INTERSTATE COMMERCE COMMISSION

REPORT OF THE DIRECTOR OF THE BUREAU OF SAFETY IN RE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE LOUISVILLE & NASHVILLE RAILROAD NEAR TORRENT, KY., ON DECEMBER 31, 1928.

May 11, 1929.

To the Commission:

On December 31, 1928, there was a derailment of a passenger train on the Louisville & Nashville Railroad near Torrent, Ky., which resulted in the death of one employee.

Location and method of operation

This accident occurred on that part of the Eastern Kentucky Division which extends between North Cabin and Maloney, Ky., a distance of 52.5 miles, in the vicinity of the point of accident this is a single-track line over which trains are operated by time-table and train orders, no block-signal system being in use. The accident occurred at a point about 1 mile north of Torrent; approaching from the south the track is tangent for a distance of 961 feet, followed by a 3° curve to the right 717 feet in length, and then tangent track for a distance of 109 feet, followed by an 8° curve to the left 840 feet in length which includes a spiral at each end 210 feet in length, the accident occurring in the center of this last-mentioned curve. The grade is generally descending for northbound trains, being 0.91 per cent at the point of accident. The track is laid with 80-pound rails, 33 feet in length, with 18 ties to the rail-length, tie-plated and single-spiked. The track is ballasted with stone and screenings and is well maintained.

South of the point of derailment a fill 260 feet in length and approximately 12 feet high leads to a bridge 53 feet in length; the fill continues north of the bridge for about 120 feet into an earth cut about 100 feet in length. The first mark of derailment was on this bridge near its southern or receiving end.

The weather was clear at the time of the accident, which occurred at 11.20 a. m.

Description

Northbound passenger train No. 4 was detouring over this portion of the road, running as extra 780, and consisted of one combination mail and baggage car, one baggage car, one combination coach, three coaches and one parlor car,

hauled by engine 780, and was in charge of Conductor Hendren and Engineman Dailey. This train departed from Maloney at 10.40 a. m., passed Torrent, 10.8 miles north of Maloney, at 11.18 a. m., and was derailed at a point about 1 mile beyond while traveling at a speed estimated to have been between 15 and 20 miles per hour.

Engine 780 came to rest leaning to the right with its front end buried in the dirt on the right or east side of the track at a point 266 feet north of the first mark of derailment; the tender remained coupled to the engine with the rear end partly on the roadbed. The first and second cars were derailed and came to rest with the wheels on the right side off the roadbed; the forward truck of the third car was also derailed. The employee killed was the engineman.

Summary of evidence

Fireman Weaver stated that they changed engines at Maloney and their only stop was at a point about 2½ miles south of the point of derailment, where he and the engineman cleaned the sparks out of the front end, resulting in a delay of about 5 or 10 minutes. He noticed nothing irregular in the riding of the engine until it commenced rocking and he heard the brake valve placed in the emergency position, shortly after which he jumped from the engine, subsequently finding the engineman on the ground near the front end of the mail car. Due to the right side of the engine being against the side of a cut and the front end buried in mud, he was unable to see if there was anything wrong with the engine on that side, but he did notice a mark on the rail which appeared as if something had been dragged along on it. He was unable to state whether or not the engineman made an examination of engine 780 before their departure from Maloney, but he noticed the brakes worked properly en route. Fireman Weaver estimated the speed to have been between 18 and 20 miles per hour at the time of the accident.

The statements of Conductor Hendren practically substantiated those of Fireman Weaver as to the operation of extra 780 from Maloney, and he estimated the speed to have been 15 or 18 miles per hour at the time of the accident. His examination of the track disclosed that something had rubbed on the top of the right rail for a distance of 12 or 15 inches, and then there were marks on the outside of the base of the rail extending across the bridge. The testimony of Flagman Watts and Train Porter Williams brought out nothing additional of importance.

Track Supervisor Akers stated that he made an examination of the track a few hours after the occurrence of the accident and he found marks where a wheel had crossed the rail. He checked the gauge and elevation of the track and found them to be in accordance with the standards required

for a curve of 8°.

