Inv-2442

INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT OF THE DIRECTOR

BUREAU OF SAFETY

ACCIDENT ON THE

BALTIMORE & OHIO RAILROAD

SYKESVILLE, MD.

AUGUST 25, 1940

INVESTIGATION NO. 2442

SUMMARY

Inv-2442

Railroad:	Baltimore & Ohio
Date:	August 25, 1940
Location:	Sykesville, Md.
Kind of accident:	Derailment
Train involved:	Freight
Train number:	Extra 4449 East
Engine number:	4449
Consist:	82 loaded and 3 empty cars, and caboose
Speed:	25-30 m.p.h.
Operation:	Timetable, train orders and manual block system
Track:	Double; 9°45' curve; 0.45 percent descending grade eastward
Weather:	Raining
Time:	8:50 p.m.
Casualties:	3 killed
Cause:	Broken rail, resulting from compound fissure

To the Commission:

On August 25, 1940, there was a derailment of a freight train on the Baltimore & Ohio Railroad near Sykesville, Md., which resulted in the death of three employees.

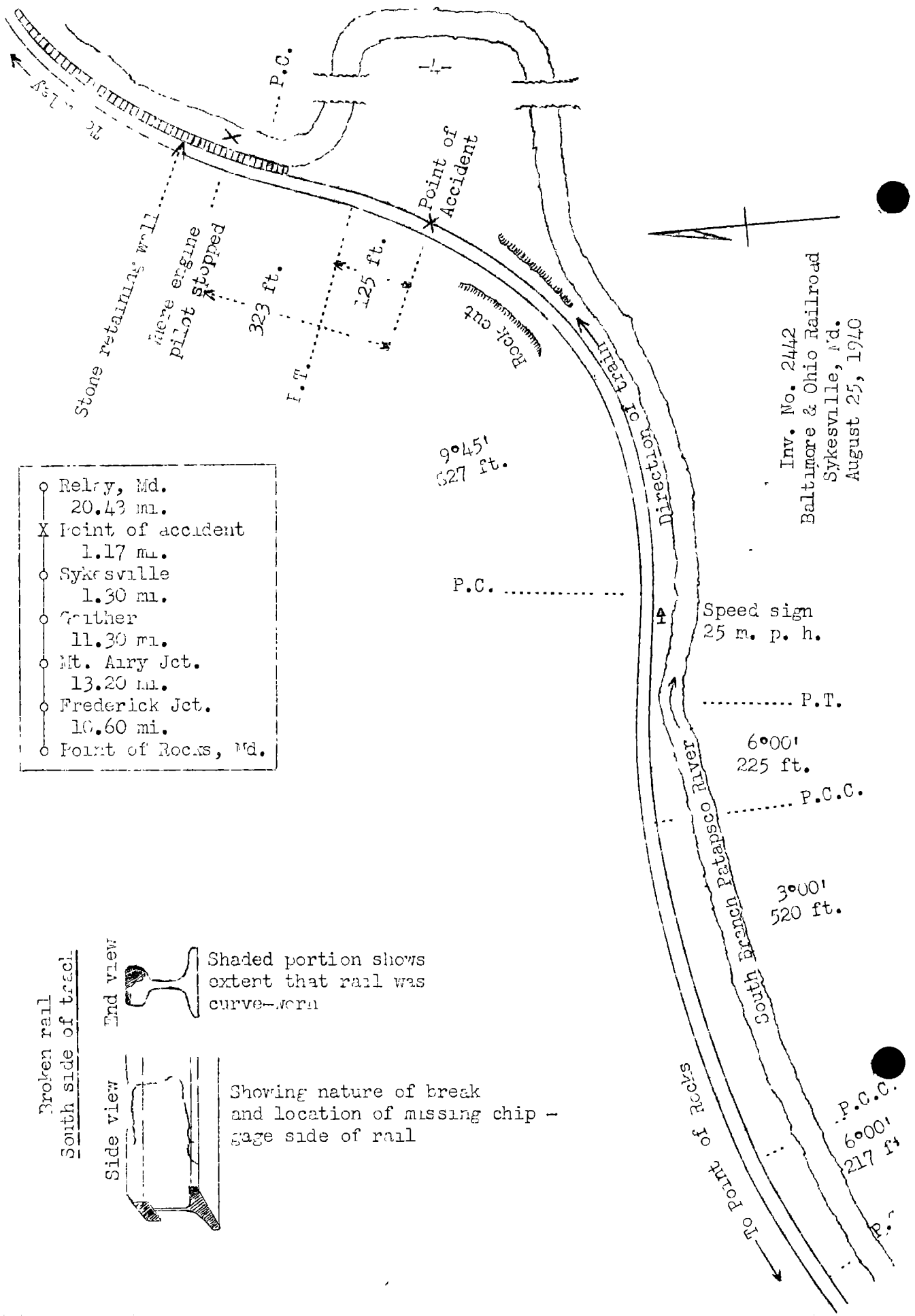
Location and Method of Operation

This accident occurred on that part of the Baltimore Division designated as the West End which extends between Point of Rocks and Relay, Md., a distance of 58 miles. In the vicinity of the point of accident this is a double-track line over which trains are operated by timetable, train orders and a manual block system. The accident occurred on the eastward main track at a point 6,200 feet east of the station at Sykesville. As the point of accident is approached from the west there are, in succession, a 10° curve to the left 698 feet in length, a tangent 239 feet in length, a compound curve to the right 962 feet in length, the maximum curvature of which is 6°, a tangent 157 feet in length, and a 9°45' curve to the left 827 feet in length; the derailment occurred on the last-mentioned curve at a point 125 feet from its eastern end. The grade for east-bound trains is 0.70 percent descending a distance of 9,500 feet and then 0.45 percent descending a distance of 2,060 feet to the point of accident.

In the vicinity of the point of accident the tracks practically parallel the north bank of the south branch of the Patapsco River. The derailment occurred a short distance east of a rock cut which is about 200 feet in length. Beginning at a point 195 feet east of the point of derailment and extending 285 feet eastward a dry masonry retaining wall, 15 feet high, the top of which is 3 feet below the level of the track, is parallel to the center-line of the eastward track and 16 feet distant from it.

