INTERSTATE COMMERCE COMMISSION

REPORT OF THE DIRECTOR OF THE BUREAU OF SAFETY IN RE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE PENNSYLVANIA RAILROAD NEAR MARTINSVILLE, ILL., ON MAY 14, 1925

SEPTEMBER 15, 1925

To the COMMISSION

On May 14, 1925, there was a derailment of a passenger train on the Pennsylvania Railroad at Dupont switch, located about 2½ miles west of Martinsville, Ill., which resulted in the death of four employees and one other person, and the injury of seven passengers, one employee, and five other persons

LOCATION AND METHOD OF OPERATION

The St Louis Division, on which this accident occurred, extends from Terre Haute, Ind., to St Louis, Mo., a distance of 169 1 miles The accident occurred about 32 miles west of Terre Haute, the railroad in this vicinity being a single-track line over which trains are operated by time-table, train orders, and a manual block-signal system In the vicinity of the point of accident the track is laid with 100-pound rails, 33 feet in length, laid in 1915, with 18 hardwood ties to the rail length, the ballast being of washed gravel 18 inches or more in depth Approaching the point of accident from the west the track is tangent for several miles and the grade is slightly descending, it is practicaly level at the point of accident The maximum speed limit for passenger trains is 70 miles an hour The switch where the accident occurred is a facing-point switch for eastbound trains, serving a stub team track about 400 feet long on the south side of the main track The switchstand is at the west end of the siding on the south side of the main track, the switch lamp being about 15 feet above rail level and displaying red when the switch is set for the siding and green when set for the main track The switch is operated by a ball lever and when thrown is latched in either position, the switch points are connected together by two bridle rods attached to the points by means of clips The switch points were 18 feet in length, the frog used was No 10, the distance from point to toe being 8 feet and from point to heel 7 feet

The accident occurred at about 4 25 a m, just as day was breaking, the weather being clear at that time

DESCRIPTION

Eastbound passenger train No 6 en route from St Louis to Indianapolis consisted of engines 3393 and 8706, one mail-storage car, two mail cars one baggage and express car, one combination car, one coach, and four Pullman sleeping cars, in the order named, all cars being of steel construction Conductor Litteral and Enginemen Muench and Walsh were in charge of this train, it left St Louis, its initial terminal, at 11 52 p m May 13, two minutes late, passed Oak Leaf, the last block station 1 24 miles west of the point of accident, at 4 24 a m May 14, as shown by the train sheet, six minutes late, and was running at about 60 miles an hour when the derailment occurred

The leading engine, No 3393, was derailed at the west end of the frog, followed the siding, and collided with a steel gondola car partially loaded with crushed stone, which was standing on the siding about 120 feet east of the frog the impact drove the gondola car beyond the end of the stub track, and engine 3393 stopped 293 feet from the point of derailment, lying on its right side on the south side of the stub track Engine 8706 and both tenders were overturned and stopped nearly opposite engine 3393 lying across the main track and siding The mail-storage car was partly turned around and came to a stop in upright position, one end being on the siding and the car extending across to the opposite side of the main track The next three cars were derailed to the south and stopped in upright position The front truck of the fifth car was also derailed, the rear truck remaining on the main track rails and the rear end coming to a stop over the frog The last five cars were not derailed Both main track and siding were torn up for a distance of 240 feet The employees killed were the two enginemen and the two firemen

SUMMARY OF EVIDENCE

Conductor Litteral, of train No 6, stated that his train left St Louis on this trip about two minutes late, and they were about two minutes late at Casey, a station about 4 miles west of the point of accident Between St Louis and the point of accident nothing out of the ordinary occurred except that at one place it was necessary to stop the train as the air brakes failed to release properly Approaching the point of accident the train was running at the rate of 55 or 60 miles an hour He was sitting in the first seat of the combination smoking car, the fifth car in the train, and he said the brakes were not applied prior to the derailment, and that he had no knowledge of anything wrong until the crash which came at the

time of derailment. He thought the accident occurred at about 4.23 a. m. After the accident he examined the track and found that a section 12 or 14 inches in length was broken out of the rail at the west end of the frog, and there were marks on the ties indicating that wheels had been derailed at that point. He therefore attributed the cause of the derailment to the broken rail, the switch was set and locked in main-track position and appeared to be in proper condition, he made no further examination of the track in the vicinity of the point of accident.

