

Inv-2312

INTERSTATE COMMERCE COMMISSION
WASHINGTON

REPORT OF THE DIRECTOR
BUREAU OF SAFETY

ACCIDENT ON THE
GRAND CENTRAL TERMINAL RAILROAD

NEW YORK, N. Y.

NOVEMBER 29, 1938.

INVESTIGATION NO. 2312

SUMMARY

Inv-2312

Railroad: Grand Central Terminal

Date: November 29, 1938

Location: New York, N. Y.

Kind of accident: Derailment

Train involved: Passenger No. Y-2

Engine number: N.Y.N.H. & H. 0364, electric articulated

Consist: 13 cars

Speed: 5 m.p.h.

Operation: Timetable and semi-automatic interlocking signals

Track: Several curves and tangents; grade level at point of accident

Weather: Tracks enclosed in substructure

Time: 12:34 a. m.

Casualties: 6 injured

Cause: Believed to have been caused by a leading guide truck wheel mounting the point of a double-slip frog that did not provide sufficient protection through the space between knuckle and point of frog for locomotive with rear unit conforming to angles set up by sharp curve when front unit was passing through frog on tangent track.

January 31, 1939.

To the Commission:

On November 29, 1938, there was a derailment of a New York, New Haven and Hartford Railroad passenger train on the Grand Central Terminal Railroad in New York City, which resulted in the injury of six passengers.

Location and Method of Operation

The Grand Central Terminal Railroad extends northward from 42nd Street to 60th Street, a distance of approximately 4,500 feet, where its tracks converge with those of the New York Central Railroad. The property is bounded on the east and west, respectively, by Lexington and Madison Avenues and comprises approximately 34 miles of trackage. Trains of the New York, New Haven and Hartford Railroad, hereinafter referred to as the New Haven, as well as those of the New York Central Railroad, hereinafter referred to as the N.Y.C., enter New York City through this terminal, and operations are conducted on two levels, this accident occurring on the upper level. Train movements, which are under the supervision of the N.Y.C., are governed by timetable and semi-automatic interlocking signals. On this level there are 42 tracks, numbered consecutively from east to west, which converge through various intersections into six tracks which extend northward a distance of approximately 2,000 feet to Signal Station U at 57th Street and are designated from east to west as tracks C, D, E, G, H and I. Ladder track O leads from the tracks lying in the eastern part of this level into these six tracks. The accident occurred at a double-slip crossing at the intersection of ladder track O and track C at a point 171.25 feet north of the intersection of track No. 20 and ladder track O.

Approaching the point of accident from the south, track No. 20 is tangent about 378 feet, followed in succession by a $6^{\circ}22'$ curve to the left 138.5 feet long, a tangent 133 feet long, a $14^{\circ}46'$ curve to the left 38 feet long, a curve $17^{\circ}40'$ to the left 63 feet long, a $12^{\circ}38'$ curve to the right 37.2 feet long, a tangent of 26.7 feet, and a $15^{\circ}36'38''$ curve to right 51.5 feet long, at the end of which there is a $1^{\circ}44'11''$ switch angle to the right 10.97 feet long, followed by approximately 40 feet of tangent to the point of derailment, the tangent extending some distance beyond. The grade is undulating and immediately preceding the point of accident it is 0.8 percent ascending for north-bound trains but it is level across the intersection.

The structure of the track is composed of 105-pound rail, 33 feet long, laid on 20 ties to the rail length; it is fully

57th Street S.S. "U"

1 h g e d c

Main tracks



50th Street

S.S. "A"

Direction of train

Point of accident

40 ft. Tangent

10.97 ft. switch angle, 1°44'11"

51.5 ft., 15°38'18"

26.7 ft. Tangent

34 ft., 12°38'

63 ft., 17°41'

38 ft., 14°46'

138 ft.

Track 20

Lower track "U"

138.5 ft. 6°22'

Upper level, Grand Central Terminal

Station tracks 21 to 42 inc.

Station tracks 1 to 19 inc.

To Station and 42nd Street.

Madison Avenue

Inv. No. 2312
Grand Central Terminal R.R
New York, N.Y.
Nov. 29, 1938.

tieplated with shoulder tieplates, spikes with two spikes on tangents and three or four spikes on curves and turn-outs, ballasted with crushed rock to a depth of 15 inches and is well drained and maintained. Speed is restricted to 12 miles per hour.

