

of Newcastle on the 24th September 1849. It had run up to the 24th October 482,758 miles.

In May 1863 this engine was thoroughly overhauled and received very extensive repairs. Before leaving the company's workshops it was tested with a pressure of 200 lbs. to the inch, by means of the hydraulic pump.

It was returned to the shops for repairs once in 1864, four times in 1865, three times in 1866, six times in 1867, six times in 1868, twice in 1869, and seven times in 1870. The repairs in 1869 and 1870 were considerable; and on leaving the workshops on the 5th July 1870 it was again tested with cold water, with a pressure of 130 lbs. to the inch. The safety valves of the boiler were arranged so that the engine could not be worked at a greater pressure than 115 lbs. of steam to the inch.

On the 23rd October the engine driver of No. 83, reported that the "top of the firebox was blowing on the right side, under the lagging," and when the engine was taken into the shops and examined, the fitter found that one of the nuts that was connected with the safety valve-seating at the right side was so defective as to allow steam to blow off badly. This was no doubt the cause of the leakage that was reported by the engine driver. A new nut was put in, the leakage stanchied, and the engine was again sent out to work. Two days afterwards the boiler exploded.

The top plate of the boiler just above the firebox was blown off. This piece of boiler plate measures 4 ft. by 2 ft. 10 in. by 7-16ths thick. The two side plates adjacent to this top plate, which measure 4 ft. 4 in. by 1 ft. 10 in. by 1/2-in., were also blown away.

The top plate was found on the bank, at the near side of the railway, 35 feet from the engine, and rather in front of it.

The plate that blew away from the right side of the firebox was found on the up platform nearly opposite to the engine, and the piece that blew away from the left side of the engine was found near the river at the south side of the railway, 500 yards from the engine.

The fractures were all rusty when I examined them, and it was difficult to detect any flaw.

Mr Saere, the engineer of the M., S., and Lincolnshire Railway, pointed out a place on the edge of the fractured plates about a foot long, close to the top seam at the right-hand side, which was rather different in colour to the rest of the fractured iron, and which he stated was very plainly to be distinguished as a flaw, immediately after the accident occurred.

The flaw was in the shoulder of the seam, about 2 1/2 inches from the edge of the plate. It appeared to commence about 10 in. from the face of the firebox, and to be from 3-16ths to 4-16ths in depth on the outside of the 7-16ths boiler plate. All the rest of the metal of the plates appeared to be good and sound.

A piece of the side plate, which was 1/2 in. thick, was tested after the accident. It gave way under a tensile force of 22 tons to the inch, and a piece of the top plate, which was only 7-16ths thick, gave way with a tensile strain of 25 tons to the inch. Part of the plate which was drawn out and twisted in a cold state did not crack, and showed the iron to be tough.

I attribute the bursting of the boiler to a flaw on the outside of the top plate of the boiler, on the right-hand side, just above the firebox.

I think the flaw existed probably at the time the boiler was made. It was 2 1/2 in. from the edge of the plate in the shoulder of the lap.

There appears to be some difficulty in regard to testing the boilers of locomotive engines, and I cannot think that a test of 130 lbs. to the inch is at all sufficient for a boiler that is to be worked up to 115 lbs. of steam. In my opinion the safety test ought to be at least double that of the working strain. I think, moreover, that a cold water test is not satisfactory for proving steam engines.

I would suggest that they should be pressed with steam to double the working pressure.

This might be effected, without danger to the lives of the persons employed in proving them, by placing the locomotive under test, between two large earthen or masonry traverses.

I have, &c.,
The Secretary · F. H. RICH,
 (Railway Department), *Lieut.-Col. R.E.*
 Board of Trade.

Printed copies of this report were sent to the company on the 1st December.

MANCHESTER, SHEFFIELD, AND LINCOLNSHIRE RAILWAY.

Board of Trade,
 (Railway Department.)
 WITCHALL, 28th December 1870.

SIR,
 In compliance with the instructions contained in your minute of the 13th inst., I have the honour to report, for the information of the Board of Trade, the result of my inquiry into the circumstances which attended the collision that occurred on the 12th December at Stairfoot station on the Manchester, Sheffield, and Lincolnshire Railway.

Twelve passengers were killed on the spot, or died the same evening. Three more have since died of the injuries that they received, and 59 others are reported to have been more or less injured.

The guard, engine-driver, and fireman of the passenger train were also bruised and shaken.

