos. 4, 6, and 7) being pulled unless the point levers are in the appropriate position, and the facing point bolt lever has been pulled. Similarly the Up Distant signal lever, No. 3, cannot be pulled unless those of the Up Fast home and starting signals (Nos. 4 and 5) have first been pulled; hence the inner and outer distant signals remain at Caution for a movement from the Fast to the Slow line.

The layout of the facing point equipment at No. 33 points is shown on the accompanying drawing. The bolt of the facing point lock A which can enter either of two notches in the stretcher connecting the switches, to hold them firmly in either position, is actuated by a drive-rod from the rocking shaft B, carried in clips bolted to the rails; the length of the arm on the rocking shaft to which the drive-rod is attached can be adjusted as shown, to give the extra stroke needed by another type of facing point mechanism widely used by the Company.

There is the usual arrangement to prevent the points being unbolted while a train is passing over them. The rocking shaft is actuated by a connection from a lifting bar C, alongside the rail, and itself worked by the rod from the signal box. This bar is so supported by short levers pivoted below the rail that during its stroke it rises to rail level from its normal position below it; if any wheels are on the bar their flanges prevent it rising, and hence the points cannot be unbolted or moved.

6. The equipment includes detectors D, one for each of the three signals leading over the points, to prevent it being cleared* if, through a failure of the rodding etc., the lie of the points does not correspond with the position of their lever in the signal box, or if they are not properly bolted. Each signal wire from the box is connected at the detector to one end of a T-section signal slide, and the wire leading to the signal to its other end. The slides travel in guides above and at right angles to three movable blades, one coupled to the tip of each switch rail and the third actuated by the bolt. Notches in the blades are so spaced that they only register with the tongue under a signal slide if both switches are in the correct position for that signal to be cleared, and if they have also been bolted; otherwise movement of the slide is prevented when the signal lever is pulled, and the signal does not respond.

7. After the accident it was found that the bolt could not be fully withdrawn from its notch in the stretcher and that it was holding the points in the opposite position to that shown, that is to say for a movement from the Fast to the Slow line. This was due to an accumulation of frozen ballast, fouling the lower end of the adjustable arm on the rocking shaft as indicated on the drawing, and restricting its movement.

It was also found that, although the points were so held reversed by the bolt, the signalman had been able to restore lever 33 to its normal position in the frame, and that the down-rod connecting the point lever to the pedestal crank under the box, at ground level, had sprung as shown; this had absorbed about half of the normal 6-inch travel of the rod, the remainder being taken up by springing distributed along the 100 yards or so of rodding in compression between the compensator and the points, and by such play as existed in the joints at the cranks and other fittings. With lever 33 thus in its normal position (though the points remained reversed), the facing point bolt lever, No. 32, was free to be pulled again, so releasing the levers of the signals applicable to a movement along the Up Fast line.

The springing of the central (channel section) portion of the down-rod was temporary, disappearing when the stress was removed, but the lower portion, of solid rodding 1¼ in. diameter and 2 feet long, was permanently distorted; its ends were slightly out of parallel and the original 5-inch offset had increased to about 7 inches. A similar distortion was found in the corresponding section of the down-rod working No. 34 points, the trailing points in the Up Slow line at the opposite end of the connection, which had been forced from normal to reverse by the wheels of the fish train.

* This term is used throughout the present Report in place of "lowered", as all the semaphore signals concerned work in the upper quadrant.

Narrative

Sequence of main events

8. While the circumstances of the accident were quite exceptional, there was no dispute about the events leading up to it, except on one point, dealt with later. For about an hour before the arrival of the passenger train, at 6.51 p.m., Nos. 33 and 34 points had remained normal, for through running along the Up Fast and Up Slow lines; four trains passed on the Up Fast line during that period. The Stafford—Nuneaton local passenger train runs on the Up Slow line from No. 2 box as a rule, but on this occasion a freight train, waiting to proceed towards Burton, was standing on that line. Signalman E. M. Williams, in No. 1 box, noticed no unusual resistance to the movement of lever 32 when he unbolted No. 33 points preparatory to reversing them to admit the passenger train to the platform, at about 6.46 p.m., or when he unbolted them previously for a similar purpose, at about 5.52 p.m., and again shortly after that time, when resetting the connection for through running.

Williams said that he saw, by the reappearance of its backlight, that No. 6 signal returned to Danger when he put back its lever, after the passenger train reached the platform. His next act was to re-set the Fast-Slow line connection normal, in readiness for the fish train, which was offered to him from No. 2 box as soon as he gave Train out of Section for the passenger train, at 6.52 p.m. by his register. For this he had to put levers 32, 34 and 33 normal, in that order, then pulling 32 again to re-bolt No. 33 points. Again, according to his evidence, there was no undue difficulty in working any of the levers, although, as afterwards transpired, the bolt had not been fully withdrawn and consequently the facing points had not moved when lever 33 was restored to normal. As the point and bolt levers were thus in the proper position for through running on the Fast line, he was able to pull signal levers 5, 4, and 3 to clear the starting, home and distant signals respectively.

The detector should have prevented No. 4 signal clearing; whether it did so or not is discussed later. But Williams said he noticed nothing unusual when pulling No. 4 lever; he was unable to state with certainty that he then looked at the backlights of the signals on the gantry, to see if the arm had responded, but thought that he must have done so.

Train Entering Section was sent for the fish train to the box ahead (Hademore Crossing) at 6.58 p.m. On hearing the collision a few seconds later Williams thought the noise must have been caused by some portion of the train striking his box, so he at once sent forward the Stop and Examine Train bell signal, believing the train to be still on the Fast line. He followed this with the Obstruction Danger signal three minutes later, when he realised what had happened, after the guard of the fish train arrived at the box; a down freight train, which he had already accepted, was accordingly stopped at Hademore Crossing. When the fireman of the fish train reached the box shortly afterwards, Williams, taking him for its driver, told him that all signals had been cleared for his train to run through on the Up Fast line.

