be a want of due precaution on the part of the Company in leaving a station of such importance without a watchman during the night. Had there been one, the accident could not have occurred; and had it terminated fatally, the Company would have incurred a serious responsibility. The circumstance of no one belonging to the station being on the alert at the last hour of the morning at which the accident is stated to have occurred, viz., 7-30, argues a general want of vigilance amongst the Company’s servants at the station.

The adoption of a fixed caution-signal always exhibited, whether danger exists or not, without any one to attend to it, is objectionable, being more likely to induce carelessness than otherwise; it appears from the evidence that this was known to be the case, and was disregarded; and such will always be the case when there is no one to enforce obedience or report the neglect of it.

A centre stop has been put in in the middle of the road, which will prevent the gates again closing across; but there is still the great objection that some careless passenger may leave the gates open and allow cattle to stray on the line. In my opinion the public safety requires that the gates should be locked at night, and that the keys should be placed in charge of a watchman.

I have, &c.,
Capt. Harney, R.E.,
&c., &c.

GEO. WYNNE, Capt. R.E.,
Inspector of Railways.

APPENDIX to REPORT of the COMMISSIONERS of RAILWAYS.

APPENDIX No. 53.

CALEDONIAN RAILWAY.—(Rockcliffe Station.)

I have to report to you, for the information of the Commissioners of Railways, in compliance with their instructions, dated the 13th February, “that I should examine and report upon the circumstances of an accident that occurred upon the Caledonian Railway on the 10th instant, near Rockcliffe station.” I proceeded on the following day to Carlisle, and on the morning of the 15th examined the spot where it occurred, being about four miles north from Carlisle, and the engine and various carriages which composed the train; and afterwards attended the inquest, then sitting at Carlisle, and which was subsequently adjourned to the 21st instant, on which day I also attended; and having made known my instructions to the coroner, was furnished by him, as well as by the Railway Company, with every assistance to enable me to arrive at satisfactory conclusions. The accident having occurred on the night of the 10th instant, the railway at the precise spot had been repaired, so as to avoid the inconvenience and risk consequent upon a stoppage of the line; but the extent of the damage was pointed out to me, and afterwards verified by evidence adduced before the coroner. And I was informed that none of the roadways had been disturbed, except where absolutely necessary for the restoration of the traffic. The accompanying plan furnished by me to the superintendent of the railway, shows the position of the train after the occurrence.

The engine was upon the line, and not in the least degree damaged, being one of the ordinary class of passenger-engine, in use upon the Caledonian Railway. The tender, which was constructed with four wheels, was entirely off the line, (its wheels being about six or eight inches from the rails,) but not uncoupled from the engine. It was much damaged, the left-hand front wheel having been forced back against the area or lever of the brake, carrying away the axle-box and one arm of the guard-plate; the brake was broken, and the trailing-wheel on the left hand was found to have shifted inwards upon its axle about four inches. The luggage-van, the coupling-chains of which were still fast to the roadway, was entirely off the rails a few inches on the same side as the tender, but not much damaged. The first-class carriage next to the van had one pair of wheels off and the other on the line, and was held to the guard’s van by the left side chain, the screw couple and right chain having been wrenched asunder. The second-class carriage, in which the five persons were killed, and another of the passengers injured, who has since had a leg amputated, succeeded the first-class carriage. It lay at the bottom of the slope of the embankment (about 10 feet high) on which the accident occurred, having been turned upside-down, and was partially under the Post-office, one pair of wheels having been forced from the carriage, the other pair remaining in their place, but both of their axles much bent. The body was entirely crushed. The Post-office, a heavy carriage upon six wheels, probably with its load nearly nine tons in weight, was not damaged in the under framing, but a hole had been knocked in the front of the body. A composite carriage followed, but was not much injured. Three horse-boxes followed, which were considerably broken, probably by the weight of the horses, as they lay over on their side on the embankment. Next followed a first, and then a second-class carriage, and last of all a horse-box. The whole of these last nine vehicles were off the rails, and with the exception of the last, either upon or down the slope of the embankment. From a few feet from the leading first-class carriage (coloured red) to the last horse-box, the left hand or west rail was either torn up or very much damaged; the right rail, with the exception of one length near the first-class carriage, which was out of its position, was scarcely stirred; and from the horse-box southwards neither the rails, sleepers, nor ballast were injured, and I was informed, had not been in any way touched, up to the period of my inspection on the 13th instant. The road was in gauge, and in good condition; and there appeared nothing as regards the permanent works or tracks in any degree to account for the disaster. From the rear of the last horse-box, for a distance of about 215 yards, the cast-iron chairs, securing the left-hand rail...
to the sleepers, were indented on the inside of the rail, as if by
the passing of a wheel, but not all of them; the wheel or sub-
stance causing the marks having occasionally missed several.
There was no corresponding mark upon the opposite rail or its
other end of the same axle as that producing the marks on the
left hand chairs.