About 5.40 p.m. on the day in question, a goods train was started from the Manchester, Sheffield, and Lincolnshire Railway Company's goods yard at Barnsley. The train was to proceed to Mexbro'.

There are two stations at Barnsley. The court-house or high-level station belongs to the Midland Railway Company. It is used by the Manchester, Sheffield, and Lincolnshire Railway Company for their passenger trains. The low-level station is a joint station of the Lancashire and Yorkshire Railway Company and the Manchester, Sheffield, and Lincolnshire Railway Company. The mineral and goods traffic of the latter company, is worked from the low-level station.

The Manchester, Sheffield, and Lincolnshire Railway Company have what is called a top goods yard at the north-west side, and a low goods yard at the south-west side of Barnsley low-level station. There are sidings for private works, and for the gas works, in the Company's yard at the south-west side of the station.

The Lancashire and Yorkshire Railway Company have goods sidings at the east and west side of the Railway at the north end of the low-level station, and goods sidings at the east side of the line at the south end of the station.

The railway at the south side of the station is a double line. It is a joint line used by the Lancashire and Yorkshire Railway Company and by the Manchester, Sheffield, and Lincolnshire Railway Company.

The low-level station has only one platform, which is at the down or west side of the railway. The railway at the north side of Barnsley low-level station consists of two single lines. The line at the west side belongs to the Manchester, Sheffield, and Lincolnshire Railway Company. It goes to Penistone, and is a single line until it approaches Court-house junction.

The line at the east side belongs to the Lancashire and Yorkshire Railway Company. It is a single line as far as Wakefield.

There are cross-over roads for exchanging traffic at both sides of the station.

The gradient from the Manchester, Sheffield, and Lincolnshire Railway Company's top goods yard falls 1 in 35 to the low-level station, and from thence the railway falls for a distance of more than seven miles towards Mexbro'. The gradient in the low-level station is 1 in 315. It is 1 in 119 for a short distance at the south side of the station platform, and then it falls 1 in 72 to within 300 yards of Stairfoot station, where it changes to 1 in 97 for about 450 yards, and from thence it continues to fall 1 in 144 for nearly 4 miles.

The Manchester, Sheffield, and Lincolnshire goods train for Mexbro' was taken from the company's top goods yard at Barnsley. It consisted of an engine and tender, 10 loaded, 8 empty waggons, and a guards' van. When it was brought out of the top goods yard the engine was in front, but it backed the train down the incline towards Barnsley low-level station.

Seven loaded waggons were put into the Lancashire and Yorkshire Railway Company's goods yard at the north-east side of Barnsley station. The van was next unhooked, and fly shunted into the gas-house siding in the Manchester, Sheffield, and Lincolnshire Company's low goods yard at the south-west side of the station. The guard put the break on the van, and took a sprag out of the break-van. A sprag is a piece of wood commonly used for fixing the wheels of railway waggons. The guard then signalled to the engine-driver to push the rest of the train back through the cross-over road at the south side of the station from the down line on to the up line of rails. When the waggons had got to the place where the guard wished to leave them, he placed the sprag in the front wheel of the waggon which was next but one to the engine. The guard unhooked 10 out of the 11 waggons that were attached to the engine. Eight of these were empty waggons. The waggon furthest from the engine except one, and another waggon about the centre of the 10, were loaded. The waggon which remained attached to the engine was next placed in the Lancashire and Yorkshire Company's sidings at the south-east side of the station, and then the engine went across to the gas-house siding at the south-west side of the station, and brought out the van which it had put in, also an empty waggon and two gas tanks. When the gas tanks were drawn to the north of the cross-over road leading to the up line, the guard gave the driver the signal to stop, and then he unhooked the two gas tanks, and gave the driver the signal to push them back. They were fly shunted by the cross-over road, on to the up line where the 10 waggons were standing. The guard then signalled to the engine-driver to go forward clear of the crossing, and when the driver had drawn the waggons forward clear of the crossing the guard signalled to him to stop.

The empty waggon was then unhooked, and fly shunted back into the gas-house siding.

The guard held the points of the gas-house siding, and then crossed to the up line to hook the gas tanks on to the rest of the train.

The guard stated that the gas tanks were moving so slowly that they had not reached the 10 waggons before he got to them. He laid hold of the chain to couple them up, but failed in doing so, owing to his hands being very cold. The gas tanks struck the 10 waggons which were standing on the up line on a gradient of 1 in 119. The sprag in the waggon next to the gas tanks broke, or was jerked out by the collision, and the 10 waggons commenced to run down the incline.