Train Porter Martindale was also riding in the smoking car, Baggagemaster Morical was in the coach, and Flagman Tipton was in the rear Pullman, the statements of these employees were similar in their essential features to the statement of Conductor Litteral. So far as they knew there was no dragging equipment or other defective condition of engines or cars in their train which could have caused or contributed to this accident.

After the accident the engine of a train which was following train No. 6 came up, the front truck of the fifth car was pulled back upon the rails, and the six rear cars were hauled away. After the combination car had been rerailed the track in the vicinity of the point of accident was examined by a number of railroad employees and officials.

Track Foreman McDaniel, in charge of the adjoining track section to the west, stated that when he arrived at the scene of accident the combination car had been rerailed, he saw the broken rail and also found that the two clips on the bridle rods which secured the north switch point were broken, he said he was the first to discover the broken clips. The switch was in normal or main-track position, the north switch point looked as though something had struck the point on the end, on the south point there were marks at two places which looked like flange marks as wheels passed over the point. The first marks on the ties, however, were opposite the frog just south of the main track, near the broken rail. He also stated that he was at this switch on the morning of May 13 and noticed nothing wrong with it at that time.

Division Engineer Hawthorne stated that when he arrived at the scene of accident Foreman McDaniel called his attention to the broken switch-point clips. The switch rods were lying on the ballast between the ties, apparently having dropped there when the clips were broken, the north switch point was marked as if something had struck it on the end and also another blow on the north side an inch or more back of the point, the point was also slightly bent. The south switch point was marked at three different places, as though wheels had climbed over it, the first mark being about 6 feet from the point, the second 57½ inches farther back, and the

third mark 12 inches beyond that There were no corresponding marks on the ties but the stock rail was only about 6 inches from the switch rail and he thought it would be possible for a wheel to climb over the switch rail to the stock rail when moving at speed Approaching the frog there was a mark on the inside of the head of the lead rail, indicating that something had rubbed against it very hard the lead rail was bent and canted toward the south, and the end of the lead rail abutting the frog was broken a piece 16¾ inches long being broken out of the ball of the rail He said it looked to him as though the first engine and possibly the front truck of the tender, must have gotten over on the rail going into the side track, the remainder of the train following the main track, but he could not say why the second engine did not follow the first engine into the siding The track was examined for some distance in each direction from the point of accident and marks were found on crossing planks at a crossing about one quarter mile west of the point of accident and also at crossings to the east These marks were 3¼ or 3½ inches inside the north rail, and consisted of a round groove throughout the length of the plank apparently made by a wheel flange or something dragging which had a uniform bearing Similar marks were noted on a frog at Martinsville The marks appeared fresh and in his opinion were not more than 24 hours old

There was some evidence that these marks were present on the day before the accident, but it was not discovered what caused them It was his conclusion that something on a preceding eastward train struck the north point of the switch, breaking the clips, and that the north switch point worked over to a position against the north rail diverting the leading engine from the main track There were five bolt holes in the web of the lead rail where broken This rail when laid in 1915 was received from the manufacturer with two bolt holes, but in fitting the rail in place it was necessary to cut two inches off from the end of the rail and drill two more bolt holes to fit the angle bars Later the angle bars were changed and one more hole was drilled three of the five bolt holes being left open The switch points were applied in 1915, and the frog which was in use at the time of the accident was installed in June 1924

Assistant Division Engineer Schilling also examined the broken switch-point clips, the broken rail, and the track in the vicinity of the point of accident He thought the marks on the south switch point were not deep enough to have been made by an engine wheel The toe of the frog where it had been bolted to the end of the lead rail which was broken was bent downward about 2 inches and it appeared to him as though the rail was broken by something which had been derailed previously The guard rail opposite the point of the frog remained in proper position The first marks on the ties

were 6 feet west of the point of frog, there were two marks on the ties, 17 inches south of the north rail and 12 inches south of the south rail of the main track, and because of the distance of these marks from the rails it appeared that whatever made them was jerked from the track These marks were deep enough to have been caused by engine wheels Examination of the broken switch-point clips disclosed that there was an old crack in each of the clips about half way through, extending from the bottom upward, and he thought an ordinary visual inspection would not have disclosed these defects He personally inspected this switch about the middle of April and did not discover any defective condition