No. 6 $\frac{1}{2}$ switch frogs with stationary points are in use at the point of derailment. There is an open space of 16 inches between the point and the guard knuckle of the frog or 32 inches between the points. The flange-ways have a width of two inches and are 2 $\frac{1}{2}$ inches wide at the knuckle with a depth of 1 $\frac{15}{16}$ inches from top of rail to bed of frog. The diagonal formed by the intersection of tracks O and C places one frog 4- $\frac{3}{8}$ inches in advance of the other, thereby reducing the open space to 11- $\frac{5}{8}$ inches for a pair of wheels.

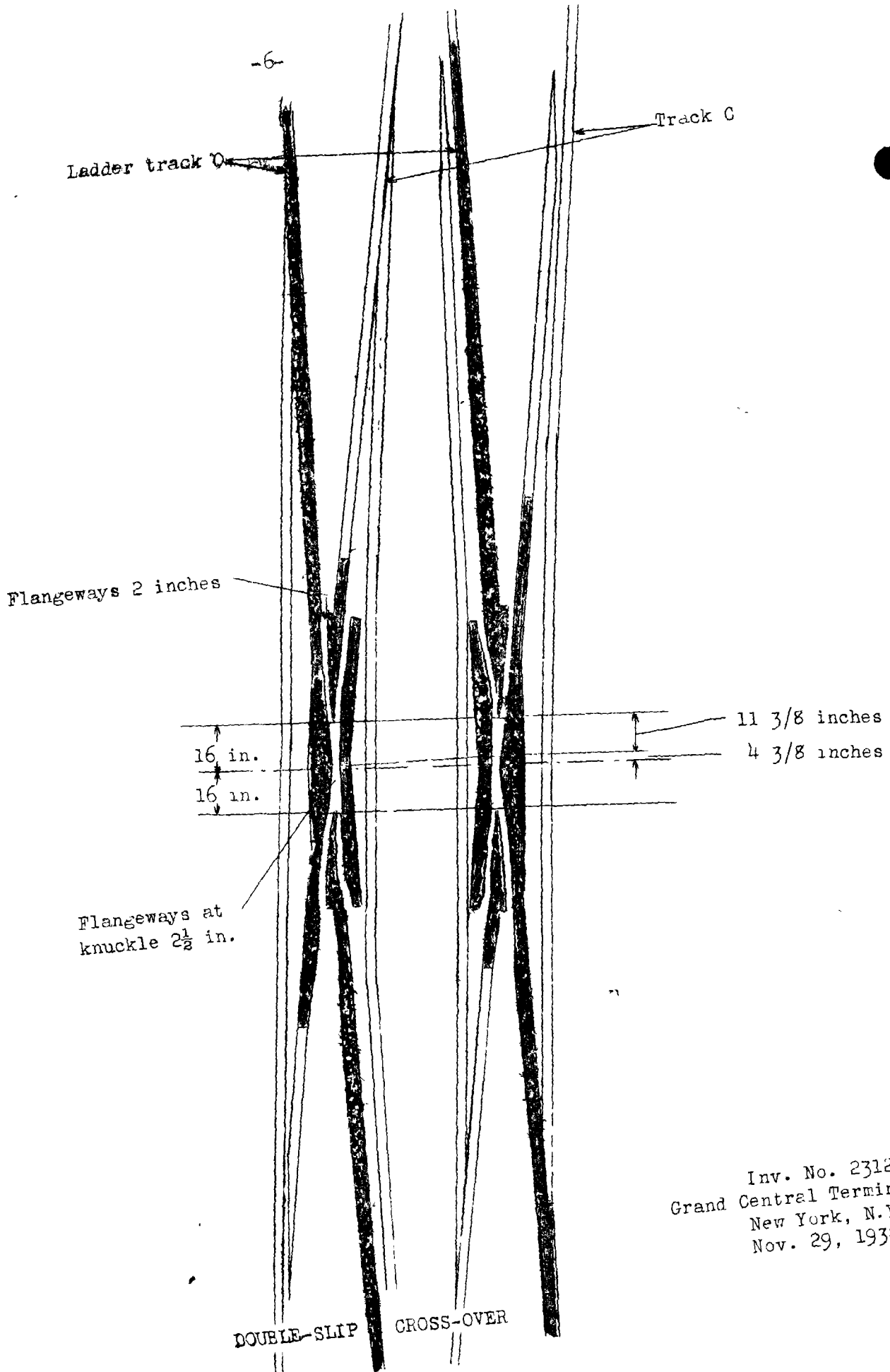
The accident occurred within a substructure and snow falling off incoming equipment had caused slippery rail conditions; the accident occurred at 12:34 a.m.

