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INTERSTATE COMMERCE COMMISSION

REPORT OF THE DIRECTOR OF THE BUREAU OF SAFETY IN RE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE FLORIDA EAST COAST RAILWAY NEAR WABASSO, FLA, ON NOVEMBER 14, 1924

DECEMBER 23, 1924

To the Commission

On November 14, 1924, there was a derailment of a passenger train on the Florida East Coast Railway near Wabasso, Fla, which resulted in the death of 4 passengers and the injury of 16 passengers

LOCATION AND METHOD OF OPERATION

This accident occurred on the second district of the northern division, which extends between New Smyrna and Fort Pierce, Fla, a distance of 117.1 miles, this being a single-track line, over which trains are operated by time-table and train orders, no block-signal system being in use The first mark of derailment occurred at a point slightly more than 1 mile north of the station at Wabasso, approaching this point from the north the track is tangent for a considerable distance, while the grade is practically level The track is laid with 90-pound rails, 33 feet in length, with about 18 ties to the rail length, tie plated and single spiked, ballasted with about 14 inches of rock, and is well maintained

The weather was clear and dark at the time of the accident, which occurred at about 6.25 p m

DESCRIPTION

Southbound passenger train No 29 consisted of two express cars, one mail car, one baggage car, four coaches, two Pullman parlor cars, and one coach, in the order named, hauled by engine 414, and was in charge of Conductor Jackson and Engineman Thomas The first, third, and fourth cars were of steel construction and the parlor cars were of steel-underframe construction, the balance being of wooden construction Train No 29 left Sebastian, 4 8 miles north of Wabasso, at 6 15 p m, 35 minutes late, and was approaching Wabasso at a speed variously estimated to have been between 35 and 55 miles an hour when the derailment occurred

The only car to be derailed was the rear car, coach 33, which turned over to the left clear of the track, its left side was badly damaged The balance of the train came to a stop with the rear car 759 feet beyond the head end of the derailed car

SUMMARY OF EVIDENCE

Examination of the track showed that the first mark of derailment was at a point about 4,300 feet north of where the car came to rest, this mark being on a tie at a point about 8 inches inside of the east or left rail, apparently having been made by the inside retaining ring from one of the wheels of the derailed coach Similar marks appeared from this point southward at intervals varying from 6 to 10 ties apart, while flange marks began on the ties on the inside of the right rail at a point 3,662 feet south of the first mark made by the retaining ring At a point 5 feet 11 inches farther south there was a mark on the outside of the left rail about 3 inches in width made by a flat surface, apparently a wheel without a tire These various marks then led to the left, and the ends of the ties were badly battered from this point to where the car came to rest, an additional distance of about 650 feet About 181 feet north of where the car stopped there were marks on the left side of each rail where the truck under the head end of the car apparently left the rails Examination of the rear truck of this car showed that the tire and retaining rings of the lead wheel on the left side were off the wheel and hanging loosely on the axle

Engineman Thomas said the speed was about 50 or 55 miles an hour when he shut off steam and made a brake-pipe reduction preparatory to making the station stop at Wabasso, but before the exhaust of this reduction ceased the brakes applied in emergency, apparently due to the breaking of the train line as a result of the derailment Conductor Jackson had been in the rear of the car just after leaving Sebastian, as well as at several times prior thereto, but at no time had he noticed anything wrong and he said no difficulty had been experienced with the brakes sticking He was in the fifth car from the rear when he felt a service application of the air brakes followed immediately by an emergency application

Flagman Davis had gotten off the rear of the rear car when the stop was made at Sebastian, at which time he noted that the air brakes released properly on the rear truck When the train departed from that station he boarded the rear of the car and rode on the rear platform until he felt the brakes begin to apply in service application as the train approached Wabasso, this was followed almost immediately by an emergency application, throwing him inside the car, which turned over before he was able to regain his footing Flagman Davis said he had heard no unusual noise nor had he noticed anything unusual in the riding of the car prior to the occurrence of the accident, and he also said that he had not smelled anything indicating overheated brakes or wheels

Statements by the track supervisor and section foreman were to the effect that the track was in good condition and safe for a much

higher rate of speed than that at which train No 29 was being operated Wreckmaster Pope said he made a thorough examination of the derailed car and also of the track north of the point of derailment but saw nothing other than a loose tire which could have caused the accident or have contributed to its occurrence

Car Inspectors Young and Sonnenburg, of the Jacksonville Terminal Railway, stated that they inspected coach 33 when it arrived in Jacksonville on November 11, and at that time they carded the car on account of the interval which had elapsed since the air brakes had last been cleaned Car Inspector McCall found no defects when he inspected train No 29 preparatory to its departure on November 14, while Car Inspector Kennard, who inspected the left side of train No 29 at New Smyrna, observed no defects on coach 33

