INTERSTATE COMMERCE COMMISSION

WASHINGTON

INVESTIGATION NO. 3232

CHICAGO AND NORTH WESTERN RAILWAY COMPANY

REPORT IN RE ACCIDENT

AT ROCK, MICH., ON

JANUARY 31, 1949

SUMMARY

Railroad:	Chicago and North Western
Date:	January 31, 1949
Location:	Rock, Mich.
Kind of accident:	Derailment
Train involved:	Passenger
Train number:	214
Engine numbers:	Diesel-electric units 5002B and 5002A
Consist:	6 cars
Speed:	68 m. p. h.
Operation:	Timetable and train orders
Track:	Single; tangent; 0.15 percent ascending grade eastward
Weather:	Snowing
Time:	8:04 a. m.
Casualties:	1 killed; 15 injured
Cause:	False flange resulting from slid-flat driving wheel

INTERSTATE COMMERCE COMMISSION

INVESTIGATION NO. 3232

IN THE MATTER OF MAKING ACCIDENT INVESTIGATION REPORTS
UNDER THE ACCIDENT REPORTS ACT OF MAY 6, 1910.

CHICAGO AND NORTH WESTERN RAILWAY COMPANY

March 30, 1949

Accident at Rock, Mich., on January 31, 1949, caused by a false flange resulting from a slid-flat driving wheel.

REPORT OF THE COMMISSION[1]

PATTERSON, Commissioner:

On January 31, 1949, there was a derailment of a passenger train on the Chicago and North Western Railway at Rock, Mich., which resulted in the death of 1 train-service employee, and the injury of 13 passengers, 1 dining-car employee and 1 train-service employee.

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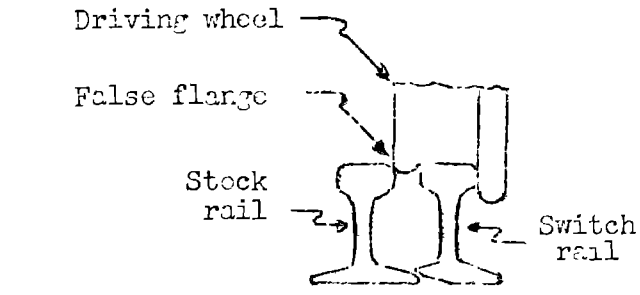
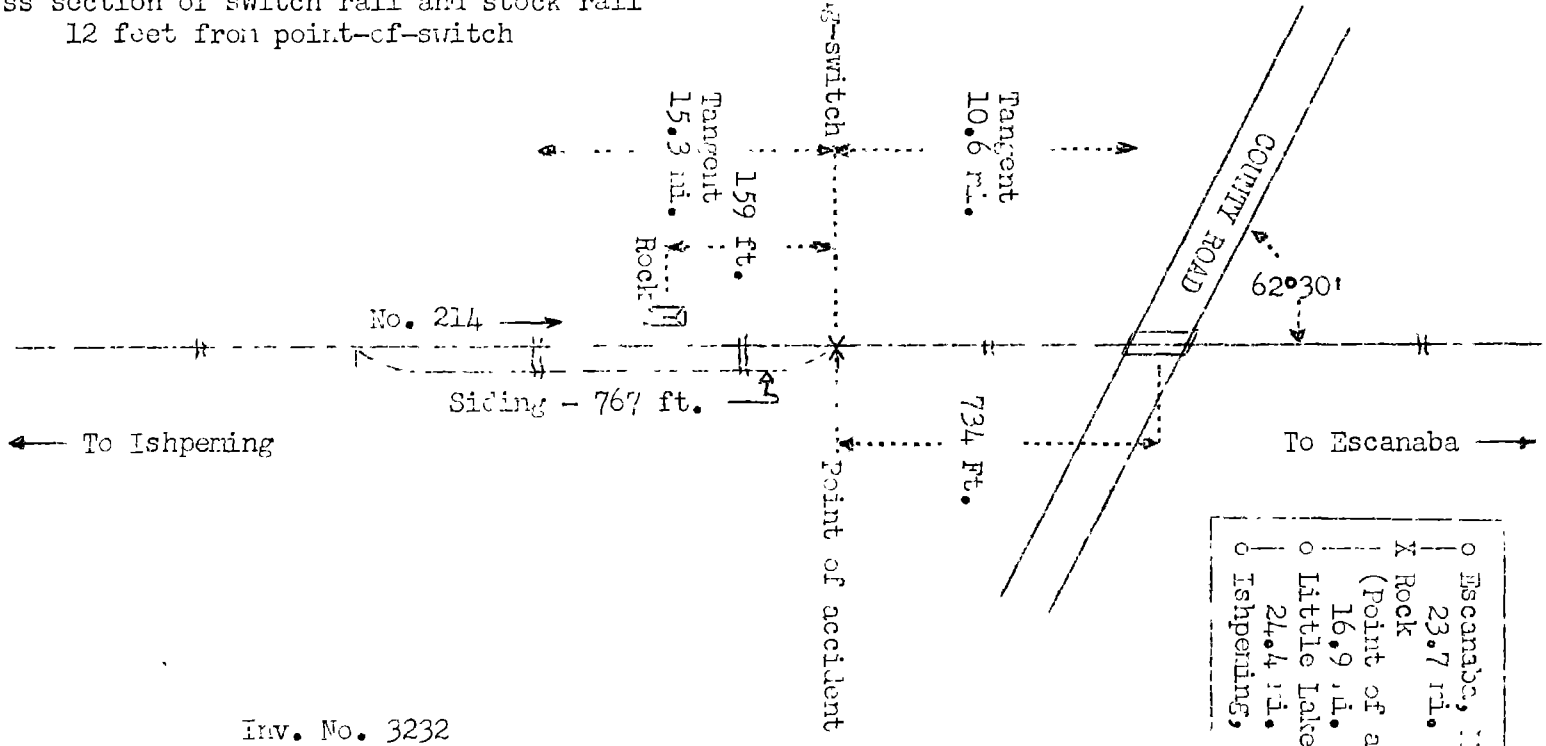
[1] Under authority of section 17 (2) of the Interstate Commerce Act the above-entitled proceeding was referred by the Commission to Commissioner Patterson for consideration and disposition.



