In Re. Investigation of an Accident which Occurred on the Rio Grande Junction Railway, near Grand Valley, Colo., May 30, 1916.

July 5, 1916.

On May 30, 1916, there was a derailment of a Denver & Rio Grande passenger train running over the tracks of the Rio Grande Junction Railway, near Grand Valley, Colo., which resulted in the injury of 6 passengers and 2 employees. The investigation of this accident was made in conjunction with a representative of the Public Utilities Commission of the State of Colorado. As a result of this investigation the Chief of the Division of Safety reports as follows:

Eastbound train No. 2 consisted of 1 baggage car, 2 coaches, 2 tourist sleeping cars, 1 dining car and 4 Pullman sleeping cars, hauled by locomotive 782, and was in charge of Conductor Gilmore and Engineman Fahrmeyer. All of the cars were of all-steel construction with the exception of the tourist sleeping cars and the dining car, which had steel underframes. Train No. 2 left Grand Junction at 3.33 a. m., 23 minutes late, and was derailed just west of Grand Valley, which is 45.6 miles from Grand Junction, while traveling at a speed estimated to have been about 40 miles an hour.

The engine and tender turned over to the right, coming to rest with the forward end of the engine about 660 feet beyond the point of derailment. The first five cars were de-

railed, as well as the forward trucks of the sixth car.

The Rio Grande Junction Railway is a single track line, 76.9 miles in length, running between New Castle, Colo., and Grand Junction, Colo. No block signal system is in use, trains being operated by time table and train orders. At the point of derailment the track is on a 6-foot fill, near the eastern end of 2,600 feet of tangent. The grade is practically level. The track is laid with 85-pound rails, single spiked to about 19 spruce ties to the rail. Neither the ties nor the spiking were in good condition. The track is laid on native soil, and, with the exception of cinders at various places, is unballasted.

Examination of the track showed that the first mark of derailment was a flange mark extending diagonally across the ball of the rail for a distance of 8 feet 5 inches before dropping off on the outside. Flange marks were then found on two or three ties, beyond which point the track was badly torn up. Extending from mile post 34 easterly to the point of derailment, a distance of 51 rail lengths, there were 15 broken ties, 144 missing spikes and 46 loose spikes, while the ends of 4 ties had been broken off and were missing. The ends of many other ties were splintered and the heads of many spikes were an inch or more above the bases of the rails. One rail had recently been drawn into gauge by driving 9 new spikes. Near one of the rail joints 9 spikes were withdrawn by hand. In a distance of 90 feet immediately preceding the point of de-

railment, 31 new ties were put in the track after the accident, leaving 25 old ties in fairly serviceable condition. In many places there was no support at the ends of the ties, particularly at rail joints, and many of the ties were center-bound, being so loose at the ends that when pressure was applied at one end the other would be raised.

Beyond the point of derailment, and extending to mile post 33, a distance of 3,200 feet, there were 21 broken and 26 splintered ties, 65 loose spikes and 344 missing spikes, while in many cases the ties were center-bound. At one of the joints five out of eight consecutive ties were broken. There was no support under them and the rails at this point had a vertical motion of two inches under the weight of passing trains.

Fireman Edwards stated that he had just finished putting in a fire when the forward tender truck was derailed. Previous to this he had not noticed any rough spots in the track or any rolling of the tender. Water was taken at Grand Junction, and he stated that ordinarily there would not be over a foot or a foot and a half of water left by the time the train reached Grand Valley. There was also a full tender of coal at Grand Junction, and he thought about five tons had been used when his train reached the point of derailment. The tender seemed to ride well, and he stated that he did not make any examination of it after the accident. He thought the speed at the time of derailment was about 35 or 40 miles an hour. Fireman Edwards also stated that there was no speed limit on passen-

ger trains, and that he had no slow orders over this particular part of the track.

Flagman Hearn stated that the derailment occurred at about 4.45 a. m., while the train was traveling at about a speed of 35 or 40 miles an hour. He did not make any examination of the track, or of the engine or tender, and said that he did not know of any speed restrictions, the question of speed being left to the engineman.

Brakeman Eldridge stated that he thought the speed of the train was about 45 miles an hour at the time of the derailment. He looked over the track where the derailment occurred, but did not form any opinion as to the cause of the accident. He did not see any marks on the rail, the only marks being on the ties.

