In re Investigation of an accident which occurred on the Denver & Salt Lake Railroad near Spruce, Colo., on April 24, 1917.

May 31, 1917.

On April 24, 1917, there was a derailment of an extra freight train on the Denver & Salt Lake Railroad near Spruce, Colo., which resulted in the death of one employee and the injury of three employees. After the investigation of this accident the Chief of the Division of Safety reports as follows:

The First Division of this railroad, on which this derailment occurred, is a single track line, extending from Denver to Tabernash, Colo., a distance of 66.66 miles. Train movements are governed by the telegraphic train order system, telephone, and time-table. Eastward from Tabernash to Corona, Colo., on the Continental Divide, a distance of 23.3 miles, the grade is about 4 per cent ascending. At Corona the altitude is 11,660 feet. Eastward from that place to the point of accident, a distance of 8.7 miles, and on beyond that point, the track descends the mountain on a grade of approximately 4 per cent. Helper engines are used on eastbound trains, leaving Tabernash; these engines are cut off at Corona, where there is employed a force of inspectors who, assisted by the members of the train crew, examine and test the air brakes on trains before starting down the mountain. The maximum tonnage per train handled down the mountain eastward from Corona is 1,200 tons.

Foreign cars are usually equipped with single-pressure, 15-pound retainers, which, when being handled over the heavy mountain grades of this railroad, are in many cases found to be inadequate. It is therefore the practice to equip all loaded foreign cars with Duplex 50-pound retainers, known as "stub" retainers. They are attached to the exhaust port of the triple by short piping, are applied on eastbound trains at Tabernash and removed at Utah Junction, 62 miles east of Corona and 3.3 miles west of Denver, the regular retainers then being reconnected.

Special time-table instructions No. 20 provide in part as follows:

"Rules 851 and 855 are hereby amended, that all trains must be carefully inspected by Trainmen at all water stops and at station stops designated

> in the time-table for defective brake appliance, running gear, heated hournals, heated wheels, etc., and the conductor must know that such inspection has been made and that any defects discovered have been remedied and parts of damaged equipment, when possible, be loaded in the car.
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> "Trains will stop and be inspected and allow time for wheels to cool when necessary. * * **

Corona is designated as one of these stops, the first one east thereof being Dixie Lake, 4.5 miles distant.

Eastbound freight train extra 118 was made up at Tabernash and consisted of 13 foreign cars and 4 system cars, all loaded with coal, and two cabooses, one of which was being hauled to the shops at Utah Junction for repairs; the gross tonnage was 1,085 tons. This train, hauled by locomotive 118, assisted by a helper locomotive, left Tabernash at 12.35 p. m., in charge of Conductor Briggs and Engineman Dittman. The air brakes on the deadhead caboose were inoperative, because of a defective and broken brake cylinder; the percentage of operative brakes in the train was 95.24. This train arrived at Corona at 5.15 p. m., where an inspection of it was made. It left there at 7.10 p. m., and reached Dixie Lake at 7.45 p. m., having consumed 35 minutes in covering the distance of 4.5 miles. This was at an average speed of 7.7 miles an hour, the speed limit for such trains being 10 miles an hour over this part of the road. The train was inspected by the train crew at Dixie Lake, about 15 minutes being consumed at that place. Beginning about 3,000 feet east of Dixie Lake, the track follows a 16-degree curve to the right, about 1,200 feet in length, at what is known as Yankee Doodle Lake. About 2,300 feet east of this curve is another 16-degree curve, leading to the left, 418 feet in length. When extra 118 reached this latter curve it stalled, due to the engineman making an unnecessary application of the air brakes. The rear brakeman then released the air on one car, through the stub retainer; the engineman, according to his own statement, bunched the slack of the first two cars, then put the engine in forward motion and worked steam, but on the first attempt failed to start the train; on the second attempt, however, the train started. The engineman then put the reverse lever in back motion and used the water brake; but did not seem to have control of the speed at any time after starting from the place where the train had stalled. The speed, from the moment of leaving there, increased so

rapidly that the two brakemen began to set hand brakes and had set several before the engineman whistled for them to do so, which he stated he did after making two 20-pound reductions of the air. The speed of extra 118 was about 25 miles an hour when it passed through Twin Rocks cut, which begins 3,700 feet east of where the train stalled and is about 1,000 feet in length; but when extra 118 passed Spruce, a station located about 1,400 feet east of Twin Rocks cut, the speed had been reduced to about 15 miles an hour. The train, however, continued beyond control and, about 8.10 p. m., was derailed at a point 1.3 miles east of Spruce, while traveling at a speed estimated to have been at least 30 miles an hour.