Assistant Master of Trains Preston and Master Mechanic Oakley arrived at the scene of the accident several hours after its occurrence and their examination of the track disclosed the first mark of derailment to be on the right or east rail at a point 14.4 feet north of the south end of the bridge. There were irregular indentations from the gauge toward the center of the running surface extending 14 inches northward, then a cut mark on the gauge side of the rail, and a flange mark across the rail extending for a distance of 3 or 4 feet. The marks continued on the outside of the base of the rail to the north end of the bridge. A short distance north of the bridge the bridge guards were torn out and from that point northward for a distance of 320 feet the track was badly damaged. An inspection of the right pony truck wheel disclosed that a section of the flange 22⅝ inches in length was missing; a piece of flange 3 inches long was found about 30 feet south of the bridge on the right side of the track, between the ties, and it was found that this piece of flange matched a place on the broken wheel, although no other broken parts were found except a sliver which was found underneath the bridge on top of the concrete abutment directly under the first mark of derailment.

After the engine had been brought to the shops a complete examination was made and it was found that on the broken part of the right pony truck wheel there was a discoloration, next to the tread, ranging from 1/8 to 3/4 inch deep and 14 inches in length. The other parts of the engine, such as spring hangers, shoes, wedges or any other part that might have contributed to the accident were found in first-class condition. The engine was last overhauled at Covington, Ky., in April, 1928, and it was at that time that this pony truck wheel was applied.

The evidence indicated that this accident was caused by a broken wheel and an investigation was conducted by Mr. James F. Howard, Engineer-Physicist, to ascertain the cause of the broken wheel, whose report immediately follows.

Report of the Engineer-Physicist.

The derailment of train extra 780 near Torrent, Ky., December 31, 1928, was evidently caused by a broken wheel on the pony truck of the engine. A segment 22½ inches long was detached from the flange of the right hand wheel of the truck, permitting the engine to pass over the high rail of an 8 degree curve leading to the left.

A short piece of the flange, from the middle part of the length of the detached segment was found, 30 feet south of the first marks on the high rail. The marks on the top of the rail indicated that something had crossed over it

A few inches beyond, the gauge side of the head of the rail was cut apparently by a broken flange. This was followed by a plain mark 3 or 4 feet long, like the print of a flange, crossing the rail. Next beyond were wheel marks on spikes and ties, and still farther along marks on the ties indicated that a portion of the flange of the wheel when at that place, was gone.

From this evidence, furnished by the track structure, it would appear that the outward thrust of the engine against the high rail of the curve had broken the flange of the right hand wheel of the pony truck; that the broken wheel had climbed the rail and crossed it tangentially; that marks beyond showed a part of the flange of the wheel had been detached before it reached that place.

The track from the point of derailment was in good condition for a distance of 125 feet, except the bridge guard had been injured. Then for a distance of 220 feet the track was badly damaged. The derailment of this northbound train began at the south end of a bridge 53 feet long.

It was observed by the master mechanic of the railroad that the fractured surface of the wheel was discolored, from the tread ranging in depth from 1/8 inch to 3/4 inch and 14 inches long. The short piece of flange 3 inches long found 30 feet south of the first marks on the high rail also showed discoloration, a blue black oxide tint. A smaller fragment of the flange which was recovered, represented one end of the 22½ inch segment. This wedge-shaped piece displayed an earlier vertical seam, slightly oblique to the plane of the wheel, with rusty surface, oxidized by exposure to the weather and not heat tinted.

The 3 inch fragment showed a condition which was not exhibited by the flange on the intact parts of it. The face of the flange on this fragment was worn smooth, and flattened. The top of the flange was also worn smooth and flattened. The flange on the opposite side of the wheel, that is 180 degrees apart, did not show these characteristics. It did show a slightly smoothed top, suggestive of having run on the head of the rail perhaps at the time of derailment. The face of the flange did not show wear. Sketch of the 3 inch fragment, end view, indicates the worn and flattened surfaces marked for identification A and B.