Examination of equipment

9. Though the signal levers had already been put to normal by Williams, the point and bolt levers were left untouched till the Company's officers from Crewe arrived, and members of the Signal Engineer's staff from Nuneaton and Rugby were available, soon after 10.0 p.m.

Mr. H. E. Morgan (Divisional Signal & Telegraph Engineer) and Mr. A. E. Matthews (Area Technical Assistant, S. & T. Dept.) then found No. 33 points reversed, i.e. set for a movement from the Fast to the Slow line, and properly bolted, although the bolt and the casting in which it slides appeared to be strained. There was also a gap of about $\frac{3}{8}$ in. between the "closed" switch and the stock rail but no mark on the tip of the switch to indicate that it had been struck by wheels passing over it.

Mr. Matthews examined the detectors carefully and found them in good order. The detector switch blade notches for No. 4 signal were about 4 inches out of line with its signal slide, and those for Nos. 6 and 7 signals (leading over the points in the direction for which they were set) were slightly out of register with the respective signal slides, due to the points being then $\frac{3}{8}$ in. open; the notches in the facing point bolt blade of the detectors were however in line with the signal slides. Consequently none of the three home signals would respond when he pulled their wires by hand on the signal box side of the detectors. He, and other witnesses, found that the signals worked properly when their wires were pulled by hand on the opposite side of the detectors, and that the tension of the wires was correct. Mr. Matthews next examined the outdoor run of rodding, finding nothing amiss with it, but on reaching the signal box he saw that No. 33 down-rod had buckled as already described. Later he found the permanent distortion previously mentioned in the solid lower section of this down-rod, and in that of No. 34 down-rod.

Next day he noticed a very slight flange mark, three inches long, on the running-on end of the lifting bar at No. 33 points. Though not conclusive, this suggested to him that friction between the bolt and its casting, due to lever 33 being put to normal with the bolt not fully withdrawn from its notch in the stretcher, had perhaps prevented the bolt from completing its travel in the opposite direction when lever 32 was again pulled, the lifting bar thus remaining high enough to be struck by the wheel flanges of the fish train, so forcing the bolt home. This is a possibility with rocking shaft actuation of the facing point bolt, since the lifting bar moves in the direction of traffic to bolt the points.

10. After the examination of No. 33 points it was necessary to set them normal, to let breakdown vans pass along the Up Fast line. Signal Installer H. J. Gunn therefore disconnected the facing point bolt from the drive-rod, and forced it out of the notch in the stretcher with some difficulty; to do this it was necessary to lever the switches over towards the "reversed" position, to ease the

thrust exerted on them by the point rodding. As soon as the bolt was removed, the points "flew back to the normal position on their own" according to Gunn, due to the thrust of the rodding, and at the same time the down-rod at the signal box straightened itself. The interlocking in the signal box was then tested, and proved to be in order. It was also found that No. 33 points responded properly to the movement of their lever; the ⅜ in. opening between the closed switch and the stock rail, in their reversed position, practically disappeared when the abnormal stress on the facing point lock etc. was removed.

Later, after midnight, it was decided to reconstruct the situation as it existed after the arrival of the passenger train, so far as possible. Mr. Matthews found that, with lever 32 normal in the locking frame, reassembly of the joint between the facing point bolt and the drive-rod caused the bolt to project through the notch in the stretcher by about ¼ in., instead of providing a clearance of about ¾ in. between those parts, which is usual when the points are unbolted. For his test the bolt, disconnected from the drive-rod, was inserted further into the stretcher, though not fully home, with the points in the reversed position and lever 33 "over" in the locking frame.

Mr. Matthews was then able, though with considerable effort, to restore lever 33 to normal, as were others present in the signal box. The facing point bolt lever, No. 32, was then pulled, followed by those of the Up Fast line signals. Though the distant and starting signals worked correctly, the arm of the Up Fast home signal, No. 4, did not respond to its lever, showing that the detector was functioning properly. This test was made more than once, and was repeated with the facing point bolt fully inserted in the stretcher to align the notches in its detector blade with the signal slides, with the same result. An examination of the gantry carrying the Up Fast and Up Slow home signals showed that all was in order there, and that the lights were burning properly.

11. After this test Chief Installer J. W. Sedgwick and Lineman A. E. Hughes replaced the distorted lower section of No. 33 down-rod; when this had been done Mr. Matthews found that he could not move lever 33 through its full stroke, from the reversed to the normal position, with the points bolted reversed. Consequently he gave it as his opinion that some previous distortion of the lower section, increasing its offset by a couple of inches as well as causing a slight lack of parallelism between its ends, had predisposed the less stiff central channel section of the rod to buckle under excessive stress.

This distortion may have existed for a considerable time and would not be easy to detect during a routine inspection of the fittings beneath the signal box, for all the down-rods do not lie in the same plane, as alternate pedestal cranks are staggered to allow their pivot pins to be withdrawn. Mr. Matthews suggested that it was probably caused by No. 33 points having been forcibly trailed through, though there is no record of such an occurrence and such a movement, with the points unbolted, would be an abnormal one. But in this connection it is significant that there was a similar distortion of the corresponding section of the down-rod working No. 34 trailing points, through which the fish train forced its way.

12. Sedgwick and Hughes then made some minor adjustments of No. 33 points, to compensate for any slight movement of crank foundations, etc. which might have been caused by the unusual stress in the rodding. They next endeavoured to ascertain why the facing point bolt could not be fully withdrawn from the stretcher, when worked from the box, although moving freely in the opposite direction to the full extent of its travel. While so engaged Hughes had his hand on the drive-rod, and "felt a grating sensation" when it was moved. This led him to look at the tail of the adjustable arm at the other end of the drive-rod, projecting below the clamp on the rocking shaft. He found that frozen ballast was impeding its movement, checking it entirely at a point at which the bolt was still just engaged with the notch in the stretcher; after the ballast had been broken up and scraped away, for which a bar had to be used, the bolt responded properly to the movement of No. 32 lever.

