INTERSTATE COMMERCE COMMISSION

WASHINGTON

INVESTIGATION NO. 3226

SEABOARD AIR LINE RAILROAD COMPANY

REPORT IN RE ACCIDENT

AT BAY LAKE, FLA., ON

JANUARY 11, 1949

SUMMARY

Railroad:	Seaboard Air Line
Date	January 11, 1949
Location:	Bay Lake, Fla.
Kind of accident	Derailment
Train involved:	Passenger
Train number	46
Engine numbers.	Diesel-electric units 3010, 3103 and 3017
Consist.	16 cars
Speed	75 m. p. h.
Operation:	Signal indications
Track.	Single, tangent, level
Weather.	Clear
Time:	6.11 p. m.
Casualties:	1 killed; 76 injured
Cause	False flange resulting from slid-flat driving wheel

INTERSTATE COMMERCE COMMISSION

INVESTIGATION NO. 3226

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

SEABOARD AIR LINE RAILROAD COMPANY

March 30, 1949

Accident at Bay Lake, Fla., on January 11, 1949, caused by a false flange resulting from a slid-flat driving wheel.

REPORT OF THE COMMISSION[1]

PATTERSON, Commissioner.

On January 11, 1949, there was a derailment of a passenger train on the Seaboard Air Line Railroad at Bay Lake, Fla., which resulted in the death of 1 dining-car employee, and the injury of 50 passengers, 4 Pullman employees, 21 dining-car employees and 1 train-service employee. This accident was investigated in conjunction with representatives of the Florida Railroad and Public Utilities Commission.

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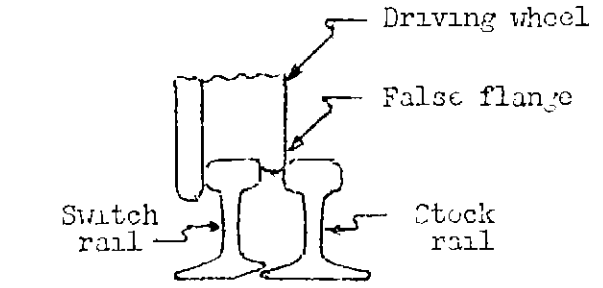
[1] Under authority of section 17 (2) of the Interstate Commerce Act the above-entitled proceeding was referred by the Commission to Commissioner Patterson for consideration and disposition.



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

Inv. No. 2236
Seaboard Air Line Railroad
Bay Lake, Fla.
January 11, 1949

Location of Accident and Method of Operation

This accident occurred on that part of the North Florida Division extending between Miami and Wildwood, Fla., 278.8 miles. In the vicinity of the point of accident this is a single-track line, over which trains are operated by signal indications. At Bay Lake, 246.42 miles north of Miami, an auxiliary track 910 feet in length parallels the main track on the west. The accident occurred on the main track at the point-of-switch of the north switch of the auxiliary track. The main track is tangent throughout a distance of 15 miles immediately south of the point of accident and 25.2 miles northward. The grade is practically level.

The structure of the main track consists of 100-pound rail, 39 feet in length, laid new during 1946 on an average of 22 treated ties per rail length. It is fully tieplated, single-spiked, provided with 4-hole joint bars and 10 rail anchors to the rail length. It is ballasted with crushed stone to a depth of 6 inches below the ties.

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

> 720. Employes should notice the condition of all passing trains, and if they observe any condition liable to cause accident, they will notify the men upon the train by proper signals, always giving a signal to stop, if in their judgment the train is endangered by the defect. The trainmen should always observe the trackmen and other employes as they pass, and be on the lookout for signals from them.
>
> 721. Enginemen and firemen must * * * frequently look back, especially while rounding curves, to see whether train is intact.

Timetable special instructions read in part as follows

> When other defects exist rendering an engine unsafe for maximum speed, superintendent will designate in each such case the reduced maximum speed to be observed.
>
> * * *

On July 1, 1944, a bulletin was addressed to enginemen and read in part as follows:

BULLETIN TO ALL CONCERNED:

On Multiple Units, Diesel electric locomotives on high speed stream lined or main line through passenger trains, a Fireman (Helper) shall be in the cab at all times when the train is in motion.

Duties of Fireman (Helper):

* * *

1. Engine rooms will be patrolled by Fireman at station stops or when the train is stopped for other reasons * * *.

* * *

If cab alarm sounds while train is in motion stop will be made if necessary until the cause can be determined and difficulty remedied if possible.