Concerning the tinted surface of the fracture on the rim observed by the master mechanic and exhibited also on the 3 inch fragment, and its possible significance, oxide tints are frequently shown on ruptured surfaces, when fracture is caused by violent blows with some shearing action, or rubbing of the parts against each other. The crystalline structure of the white iron on these surfaces was not destroyed, merely tinted and only

slightly. The entire fractured area was not tinted, only a portion of it. The portion tinted, however, was adjacent to the surface of the tread.

The rusty surface of the crack or seam in the fragment detached from the end of the 22½ inch segment did not suggest the action of heat in its formation; rather a split from a vertical blow. Iron rust is of course an oxide but distinguishable from heat tinted oxides.

The explanation of the cause of the broken flange depends upon the correct interpretation of the somewhat limited evidence presented by the fragments. It is known that throat seams, thermal, shrinkage seams, sometimes occur. Also that warped flanges are known to occur at times. A flange with a throat seam is necessarily a weak flange. A warped wheel may not be a weak wheel, but unserviceable. In any event the correct diagnosis must be the one which satisfies all the conditions of rupture.

In the present case opinions have been expressed that the basal cause of the flange fracture was a throat seam. These expressions of opinions have been given weight, and throat seams do result in the failures of wheels. These opinions appear to have been based upon the fact that the line of rupture was at the throat of the flange at the middle of the length of the 22½ inch segment. The character of the fractured surface, however, introduces a doubt whether that was the primitive cause. It is believed that a controlling feature is exhibited in the local wear of the face of the flange and which is inconsistent with the primary cause being a throat seam.

This wheel was one of two on a single axle truck, axle load 18,000 pounds. It was mounted on a swing bolster having some three inches lateral motion. This pony truck was applied when the engine was overhauled in April, 1927 and was put into service May 1, 1927. Up to the time of derailment the engine made 22,248 miles. The average mileage per day was therefore less than 40 miles.

The broken wheel was pressed off its axle, requiring 100 tons pressure. Not an unusual resistance to pressing off, which is expected to be a little higher than pressing on. It was returned to its seat, and the axle mounted on centers. Both wheels, the fractured wheel and its mate ran true, so far as pertained to the remaining portion of the flange of the broken wheel. Each wheel was taped to size. Additional pieces of the flange of the broken wheel were knocked off with a sledge, all showing a good depth of chill and sound metal.

If there was a throat seam, it was of limited extent, not covering one fifth of the circumference of the wheel. Shrinkage seams are not necessarily widely open. The actual separation of the metal required to cause a shrinkage crack is minute in width possibly immeasurable. A wide open seam is the

result of contractile forces in adjacent metal, or depending upon circumstances, the reaction of tensile strains. If locally warped, the opportunity for discovery is present when the wheel is centered in the mill for boring the hub. A warped condition is also apparent when the wheel is "rolled". Those who are expert in "rolling" wheels have no difficulty in detecting an irregular flange.

In choosing between the two explanations, a throat seam, or a warped wheel, the latter is the more consistent one. The flange of the broken wheel was worn locally along less than one fifth of its circumference. The balance of the flange showed no appreciable wear. There was no evidence on the mate of the broken wheel of reaction which would cause local flange wear concentrated on one part of the circumference. These truck wheels, at ordinary speeds, make several rotations per second. A local accelerating force, adequate to cause flange wear on one side only of the broken wheel cannot be conceived. If the fracture of the flange was due to a pre-existing throat seam, the strength of the flange would not appear to have been sufficient to endure the thrusts which its wear calls for. There was no brake action on this truck; no differences in temperature while in service to overstrain the wheel. Repeated side thrusts which may have been received several times per second, would account for the local wear exhibited by the 3-inch fragment of the detached segment. Repeated side thrusts in service would tend to break off a segment of the flange. Other parts of the flange running true would indicate that some local cause attached to that part of the wheel which ultimately ruptured. In conclusion the most reasonable explanation of the cause of rupture is that a warped condition of the wheel pre-existed.

Respectfully submitted,

W. P. BORLAND,

Director.