With regard to the presence of this ballast, Acting Ganger W. F. Wright said that he had walked through the section of line for which he is responsible, in which No. 33 points are situated, twice on the day of the accident, passing the points on the second occasion at about 3.45 p.m. He regarded it as his duty to deal with any accumulation of ballast which might interfere with the working of the rocking shaft. To remove it he would have to lift the hinged cover which lies over the facing point lock and drive-rod, protecting them against damage by dragging couplings etc., but he agreed that it is quite easy to see from the side, without raising the cover board, if any excess of ballast has worked its way from under the sleepers into the space between them on either side of the rocking shaft, which, he said, it is his custom to keep "three parts empty". He was quite sure, however, that if there had been an undue amount of ballast there on either of the occasions when he passed the points, it would have attracted his attention.

In this connection Wright, as well as the District Engineer, Mr. F. Everitt, referred to the swelling and heaving of the roadbed in frosty weather, which might well have occurred after Wright's second inspection, under the prevailing weather conditions.

13. Subsequently the detector assembly was removed from the track bodily, with its supporting timber and the ends of the signal wires still attached, and the detectors were dismantled in my presence. Though the signal slides showed some wear, as might be expected after 15 years' use, all the parts were in very good condition, and the notches in the three blades, and in the signal slides, were of the correct size. There was moreover no distortion or wear of any of the parts such as might have allowed No. 4 signal slide to override the blades connected to the switches when the points were reversed, that is to say set for a movement from the Fast to the Slow line.

I had been assured previously that no replacement or alteration whatever of the blades or signal slides of the detectors had been made after the accident, and the appearance and condition of the apparatus when I saw it dismantled confirmed this. It had however been necessary to renew a portion of the rodding between one of the detector blades and the points, in which an incipient crack was found, but this has no bearing on the present case.

Evidence about signal indications

14. While it thus appears that No. 4 signal, the Up Fast home, could not have been cleared for the fish train, statements to the contrary were made by its driver, G. F. Read, and by three independent witnesses.

Read escaped serious injury in the accident but sustained a severe shock. As a result of this I was unable to interview him until over six weeks later, on 15th February, when he was still decidedly shaky and nervous. He had been running through Lichfield every other week for six months and had worked the fish train from Crewe, where he came on duty at 4.0 p.m. after 16½ hours rest. South of Stafford there had been several signal checks, and the train had been stopped by signal once.

He said that when approaching Lichfield he found the colour-light distant at Green, also that the inner distant for No. 1 box and the home signal for No. 2 above it were both at Clear when he first saw them, 200–300 yards away; to the best of his recollection the smoke from his own engine was blowing away to the left, and not impeding his view by drifting back along the train. He thought that he picked up the home signals for No. 1 box when passing No. 2 box or thereabouts, and insisted that he watched them continuously, round the side of the cab, until he passed them, and that No. 4 was at Clear, showing a good green light, all the time. Also he was certain that the green light he saw was that of the signal furthest to the right, though when questioned about the arrangement of the others on the gantry his answers were confused; he had, for instance, forgotten the existence of the signals applying to the Up Slow line, which, he maintained, were nearer to the station.

He said that he was then thrown into the middle of the cab by a violent lurch, when the engine was diverted from the Fast line. Consequently he never saw the Up Fast starting signal, No. 5, which usually comes into view at about that point, though he thought that a glimpse of it could sometimes be had further back, somewhere near the bridge just north of No. 2 box. He saw nothing of the tail light of the passenger train, but managed to shut the regulator and to apply the brake just before his engine struck it, at 30–35 m.p.h. in his estimation.

Read's statement that the colour-light distant was at Green was confirmed by his fireman, C. B. Beckett, and by the guard of the train, F. F. G. Freeman, both of whom noticed this signal but not those nearer the station; the former exchanged remarks with Read about it, to the effect that they were going to get a clear run at last. Shortly after the accident Beckett told Read and Freeman that he had learnt from Signalman Williams that all signals had been cleared for the train.

15. A freight train, bound for Burton, had been waiting on the Up Slow line for over an hour before the accident with its engine about 50 yards ahead of the signal gantry and thus nearly abreast of No. 33 points; it had moved past the signals to this position on arrival, to draw the rear end of the train clear of the connection from the Up Fast line at No. 2 box.

Its driver, G. Kendall, who appeared to be a reliable witness and gave his evidence very clearly, had glanced back at the home signals occasionally to see if No. 12 (Up Slow to Burton) had cleared for his train to start. He was ready to leave at any time, but did not know when he would be able to do so, as a light engine had been sent forward towards Burton at about 6.0 p.m., on the scheduled timing often followed by his train. He could see the backlights of the signals on the gantry plainly, and also the outline of the signals themselves against the sky, as it was a clear night; moreover, there was no smoke or steam blowing about to obscure the signals at the material time, for his engine was not blowing off and the fire had been made up much earlier.

Kendall clearly remembered noticing that No. 6 signal had been cleared for the passenger train, for this indicated to him that his own train could not leave until the passenger train arrived. He made a remark to that effect to his fireman, W. Harley, who recollected it. Kendall was also certain that No. 6 signal was put back to Danger behind the passenger train, for this suggested to him that there was no longer anything to prevent his own train departing.

He said that very shortly afterwards he saw No. 4 signal move to Clear, and thought that this was about three minutes before the fish train arrived. He drew Harley's attention to this also, saying "They've pulled off for the main again; they're busy tonight" or something to the same effect. Harley remembered this as well, and said that in conversation soon after the accident Kendall recalled these two remarks. The latter had been to the station in the meantime to find out what had happened; he had seen Freeman, the guard of the fish train, there and had arranged with him that Harley should go back to No. 2 box to protect the obstruction.

I suggested to Kendall that possibly, through some mischance, No. 6 signal and not No. 4 might have been cleared for the fish train, but he was positive that this was not so. He said he knew that the passenger train was still at the platform—in fact he could see it there—so would have realised at once that something most unusual had happened if he had seen No. 6 cleared a second time.