On account of injuries, no statements could be obtained from the conductor or engineman.

Section Foreman Pratt, in charge of the section east of Grand Valley, stated that he made an inspection of the track after the accident and thought it was best between Grand Valley and Una, 4.8 miles west of Grand Valley, saying there were no track conditions which could have caused the derailment. He did not examine the equipment of the derailed train, but stated that he did not know what could have caused the accident unless a broken shoe or something else had dropped on the rails. He also said that he did not find any marks on the rails. The ties were in good condition, the gauge correct, and the surface and

alignment fair. Section Foreman Pratt further stated that he had been working on the section on which the accident occurred for about one week, smoothing it up, and he thought the track was safe for a speed of 40 miles an hour. He also said that he did not know that he would consider track to be in safe condition where seven of the spikes in six ties, all under one rail, could be withdrawn by hand.

Roadmaster Groves stated that he walked over the track at the point of derailment about five days previously, and at that time the track conditions apparently were good, and he did not see anything unusual. After the derailment he examined the track, and said that it was in fair condition, that it was in good gauge, surface and alignment, and that there was nothing which would have caused the derailment. The only marks on the rail discovered by him were two dents on the right rail about 30 feet west of where the wheels left the rails. The appearance of these dents was similar to marks which would have been made by a countersink. He stated, however, that he did not look to see if anything had crossed the rail, but only to see if anything had dropped onto the track. He thought these marks might have been made by a brake-shoe, saying that he could not think of anything else which might have made them, and that the derailment might have been caused in that way, but he was unable to say definitely that this was the case. Roadmaster Groves also said that he thought the track was good for at least 45 miles an hour. On tangent track he said the rails were not apt to turn over if there were no spikes on the inside, the spikes on the

inside bearing no part in holding the rail to gauge. He also said that it was not necessary to have the spikes driven down to a firm contact with the rails in order to prevent the spreading of the track, and that in his 35 years' experience he had never seen spikes that were tight against the rail for any length of time after they had been driven. He also stated that the importance of having the rails spiked on the inside existed in the case of broken rails when such spikes would not allow the rails to turn over, and he said that they would also be of some assistance in keeping the track from running. Roadmaster Groves also stated that the ties being used at the present time were of native red spruce, and that where they were center-bound they would break occasionally.

General Roadmaster Whitfield stated that there was a flange mark on the ball of the rail, showing where a wheel had mounted the rail and had run along on it before dropping off. The dents referred to by Roadmaster Groves were right at the beginning of the flange mark. He stated that the gauge was practically standard and that the track was fair as to alignment and surface. He did not discover any undriven spikes in the immediate vicinity, but said that along the section there were some ties which apparently had been placed in the track about three years previously, and which were not spiked. This, however, was not the general condition. He considered the general condition of the ties to be good. General Roadmaster Whitfield also said that with the train moving at a speed of 40

miles an hour, at which it was estimated to have been travelling, it would go 20 feet in one-half second, and he thought that if there was an obstruction on the rails it would have raised the wheel enough to allow it to land on the ties at the point at which it did, about 20 feet beyond the obstruction.

The investigation of the track conditions existing in the vicinity of the point of derailment showed that it was not maintained in the proper condition as to spiking, while the track was badly center-bound. The track was badly torn up by the derailment, and it was impossible to determine with certainty the conditions which had existed prior thereto at that particular point. It is believed, however, that this accident was caused by the bad condition of track and roadway, it not being sufficiently well maintained to permit the operation of trains in safety at the speed at which this train was running. The forward tender truck was the first part of the train to be derailed, the condition of the track being such as to cause the tender to rock to such an extent that this truck mounted the rail, dropping off on the outside of the same, tearing up the track and causing the derailment of the train.

Tender derailments, in which the forward tender trucks usually are the first to be derailed, are very common, and their causes are difficult to determine with certainty. Tenders have comparatively short wheel bases, with a consequent high center of gravity, and with the surging back and forth of the water in the cistern they are subjected to forces which are

difficult to overcome and which are easily aggravated by irregularities in track. Such derailments must be given close study, with a view of definitely ascertaining their causes, in order that they may be eliminated as far as possible.