Description

New Haven passenger train No. Y-2 consisted of 1 baggage car and 12 Pullmans in the order named, all of all-steel construction, hauled by New Haven electric locomotive 0364 and was in charge of Conductor Darby and Engineman Haggerty. This train was routed from track No. 20 to ladder track O, thence across tracks C, D, E and G to track H. It departed at 12:32 a. m., according to the testimony, 1 minute late, and after traveling about 1,000 feet the forward engine truck and the first and second pairs of driving wheels were derailed while traveling at a speed estimated to have been 5 or 6 miles per hour.

New Haven locomotive 0364 is a 4-6-6-4 articulated electric type and has an over-all length of 77 feet with a single cab 74 feet long and 10 feet wide carried upon a four-wheel guide truck at each end and two sets of driving-wheel units of three pairs of wheels each. The locomotive has a wheel base of 66 feet divided as follows: Open ends 5 feet 6 inches from center line of coupler to center line of leading guide truck wheel, 8 feet from center of leading guide truck wheel to center of rear guide truck wheel, 6 feet 4 inches from center of rear guide truck wheel to center of No. 1 driving wheel, 6 feet 10 inches each between the centers of No. 1 and No. 2, and No. 2 and No. 3 driving wheels, 5 feet clear space between center of No. 3 driving wheel and center of articulating pin, from which point the above measurements are in reverse order for the second unit.

The two units are connected by an articulating device which allows a radial movement of the individual units. Each guide



truck has a stabilizing device attached to the center of its frame adjacent to the leading driving-wheel unit, with connecting rod attached to the front pedestal in the direction in which the engine moves. There is a lateral restraining assembly between the cab and the truck which has a travel of 14-9/16 inches controlling the lateral movement of the cab.

Measurement of wheels and distribution of weight of the locomotive are as follows:

Diameter of truck wheels	36 inches,
Diameter of driving wheels	56 inches,
Weight of No. 1 and guide truck	84,300 pounds,
Weight on drivers	135,400 pounds,
Weight on No. 2 and guide truck	74,700 pounds,
Weight on drivers	137,600 pounds,
Total weight of engine	432,000 pounds.

Summary of Evidence

Engineman Haggerty stated that his examination of the engine before departure was as thorough as conditions would permit. After making the usual terminal air-brake test, he left track No. 20 at 12:32 a. m., and due to a wet, slippery rail, the engine slipped somewhat although the sanders were working properly. He did not observe any slack action in the train. The engine began slipping a second or two before the derailment occurred and he thought that possibly it might have been slipping while passing over the frog involved. He observed nothing wrong until the front of the engine dropped to the ground, at which time he estimated the speed at about 5 miles per hour. He could give no apparent cause for the derailment.

Fireman Hello corroborated the statement of the engineman relative to the speed and the engine slipping, and thought that the train moved only about 10 feet after the engineman made an emergency brake application. He said that after the derailment he observed that the front engine truck and the first driver were derailed with the front drivers about 4 or 5 feet over the frog and the second driver atop the frog rail and, although he saw marks on the rails, he could see no object lying about that might have caused or contributed to the accident.

Conductor Darby stated that after the usual terminal brake test was made, the train departed at 12:32 a.m.; the movement of the train was steady and without jar or slack action. He said that he was in the second car at the time of the derailment. He was not conscious of any violent brake action and thought the train was stopping for a signal. He observed no defective track condition that might have caused the derailment.

Flagman Heffernan stated that he was in the second car from rear at the time of the accident and that the emergency brake application caused a rough, sudden stop.

Assistant Master Mechanic O'Meara, of the New Haven, stated he examined locomotive 0364 about one and one-half hours after the derailment and discovered nothing that might have contributed to the accident.

Chief Inspector Kelly, of the New Haven, stated that his examination of locomotive 0364 subsequent to the derailment, disclosed considerable damage but nothing that might have caused the derailment. He further stated that this locomotive has been operated over curves of more than 17 degrees.

