IN RE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE MISSOURI PACIFIC RAILROAD NEAR GULPHA, ARK., ON FEBRUARY 10, 1921.

March 31, 1921.

On February 10, 1921, there was a derailment of a passenger train on the Missouri Pacific Railroad near Gulpha, Ark., which resulted in the death of 2 employees, and the injury of 61 passengers, 3 employees and 1 trespasser. After investigation of this accident the Chief of the Bureau of Safety reports as follows:

Location.

This accident occurred on the Arkansas Division, which in the vicinity of the point of accident is a single-track line over which trains are operated by time-table and train orders, no block-signal system being in use. Approaching the point of accident from the north there are several short curves and tangents, followed by 157 feet of tangent and a curve of 6° 10' to the left 979 feet in length; the accident occurred on this curve at a point about 300 feet from its northern end. Except for practically level track across two bridges, the grade varies from 1.2 to 1.5 per cent descending for more than 2 miles; at the point of accident it is 1.2 per cent. The track is laid with 75-pound rails, 30 feet in length, with an average of 18 white oak ties to the rail, single-spiked, and ballasted with gravel and cinders about 12 inches in depth, no tie plates or rail braces are used. The track was maintained in good condition except in the immediate vicinity

of the point of accident. The speed of trains from about mile post 386 to about mile post 393, within which territory this accident occurred, is restricted to 30 miles an hour. There are time-table instructions to this effect, as well as a slow board reading "Reduce speed to 30". At the time of the accident the weather was clear.

Description.

The train involved was southbound passenger train No. 17, operating between St. Louis, Mo., and Hot Springs, Ark. It consisted of 1 baggage car, 1 coach, 2 chair cars, 1 dining car and 4 Pullman cars, in the order named, hauled by engine 429, and was in charge of Conductor Graves and Engineman Sullivan. The cars were of all-steel construction with the exception of the rear car, which had a steel underframe. The train left Lonsdale, 9.4 miles from Gulpha, at 9.32 a.m., 19 minutes late, and at about 9.55 a.m. was derailed at a point about 1.09 miles north of Gulpha, while running at a speed variously estimated at between 30 and 50 miles per hour.

Engine 429 came to rest on its right side on the outside of the curve 345 feet beyond the point of derailment, with its head end about 35 feet from the track; the tender came to rest just beyond the engine. The baggage car was at right angles to the track, with the end nearest the track resting on the tender; the coach was nearly parallel with the track, with its forward end resting on the

engine. The next three cars and the forward truck of the first Pullman car were also derailed to the right, and were not seriously damaged, none of the cars in the train was overturned. The employees killed were the engineman and fireman.

Summary of evidence.

Conductor Graves, who was in the forward end of the sixth car, felt the air brakes applied as if to reduce the speed of the train, followed almost immediately by the derailment. Brakeman Dillon, who was riding in the forward end of the second car, noticed an application of the brakes at the time the accident occurred The estimates of these employees, and also of Flagman Edwards, as to the speed at the time of the accident varied from 30 to 38 miles an hour, the conductor making the maximum estimate.

General Master Mechanic Cunningham, who was riding in the sixth car, had noticed after leaving High Point, 3.18 miles from Gulpha, that the speed increased to such an extent as to indicate to him that the engineman was not using good judgment, it was increased to about 35 miles an hour, at which time the engineman made an application of the brakes, reducing the speed to about 25 or 30 miles an hour, releasing the brakes at a point he estimated to have been about $\frac{3}{4}$ mile north of the point of derailment. The speed then increased to such an extent that he became alarmed and he said he was about to start for the emergency cord for the purpose of stopping the train and having an inter-

view with the engineman when the brakes were applied in emergency, this being at the time the train was derailed. He estimated the speed at the time of the derailment to have been 43 or 45 miles an hour. Division Master Mechanic Whalen and Assistant General Passenger Agent Bothwell were also riding in the sixth car. Mr. Whalen noticed the first application of the brakes described by Mr. Cunningham, but Mr. Bothwell had noticed no application of the brakes between the top of the hill at High Point and the point of derailment. Mr. Whalen estimated the speed at from 36 to 40 miles an hour while Mr. Bothwell thought it was from 40 to 42 miles an hour. Section Foreman McDougal was working just north of the point of derailment, and estimated the speed of train No. 17 when it passed him to have been 45 or 50 miles an hour.

Examination of the track showed that the first mark of the derailment was a flange mark on the web of a rail on the outside of the curve 11 feet 6 inches from its receiving end. This mark continued to the leaving end, and there were additional marks of a similar character on the next succeeding rail. The spikes on the inside of this first rail had been pulled, while on the outside of the rail, near its leaving end, there was a well-defined mark on the ties $4\frac{1}{4}$ inches from the base of the rail which appeared to have been made by the head of the rail while in an overturned position. The next 9 rails to the south had been forced off

the ties, while the eighth and tenth rails were broken, each in two places. Examination of the fractured surfaces of these rails did not disclose any defects which could have been responsible for their failure. The first mark on the inside of the curve was a flange mark on the ties 6 inches inside of the gauge of the inside rail, at a point directly opposite the mark on the web of the outside rail. This mark ran parallel to the rail for a distance of about 70 feet, within which distance only six ties were broken, while in the next 160 feet all of the ties were broken.

The angle bars in use in this vicinity were of the 6-hole, supported type. Examination of the track at the joint at the north end of the first rail which was marked showed that the ties on each side of the joint, as well as the supporting tie, were worn and that the rails had worked outward $\frac{1}{4}$ inch on the tie north of the joint, 7/16 inch on the supporting tie, and 9/16 inch on the tie south of the joint. The top of the supporting tie was split and decayed, and was about $\frac{1}{2}$ inch below the base of the rail Further examination of the track showed it to be in good gauge, surface and alignment, and failed to disclose anything which could have caused the accident, while Section Foreman McDougal said he had personally examined the track on this curve within an hour previous to the time of the derailment and that at that time it was in good condition. Examination of the equipment failed to disclose anything which could have contributed to this accident.

The day of this accident was Engineman Sullivan's third trip on this train. On February 8 Conductor Graves cautioned Engineman Sullivan about running too fast down the hill, while Roadmaster Dillon, who was a passenger on train No. 17 on February 8, estimated the speed on that day on the curve on which this accident occurred to have been about 45 miles an hour and he said that when the train arrived at Hot Springs he went to Engineman Sullivan, told him that he had operated the train down the hill at too high a rate of speed, and cautioned him about observing the speed restriction of 30 miles an hour, saying that the curves were not elevated for a higher rate of speed. According to Division Engineer Davis, the standard elevation for this curve was $3\frac{3}{4}$ inches. This is in line with the recommended practice of the American Railway Engineering Association, which on a curve of this degree calls for an elevation of about $6\frac{1}{2}$ inches for a speed of 40 miles an hour, and about $8\frac{1}{4}$ inches for a speed of 45 miles an hour.

This accident was caused by Engineman Sullivan operating his train around a curve at an excessive rate of speed, resulting in the outside rail turning over.

The elevation of the curve on which this accident occurred was sufficient for the maximum rate of speed allowed, while examination of the track showed it to be maintained in good condition, with the exception of the irregularities noted at the rail joint immediately north of the point of derailment. Engineman Sullivan had been warned

about operating his train at an excessive rate of speed over this part of the road, yet the evidence is clear that the speed of train No. 17 was excessive and that the outside rail overturned as a result of the strain placed upon it.

All of the employees involved were experienced men. At the time of the accident the crew of train No. 17 had been on duty about 2 hours, previous to which they had been off duty about 12 hours.