Cross section of switch rail and stock rail
12 feet from point-of-switch



Inv. No. 3232
Chicago and North Western Railway
Rock, Mich.
January 31, 1949

Location of Accident and Method of Operation

This accident occurred on that part of the Peninsula Division extending between Ishpeming and Escanaba, Mich., 65 miles, a single-track line, over which trains are operated by timetable and train orders. There is no block system in use. At Rock, 41.3 miles east of Ishpeming, a siding 767 feet in length parallels the main track on the south. The east switch of this siding is 159 feet east of the station. The accident occurred on the main track at the east siding-switch. The main track is tangent throughout a distance of 15.3 miles west of the east siding-switch and 10.6 miles eastward. The grade for east-bound trains is 0.15 percent ascending.

The structure of the main track consists of 100-pound cropped rail averaging 31 feet in length, laid on an average of 19 treated ties per rail length. It is fully tieplated, single-spiked, provided with 4-hole joint bars, and an average of 8 rail anchors to the rail length. It is ballasted with gravel to a depth of 12 inches below the ties.

The turnout of the east siding-switch consists of 100-pound switch rails 16.5 feet long, 100-pound rails and a No. 10 spring-rail frog. The frog is protected by a guard rail 8.3 feet long.

A county road crosses the railroad at grade at a point 734 feet east of the east siding-switch, and intersects the railroad at an angle of 62°30'. The crossing is surfaced between the rails and outside each rail by planking. Flangeways 2-1/4 inches wide are provided by 72-pound rails laid on their sides inside each rail. The planking is beveled a distance of 10 inches at each end of the crossing.

This carrier's operating rules read in part as follows:

ENGINEMEN AND FIREMEN.

1042. Keep a vigilant look-out at all times, particularly when passing around curves, through stations and yards, and must frequently look back to see that no portion of the train has become detached or derailed; also for any signals that may be given by trainmen or others. They must not be so occupied as to prevent themselves from keeping a constant look-out the entire trip.

The Instruction Manual for the Operation of Diesel-electric Equipment reads in part as follows:

GROUND PROTECTIVE RELAY

* * * If the relay repeatedly opens * * * Call an electrician and do not run the locomotive unless absolutely necessary. * * *

In the vicinity of the point of accident, the maximum authorized speed for the train involved was 70 miles per hour.