The pointsman who works the cross-over road at the south side of the station, over which the gas tanks were running, put the break on the leading gas tank waggon, and pinned it down. He subsequently heard the guard call out that the whole of the waggons had run away, and he ran to the gas tank waggon on which he had placed the break, got on it, and pressed down the break, but he slipped off, and could not stop the waggons.

Another pointsman at the south end of the sidings

also heard the guard calling out. He ran after the waggons, and succeeded in getting on the foremost of the two gas tank waggons which the other pointsman had slipped off. He pressed down the break; but the 10 waggons and two gas tanks were all running close together at a speed of about seven miles an hour, and he could not check them. He was knocked off, by his knee coming in contact with the central iron girder of an under bridge, to the south of his station.

The whole of the waggons were seen by the signalman at Pinder Oaks Colliery junction, by the signalman at the Quarry junctions, and by the signalman at the Old Oaks Colliery junction, as they ran past them down the incline on the rail to Stairfoot station. These men saw the danger, but the only one of them who had the control of facing points, to turn the waggons, was the signalman at the Quarry junctions, and this man could only have turned them on to the Midland Railway, which is also on a falling gradient, where the danger would not have been avoided. These junction signalmen had block telegraph instruments by which they could call the attention of the signalman in advance to something being wrong; but the signal posts are within $\frac{1}{2}$ of a mile of each other, and the Old Oaks Colliery junction, which was next to Stairfoot, is 250 yards to the north of that station, so that there was no time to do anything.

The waggons gradually gained a speed of 30 to 40 miles an hour before they reached Stairfoot station, which is a mile and a half from Barnsley. A passenger train, which consisted of a tender and engine, a third-class carriage with a break compartment and a guard, another third-class, a first, a second and a third class carriage, with a break compartment at the end, was standing at Stairfoot station, setting down passengers. The vehicles were coupled together in the order given. This train had left Barnsley high-level station, at 6.15 p.m. It had been detained 10 minutes by signals on its way to Barnsley. The passengers and the persons attending this train at Stairfoot station were only aware of their danger a moment before the goods waggons crashed into their train.

They were surprised by the noise of the goods waggons running across an iron under-bridge, which is situated about 200 yards to the north-west of Stairfoot station. The driver of the passenger train had only time to look out, and see what was coming, when he was knocked down by the shock of the goods waggons striking the tail of his train. He got up, eased his tender break, and his engine shot forward 30 to 40 yards. The fireman jumped off immediately after the collision occurred.

The guard, and the Stairfoot station-master, who were standing on the platform, found themselves on the line at the back of the platform after the collision.

They conceive that they were thrown over the platform railing. The front of the platform was somewhat damaged. The third-class break carriage at the back of the train was broken to pieces, and one half of the carriage next to it was broken up. The front buffer of the third-class break carriage in the front of the train was broken, and some few windows of the other carriages.

Nine of the goods waggons were broken to pieces, and were heaped on top of each other at the tail of the passenger train.

The debris were strewn on the up and down lines and on the station platform, where it is believed some of the persons were killed.

The 10th waggon, and the two gas tank waggons, which appear to have been running along with the other nine waggons, were very little damaged. The permanent way was very little damaged.

The accident was caused by the gross neglect of the guard of the goods train who omitted to secure the 10 waggons which he left standing on the up line of rails, on a gradient of 1 in 119. Placing a sprag in the wheel of an empty waggon was the only means he took to secure his train.

The shock of the two gas tanks running against

these 10 waggons appears to have been very slight, but it was sufficient to start them down the incline.

The break on the front gas tank must have been in an inefficient state, or it would have been stopped by the two signalmen, who got on the front tank, and pressed down the break, and the two gas tanks could not have kept pace with the 10 waggons that had no break on, if the break on the front gas tank had been effective.

The excuse that the guard of the goods train makes for his conduct is, that he did *all* that he had been taught to do when he became a guard, nearly four years since.

If the station-masters, and persons who should look after the working of the railway, allow the servants to do their duties in such a very dangerous and inefficient manner, from day to day, they have much to answer for, and if the guard's statement is true the supervision of the breaksmen must be insufficient.

Backing the train down the incline in front of the engine, and placing and leaving 10 waggons on the main up line, on a gradient of 1 in 119, with a falling

incline of seven miles behind, are most objectionable practices. If by accident waggons are so placed, every one of them should have their breaks pinned down, and the front and hind waggons should be spragged, but nothing, except unavoidable necessity, could warrant their being thus placed. Proper sidings, well guarded with blind sidings, connected with the signals, should be provided for the formation of the trains. The several sidings to the east, west, north, and south of Barnsley low-level station should be rearranged, and interlocked with the signals.