The last four cars and the two cabooses in the train were not damaged, but the rest of the train was quite seriously damaged, the first 13 cars having been piled up in a space about 150 feet in length. The conductor was killed in the accident, and the fireman was so seriously injured that he was unable to testify concerning the derailment.

The line of this railroad, eastward from Corona to the point of derailment is composed largely of curves, the maximum curvature being 16 degrees. In the vicinity of the point of accident, approaching from the west, the track is tangent for 634 feet, followed by a compound curve to the right, 275 feet in length, its maximum curvature being 8 degrees. There are then 187 feet of tangent track, followed by a compound curve to the left, about 425 feet in length, with a maximum curvature of 16 degrees, the derailment occurring on this latter curve. The weather at the time of accident was clear.

Engineman Dittman stated that when his train reached Corona the helper engine was cut out and the train was inspected. He said that about one and one-fourth hours were devoted to the inspection; that he personally handled the brake valve when the retainers were tested, before which he adjusted the brake-pipe pressure to 100 pounds; that this was the pressure he had when leaving Corona, at which time the air brakes were working satisfactorily; that the holding power of the brakes was as strong as in the average freight train; and that going down this mountain grade he was using the water-brake. He said that he had no trouble in controlling the speed of the train between Corona and Dixie Lake, he being able to keep it between 6 and 10 miles an hour with from seven to ten-pound brake applications, there being a sufficient interval between each application to allow the train line to be fully recharged. At Dixie Lake the crew again inspected the train, after which it proceeded to the

point where it stalled, east of Yankee Doodle Lake, up to which point the brakes had caused no trouble and the air pumps had worked satisfactorily. Engineman Dittman further stated that when his train was in the vicinity of Yankee Doodle Lake, he made a seven or eight-pound application of the brakes, the speed then being about six miles an hour; and, not wanting to hold the brake valve on lap too long, he soon made another slight application, causing the train to stall. After the train had stood there a few minutes he backed the locomotive sufficient to bunch the slack on the first two cars, then reversed and worked a little steam, but was unable to start the train forward. After a short while he again tried and this time succeeded in starting the train, he stating that he did not think he worked steam on this second attempt, because, as soon as the train started, he reversed the locomotive and used the water-brake, which he stated he could not have done if he had been working steam. He said that when the speed was from 2 to 4 miles an hour, he made a 20-pound reduction of the air, there having been 100 pounds pressure, but the speed was not checked. The speed had increased to about six or eight miles an hour, when he made another reduction of about 20 pounds; he had not released the brakes after the first application. Engineman Dittman stated that he first realized that he had lost control of the speed when the train was going through Twin Rocks cut, at about which time he whistled for hand brakes. He stated that when his train was approaching Spruce the speed seemed to have been checked slightly, it being about 15 miles an hour. About that time he discovered that the air pressure was below equalization, whereupon he placed his brake valve in the full-release position, allowed the train line to be recharged for about 1-1/2 minutes, or until there were 110 pounds pressure, and then made an emergency application. He said that he had been figuring on getting the train stopped at Spruce, but did not succeed, the speed being 16 or 17 miles an hour when passing there. Engineman Dittman stated that he left the brake valve in the emergency position, and the speed increased so rapidly that he jumped from the locomotive--he was not certain as to just where, but between Spruce and the point of derailment,--the speed at the time being 30 or 35 miles an hour. Engineman Dittman also stated that he did not cut in his driver brake until approaching Spruce, where he also had the sand working. He said that he knew of nothing that he left undone in his efforts to bring the train under control. He stated that in November, 1916, he passed an oral examination on air brakes, and that he had been instructed in the short-cycle method of braking, which is the practice of making a sufficient brake-pipe

reduction to check the speed of a train immediately, then placing the brake-valve in the full-release position, allowing the train line to recharge, and making another application before the speed accelerates, this being the most approved method of braking trains on heavy grades. Engineman Dittman stated that after he jumped from the locomotive he looked at the train and saw sparks flying from all the wheels.

Head Brakeman Wilson stated that he always assists in making the inspection of his train at Corona; and that on this trip the brakes worked very well between Corona and Dixie Lake. At the latter place the train was again inspected; the brakes were found in good condition, and the piston travel on all cars was found to be five or six inches. He stated that, leaving Dixie Lake, he was riding on the first car in the train; that the speed was kept at about 10 miles an hour until the train was stalled; and that the rail was in fine condition and he had never known a train to be handled better, coming down this mountain, to the point where it stalled. After it stalled he got down on the ground to look the train over, but the engineman had started to work steam, with the engine in forward motion, and the train was started without any difficulty, the steam being shut off as soon as the train began to move. The speed increased quite rapidly and he at once started to set hand brakes, beginning on the first car in the train. Head Brakeman Wilson stated that he then heard an application of the brakes being made by the engineman, and he was on the fifth car when the engineman whistled for brakes. He stated that the speed was checked to about 15 miles an hour when the train passed Spruce, previous to which it had been possibly 25 miles an hour, and he thought it was under control; but after passing Spruce the speed increased very rapidly and he continued back over the train until he reached about the twelfth car, where he was when the derailment occurred.