Description of Accident

No. 214, an east-bound first-class passenger train, consisted of Diesel-electric units 5002B and 5002A, coupled in multiple-unit control, one parlor car, four coaches and one mail-baggage-taproom car, in the order named. All cars were of high-tensile lightweight steel construction. This train departed from Ishpeming at 7:10 a. m., on time, departed from Little Lake, 16.9 miles west of Rock, at 7:46 a. m., 3 minutes late, passed the station at Rock at 8:04 a. m., 3 minutes late, and while it was moving at a speed of 68 miles per hour the right No. 3 wheel of the rear truck of the first Diesel-electric unit, all wheels of the second unit and all the cars were derailed at the east siding-switch.

A separation occurred between the fourth and the fifth cars as a result of a broken coupler. The Diesel units and the first four cars remained coupled and stopped with the front end of the first unit 1,963 feet east of the point of accident. The right No. 3 wheel of the rear truck of the first unit became derailed at the rail-highway crossing east of the east switch. The second unit and the first to fourth cars, inclusive, stopped upright on the roadbed and in line with it. The fifth and sixth cars remained coupled, stopped about 10 feet north of the main track and parallel to it, and leaned against the wall of a cut at an angle of about 20 degrees, with the front end of the fifth car 935 feet east of the east siding-switch. The trucks and appurtenances below the floor line of the second Diesel unit and all the cars were somewhat damaged.

A light snow was falling at the time of the accident, which occurred about 8:04 a. m.

The flagman was killed, and the baggageman was injured.

Diesel-electric units 5002A and 5002B are of the 0-6-6-0 type, and were built during 1939. Each is provided with a control compartment. These units were coupled back-to-back at the time of the accident. Each unit is 70 feet 4 inches long between the pulling faces of the couplers. The weight of each in loaded working order is 303,400 pounds. These units are equipped with two 6-wheel traction-trucks of the swing-motion equalized type. The wheelbase of each truck is 14 feet 1 inch long, and the centers of the trucks are spaced 43 feet apart. The specified diameter of the wheels is 36 inches. The Nos. 1 and 3 pairs of wheels of each truck are driving wheels. The No 2 pair are idler wheels, and are provided for weight distribution. A traction-motor transmits power to the axle of each pair of driving wheels by a pinion on the armature shafting that engages a ring gear on the axle. One set of gearing per axle is used, and the gears and housing are parallel to the inner surface of each driving wheel. Each unit is equipped with two Diesel motors, each of which drives a generator to supply power at 600 volts to the two traction motors of each truck. The traction motors on each truck are interconnected through a motor-control circuit. The traction motors are pressure-ventilated by a blower system.

When two or more units are coupled in multiple-unit control, the controlling appurtenances, together with various visual indicators, such as wheel-slip lamps, hot-engine lamps, low-oil pressure lamp, and an audible signal connected to the ground-protective-relay system, are interconnected between units by cables. When so connected, the control of all units is under the charge of the engineer's throttle, which controls the injection of fuel through a governor system. Both traction-motors of each truck are connected to operate in series, in parallel, or in parallel with field shunting. The changes from one connection to another are designated as transitions, and are correlated with the speed.

The wheel-slip indication lamp becomes illuminated during transition from series to parallel, or by the slipping of any pair of motor-driven wheels. Except at low speed, this lamp will be continuously lighted whenever any pair of motor-driven wheels ceases to rotate because of the failure either of the ring or pinion gearing or of the armature-shaft bearings, and it will continue to be illuminated under such conditions while energy is supplied to the motor. Ground-protective relays are provided for each traction-truck

and are so arranged that a grounding or a flashover affecting the high-voltage system energizes the relay, which opens the battery and shunt fields and changes the governor setting of the related Diesel-motor to idling position. When this occurs the ground indication lamp on the Diesel-motor control panel, located adjacent to the motor affected, will be illuminated and an alarm will sound in the control compartment.