16. The guard of the freight train, J. W. Moors, had frequently worked through Lichfield and, like Kendall, had looked at the signals on the gantry from time to time as a matter of habit, wondering when his train would leave; he could see them clearly from his seat in the van, through the end windows,

as there were four coal wagons next ahead of it. He could not remember how many trains passed while he was waiting, but he particularly noticed the local passenger train, on which he sometimes works. He thought he saw all the home signals at Danger after that train passed, but was not absolutely certain about this—it might have been before it arrived.

He remembered looking at the signals again, when he heard the fish train coming. He agreed that this was only a casual glance, but was sure that No. 4 was then at Clear; it had gone back to Danger when he next looked at it, after hearing the collision. Not long afterwards he saw Driver Kendall and learnt from him that he also had seen No. 4 signal at Clear.

17. Evidence substantially to the same effect was given by Signalman J. T. Shone, who was on duty in No. 2 box; with the exception of No. 6, which is partly hidden by a signal-post just outside the box, the signals on the gantry are easily visible from there. Soon after the fish train had been accepted by No. 1 box, six minutes or so before its arrival, he heard the movement of the wire working No. 1 box inner (semaphore) distant, which passes through the underpart of No. 2 box. In addition he heard the click of the repeater for the colour-light distant changing from Yellow to Green, and saw that it had done so; he had already pulled his own distant signal lever, also controlling the colour-light distant.

He said that he then looked at No. 1 box home signals, as is his custom from time to time, and saw that No. 4 was at Clear. Though this was no more than a casual glance, he was sure that he was not mistaken and that if, for instance, No. 6 had been showing a green light in place of No. 4 he would have remembered it, as he is so well acquainted with the pattern of the lights of the signals on the gantry. He was less certain whether he had seen all the home signals at Danger after the passage of the local passenger train.

Shone said that on hearing the noise of the collision he went outside the door of the box and he thought that No. 4 signal was then still at Clear; he did not notice how soon afterwards it was put back to Danger. He did not learn what had happened till an hour or so later, when Williams telephoned to him from No. 1 box.

Investigation of alternative possibilities

18. The foregoing statements entirely conflict with the evidence that No. 4 signal could not have responded when its lever was pulled, afforded by the fact that its detector was found to be in proper order. There is the possibility, nevertheless, that it might have cleared as a result of accidental interference with its wire between the detector and the signal gantry, such as entanglement with the wire of the distant signal (No. 3), which was cleared and restored to Caution at the appropriate times.

Examination of the run of the wires showed such an occurrence to be most unlikely. The distance over which Nos. 3 and 4 wires are carried on the same stakes is less than 50 yards; they are well separated, and there are no joints which might have caused a temporary "hook-up". Indeed, one of the Signal Engineer's staff said that it would be difficult to entangle the two wires purposely; an attempt to do so made in my presence showed this to be the case. The stakes concerned carry 12 wires in all, in four sets of treble pulleys; No. 3 wire lies vertically over No. 4, four inches above it. Of the 12 wires, ten lead from No. 1 box and two from No. 2, but the only one worked at the material time was No. 3, operating No. 1 box Up distant.

It may be added here that it was established that No. 4 signal was properly at Danger earlier, for Driver E. Major and Fireman D. Owen, who worked the passenger train, both stated that the three Up Fast home signals were at Danger when they first saw them, and that No. 6 was not cleared for their train to run to the platform until they had passed No. 2 box.

19. With No. 33 points reversed and properly bolted the detectors would offer no impediment to the clearing of No. 6 or of No. 7 signal. In seeking for an alternative explanation, therefore, I felt it appropriate to consider—despite the witnesses' statements—whether No. 6, the signal adjacent to No. 4, could have been cleared by mischance as the fish train approached; in such an event its green light might perhaps have been mistaken by Driver Read for that of No. 4 signal, which he was expecting to see after passing both distant signals at Clear. But as No. 6 lever was held normal by the interlocking at the time, and also by track circuit control since the platform line was occupied, this presupposes interference with its wire at some point between the lever and the signal.

Such a theory is not inconsistent with the fact that the detectors prevented No. 6 wire being pulled by hand after the accident, due to the points being then ⅜ in. open; it may well be the case that the thrust exerted on the points and the facing point lock by the springing of the point rodding under the box and elsewhere did not take up trifling clearances in the various fastenings etc., thus causing the closed switch to open by this small amount, until assisted by vibration, arising from the passage of the fish train. Equally Mr. Matthews' inference from the flange mark on the lifting bar that the facing point bolt was not forced fully home till the fish train arrived, and that consequently the associated detector blade would have prevented any of the three home signals clearing, is not entirely convincing. It presupposes that the bolt made at least half its normal stroke when lever 32 was pulled, and that it was not arrested by friction till the lifting bar had passed its highest point. The mark may quite well have been made later, by the breakdown train, for when Gunn disconnected the bolt preparatory to clipping the points normal for that train the obstructed rocking shaft would cause the lifting bar to lie slightly above its lowest (unbolted) position.

The whole length of No. 6 wire, from the lever to the signal gantry, was accordingly examined, but nothing was found to suggest that it might have been pulled accidentally, either by entanglement with other wires worked at the appropriate time, such as Nos. 3, 4 and 5, or by catching in the nuts of a joint in the rodding leading to No. 33 points, above and close to which No. 6 wire runs for a few yards, under a barrow crossing.

In addition, a test was made to determine what travel of their wires, measured at the detectors, was needed for the display of a full green light by Nos. 4 and 6 signals. It was found that Nos. 4 and 6 wires had to be pulled 4 inches and 4¾ inches respectively to raise the arms to 37½ degrees above the horizontal, which is just sufficient for a full green light to be shown; corresponding pulls of 3 inches and of 3⅛ inches moved the arms through 25 degrees, at which point the light shows half green and half red. These wires run a foot from the ground for some distance with others a foot above them, but this test shows that anyone climbing over them or treading on them there could not have caused the signals to clear, even momentarily but perhaps while those concerned were looking at them. I made such an experiment myself, but found that when the wire was pressed down to the ground the arm scarcely stirred.