* * *

In the vicinity of the point of accident, the maximum authorized speed for Diesel-powered passenger trains is 75 miles per hour.

Description of Accident

No. 46, a north-bound first-class passenger train, consisted of Diesel-electric units 3010, 3103 and 3017, coupled in multiple-unit control, one baggage-dormitory car, four sleeping cars, one dining car, four sleeping cars, one observation-lounge-buffet car, one dining car, three sleeping cars and one lounge-observation car, in the order named. All cars were of steel construction. This train departed from Miami at 1 45 p. m., on time, passed NU Cabin, the last open office, 28.92 miles south of Bay Lake, at 5:47 p. m., 18 minutes late, and while it was moving at a speed of 75 miles per hour the left rear wheel of the front truck and the rear truck of the second Diesel-electric unit, the third unit and the first to twelfth cars, inclusive, were derailed at the north switch of the auxiliary track at Bay Lake.

The Diesel-electric units and the first car remained coupled and stopped with the front end of the first unit 2,651 feet north of the point of derailment. This portion of the train remained upright on the roadbed and in line with it. Separations occurred at each end of the second to the

fifth cars, inclusive. The second car stopped on its side, west of the main track and at an angle of 15 degrees to it, with one end on the track 810 feet north of the point of derailment. The third car stopped upright, 78 feet west of the main track and parallel to it, with the front end about 20 feet south of the second car. The fourth car stopped upright and at an angle of 75 degrees to the main track, with the south end on the roadbed and the north end 5 feet south of the third car. The fifth car stopped on its side, west of the main track and at an angle of 45 degrees to it, with the front end about 10 feet south of the fourth car and the south end on the roadbed. The sixth to twelfth cars, inclusive, remained coupled at each end and stopped upright, with the front end of the sixth car about 70 feet west of the main track and 600 feet north of the point of derailment, and the rear end of the twelfth car on the roadbed and 32 feet north of the auxiliary track switch. The second Diesel-electric unit was considerably damaged, and the third Diesel-electric unit was badly damaged in the derailment and by fire. The second to sixth cars, inclusive, were badly damaged, and the other derailed cars were more or less damaged.

The conductor was injured.

The weather was clear at the time of the accident, which occurred about 9:11 a. m.

Unit 3103, the second Diesel-electric unit of No. 46, is a booster unit of the 0-6-6-0 type, and is not provided with a control compartment. It was built in 1939. It is 67 feet in length over end-sills, and its weight in working order is 295,960 pounds. This unit is equipped with two 6-wheel 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. A traction motor is mounted between each pair of these wheels, and transmits power to each axle 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 mounted parallel to the inner surface of each driving wheel. The motors on each truck are interconnected through the motor control-circuit. Traction motors are pressure-ventilated by a blower system. The middle pair of wheels of each truck are idler wheels, and are provided for weight distribution. A train-heating boiler is at one end and a fuel-oil tank is at the other end. At the boiler end, each pair of driving wheels supports 50,550 pounds, and the idler wheels, 48,660 pounds. At the fuel-oil end, each pair of driving wheels supports 50,150 pounds, and the idler wheels, 48,300 pounds.

When two or more Diesel-electric units are coupled in multiple-unit control, the controlling quarter cabs, together with such visual indicators as wheel-slip lamp, hot-engine lamp, load-meter, and 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 indicator lamp is illuminated momentarily during transition from series to parallel, or by the sliding of any pair of motor-driven wheels. Except during 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-and-pinion gearing or of the armature shaft bearings, and it will continue to be illuminated under these conditions while current is supplied to the motor. Ground protective relays are provided for each truck and are so arranged that a grounding of the electrical circuits, or a flashover, will energize the relay and change the governor setting of the Diesel motor effected at idling position. When this occurs the ground-indicator lamp located on the Diesel-motor control panel becomes illuminated and an audible alarm sounds 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 roller bearings. These bearings consist of an assembly of 14 solid steel rollers inserted in bronze cages, or separators. They rotate around an inner race and within an outer race. The inner races are secured on the shaft by shrinkage. The rollers at the commutator-end average 1.077 inches in diameter by 1.506 inches long. The rollers at the pinion-end average 1.501 inches in diameter by 1.506 inches long. These roller-bearing assemblies are lubricated by grease, and are sealed against the entrance of dirt or water by bearing cap-plates. The traction-motor assembly and related bearings were applied to the No. 3 axle of the front truck of unit 3103 on April 8, 1948, and were cleaned and inspected on October 30, 1948. At that time a 1-minute dielectric test of 1,500 volts was made. This motor was last greased at Hialeah, Fla., on January 10, 1949, and 2 ounces of grease were applied to the bearings. The shop practice of this carrier requires inspection of armature bearings after 200,000 miles. At the time of the accident, the accumulated mileage was 149,377 miles.