The wheels in the rear truck of coach 33 were 33-inch wheels with steel tires which were shrunk in place, after which retaining rings were applied to both the inside and outside surfaces of the wheels, these retaining rings being held in place by means of 10 five-eighth-inch bolts passing through the retaining rings and the body of the wheels, the nuts of these bolts were on the inside surfaces When the defective wheel was examined after the accident all the bolts were missing but one, while the remaining bolt was badly bent, none of the missing bolts was found Neither the tire nor the brake shoe showed any signs of having been overheated The record of repairs to this car covering the period from June, 1909, to January 21, 1924, showed that the car was last given heavy repairs on the latter date and at that time two new tires were applied to the wheels The loose tire was up to gauge and showed no effects of wear The examination also showed that this tire could be replaced on the wheel without heating, its inside diameter being three thirty-seconds inch larger than the external diameter of the wheel center

The evidence having indicated that the accident was due to a loose tire under coach 33, a further investigation to ascertain the reason for its failure was made by Mr James E Howard, engineer-physicist of this bureau, whose report follows

REPORT OF THE ENGINEER-PHYSICIST

The derailment of car No 33, of train No 29, southbound, near Wabasso, on November 14 last, was clearly caused by a defective wheel The tire of the east wheel of the leading axle of the rear truck of this car was detached from its center and became the proximate cause of the derailment

The records show that this car was built at Wilmington, Del, February 1893, and that repairs upon it had been made from time to time at the St Augustine shops of the Florida East Coast Railway Co, the last two of which were in April, 1922, and September,

1923 After the last repairs were made the car was not returned to service until January 22 of the present year

On the former of the above two dates three axles were put in the two trucks of the car, leaving the same tires and wheel centers in place as before On September 5, 1923, two new tires and one new axle were put in This was the axle upon which the wheel was located which failed

It appears that the original wheel centers remained on each axle They were of cast iron, said to have been made by Krupp, and branded "Patented October 28, 1886" Figure No 2 illustrates the construction of these wheels They consisted of a double plate cast-iron center, upon which a steel tire was shrunk, the tire being further secured by two retaining rings, with 10 five-eighths-inch through bolts The inner and outer plates were connected at intervals by webs, the sketch of the wheel showing only the plates in cross-section

Examination of the truck immediately following the derailment showed the tire of the wheel, mentioned in the first paragraph above, had been detached from its center, the retaining rings loose, and nine of the through bolts missing One bolt, considerably bent, remained attached to the outer ring

The examination of the failed wheel which was subsequently made showed the outside diameter of the cast-iron center to be much smaller than the inside diameter of the tire There was a clearance amounting to some three thirty-seconds of an inch Through lack of rotundity of the tire a more exact measurement of this clearance was not determined

The rim of the cast-iron center showed wear A slight shoulder had been formed at its inner edge This was evidence that some looseness between the tire and the cast-iron center existed before the derailment occurred, furthermore, that the clearance between them must have been filled by a liner

The tread of this tire showed practically no wear Its diameter at the middle of the tread was a little under 33¾ inches The inside diameter of the tire was 27¼ inches, the prescribed diameter for this sized tire

An examination of the mate of the failed wheel next followed The through bolts and retaining rings were removed The axle was stood on end and while in that position the tire was driven off its cast-iron center by means of blows of a heavy sledge This dismounting was done without special difficulty

Between this tire and its center was found a sheetmetal liner, occupying the clearance which otherwise would have existed between them two diameters The liner was made up of three pieces, each covering one-third the circumference of the center, and was 3 inches wide by 3½ hundredths inch in thickness It was evident that such

a liner had been used under the tire of the wheel which failed, the abrasive action of which, with a somewhat loose fit, would account for the slight shoulder displayed on the rim of the cast-iron center

The center of this wheel was a little larger in diameter than the center of the failed wheel There was appreciable shrinkage of the tire on its center, as witnessed in knocking off the tire with a sledge, although the measurements would hardly account for any This tire showed no evidence of having rotated upon its center

The examination was next directed to the rear axle of the truck The retaining rings of one wheel were removed The axle was stood on end and the tire struck with the sledge as before Efforts to drive it off were unavailing, the tire remaining fast upon its center

The tires upon this axle showed wear The treads were worn hollow Measurement showed a diameter a little less than 32½ inches, that is, an inch and a quarter smaller than the wheels on the forward axle of this truck

The treads of tires acquire a state of internal strain of compression similar to the cold rolling strains introduced in the heads of rails and for the same reason Such internal strains tend to relieve the initial shrinkage strains of tires introduced when assembled The residual strains in the tire of the wheel on the rear axle were sufficient to hold it firmly in place, notwithstanding the influence of internal strains which it had acquired in service

