INTERSTATE COMMERCE COMMISSION

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REPORT OF THE DIRECTOR OF THE BUREAU OF SAFETY IN RE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE SOUTHERN RAILWAY NEAR JULIETTE, GA., ON AUGUST 2, 1925.

November 4, 1925.

To the Commission:

On August 2, 1925, there was a derailment of a passenger train on the Southern Railway near Juliette, Ga., resulting in the injury of 19 passengers, 2 mail clerks, 1 employee, and 1 news agent.

Location and Method of Operation

This accident occurred on that part of the Atlanta Division extending between Atlanta and Macon, Ga., a distance of 87.8 miles, in the vicinity of the point of accident this is a single-track line over which trains are operated by time-table, train orders, and a manual block-signal system. The accident occurred at a point about 2.6 miles south of Juliette, approaching this point from the south there is a 3° 58.8' curve to the left 887.8 feet in length, followed by 896.7 feet of tangent, the accident occurring on this tangent at a point 496.8 feet from its southern end. The grade is practically level. The track in this vicinity is laid with 85-pound rails, 33 feet in length, with an average of 18 to 20 oak, pine and cypress ties to the rail-length, single-spiked, and ballasted with crushed slag to a depth of about 18 inches. The speed of passenger trains is limited to 48 miles an hour.

The weather was clear at the time of the accident, which occurred at about 6.46 a.m.

## Description

Northbound passenger train No. 4 consisted of one express car, one mail car, one express car, one combination passenger and baggage car, two coaches, and five Pullman cars, in the order named, all of steel construction, hauled by engine 1226, and was in charge of Conductor Butler and Engineman Garmon. This train passed Dames' Ferry, 7.6 miles south of Juliette, at 6.40 a.m., 1 hour and 47 minutes late, and was derailed while traveling at a speed estimated to have been between 40 and 45 miles an hour.

The first eight cars were derailed to the right and came to rest parallel to the track, the first car was at the foot of an embankment with its rear end opposite the north end of a trestle, known as trestle 219.5-H, located about 530 feet beyond the point of derailment, the head end of the next car was opposite the south end of the trestle, the remaining derailed cars came to rest in general line with the track. The engine and last three Pullman cars were not derailed.

## Summary of Evidence

None of the members of the crew noticed anything unusual prior to the accident. Engineman Garmon stated that the first he knew of anything wrong was on feeling the engine dip on the right side, on account of passing over a broken rail, at which time he estimated the speed to have been between 40 and 45 miles an hour. He immediately applied the air brakes in emergency and on looking back observed that the rear truck of the head car had been derailed at the approximate point where he had felt the unusual motion of the engine. On reaching the trestle the head car broke its coupling with the second car and after passing over the trestle broke away from the engine and turned over to the right down the embankment. Engineman Garmon did not know whether the rail broke at the time the engine passed over it or whether it was broken prior to the arrival of the train. He said the headlight was burning brightly and that he was looking ahead approaching the point of derailment, and if there had been a short section of the rail missing he would have noticed it. The statements of Fireman Clark practically corroborated those of Engineman Garmon.

Conductor Butler observed a piece of broken

rail on the right side of the track near where the head end of the car in which he was riding came to a stop, this being the ninth car in the train; he estimated the speed to have been about 45 miles an hour at the time of the accident. Conductor Butler said that in his opinion the accident was caused by a broken rail. Baggagemaster Cranford also was of the opinion that the accident was caused by a broken rail, and after the accident he saw a piece of the rail beside the track. Flagman Everett stated that the accident apparently was caused by a broken rail, and he also saw a piece of this rail, about 4 feet in length, beside the track.

Section Foreman Bray stated that he last inspected the track at the point of derailment at 4.30 p.m., July 31, and at that time he noticed nothing unusual. Tie renewals were made and the track in the immediate vicinity of the point of accident was surfaced and ballasted nine days prior to the accident. He arrived at the scene of the accident shortly after its occurrence and found four pieces of broken rail, measuring about 8, 4, 3, and 18 feet in length, and in his opinion the accident was caused by a broken rail.

Engine 1226 is of the 4-6-2 type, having a total weight, engine and tender loaded, of 349,915 pounds; the weight of the engine is distributed as follows: Engine truck, 41,075 pounds, driving wheels, 133,800 pounds; trailing truck, 42,700 pounds.

The rail which failed was on the east or enginemen's side of the track and it was found to have broken at three points. The investigation having indicated that the accident was caused by a broken rail, an examination of the rail to ascertain the reason for its failure was made by Mr. James E. Howard, engineer-physicist, whose report follows:

Report of the Engineer-Physicist

The derailment of northbound passenger train No. 4, which occurred on August 2, 1925, at a point about 5 miles north of Dames' Ferry, was caused by a broken rail, which broke at three places, two of which displayed transverse fissures. The engine, tender and forward truck of the head car of the train passed over this portion of the track without being derailed, the

rear truck of the head car and seven following cars of the train being derailed.