Rear Brakeman Hall stated that when his train stalled he got down on the ground, about the middle of the train, and released the air from the brake cylinder on one car, through the stub retainer, and turned up the retainer again. The train then started, having been delayed not more than two minutes. He said the speed increased to 25 miles an hour within half a mile; that he felt an application of the air brakes after the train was traveling quite rapidly; and that he started to set hand brakes, having set five or six before reaching Spruce. He thought the speed, passing that place, had been reduced to about 15 miles an hour, but after passing there the speed increased very rapidly, and he thought the speed at the time of derailment was about 90 miles an hour. Brakeman Hall stated that, if the same good judgment had been exercised in handling this train down the mountain, after it was stalled,

as had been exercised before, the train would not have gotten beyond control.

Student Engineer Morris, who boarded the locomotive at Corona, stated that up until the time the train stalled the engineman had been practicing the short-cycle method of handling the brakes; that after the train stalled the engineman made an unsuccessful attempt to start the train, then reversed and bunched the slack, and again tried to start, this time succeeding. He stated that the engineman only worked steam until the train started to move, or until the speed was no more than 2 miles an hour; that he reversed the engine and used the water-brake; but did not seem to have any control of the train. He also stated that the speed was about 8 miles an hour when the engineman made the first application of the air brakes,----about a 20-pound reduction; that within about one-fourth of a mile he whistled for brakes, kept applying and releasing the air brakes, and in addition, when about in Twin Rocks cut, he worked steam, but without avail; and finally advised him to jump. He thought the speed was 25 or 30 miles an hour, passing Spruce, and about 40 miles an hour when he jumped from the train, between one-fourth and one-half mile from where the derailment occurred. Student Engineer Morris stated that he did not at any time on this trip handle the air brakes.

Chief Inspector Ames, on duty at Corona, stated that when extra 118 reached there he personally inspected it, assisted by members of the train crew. He said the retainers were tested and worked properly; that the piston travel was practically uniform--from four to four and one-half inches; that he noticed that the foreign cars were equipped with stub retainers; that the brakes were working on only one of the cabooses,--the one belonging to the train; and that there was no leakage of air. He stated that the inspection was completed at 6.20 p. m., and when the train left, 50 minutes later, he observed the brakes, and saw that the pistons were out as far as the pressure would permit. Inspector Ames, in explaining the method of testing retainers, said that after the slack has been taken up he goes to the engine and tells the engineman that he is ready to have the retainers tested; the retainers are turned up by the train crew; the engineman applies the brakes and releases them; and each individual car is then inspected. After two or three minutes the brakes are applied again.

After the accident, all the brake shoes examined were found to have been burned blue because of the intensity of the brake action, but there was no indication of the wheels sliding.

All the evidence indicated that the brakes on extra 118, with the exception of those on the deadhead caboose, were in good condition, as was substantiated by the fact that in descending the mountain from Corona to the point where the train was stalled, no trouble was experienced in controlling the speed.

It is therefore believed that this accident was due to an error in judgment on the part of Engineman Dittman, in failing to apply the air brakes soon enough after his train started from the place where it was stalled. He stated that he made the first application when the speed was from 2 to 4 miles an hour. Student Engineer Morris, however, stated that the speed was about 8 miles an hour when the engineman first applied the brakes. The testimony of all the employees of extra 118 who were interviewed was to the effect that Engineman Dittman controlled the speed of the train very well up to the point where it stalled; but as he immediately lost control after starting the train from that place, it is apparent that he permitted the speed to become too great before applying the brakes. The margin of braking power for the weight of this train was entirely too small to permit of its safe control on a 4 per cent grade. The weight of train was 1,085 tons, and to control this weight there were 18 brakes available. This was an average of slightly more than 60 tons per brake, which is an excessive load to be safely controlled on such a steep grade. After the train had gained momentum, even slightly, the available braking power was insufficient to control it.

Engineman Dittman entered the service of this railroad December 3, 1911, as fireman; was laid off April 9, 1912, because of a reduction of force; was reinstated as fireman September 18, 1912; was promoted to engineer December 7, 1915; was reduced to fireman March 21, 1916, on account of a reduction of force; was reinstated as engineman December 1, 1916, and had a good record. Engineman Dittman stated that he had had about four months' experience as train engineman on the First District, on which this derailment occurred.

At the time of accident the entire crew had been on duty 7 hours and 35 minutes, after 11 hours and 10 minutes off duty.