The wheels on the No. 3 axle were multiple-wear wrought-steel type BP wheels manufactured during April, 1947, and mounted new on the axle on March 20, 1948. No further wheel-shop records are available as to the date these wheels were applied to the truck.

The third Diesel-electric unit and the first, sixth, eighth, eleventh and twelfth cars were equipped with tight-lock couplers.

Discussion

As No. 46 was approaching Bay Lake, the speed was about 75 miles per hour, as indicated by the speedometer with which the first Diesel-electric unit was equipped. The engineer was alone in the control compartment at the front of the first Diesel-electric unit, the fireman was in the engine compartment of the second unit, and the members of the train crew were in various locations throughout the cars of the train. Signal 7928, governing north-bound movements and located 1.11 miles south of the north switch of the auxiliary track at Bay Lake, indicated Clear. The first that the members of the crew knew of anything being wrong was when the derailment occurred and the brakes became applied in emergency.

Examination after the accident disclosed that the inside spikes holding the west stock rail, the closed-point side, had been partially pulled, the tieplates had been forced outward on the ties, and the stock rail had been canted and forced outward. The switch was lined for main-track movement and locked. The gap between the switch point and the stock rail was about 1-1/2 inches. At a point about 12 feet south of the west switch point, where the distance between the gage sides of the switch rail and the stock rail was 3-3/4 inches, the gage side of the stock rail was scraped to a depth of 3/8-inch below the top of the rail. This scraping mark continued to a point about 44 feet northward, where one wheel had dropped to the tops of the ties inside the west rail. The wheel continued on the ties inside the west rail to a point about 85 feet north of the switch, where the joint bars were torn loose and where the general derailment occurred.

Examination of the front truck of the second Diesel-electric unit disclosed that the bearings of the armature of the tractor-motor, which was driving the third pair of wheels, had been overheated and had seized. As a result, the third pair of wheels stopped rotating, and there were slid-flat spots about 9 inches long on the treads of these wheels. Apparently, the wheels had turned slightly after the first spots were made, as another flat spot about 9 inches long overlapped the first slid-flat spot on each wheel tread. These slid-flat spots were about 9/16-inch deep. A false flange, about 1/2 inch wide by 1/2-inch in height, had been formed on

the outer edge of the tread. At other points on these wheels the tread-wear was negligible, and the flange height and thickness conformed to good contour and were within the specified limits of the carrier. The outer face of the rim of the left No. 3 wheel of the front truck was cut to a maximum depth of 1-3/4 inches. This cut formed a chord about 18 inches in length, and it was about 3 inches above the tread at the center of the chord. The scraping mark on the stock rail of the turnout, the displacement of the stock rail, the marks on the track structure immediately north of the switch points, and the marks on the left No. 3 wheel of the front truck of the second unit indicate that the outer edge of the wheel rim was lowered sufficiently, by the excessive tread wear resulting from the slid-flat spots, 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 rail immediately north of the switch points. Apparently, the rail then returned to a more or less upright position, because the following wheels did not become derailed until the track became separated about 85 feet north of the switch.

The roller bearing at the commutator-end of the traction-motor armature had failed to the extent that the inner race was heavily scored and was fractured at one place. At the point of fracture the metal was slightly blued. The outer race was not broken. All rollers of this bearing were damaged. Some were badly deformed and flattened. Except for three small pieces, the bronze separator cage was destroyed. This bearing bore evidence of having been overheated to a high degree. The roller bearing at the pinion-end of the armature also had failed. The inner race was badly scored. The rollers were slightly deformed, and some were coated with metal from the separator cage, which was broken into six pieces. This bearing also bore evidence of having been overheated to a high degree. According to a report of the superintendent of fuel and water service of the railroad, only 0.787 gram of grease remained in the commutator-end bearing, and 0.1078 gram of grease in the pinion-end bearing. The report contained the statements that, because of the high degree of heat, it is probable that the grease had melted and had drained from the grease application pipes, that the depth of hardness of the rollers of the failed bearings could not be determined because overheating had changed the structural characteristics of the metal, and that the steel of both bearings contained too many inclusions to be considered as good bearing steel.