20. I also learnt that the wire of No. 7 signal had broken when its lever was worked an hour or so before the accident, and that it was about to be repaired when the collision took place; this signal is rarely used, and the breakage was afterwards found to be due to faulty adjustment of its detector at the facing points in the Up Slow line, leading to the Burton branch. Lengthman F. A. Cope had been summoned to mend this wire, and it seemed possible that in identifying it and in searching for the break in the dark he might have unwittingly caused No. 6 signal to clear for a short time by pulling its wire, since Nos. 6 and 7 wires run together for most of their length.

There had been some delay in calling Cope, who lives a mile away. He said that he did not leave home till about 6.30 p.m. and that the passenger train was at the platform when he reached the station, which indicates that he got there seven minutes at most before the accident. He remembered that the Up Fast starting signal had already been cleared for the fish train, for he looked at it before crossing the line to get to the signal box, where he went straight upstairs.

Cope did not know why he had been sent for till told by Signalman Williams. He had not previously mended any of the No. 1 box wires, and so was unacquainted with their routes and numbering. He thought that he was in the upper part of the box for about five minutes, talking to Williams and obtaining a lamp. When he left, Williams told him that the fish train was coming on the Up Fast line, so he went over to the Up Slow line to wait there till it passed. He said that as it did not arrive immediately he re-crossed the Fast line, and that he was about to enter the lower part of the box, for the first time that evening, when the collision took place. It was his intention to trace No. 7 wire outwards from the box, but he assured me that he had not begun to do so and consequently had not attempted to identify it or any of the other wires by pulling them.

Though Williams could not recollect what time Cope reported, he remembered that he left the box only a short time before the fish train arrived, and that he had warned him to look out for it. Materials for repairing broken wires are kept in the lower part of the box, and Williams thought he had heard Cope there earlier, but was not certain about this. He agreed that Cope did not know why he had been summoned till he himself told him that it was to mend No. 7 wire.

21. The points at which No. 1 box Up Fast home and starting signals become clearly visible from the left side of the footplate were determined a day or two after the accident; as shown on the accompanying drawing the respective sighting distances are 421 and 285 yards. But as Driver Read had said—rather vaguely—that the starting signal (No. 5) could sometimes be seen from further back, and as one of the Signal Engineer's staff suggested that its green light, viewed from No. 2 box, might possibly be mistaken for that of one of the home signals on the gantry, a fresh test was made; this showed the possibility of confusion of the lights of the home and starting signals to be most unlikely.

I found that the arm of the starting signal can be seen from the footplate by day—indistinctly, through a fence on the eastern approach to overbridge 100, and against a confusing background—from the point at which the Up Fast home signals first appear; the latter come into view under the middle arch of overbridge 101, and the starting signal under the left hand arch. After passing that bridge, the starting signal arm is again to be seen, still with difficulty, until a point about 90 yards north of the home signal gantry is reached; it then disappears behind overbridge 100. At night, however, its light, which is aligned to suit the left hand curve of the up line through the station, can only be seen, dimly, for the last ten yards of this distance, that is to say between points 100 yards and 90 yards north of the gantry, next coming into full view 190 yards further on, below overbridge 100 and at a range of 285 yards. Also, if a glimpse of the starting signal light is obtained before passing the home signals, it appears well away from their lights, under and considerably below the middle of the gantry cross-beam.

From the greater elevation of No. 2 box the arm and light of the starting signal are visible just above the parapet of overbridge 100, a little to the left of the doll of No. 7 home signal and under the gantry cross-beam. Viewed from this point the light is well separated from that of No. 4 home signal, and appears poor, as the lamp is aligned in a different direction.

Conclusions

22. It is clear that three factors contributed to this regrettable accident, namely :—

(1) The failure of the facing point bolt to disengage from the stretcher of No. 33 points, preventing their restoration to normal.

(2) The buckling of the down-rod underneath the signal box which allowed Signalman Williams to put No. 33 point lever normal, so releasing No. 4 signal lever.

(3) The alleged failure of the detector to prevent No. 4 home signal responding to its lever, or alternatively the non-observance of that signal at Danger by Driver Read.

With regard to the first of these, I accept the assurance of Acting Ganger Wright that there was not sufficient loose ballast around the rocking shaft to impede its movement when he passed the points three hours earlier. His remark that the space between the sleepers there is usually " kept three parts empty " cannot be taken too literally for, as shown on the drawing, the lower end of the rocking shaft lever moves to and fro at about the level of the underside of the sleepers, and he seemed well aware of the need for allowing reasonable clearance for it in the centre of the track, even though the ballast level is kept rather higher below the rails.

But with the vibration and slight undulatory movement of the track caused by the frequent passage of fast trains, there is nothing remarkable in a small quantity of ballast working out from beneath the sleepers into such a depression, and this is evidently what occurred in the present instance, possibly accentuated by some heaving of the surface through frost. Though the whole of the ballast obstructing the rocking shaft lever was found to be frozen solid several hours later, it does not follow that this solidification took place in the interval of some six minutes (6.46 to 6.52 p.m.) during which the points were bolted reversed to allow the passenger train to reach the platform, though it may have done so ; it is possible that the accumulation and freezing was gradual, and that a few stones, disturbed by the passenger train, sufficed to prevent full movement of the rocking shaft lever subsequently, afterwards freezing in that position.

In any case this incident, the first in the chain of events leading to the accident, was due to extreme mischance, but the arrangement of the rocking shaft lever, with its end moving at so low a level, is not a satisfactory one, and I refer to this feature later.