The track structure consists of 130-pound rail, 39 feet in length, laid new in 1932 on an average of 22 treated hardwood ties to the rail length; it is fully tie-plated, double spiked on the gage side and single spiked on the outside of the rail, equipped with 4-hole continuous angle bars, and is laid on 12 inches of crushed rock. At the time of the accident the superelevation of the eastward main track at the point of accident was 3 inches. The gage varied between 4 feet 8-3/4 inches and 4 feet 9 inches.

The maximum authorized speed for fast-freight trains in the vicinity of the point of accident is 25 miles per hour.


Stone retaining wall
Where engine pilot stopped
323 ft.
125 ft.
I.T.
Point of Accident
Rock cut
Direction of train
9°45'
327 ft.
P.C.
Speed sign
25 m. p. h.
P.T.
6°00'
225 ft.
P.C.C.
3°00'
520 ft.
South Branch Patapsco River
To Point of Rocks
Relay, Md.
20.43 mi.
Point of accident
1.17 mi.
Sykesville
1.30 mi.
Gaither
11.30 mi.
Mt. Airy Jct.
13.20 mi.
Frederick Jct.
10.60 mi.
Point of Rocks, Md.
Broken rail
South side of track
End view
Shaded portion shows extent that rail was curve-worn
Side view
Showing nature of break and location of missing chip - gage side of rail
Inv. No. 2442
Baltimore & Ohio Railroad
Sykesville, Md.
August 25, 1940

It was raining at the time of the accident, which occurred at 8:50 p.m.

Description

Extra 4449, symbol Philadelphia 94, an east-bound fast freight train, with Conductor Turner and Engineman Evans in charge, consisted at the time of the accident of engine 4449, of the 2-8-2 type, 82 loaded and 3 empty cars, and a caboose. This train departed from Brunswick, 43.3 miles west of Sykesville, at 7:08 p.m., according to the train sheet, passed Mt. Airy Jct., 12.6 miles west of Sykesville, at 8:20 p.m., and was derailed while moving at a speed estimated at 25 to 30 miles per hour.

Engine 4449 and its tender, remaining coupled, became derailed to the right, rolled over the retaining wall, and stopped upright in the river bed, practically parallel to the track, at a point 323 feet east of the point of derailment. The safety valves and the whistle were broken off. The engine truck and the trailer-truck frame were bent. The smoke-box and the cab were badly damaged. The tender frame and the cistern were damaged; both tender-trucks became detached and stopped together in the stream bed. The first 22 cars were derailed; the first car stopped bottom up in the river 40 feet west of the tender; the second car stopped down the embankment 30 feet west of the retaining wall; the third car stopped on the track with its rear truck derailed; the next 17 cars stopped at various angles across both tracks; some were down the embankment and some were in the cut; these 17 cars were bunched within a space of 245 feet. The twenty-first car stopped on the ties; the rear truck of the twenty-second car was not derailed.