The fracture of the rail doubtless occurred under the engine, the testimony of the enginemen is to that effect. It is not unusual in rail fractures of this kind that while the actual separation of the rail occurs under a certain wheel the continuity of the track is maintained during the passage of several following wheels, the track structure, independent of the rail, sufficed to carry several wheels across the broken rail before a gap is made in the track. The formation of a gap causes the derailment of the wheels which next follow.

The broken rail, 85-lbs. in weight per yard, A. S.C.E. section, was rolled by the Tennessee Coal, Iron & Railroad Co., heat No. 20690, in December, 1910, and was laid in the track in April, 1911. It was therefore 14 years 4 months old when the derailment took place. Its chemical composition, adjacent to one of the transverse fissures, was carbon .68, manganese .80, phosporus .029, sulphur .025. These constituents were within the limits prescribed by the specifications governing the composition of the steel. In cross section dimensions the rail showed but little wear.

Bending tests were made on two fragments of the rail, for the purpose of noting the character of additional fractured surfaces, in quest also of incipient transverse fissures, not displayed when the rail broke in the track. The tests were made with the head of the rail in tension. The fractures showed structurally sound metal. The origins of the fractures were at the peripheral surface, where the cold rolling action of the wheels impairs the toughness of the steel and leads to structural brittleness. No additional transverse fissures were discovered.

The formation of transverse fissures in the central part of the head and their progressive development, weaken the rail, and lead directly to fracture under service conditions. The weakness of the rail goes on as the interior fissure increases in size. It culminates in complete rupture without the rail necessarily being exposed to exceptionally severe stresses at the time of complete rupture.

This type of fracture is peculiar in respect to its inception and subsequent extension, no means for its detection having been discovered until the interior fracture reaches or nearly reaches the peripheral surface of the head. At the time the fracture is visible, if not broken by a train, the rail is greatly weakened. In the majority of cases of transverse fissured rails, which in the aggregate far exceed ten thousand in numbers, final ruptures have not been attended with derailments. These must be considered as fortunate circumstances, over which there is little control.

On trunk lines of great traffic, where transverse fissures are most prevalent, such experience has been acquired and vigilance exercised that many transverse fissures have been detected upon their appearance at the side of the head of the rail and the rail removed from the track. A fine hair line on the side of the head or rust streak constitutes the evidence.

Transverse fissures came prominently into notice fourteen years ago in a report by the Commission. High wheel loads and the display of transverse fissures bear a relation to each other, by reason of the cold rolling strains set up by the wheel pressures. Rails differ in their ability to endure wheel pressures, and track reports show that some heats or rollings are more prone to display transverse fissures than other heats or rollings, without a cause for the same having been established.

It is the practice on some railroads to withdraw from service entire heats when two or more rails of the same heat have displayed transverse fissures. This results in taking out old rails and putting in new without advancing information upon the reason why fissures were displayed or ascertaining wherein the rails removed differ from others which are allowed to remain in service. If suspicion attaches to the safety of certain rails the opportunity is presented to ascertain or endeavor to ascertain upon what that suspicion rests. It is realized, however, that direct results have been evasive.

On account of the obscurity which surrounds the display of transverse fissures, respecting differences in the ages of the rails, efforts are being continued to acquire information to explain why rails of a given

composition and exposed to similar track conditions differ in respect to longevity. One of the present lines of inquiry is directed to the structural state of the steel along those elements where transverse fissures originate. The opinion is entertained by some metallographists that a central shattered core in the head of a rail represents the starting place of transverse fissures and that the elimination of this shattered condition would render rails immune from the formation of fissures.

Investigations are going forward but as yet no method of examination has been found which will indicate the presence of transverse fissures in their early stage of development, nor means which would prevent the recurrence of such fractures as witnessed in the present rail.

## Summary

The present derailment was caused by a broken rail, which fractured by reason of the presence of two transverse fissures. Reports emanating from the Bureau have from time to time described this type of fracture. When first brought to general notice in a report of the Commission in the year 1911 they were of infrequent occurrence. They have since increased in numbers, now being enumerated by the thousands, and appear to continue in their display.

Transverse fissures result from the action of wheel pressures, and are displayed in rails which outwardly appear in good serviceable condition. On account of their display by rails which in other respects are in good condition they constitute an ever-present menace to safety from which no escape has been found. Well maintained track furnishes the best security now at hand. Since no remedy or palliative, so far as known, has been discovered during the term of years that transverse fissures have been prevalent, it must be inferred that track stresses impose conditions which, in the light of present knowledge, steel rails can not permanently endure. Nevertheless, diligent efforts are in progress directed to the study of this important matter.

Respectfully submitted,

W. P. Borland
Director.