The armature of each traction-motor is supported parallel to its driving-wheel axle by a shaft, and revolves at each end within a roller-type bearing. Each bearing consists of an assembly of 14 solid steel rollers inserted in bronze cages, or separators, and rotates around an inner race and within an outer race. The inner race is secured on the shafting by shrinkage. The roller-bearing assembly is lubricated by oil, which circulates from a reservoir. The bearing is protected against the entrance of dirt or water by a tightly fitted bearing-cap plate. The traction motor involved was manufactured in February, 1948, and it was mounted on the rear truck of unit 5002B on August 18, 1948. The accumulated mileage since the last major repairs was 80,328 miles. The traction motors on this unit were blown by compressed air on January 10, 1949. Five ounces of oil were applied to the bearings on January 17, 1949, in accordance with the schedule requiring this maintenance at 8,000-mile intervals. At that time there was no indication of leakage around the bearings. The last trip inspection and repairs were completed at Ishpeming about 6 hours prior to the time of the accident.

The rear ends of the Diesel-electric units and each end of the cars were equipped with tightlock couplers. The pilot end of each Diesel-electric unit was equipped with a type D coupler.

Discussion

As No. 214 was approaching Rock, the enginemen were in the control compartment of the first unit, the conductor and the front brakeman were in the second car, the baggageman was in the rear car, and the flagman was in the front vestibule of the rear car. The speed was 68 miles per hour, as indicated by the speedometer with which the first Diesel-electric unit was equipped. The first that any surviving member of the crew was aware of anything being wrong was when the brakes became applied in emergency. This was when a separation in the train occurred as a result of the derailment. The automatic-brake system and the electro-pneumatic straight-air-brake system had been tested and had functioned properly en route. At the time of the accident the electro-pneumatic system was in use.

Examination after the accident disclosed that the first mark on the track structure in the vicinity of the east siding-switch was a scratch mark extending across the top of the frog of the turnout at a point 3-1/2 inches outside the gage side of the south main track rail. The next mark eastward was on the gage side of the south stock rail at a point 12 feet west of the switch points. At that point the distance between the gage sides of the switch-rail and the corresponding stock rail was 4 inches. Throughout a distance of 20 feet east of this point there was a pronounced scoring on the gage side of the stock rail at its upper edge. The inside of the base of the stock rail was raised about 1/2 inch at the switch points. The stock rail was canted outward and there was a gap of about 1 inch between the stock rail and the switch point. Beginning about 8 feet east of the switch points the gage side of the south rail was heavily scored, and it was canted outward throughout a distance of 157 feet eastward. Between points 38.7 feet and 162.7 feet east of the switch points the inside joint bars and bolts of the south rail were heavily damaged and some were broken. Between points 162.7 feet and 717.7 feet east of the switch the south rail was overturned southward. Between points 240 and 714 feet east of the switch the north rail was overturned northward.

Examination of the rear truck of the first Diesel-electric unit disclosed a slid-flat spot on the left rear wheel tread 8-7/8 inches long, and on the companion right wheel tread, 9-1/4 inches long. These slid-flat spots were about 9/16-inch deep at their centers. False flanges, about 9/16-inch in height and 1-inch wide at their bases, were formed on the outer edge of the treads. At other points on these wheels the flanges and treads showed considerable service wear, but all measurements were within the specified limits of the carrier. The outer face of the rim of the right wheel was deeply grooved. This groove formed a chord to the tread of the wheel, and, at its center, was about 4-1/2 inches above the tread. The scraping mark on the stock rail, the displacement of the stock rail, the marks on the track structure immediately east of the switch points, and the marks on the right rear wheel of the rear truck of the first Diesel-electric unit indicate that the outer edge of the wheel rim was lowered sufficiently by the excessive tread wear resulting from the slid-flat spot to engage the inside surface of the head of the stock rail and to force the rail outward until the gage widened, then this wheel dropped inside the south rail. Apparently, the rail returned to a more or less upright position, because the following wheels were not derailed until the rails became separated 162.7 feet east of the switch. At that point, the general derailment occurred.