From this point, marked A on the plan, for a distance of 106
yards, a trace was discernible of some hard-edged substance
having run along the top of the rail, nearing its side gradually
as it approached the point A, and then scorching it as if it had
slid down upon the inside of the rail. Hence southwards no trace
of any sort was discernible.

The marks described as existing upon the chairs were of so
very light a nature that it could hardly be conceived that they
had been produced by the wheel of a tender, which must, with
its load, have been weighed from 9 to 10 tons. I therefore
requested that the same tender might be filled as upon the night
of the occurrence, and caused it to moved upon the rails until
the wheel had been forced in upon the axle, when it dropped
within the rail, and I found that it only made such marks as
those near the scene of the accident, the weight being supported
by the other three wheels, which remained upon the rails, and
by the pressure of this wheel itself against the inside of the
rail, which remained in gauge. Whilst in this position, a con-
stant pressure existed to force the wheel inwards, and I there-
fore am led to believe that the sliding of the tender-wheel upon
its axle must, after it had moved so far as to allow it to descend
upon the sleepers and ballast, have injured the rails on the
near side, which were torn up by it, and by the two carriages
which remained attached to it; and that the second-class,
having a broken road to run upon, met with such resistance
that it burst from its connexion with the second carriage, and in
doing so was hurled down the bank, the other carriages behind
following it.

Having thus described the results of the accident and facts
connected therewith, and stated what I conceive to have been
the probable cause, I shall now proceed with a few remarks on
the method by which the tender-wheel appears to have been fitted
and fixed on the axle:—

The instructions given to the workmen in the Company's
engine factory at Greenock are, to turn the seat of the wheel
upon the axle in a slightly conical form, the smaller diameter
being towards the outer end of the axle, the amount of the cone
being 1-16th of an inch to a foot, rather more than the thirty-
second part of an inch in the thickness (7 inches) of the boss or
nave of the wheel. The centre of the boss is also turned with a
similar amount of cone, but so that the inside or larger end of
the conic frustum tightly fits the smaller end of that upon the
axle, upon which the wheel is forced by hydrostatic pressure,
equal to 250 tons. After this keys, slightly wedge-formed, are
driven from the outside into ways formed for their reception,
partly in the axles and partly in the bosses of the wheels.
The axles are formed without shoulders on the inside, so that
entire dependence is placed on the conical form of the seat of
the wheel and on the accuracy of fit. In the present instance,
after that the wheel of the tender had been replaced in its
proper position, and the engine brought to Carlisle, the wheel
was moved by repeated blows from an ordinary sledge-hammer
(14 lbs. weight), 42 blows being sufficient to move it 24 inches
inwards, and 57 to draw it completely in upon the axle. Upon
examination it was found that it had been badly fitted upon its
axle, which was not conical in form in the right direction.

There appears, therefore, but too just cause to believe that
the man intrusted with the fitting of this wheel upon its axle
had been guilty of neglect, as he should have known by the
manner in which it must have yielded to the pressure in fixing
that it was not an accurate fit, and I doubt very much whether
the full pressure of 250 tons had ever been applied. This man
had been discharged from the service of the Caledonian Com-
pany in consequence of a discovery, previous to the accident now
under consideration, of a misfit in another wheel.

From the evidence adduced before the coroner, it appears
that although such occurrences as a loose wheel have not been
common upon this railway, that nevertheless they have been

Appendix No. 53.]
Caledonian
Railway.
(Roseliffe Station.)

Horse-box, L.&N.W
No. 63.
2nd class, C.R., No. 8.
1st class, L. & N. W.,
No. 257.

Ditto L. & C., No. 3.
Ditto G. J., No. 40.
Composite, B.C., No. 7.

Post-office, L. & N.W.,
No. 6.
2nd class, L. & N. W.,
No. 259.

1st class, C.R, No. 17.

Luggage van, No. 2.

Tender

Region
frequent elsewhere, one witness having known a number of cases in similarly constructed axles on the Paris and Rouen Railway. As it is clear, therefore, that wheels do occasionally slip upon their axles from neglect in workmanship, it would be well if in future constructions a slight shoulder were left, or some other means provided to prevent them from moving to such an extent as would become dangerous. An objection has been taken to the construction of axles with shoulders, in consequence of their greater liability to fracture, which generally takes place inside the boss of the wheel at the shoulder; and therefore great numbers of wheels are now fixed upon their axles, either in the manner above detailed or even with parallel, and not conical seats, in which everything depends upon workmanship. A slight shoulder, such as that above mentioned, which for this purpose need not exceed the sixteenth part of an inch, would not, I conceive, be found injurious, unless in an axle the strength of which might not be in excess. Upon considering this accident, therefore, in which the wheel that shifted had travelled from 12,000 to 13,000 miles, and the evidence adduced in the inquiry, it would appear advisable, if such wheels and axles as are fixed without shoulders, and are now running upon railways, were carefully examined, and some means provided, either by a key with a head to it on the inside, or a false shoulder, or some such remedy as will easily suggest itself to those intrusted with the care of the locomotives and carriages upon railways, as will be an effectual preventive, even in case of an ill-fitted wheel, to its motion along its axle to such an extent as to be productive of serious results.