Trainmaster Kelly examined the track and equipment at the scene of the accident and was of the opinion that something dragging on a preceding train caught the switch point and broke the clips, and that the point loosened in that manner caused this derailment At first he thought possibly a loose wheel had struck the north switch point and broken the clips, but later thought it must have been something dragging from a preceding train When he learned of the marks on the crossing planks he notified the superintendent in order that inspections could be made of trains which immediately preceded train No 6 However, these inspections failed to disclose what caused the marks on the track

Road Foreman of Engines Riddle stated that prior to the accident engines 3393 and 8706 were both in good condition, after the accident, in company with Enginehouse Foreman Myer, he made a thorough examination of them, but did not find any condition which might have caused or contributed to the cause of the accident Damage done to the engines was apparently the result and not the cause of the accident Master Mechanic Cheeseman also examined the engines, but found nothing on them which could have caused the accident He thought the marks on the crossing planks were made by something dragging rather than by a wheel flange

Track Foreman Shull stated that prior to the accident the track in this vicinity was last inspected on May 12, and the frog and switch at that time appeared to be in good condition No track work had been done at this point since April 13 After the accident he examined the track in this vicinity and saw the marks on the crossing planks, he stated that he saw similar marks on one of the crossings at Martinsville on May 12, two days before this accident occurred

The car loaded with stone was placed on this siding by a local freight crew on the day before the accident, and at that time there was nothing unusual noted in connection with the condition or operation of the switch

On the day of the accident one freight train and two passenger trains, westbound, passed over this switch between 1 23 and 3 06

a m , eastbound, one freight train and one train of deadhead equipment passed this point after 9 30 p m May 13, and one passenger train passed at 12 51 a m May 14 The switch was last used to set out the car of stone shortly after noon on May 13

The opinion expressed by a number of railroad employees and officials that the switch-point clips were broken prior to this accident and that this condition was the primary cause of the accident does not appear to be substantiated by the evidence According to this theory the marks on the north switch point were made by a wheel or something dragging and the blow causing these marks broke the switch-point clips, the same wheel or dragging equipment marked the planks in various road crossings both east and west of the point of accident The evidence indicated, however, that these marks on crossing planks were made at least two days prior to the accident, and there was positive evidence that the switch was in proper working condition about noon of the day prior to the accident, furthermore, six trains passed safely over this switch within seven hours prior to this accident

The evidence also discloses that the broken switch-point clips were not discovered until after the combination car was derailed, and it is quite possible that these clips were broken during this operation Flange marks on the web of the broken rail indicate that this rail was used to carry the south wheels as this car was derailed There is considerable doubt whether the marks on the switch points were heavy enough to have been made by wheel flanges The south switch point was not damaged sufficiently to require its removal, and the marks on it which were assumed to have been made by wheel flanges were entirely obliterated soon after the traffic had been resumed on the main line

In the immediate vicinity of the frog there were six ties which were somewhat decayed, and while tie plates were used a shim three-eighths inch thick was used between the base of the rail and a plate near the toe of the frog, these conditions, no doubt, resulted in some inequality in the support of the frog and the adjoining lead rail The first wheel marks on the ties were opposite the frog, about 75 feet from the point of the switch, these wheels undoubtedly having left the track where the lead rail adjoining the frog was broken

Examination of the broken rail was made by J E Howard, engineer-physicist of the Bureau of Safety, who reported as follows

REPORT OF THE ENGINEER-PHYSICIST

The derailment of eastbound train No 6 at Dupont Switch, 1 24 miles east of Oak Leaf Station, Ill , which occurred on May 14, 1925, was caused by a broken rail, the lead rail of a switch

The history of the rail as furnished by the railroad company, is as follows: The original length of the rail was 30 feet. It was drilled originally to receive track bolts spaced according to angle bars in current use in 1915.

When prepared as a lead rail, in order to make the switch points come opposite each other it was shortened in length about 2⅛ inches, new holes being drilled with the same spacing as before. This was done in August, 1915. Four bolt holes were then in one end of the rail.