23. It is not surprising that Signalman Williams was unaware that the bolt had failed to complete its stroke by about 1½ inches, so remaining foul of the notch in the stretcher by less than an inch, for this would be concealed from him by spring in the rodding, and I also hesitate to criticise him for not noticing that there was unusual resistance when he put back lever 33 to normal. No little effort is needed to work points 200 yards or so from the box, for the inertia of nearly a ton of rodding has to be overcome, as well as some springiness at each end of the lever travel, due to the " nip " given to the points by the provision of a little extra stroke in the rodding between them and the nearest crank, to ensure that the switches fit snugly against the stock rails. Williams, though not powerfully built, was described as a man who habitually works his levers very smartly ; he is of medium height, and weighs 9½ stone. In the circumstances I can understand his failure to realise that there was more " spring " than usual when the lever approached its normal position in the frame, as must have been the case.

I consider that the real fault is to be found in the arrangement of the down-rod. Lacking an intermediate guide in its length of over ten feet, it was clearly ill-adapted to take the eccentric thrust imposed upon it, caused by the offset of five inches (or possibly as much as seven inches) at its lower end. I refer later to this point, but it is pertinent to remark here that on outdoor runs of rodding the supporting rollers are spaced no more than nine feet apart, this distance being often reduced to eight feet and sometimes to six ; moreover, I believe that an offset of more than three inches in the rodding between a pair of supports is generally regarded as undesirable.

Nevertheless I am not entirely satisfied with Williams' inability to remember if he saw that No. 4 signal cleared when he pulled its lever, and I suspect that he took it for granted that it had. Whether it did so is a matter of controversy, dealt with below, but if it did not obey the lever the action demanded of Williams by the Rules relating to defective signals would have led to discovery of the fact that the points were wrongly set and the accident would not have happened. Within these limitations, therefore, I consider that he cannot escape some responsibility for it.

24. The distance between the point at which No. 1 box Up Fast home signals become visible and that at which the collision took place, namely 755 yards, is considerably greater than that needed to stop a fully braked train travelling at about 35 m.p.h. Therefore, in a sense, the obstruction of the free movement of the rocking shaft and the lack of stiffness in the down-rod, though sufficiently serious, were no more than incidental features of the accident. Detectors are provided to act as a safeguard against such occurrences, by holding the relevant signals at Danger, and thus the important question arises whether No. 4 signal was in fact cleared for the fish train, as Driver Read and the three witnesses supporting him maintained, and if so, how this can have happened.

The evidence of those who examined the detector concerned, about three hours after the accident, showed that it was then in proper order ; this was confirmed when I saw it being dismantled subsequently, and found no sign that it had been tampered with to conceal defects. Also, when the situation as it existed just before the accident was reconstructed a few hours afterwards, it was found impossible to clear No. 4 signal in the normal way.

This may be thought to show conclusively that Read must have disregarded that signal. It is true that he insisted that he did not do so, but when I saw him he was obviously still suffering from the after-effects of the shock sustained six weeks earlier and his memory appeared unreliable in other respects. Nevertheless the evidence of Driver Kendall, Guard Moors, and Signalman Shone in support of his statement cannot be lightly dismissed. These three men were informally questioned, separately, by the Company's officers a few hours after the accident, when their statements agreed in all material respects with those they made at the Company's formal Inquiry, and later at my own. I saw each of them on two occasions, and fully believe that they gave me a conscientious account of what they believed they saw before the accident. Moreover, there can be no suggestion that their support of Read's statement that No. 4 signal was at Clear had been agreed beforehand, in consultation with him, for he was sent away by car, badly shaken, not long after the accident and they did not see him till two days later, at the Company's Inquiry.

The incompatibility of the tangible and the oral evidence made it necessary to consider whether any or all of the witnesses might have been mistaken about the identity of the signal said to have been seen at Clear, also whether No. 4 signal could have been worked accidentally by interference with its wire beyond the detector. These possibilities were exhaustively discussed and I have alluded to some of the consequent investigations, all of which were carried out with great diligence by the Company, but with negative results.

25. A review of all the circumstances leads me to attach more weight to the tangible evidence than to the witnesses' recollection. Consequently I have formed the opinion that in all probability the Up Fast home signal, No. 4, remained at Danger at the material time and that Driver Read failed to observe and to obey its indication. If this was so, he must share responsibility for the accident, but there are extenuating circumstances. Having had a succession of signal checks over a distance of 17 miles, he undoubtedly welcomed the Clear indication of the colour-light distant, and naturally assumed from it that there was at last a clear path ahead. This impression was then confirmed by the similar indication of the inner distant, maintained till he reached the point at which the home signals became visible, closer to them than that at which an outer home signal is often placed. Thereafter I imagine that he must have missed seeing the home signal, perhaps while trying to pick out the light of the starting signal as early as possible. Thus, even though a driver is expected to observe all signals, in case a stop signal has been put to Danger in emergency after he has passed a distant signal at Clear, I consider that he was misled to some extent.

His repeated insistence that he saw the home signal at Clear may be explained, I think, by the fact that soon after the accident he was told by his fireman, Beckett, that Signalman Williams said that all signals were at Clear for him. As subsequent events showed, he was then suffering badly from shock, and I feel little doubt that this reassuring information became firmly fixed in his mind to the exclusion of his memory of his previous actions. He is a man of 56, with 19 years' service as a driver, and has a very good record.

26. In fairness to Driver Kendall, Guard Moors, and Signalman Shone I feel that I ought to say why I have disregarded their unswerving support of Read's statement. For this it is necessary to have regard to what took place just after the accident, and to the probable mental reactions of those concerned.

It is not surprising that Signalman Williams was completely mystified. He expected the fish train to arrive on the Fast line; all his levers were in the proper position for it to run through on that line; it could not possibly have arrived on the Slow line, already occupied by the Burton freight train; yet it had somehow transferred itself to that line and had come to grief there. In the circumstances he naturally told Fireman Beckett that all the Fast line signals had been cleared.

I was able to establish that Beckett gave this information to Freeman, the guard of the fish train, though Freeman probably had it direct from Williams as well, for he went to the signal box before Beckett and was there again shortly afterwards. Then when Kendall came from his engine to the station to find out what had happened he met Freeman there, and it would be natural for the latter to tell him what he had learnt about the signals. When Kendall then returned to his train he saw Moors and there can be little doubt that he passed on this piece of information.