I have, &c.,

J. L. A. Simmons,
Capt. Royal Engineers.

Sir,

I have been directed by the Commissioners of Railways to forward you the enclosed copy of the report made to them by Capt. Simmons, after inquiring into the circumstances attendant on the fatal accident which occurred on the Caledonian Railway on the 10th instant, and to express their hope that the remarks made therein by Capt. Simmons, with respect to the fixing of the wheels of railway carriages upon their axles, will receive the careful consideration of the Directors of the Company.

I have, &c.,

H. D. Harness,
Capt. Royal Engineers.

Sir,

I have the honour to forward a sketch-tracing of the mode adopted on this railway, in compliance with the recommendation of the Inspector of Railways, communicated in your letter of the 26th February, for preventing the possibility of the recurrence of an accident from the inward slipping of a wheel upon its axle.

Company’s Offices, George-street, Edinburgh,
March 29, 1849.
A small cottage, A B, has been introduced, partly countersunk into the axle, and partly into the boss of the wheel. The expense is inconsiderable, and it will be seen that as the boss of the wheel presses against the shoulder at A, while the shoulder at B presses against the axles, that it effectually prevents any inward movement; while the key CD, drawn from the outside, prevents any movement in the opposite direction.

I have, &c.,

J. W. CODDINGTON, Secretary.

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Office of Commissioners of Railways, Whitehall, April 5, 1849.

Sir,

I have been directed by the Commissioners of Railways, with reference to the Circular from this Office, of the 26th February, requesting the attention of the Directors of the Company to the remarks of Capt. Simmons on the fixing of the wheels of railway carriages, contained in a Report of that officer, of which a copy was enclosed, to transmit to you the accompanying extract from a communication received by the Commissioners from the Caledonian Railway Company, describing the method which has been adopted by that Company to prevent the recurrence of an accident from the inward slipping of a wheel upon its axle.

I have, &c.,

H. D. HARENS,

Capt. Royal Engineers.

[Extract from Caledonian Railway Company's Letter of the 29th March, 1849.]

"A small cottage, A B, has been introduced, partly countersunk into the axle, and partly into the boss of the wheel. The expense is inconsiderable, and it will be seen that as the boss of the wheel presses against the shoulder at A, while the shoulder at B presses against the axles, that it effectually prevents any inward movement, while the key CD, drawn from the outside, prevent any movement in the opposite direction."

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APPENDIX No. 54.

SCOTTISH CENTRAL RAILWAY.

Whitehall, February 26, 1849.

Sir,

I have to report to you that, in accordance with the appointment of the Commissioners of Railways, I inspected, on the 17th instant, the site of an accident which occurred on the Scottish Central Railway on the 27th November last, when the mail-train proceeding to the North was thrown off the line in consequence of the washing away of the ballast, which was caused by the choking of a culvert used to convey the water of a small burn under the railway, which was then swollen to an inordinate extent by heavy rains. The stream carries with it in suspension, or rather moves along on its bed, a considerable quantity of fine sand, which being deposited in the culverts, narrows the channels, and they are, therefore, constantly liable to become choked. It crosses under the railway in three places, the upper of which produced the accident in November last. This (the upper) culvert has been replaced by a stone drain about 4 feet square. The culvert lowest down in the course of the stream is 3 feet in diameter, of which at least one-half was at the time of my inspection filled with sand. The centre of the three culverts was somewhat less than 2 feet square. In ordinary times the smallest is quite sufficient to carry the small stream which constantly flows; but, from experience, it appears doubtful whether it can carry away flood-waters, even when free from deposit.

I therefore, suggested to the engineer the advisability of replacing it by one of larger dimensions, of keeping them all three clear of sand, and of endeavouring by some means to cleanse the stream from deposit before arriving at the culverts.

On the 20th instant, on my return southwards, I inspected the state of the bridges and works of the Caledonian Railway in the valley of the Clyde, which have lately suffered from floods. At 55 miles from Carlisle, the Clyde is crossed by a flat timber bridge, at an angle of 55°, having four spans of 40 feet each; the clear height from the level of mean water to the under side of the timbers being about 14 feet. The approach to this bridge on the south side is by an embankment across a flat meadow, over which, during floods, the water has been accustomed to extend. On the north side the bridge abuts against a steep gravelly bank upwards of 50 feet in height, and upon the occasion when the injury was sustained, the water being dammed across, and not finding an outlet over the meadow, rushed with violence along the high bank opposite, which, being in a bend, had to resist the full force of the stream, and, undermining it, cut off the communication of the bridge with the railway to the north. The Company have extended the opening of the bridge to the extent of the injured bank, and have footed the