The first mark on the track structure indicating a slid-flat spot of any considerable depth appeared on the west rail at a point 44.2 miles south of the point of derailment. This was a scraping mark on the outside edge of the top surface of the rail near a facing-point switch. This mark then crossed over the stock rail of the turnout. Similar marks appeared

on the east rail at this location. The frog in the west rail was scored a distance of 7 inches on the top surface. From this point northward to Bay Lake similar marks were found on rails and frogs at all switches, numerous joint bars were scored, and some rail-bond wires were disturbed. At the facing-point switch at the south end of the auxiliary track at Bay Lake the outside edge of the wing rail of the frog was cut severely and slivers of steel were on this rail. The top surface of the frog at this location was scored. There was no mark of similar nature north of the point of derailment.

The engineman of No. 16 said that when their train was about 245 miles south of Bay Lake the protective ground relay alarm sounded in the control compartment, and the fireman discovered that the Diesel motor supplying power to the front truck of the second unit was operating in idling position. The fireman reset the relay and restored this motor to normal operation. When No. 46 stopped at West Palm Beach, 178.32 miles south of Bay Lake, the fireman alighted and inspected the traction-motors and wheels of the front truck of the second unit, and found no abnormal condition. When No. 46 was about 75 miles south of Bay Lake the protective ground relay alarm sounded again, and the fireman discovered the same Diesel motor was operating in idling position. Instead of resetting the relay, he moved the isolation switch to position to shut off power from the generator to the traction motor. At this time smoke was escaping around the traction-motor blower system. The fireman reported this condition to the engineer, who stopped the train several miles farther north. The engineman then discovered excessive smoke emerging from the cooling vents of the traction-motor attached to the No. 3 pair of wheels of the front truck of the second unit. They thought that accumulated lint and grease had caught fire from brake-shoe sparks, because the motor housing was cool to the touch. They emptied the contents of a fire-extinguisher through the vent. The train then was started and the fireman said that he observed from the ground that the driving wheels of the front truck rotated and that there was no apparent defective condition. Members of the crew said that during the remainder of the trip they made frequent observation of the equipment as it rounded curves, and they did not see any condition indicating the presence of overheated motor bearings or sliding wheels. In addition, the fireman patrolled the units en route, and was in the second unit when the accident occurred. Operators located at open stations 66.6 miles, 34.6 miles, and 28.8 miles south of Bay Lake, and members of crews of freight trains which were on sidings at stations 34.6 miles and 29.8 miles south of Bay Lake, said that they observed the passage of No. 46, but saw no indication of defective equipment. These employees said that, as No. 46 passed their respective locations, the only indication of fire was sparks from brake shoes. However, an employee of a commercial firm, located adjacent to the main track 34.6 miles

south of Bay Lake, said that his attention was directed to an unusual amount of sparks around one of the Diesel-unit trucks.

The armature shaft of the traction-motor involved was connected to the driving-wheel axle by a ring-and-pinion gearing, therefore, the armature shaft continued to rotate in its bearings as long as the driving wheels rotated and proportionately to the speed of the train. It is apparent that these bearings continued to heat after the crew inspected them from the ground, and finally became heated to a degree which resulted in the bearings seizing the shaft and stopping its rotation, and in turn, stopping the rotation of the driving wheels. The members of the crew of No. 46 understood that they are required frequently to observe their train for indications of defective equipment. These employees said that there was no indication of overheating when they inspected the motor about 73 miles south of Bay Lake, and there was no indication of overheating of bearings or of sliding wheels en route to the point of accident. These traction-motor trucks are so constructed that it is practically impossible to touch the motor housing near the pinion-end, because of limited clearance between the main frame of the unit and the side frame of the truck. The traction-motor assembly is covered by a housing and it is cooled by an air-pressure system, so that an overheated bearing would be difficult to detect by touch. In addition, the view of the pinion-end of the bearing and of the driving wheels is obstructed by the truck sides.

The only provision for detecting defective conditions of the traction-motors is by ground-protective relay systems and wheel-slip indication lamps. After the Diesel-motor was isolated, the protection for the traction motor involved which was normally provided 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. On January 28, 1949, the carrier issued a bulletin addressed to train and engine crews and containing the instruction that when bearings of traction motors become overheated the train must proceed at reduced speed to the first auxiliary track, and the defective unit left at that point for inspection and repair.

Cause

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

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

By the Commission, Commissioner Patterson.

W. P. BARTEL,
Secretary.

(SEAL)