Examination of the traction motors of the rear truck of the first unit disclosed that both armature bearings of the motor driving the rear pair of driving wheels had become overheated and had seized. As a result, the rear pair of wheels stopped rotating, and there were slid-flat spots on the treads of these wheels. The bearing at the commutator-end showed evidence of overheating to a high degree. The inner race was badly distorted, the metal had flowed and had conformed at some places to the rounded contour of the rollers. The rollers were somewhat flattened. The separator cage had disintegrated. The thrust collar was broken into five pieces. Considerable quantities of oxides of iron and of copper were deposited on the various parts. Very little carbon residue of oil was present. The hardness of the rollers had been reduced by the heat. The pinion-end bearing showed lesser evidence of overheating. The inner race was broken into three pieces, there was excessive wear on the bearing surface, and evidence of a high degree of heat. The rollers were flattened and otherwise distorted. The separator cage had disintegrated. The outer race was considerably worn and showed evidence of having been heated to a temperature of about 700°F. There was evidence of carbonized oil on all the parts. The bearing cap plates were in place and in good condition. The report of the chief metallurgist of the carrier said that the bearing at the commutator-end was the first to fail, and that lack of lubrication caused the armature-shaft bearings to become overheated and to seize.

The investigation disclosed that on January 30, 1949, while Diesel-electric unit 5002B was en route from Ishpeming to Chicago, the ground-protective relay was actuated on three occasions. In accordance with instructions, the engineer then shut off the Diesel-motor for the truck involved, and this condition was reported upon arrival at Chicago. An electrician inspected the Diesel-motor and its related traction-motors at Chicago. At that time the truck was heavily coated with snow and ice. He said that the bottom cover plate of the traction-motor driving the rear axle of the rear truck showed indications of moisture, and he thought there was water in the motor. Therefore, he isolated that motor, but let the traction-motor driving the front axle of this truck remain in operation. He tested the ground-relay system, and there were no grounds present at that time. He said that a complete inspection of the motor could have been made only by dismantling it. However, he reduced the maximum speed of the Diesel-motor and posted a notice on the control panel adjacent to the Diesel-motor that the No. 4 traction motor was isolated and that the wheel-slip indication lamp for this motor was inoperative. On the return trip to Ishpeming, the electrician

rode the unit from Chicago to Milwaukee, and he observed no indication of any defective condition of the motor involved. The engine crew on duty on the day of the accident was in charge of the units upon their arrival at Ishpeming enginehouse at 2:20 a. m. January 31, and they, as well as the mechanical force at that point, found no defective condition. On the trip on which the accident occurred, the engineer and the fireman of No. 214 inspected their train at frequent intervals en route between Ishpeming and Rock, and the fireman made several inspection trips through the Diesel units, but there was no indication of overheated bearings or sliding wheels. The division engineer said that the first indication of sliding wheels was found on a stock rail of a switch at a point 38 miles west of Rock, and that this mark was similar to the marks found at the east siding-switch at Rock. Similar marks were found at all switches and frogs throughout a distance of 38 miles west of Rock, but no marks of similar nature were found east of Rock.

It is apparent that the armature-shaft bearings were defective on the day prior to the accident, when the protective ground-relay was actuated a number of times. After this traction motor was isolated, the armature shaft continued to rotate as long as its related driving-wheel axle rotated, since they are interconnected by a ring-and-pinion gearing. The rotation of the armature shaft was proportionate to the speed of the train. It is also apparent that these bearings overheated to a degree that sufficient distortion occurred to cause them to seize. This seizure stopped the rotation of the armature shaft which, in turn, stopped the rotation of the driving wheels. The electrician who inspected the motors the day before the accident occurred said that the traction-truck motors are so constructed that a proper inspection cannot be made from the ground, and that, unless the housings are removed, inspection from a pit is of little value. The only proper inspection is by removal of the housings. On the day of the accident, considerable snow was on the ground and a light snow was falling. This condition would tend to obscure from view any indication of overheated bearings or of sliding wheels.

The only provision for detecting defective conditions of the traction motors is by the ground-protective relay system and by wheel-slip indication lamps. After the traction

motor was isolated, the protection for the traction-motor involved which was afforded by these devices was nullified. Although there was no warning device to indicate the seized condition of a motor armature, there were protective devices in use which indicated a defective condition, but the cause was not definitely located; instead, the traction motor was isolated and the unit was continued in service until the derailment occurred. The carrier is presently searching for a device that will give warning of the sliding of driving wheels of Diesel-electric engines.

Cause

It is found that this accident was caused by a false flange resulting from a slid-flat driving wheel.

Dated at Washington, D. C., this thirtieth day of March, 1949.

By the Commission, Commissioner Patterson.

(SEAL)

W. P. BARTEL,

Secretary.