Kendall and Moors had been unoccupied for an hour or more, wondering when their own train would be able to leave and seeing others pass fairly frequently. Their observation of these would be more or less automatic, nor was there any reason why they should pay particular attention to them; what they were looking for was the clearing of No. 12 signal for their own departure. But on learning that something apparently quite inexplicable had happened close to them, they would undoubtedly try to relate what they had just heard with what they had seen, casually, a short time before.

27. There is always a likelihood of auto-suggestion in the light of after-knowledge when an endeavour is made to recall subsequently the precise details or sequence of incidents so familiar as to call for no special notice at the time of their occurrence. This, I think, is what must have happened here, causing Kendall and Moors unconsciously to confuse the passage of the fish train with that of an earlier one, for which they had in fact seen the Up Fast home signal cleared, and leading them to give in all good faith an inaccurate account of what took place.

The same considerations apply to Shone, who had looked at No. 1 box home signals from time to time, with no special interest but as a matter of habit. When giving him an account of what had happened, Williams would undoubtedly tell a fellow-signalman that everything had been in order for the fish train to run through on the Fast line, so initiating an attempt on Shone's part to relate this with what he had seen an hour or so previously, with similar inaccurate results.

Though much of this reasoning is purely conjectural, I can suggest no other likely explanation of what is undoubtedly a perplexing feature of the case.

Remarks and Recommendations

28. At an early stage of the Inquiry, before I saw the witnesses, there was some discussion whether responsibility for seeing that the rocking shaft could move freely lay with the Engineer's or with the Signal Engineer's staff. In his evidence Acting Ganger Wright at once accepted the responsibility for keeping ballast away from the rocking shaft as his. Since the points are visited by the permanent way staff much more frequently than by the signalling staff this allocation of responsibility seems to be the correct one; I learnt later that this had been confirmed by the Company's chief officers, and that those concerned had been informed accordingly.

29. The use of a rocking shaft to operate the facing point bolt is only unavoidable where the lifting bar lies in the space between a check rail and the running rail. Where there are no check rails, as in the present case, the use of a horizontal "scale-beam" lever working entirely above the sleepers, with one end coupled to the lifting bar and the other to the drive-rod of the bolt, appears to be preferable; this arrangement is in common use, and does away with the need for special attention to the ballast level round the rocking shaft.

Quite apart from this, the use on the rocking shaft of an adjustable arm, with its tail moving at about the level of the bottom of the sleepers, thus needlessly accentuating the risk of obstruction by ballast, is clearly most undesirable. The projecting tail has no useful function, and should be removed once the arm has been set at the correct radius. I was glad to hear from the Divisional Signal Engineer recently that instructions have been given for this to be done wherever this arrangement exists.

I also feel that, if it is really necessary to use an arm adjustable for length on the rocking shaft, an alteration of the design of this component should be considered in order to get rid of any projections which might rotate into contact with the ballast, such as the heads and nuts of the clamping bolts shown on the drawing. The simplest way of doing this would be to make the arm integral with the shaft, and to provide a series of holes at different radii for the joint pin at its upper end; alternatively the heads and nuts of the bolts could be recessed below the surface of a clamp of smooth contour. Failing some such alteration in design, the provision of boxing of any suitable type on each side of the rocking shaft seems desirable, to prevent ballast accumulating there.

30. With regard to the bending of the down-rod under the signal box, I have been given the following explanation of the use of the 5-inch offset at its bottom end, which I have criticised as tending to cause lack of stiffness. When the box was built by the former L. & N.W. Railway it was equipped with that Company's standard pedestal cranks, having 9-inch arms. At some subsequent date 12-inch pedestal cranks were substituted, in accordance with L.M.S. standards, and the down-rods were given a greater offset than formerly to suit the new cranks, which were fixed in the same positions as those they replaced.

It was not possible to establish when the distortion found in the bottom section of No. 33 down-rod, further increasing its offset to seven inches and difficult to detect under working conditions, took place or how it was caused. But if it is the case, as was suggested, that this additional 2-inch offset was responsible for the bending of the down-rod it indicates that the margin of reliability was undesirably small. In this connection a test made in my presence showed that another down-rod having the proper 5-inch offset was distinctly "whippy" when an attempt was made to work a set of points which had been previously clamped to prevent response to their lever.

I have commented earlier on the absence of any intermediate guides for the down-rods, contrasting their length with the spacing of the supports of the outdoor rodding. As the movement of the down-rod is not truly linear it would be difficult to guide it exactly, but a simple fitting, allowing some side-play, would have prevented the buckling which took place. I found, however, when I re-visited Lichfield for the signal sighting tests that an alteration in the arrangement of the down-rods etc. was in progress at No. 1 box. This consists of the reversal of each pedestal crank, bringing the end of its arm vertically under the tail of the lever above it, and so enabling a straight down-rod to be used without fouling the connections to the locking troughs; the original direction of movement of the outdoor rodding is preserved by reversing the horizontal leading-off cranks immediately outside the box as well.

This is a decided improvement on the previous arrangement, and makes the absence of guides for the down-rods less objectionable. I hope the Company will not confine it to this box, as similar conditions probably exist elsewhere.

I have the honour to be,

Sir,

Your obedient Servant,

E. WOODHOUSE,

Lieut-Colonel.

The Secretary,

Ministry of Transport.

(49980) Wt. 2603—1107 1000 5/46 D.L. G. 379/13

L.M.S. RLY. LICHFIELD (TRENT VALLEY) — COLLISION 1.1.46.