Superintendent of Electrical Equipment Clarkson, of the N.Y.C., stated that in his examination of the locomotive subsequent to the accident, he found everything functioning properly. The center pin on the leading unit was well lubricated and both sections seemed to have been working properly and there was no indication of chafing where the truck clearance is close.

Assistant Engineer Moorhouse, of the N.Y.C., stated that in his opinion, the open, unguarded space in the frog permitted the wheels to crowd over enough to contact the frog point. He said that the north point of the eastward frog was worn low 17/32 inch and had a gradual gradient of from 8 to 10 inches from the worn spot northward to the rail level.

Engineer of Tracks Edmondson, of the N.Y.C., stated that in the first two tests made with locomotive 0364 subsequent to the derailment, marks were left in the throat between the tread and the flange where it had contacted the frog point, and that on the third test the flange mounted the point of the frog. He said that the position of the wheels when stopped indicated that the forward unit of the engine was slipping to the right and that the entire truck or frame, after passing over approximately 40 feet of straight track, should have been, when standing, either straight or headed toward the left whereas, while the rear half was in proper position against the west rail of the curve, the head end was not straightened out and he thought that if the engine functioned properly, this would not occur.

Assistant Chief Engineer Sterling, of the New Haven, stated that the type of frog involved in the accident has no guard rail protection for the opposite frog for a space of 15 to 18 inches and that it was his opinion that engine 0364 was crowded over sufficiently to permit the lead truck to take the

wrong side of the frog point. He said that when making tests on the day following the accident, he observed that the first mark of the derailment was at an angle of 45 degrees across the ball of the rail about 23 feet ahead of the right frog and that the marks on the ties extended about 25 or 30 feet beyond the first point of derailment.

Division Engineer McCallum, of the N.Y.C., stated that as the throat of the frog at the center is $2\frac{1}{2}$ inches wide and the unguarded distance between the points nearly 17 inches, the engine wheels moved laterally a sufficient distance to directly strike and mount the frog point and he thought that this danger would be present even though the frog was in perfect condition and that this type of engine, owing to its length, should not be operated over this track. He said that there was no unguarded distance to wheels of 36-inch diameter in between these frog points and that in the diagonal crossing of the two tracks there is an overlapping of $4\text{-}\frac{3}{8}$ inches of the center points, leaving $11\text{-}\frac{5}{8}$ inches between the guard knuckle of the west and the facing point of the east frog and that the effective flange contact of a 36-inch wheel at the top of the rail is $12\frac{1}{2}$ inches thereby completely overlapping the so-called unguarded gap. He said that upon his examination of the track after the derailment he could discover no flange marks, either at the center of the frog or atop the rail, between center frogs and north-end points of slip, nor were there visible marks on the switch plates or braces between center frogs and the north end points of slip, a distance of 22 feet 10 inches. Eleven inches ahead of the north-end points of the slip there was a diagonal mark on the head of the east rail of ladder track O running from the gage side of the rail to the outside of the head of the rail and at this point the first marks on the track fastenings appeared. The 11-inch mark was comparatively light and by 10 o'clock that morning it had been obliterated by routine operation. Northward from this point a mark appeared on the ties and track fastenings and extended to the north frog of the slip. The south end of the guard rail of the north-end frog had been struck, evidently, by a pair of wheels derailed ahead of the end points of the slip. Marks on the east side of the north-end frog showed that a wheel climbed the frog bolts and crossed the wing of the rail of the frog 11 inches ahead of the frog point. On the east side of the frog, 3 inches ahead of the frog point, a bolt was broken indicating a probability of a second pair of wheels being derailed ahead of that location although rail heads showed no marks of this derailment. Eleven feet north of the point of the north frog there was a mark on a tie 7 inches east of the gage side of the east rail of ladder track O and another mark on the same tie 14 inches from the same gage line; these marks were evidently from wheels of both axles of the lead truck. The lead truck wheels stopped 34 feet