The passenger train was running with the tender in front of the engine, and the guard was travelling in the break compartment next to the engine. Both these practices are objectionable. There should be a guard in the break van at the tail of all passenger trains.

*The Secretary,
Board of Trade,
Railway Department.*

I have, &c.
F. H. RICH,
Lieut.-Col. R. & E.

Printed copies of this report were sent to the company on the 14th January 1871.

MANCHESTER SOUTH JUNCTION AND ALTRINCHAM RAILWAY.

*Board of Trade,
(Railway Department.)
Whitehall, 23d January 1871.*

Sir,

In compliance with the instructions contained in your minute of the 10th inst., I have the honour to report, for the information of the Board of Trade, the result of my inquiry into the circumstances which attended the collision that occurred on the 27th December last at Altrincham station, on the Manchester South Junction and Altrincham Railway.

Eighteen passengers are reported to have been slightly cut, bruised, or shaken.

On the day in question, when the 6.15 p.m. train from Manchester to Bowdon arrived at Altrincham station, a guard's-van and four passenger carriages were detached and put into the engine shed siding, for the purpose of being attached as usual to the train which is due to arrive at Altrincham from Baguley at 6.41 p.m.

The train from Baguley, which is due to leave Altrincham at 6.50 p.m., arrived there about 7 p.m. It consisted of an engine and tender, a composite carriage with a break compartment, and a third-class carriage. A first, a second, two third-class carriages, and a guard's-van (which had been placed in the engine shed siding) were attached to it, and the train drew up, about 7.4 p.m., to the Altrincham station platform, to take up the passengers previous to proceeding on its journey to Northwich.

About 7.7 p.m., while the train was standing at the platform, it was run into by the train due to leave Manchester for Bowdon at 6.45 p.m., and due to arrive at Altrincham at 7.5 p.m.

Altrincham station is protected by signals and distant signals, which are worked from a signalman's box at the north end of the down platform, in connexion with the points. They are arranged on the locking principle.

The Manchester South Junction and Altrincham Railway is worked on the absolute block telegraph system from Castlefield junction at Manchester to Altrincham. The block telegraph and bell instruments at Altrincham are placed in the signalman's box at the north end of the station, and are worked by the man stationed there, who works the signals and points. The next telegraph block station to Altrincham is at Deane's Gate junction, about half a mile to the north of Altrincham, where the line from Baguley joins the Manchester South Junction and Altrincham Railway.

After the train from Baguley had been made up in the yard at Altrincham, and was standing at the down platform, the section of railway between Dean's Gate junction and Altrincham signal-box was clear, and the signalman at Altrincham gave "line clear" to Dean's Gate junction.

The 6.45 p.m. train from Manchester to Bowdon left Manchester at 6.46 p.m.

It consisted of a tank engine, three third-class carriages, a break-van with a guard, three first, one composite, one second, and one first-class carriage, coupled together in the order that the vehicles are given. The signals at Dean's Gate junction were at "all right" for the train to proceed.

The engine driver and guard of the train stated that the Altrincham down distant signal, which is about 690 yards from the station, was also at "all right," and the train ran past it at a speed of about 25 miles an hour.

The engine-driver had shut off steam, and the guard had applied his break, so as to stop at Altrincham station, and when the train was about 50 yards from the signal-box at the north end of the station platform, the driver saw a red light hand-signal, which was being waved from the signal-box.

He noticed the station signal at danger, and a train standing at the platform, almost at the same moment. He applied the engine breaks and sand, and whistled for the guard's breaks, but could not stop his train, and ran against the train that was standing at the platform at a speed of about five miles an hour.

No vehicles of either train left the rails, but the buffer of the guard's van of the Northwich train, and one buffer of the front third-class carriage of the Bowdon train were broken by the collision.

The signalman at Altrincham stated that he gave "line clear" to Dean's Gate junction as soon as the Northwich train was made up, and had drawn up to the platform at the south side of his box, but that he kept his down distant signal as well as his station signal at danger, to protect the train that was standing at the platform.

Altrincham station is usually lit with gas, but the frost had affected it, and oil lamps had been substituted. The station signal light is stated to have been rather dull, and there was a thick fog. The frost had also affected the working of the distant signal, and it does not appear to have gone to danger, when the Altrincham signalman replaced the lever that works the