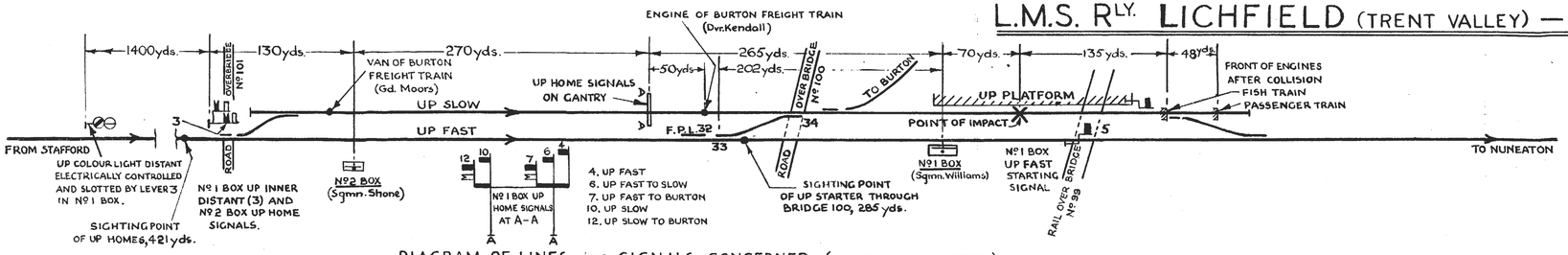
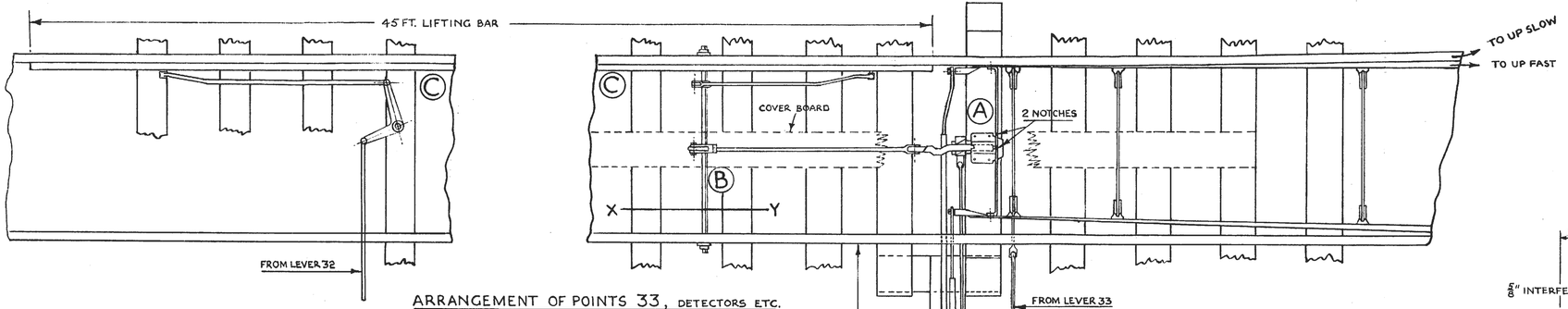


DIAGRAM OF LINES AND SIGNALS CONCERNED (DOWN LINES OMITTED)

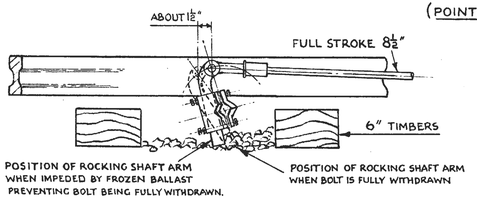
LONGITUDINAL SCALE: 200 FEET = 1 INCH. No 1 BOX SIGNALS SHEWN THUS:-



ARRANGEMENT OF POINTS 33, DETECTORS ETC.

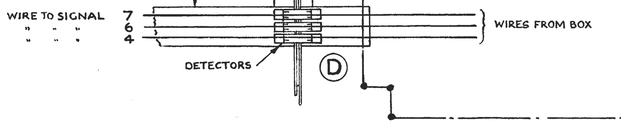
(POINTS SHOWN IN NORMAL POSITION, BOLT "OUT").

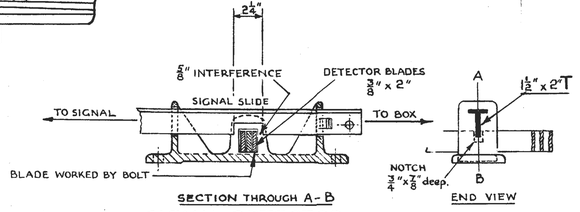
SCALE: ½" = 1 FOOT.



SECTION THROUGH X-Y

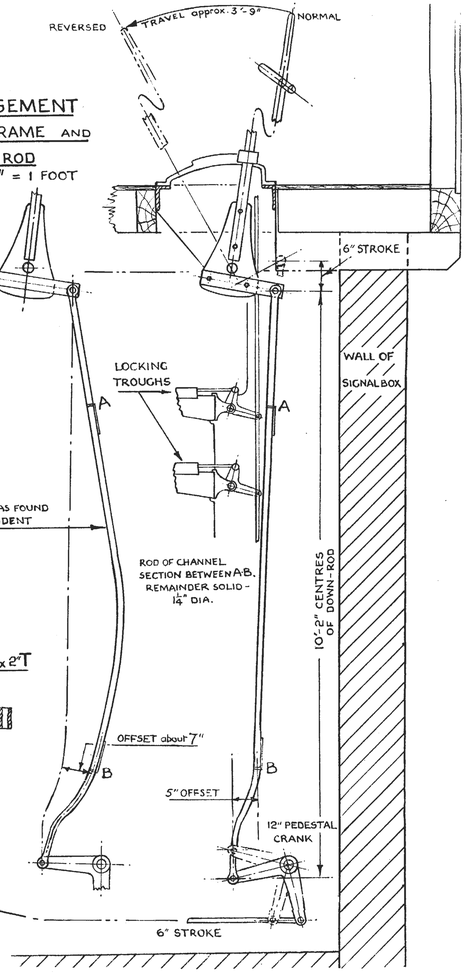
SCALE 1" = 1 FOOT





SIGNAL DETECTOR

SCALE: 2" = 1 FOOT



ARRANGEMENT OF LOCKING FRAME AND DOWN ROD

SCALE: ¾" = 1 FOOT