north of the east points of slip and 10 inches from the gage side of ladder track O. The drivers apparently were derailed at the north-end frog, the most northerly mark of the north driver being 10 feet north of point of end frog with the west wheel flange marks 20 inches east of west gage line of ladder track O, this rail being tipped partially toward the west. He further stated that the function of the stabilizer is to keep the engine truck straight with the front driving unit. His examination of the truck of engine 0364 indicated that the lead truck had been riding toward the right as indicated by the wear on the right flange as compared with no wear on the left flange. In making this examination engine 0364 was pushed through the route of train No. Y-2 and at the point of derailment, the truck wheel mounted the point of the frog after which it dropped back into the flangeway. Later a test was made with engine 0362, an engine of the same design as 0364, and it also showed a tendency to mount the frog point and for that reason the frog was changed that night and the route left open for use without restriction. Further tests were made the following morning with the same engine over the same route under its own power and although the lead wheel did not mount the rail at the frog point, a small steel shaving was sheared off the back of the flange of the opposite wheel by the guard rail of the facing point of the opposite frog. He further stated that the elevation of the frog involved in the derailment is 9/16 inch and that there are 9 slip frogs of identical design in use in the terminal which, in some instances, have a curvature of approximately 15 to 18 degrees and that no difficulty had been experienced with them and he did not think their use necessitated any special restrictions.

Observations of Commission's Inspectors

Examination of engine 0364 by the Commission's inspectors disclosed no defect that might have contributed to the derailment and tests made with engine 0364, as well as with engine 0362, of identical design, showed that the leading guide truck wheels, although they did not mount the frog, so severely crowded the point on the east side as to prevent their safe movement through the slip, and in tests made with engine 0353, of practically the same wheel arrangement, although of a different design, the engine passed through the frog without difficulty at the maximum authorized speed of 12 miles per hour. Their inspection also disclosed the lateral and wheel wear of engine 0364 to be well within the limits of the U.S. Bureau of Locomotive Inspection requirements. The center casting, movable bolsters and stabilizing and articulating devices were well lubricated and no unusual marks to indicate striking or rubbing were found although there were some marks on the flanges and treads of one guide truck wheel and on the No. 1 and No. 3 pairs of

driving wheels, made at the time of the accident. At the time of their inspection of the tracks, all marks of the derailment except some scarred ties north of the switch point had been obliterated by continued use or eliminated by replacement. The frogs had been removed and an inspection of these showed an abrasion at the point of one; otherwise there was no wear indicated which necessitated their removal.

Discussion

According to the evidence locomotives of the type involved in the accident had successfully passed over the crossing involved for a period of more than 7 months. Engine 0364 had a wheel base 66 feet long. The rear of this engine was on a more than 15-degree curve to the right when the forward wheels were entering the crossing. Apparently the position of the rear of the engine at this instant caused the right front wheel of the guide truck to crowd to the right to the extent that, instead of passing on the inside, it mounted the point. Apparently the weight of the engine was thrown toward the left rail and with the rear end on the curve the cab remained in position to take much of the weight off the right side of the front end; when the rear end came into the tangent and the engine assumed normal position, the weight returned to the right side forcing the right wheels across the east rail where they dropped and moved upon the ties for 34 feet, finally stopping 18 inches from the rail.

Tests were made with engines 0362 and 0364, of the same type, with uniform results. In one of these tests the right front wheel rode the point of the frog after which the frogs were replaced. Later tests with the new frogs in service showed heavy pressure against the frog point as well as an impingement of the back of the flange of the left wheel against the point on the opposite side; the pressure was sufficient to grind off small pieces of metal from the backs of the flanges. Further tests made with engine 0362 with the stabilizing device disconnected gave practically the same results. These tests indicated that with the flanges of the wheels and the frog points in perfect condition there was still the possibility of derailment, and that the 7/8-inch overlap of the flange on a 36-inch wheel was not sufficient for even slightly worn equipment especially when the engine is equipped with an articulating and stabilizing device. The tests also developed that under the operating conditions existing at the time of the derailment, the flange could pass through the unguarded space in the frog sufficiently to strike and climb the point of a partially worn frog with the engine conforming to the track alignment. There are 9 sets of frogs of this description in use in the terminal but none of the others has the same approach conditions.

Conclusion

It is believed that this accident was caused by the leading guide truck wheel of an electric engine mounting the point of a double-slip frog that did not provide sufficient protection through the space between the knuckle and the point of frog for a locomotive of this design with the rear unit conforming to the angles set up by a sharp curve when the front unit was passing through a frog on tangent track.

Respectfully submitted,

W. J. PATTERSON,

Director.