In respect to mileage, the track record of car No 33 showed a mileage of 10,956 miles since the new tires were put on the forward axle of the rear truck, that is, during the interval from January 22, 1924, to the date of derailment Since April, 1922, the mileage for the rear axle was 36,768 miles The total mileage for the wheels on the rear axle was not looked up

Since the evidence presented by the failed wheel indicated that a degree of looseness prevailed prior to the time of derailment, the question of efficiency of wheel inspection is brought into consideration It will be assumed that the 10 retaining ring bolts were in place and the wheel to all outward appearance was in good order when inspections were made at Jacksonville and at New Smyrna last preceding the time of its failure The query is whether such inspections could meet such a case as here presented

There is no necessary relation between the retaining ring bolts and the tire The bolts clamp the retaining rings to the wheel center The bolts might be tight and the tire loose The load on the axle would close any clearance existing between the tire and its center, in the lower part of the wheel, and presumably nullify hammering results which depend upon sound emitted Unless it can be shown that inspection is adequate to detect the presence of a loose

tire, then responsibility for such a contingency attaches solely to the operation of assembling the tire upon its center, specifically its shrinkage fit

The shrinkage should be sufficient to meet those changes in temperature which normally occur during braking, when the tire is at least for a short time hotter than the wheel center, and, furthermore, provide against loss of shrinkage effect by reason of internal strains acquired The failure of this wheel appears to have been due to inefficient machine operations having to do with giving the tire sufficient shrinkage upon its center, that a low margin in shrinkage strength also existed in the mate to the wheel which failed

While adequate shrinkage fits can doubtless be acquired in the use of liners, their employment causes an uncertainty in the machining operations, desirable to avoid Liners in a wheel of this type are not to be classed with shims in driving wheel tires which are accessible and where opportunity to tighten them is present

SUMMARY

The failure of the wheel in the truck of car No 33, investigation showed, was due to a loose tire The tire was detached from its center, thereby precipitating the derailment The tire was larger than the center upon which it was assembled, the space between them doubtless having been filled with a liner The wheel center showed wear, a slight shoulder having been formed on its rim, apparently by the looseness of the liner

The tire of the opposite wheel, the mate of the wheel which failed, was insecurely shrunk upon its center This wheel had a liner between the tire and the cast-iron wheel center, a detail of construction prudently to be avoided

Inspection of the equipment was regularly made and nothing out of order discovered prior to the accident The engineer-physicist has pointed out features in a wheel of this type which raise a doubt concerning the efficiency of inspection of a wheel on which a loose tire is located If uncertainty attaches to such inspection, it places greater responsibility on the operations of machining and assembling the tire on its center

Each tire on this axle appeared to have had inadequate shrinkage, one having failed, the other with a limited margin in strength and safety remaining

Responsibility for this derailment seems to attach primarily to an improper shrinkage fit between tire and wheel center