In June, 1924 a new No. 10 frog was installed. The new frog was drilled for a new standard angle bar, the bolt holes of which were spaced 7¼ inches apart instead of the former spacing of 5½ inches. Another hole was drilled in this rail to accommodate the new angle bars, making five holes in all. The bolt holes were $1\frac{3}{16}$ inches diameters each.

The angle bars were 24 inches long, therefore covering 12 inches in length of the rail. Of this length the five $1\frac{3}{16}$-inch holes reduced the area of the web along its middle element 49½ per cent. In this weakened condition the rail was put into service, where it remained for a period of 11 months and then failed, precipitating this derailment.

Some time during the period the rail was in service partial rupture of the web took place, separating the section between the first and second bolt holes, counting from the end of the rail. A fracture was also started in the web below the first bolt hole near its junction with the base.

The line of rupture in the final fracture of the rail passed through the remaining sections between bolt holes. From the fifth bolt hole the line of rupture extended obliquely downward to the upper surface of the base. It bifurcated when the base was reached, one branch separated the base, the other branch took an upward course and separated the metal of the web and the head, thus completely rupturing the rail. Longitudinally the greater part of the length of the line of rupture was covered by the angle bars.

A blue print furnished by the railroad company, plan No. 25049, file No. K 302, has this notation upon it: "Break probably started at this point on gauge side of flange," ascribing the origin of the fracture to the base of the rail beyond the portion covered by the angle bars. The evidence presented by the fractured surfaces of the rail showed the line of rupture terminated where the blue print indicated it began.

Familiarity in reading fractures should prevent errors of this kind. Interest centers upon conditions which prevailed at the origins of fractures. Commonly no useful information is presented at the places where they come to an end. In this case the supposition that

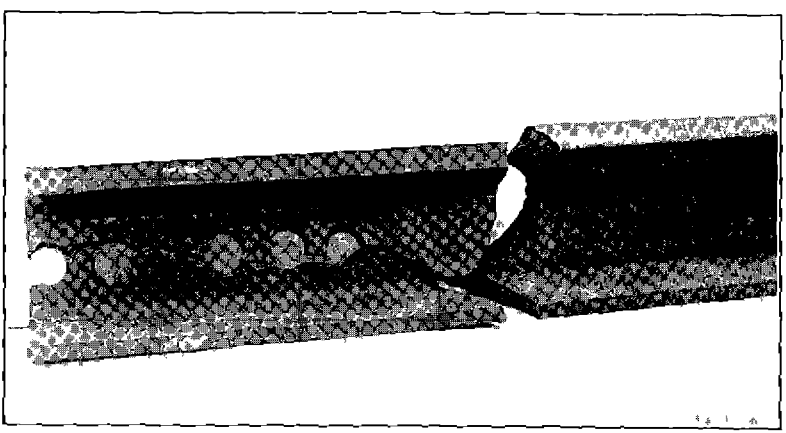

FIG NO 1—VIEW SHOWING THE END OF THE LEAD RAIL WEAKENED BY FIVE DRILLED BOLT HOLES FRACTURE OF THE WEB ACROSS THE LINE OF BOLT HOLES THENCE TO THE BASE AND HEAD CAUSED THE DERAILMENT

the fracture had its origin at the edge of the flange of the base, extending thence across the base, thence upward through the web and head, and then backward through the weakened web, is not even a probability Such an interpretation of the manner of failure completely overlooks and obscures the real issue

This rail was weakened in the web by a multiplicity of bolt holes, and the injury which was done was hidden by bolting angle bars over the weakened portion This weakening of the rail prepared the way for its ultimate failure Such practice as disclosed by this derailment can find no justification

CONCLUSIONS

This derailment was caused by a broken rail, the lead rail of a switch The rail had been weakened in the web by the drilling of five bolt holes The weakness thus caused was responsible for the derailment of the train

At some period prior to the derailment there occurred a partial rupture of the web in two places—at a section between two bolt holes and at the end of the web just above the base

Nine months elapsed after the last bolt hole was drilled Such a condition inevitably led to ultimate failure This example of the weakening of the rail and covering the weakened section by angle bars can not be too strongly condemned

Respectfully submitted

W P Borland, *Director*

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