Respectfully submitted

W P Borland, *Director*

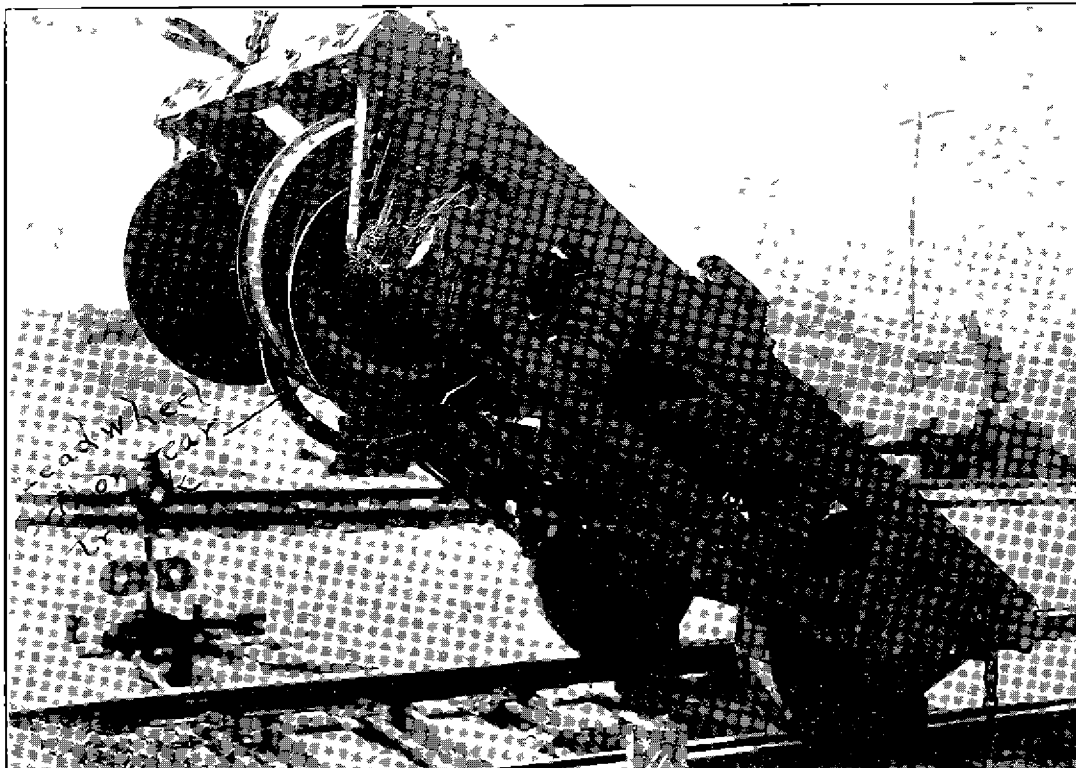

FIGURE No 1 —Appearance of truck after derailment, showing retaining rings detached and tire loose on wheel center

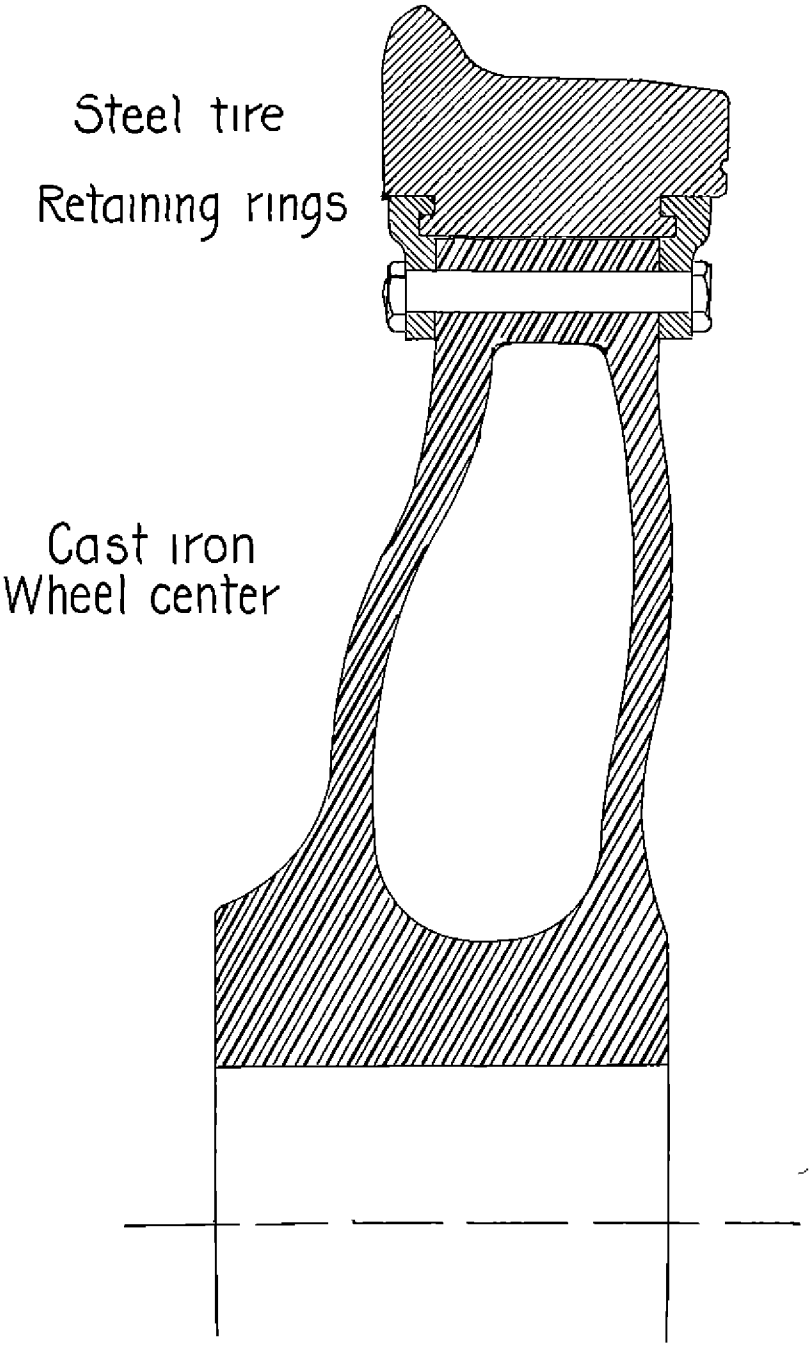

FIGURE NO 2.—Showing construction of wheel which failed

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