The employees killed were the engineman, the fireman and the front brakeman.

Summary of Evidence

Conductor Turner stated that the air brakes were tested at Brunswick and they functioned properly en route. He saw the reflection from the headlight as the train rounded the curve at Frederick Jct., 25.8 miles west of Sykesville. The train was handled properly and no stop was made between Brunswick and the point of accident. At Mt. Airy, 10.8 miles west of Sykesville, the caboose air-gauge indicated 70 pounds brake-pipe pressure. Because of the descending grade west of Sykesville three air-brake applications were made to control the speed of the train; the last brake application was made at Gaither, 1.3 miles west of Sykesville, and, after the brakes were released, the speed

of the train was about 15 or 18 miles per hour. As the train moved down the grade the speed gradually increased until it was slightly faster than usual; however, the conductor was not alarmed and he did not feel any unusual movement of the caboose such as lateral thrust or the wheels hugging the high rail of curves. When his train was approaching the point where the accident occurred the speed was about 30 miles per hour; the first intimation he had of anything being wrong was when the brakes became applied in emergency, the train stopped at 8:50 p.m. After the accident occurred he went forward and made as good an examination as he could considering the rain and the darkness, but he could not determine the cause of the accident. At Brunswick the engineman appeared normal. He said that 5 miles per hour in excess of the maximum authorized speed of 25 miles per hour was safe. Officials had never criticized him, nor, to his knowledge, any member of his crew for exceeding the speed limit.

Flagman Feeley corroborated in substance the testimony of Conductor Turner. The flagman estimated the speed of the train to have been 25 or 30 miles per hour at the time of the accident. Immediately after the accident occurred, he went back to flag and found no indication of dragging equipment.

Engineman Glaze stated that he operated engine 4449 from Baltimore to Brunswick on August 25. The engine was in good mechanical condition and its riding qualities were good.

Trainmaster Norris stated that subsequent to the accident he inspected engine 4449 where it stood in the stream. The automatic brake-valve was in emergency position, the independent brake-valve in running position, the reverse lever about 8 notches ahead of center and the drifting valve open; the main throttle was bent against the boiler head in such manner that it was impossible to determine whether it had been closed by the engineman.

Division Engineer Maher stated that he arrived at the scene of the accident about 2:10 a.m., August 26, and inspected the track and equipment. At a point 702 feet east of the west end of the curve involved he found a broken rail on the outside of the curve on the eastward track. This rail was broken at a point 6 feet 10 inches east of its receiving end; it was considerably battered by derailed wheels striking it. This fracture was at a compound fissure and apparently the initial point of derailment was at this location. The twenty-first car stopped on the fourth rail west of the broken rail. The eastward main track was destroyed a distance of 3 rail lengths west of the broken rail. A number of other rails were twisted

and broken. There was a light flange mark on the ties on the gage side of the north rail, starting at the point of derailment and extending eastward a distance of 3 rail lengths, and there was a scrape mark on the gage side of the south rail; these marks converged near the east end of the third rail. Within this distance the tie-plates on the second and the third rails on the south side of the track were bent upward. At the leaving end of the fourth rail the bolts of the angle-bars were scarred and the track was raised, the gage was tight, 8 ties were bunched and their south ends were broken off. The third, fourth, fifth, and sixth rails were heavily rubbed and the bolts of the angle bars were scarred at joints of the fifth, sixth, and seventh rails. The east end of the sixth rail throughout a distance of 5 feet was kinked outward 2 inches. Starting at a point about midway of the second rail east of the point of derailment and extending to a point midway of the third rail the south ends of the ties were broken. The engine pilot was 323 feet east of the initial point of derailment. It was apparent that the engine rolled over, struck the retaining wall, and continued turning until it landed upright in the stream; its tender remained coupled. The front and rear trucks of the tender were 6 or 8 feet distant from the bottom of the retaining wall and opposite the rear end of the tender. About the center of the curve there were a number of rails which were considerably worn on the high side of the curve and considerably mashed on the low side. There was no indication of break-down of the head of rails on the low side of the curve. At the center of the curve the high rail was curve-worn 1-1/8 inches, measured at the gaging point approximately 5/8 inch below the original head of the rail. At the point where the rail was broken the curve wear was taken 7/8 inch below the head of the rail. He thought the maintenance was fair and adequate for the speed permitted. No rail-detector car had been operated in this locality, and he did not think that satisfactory results would be obtained if a detector-car test were made, because of the number of wheel-burnt and flowed-head rails. During the early part of 1940 detailed inspection of all rail was made in this territory by the engineer of maintenance, who was accompanied by supervisors and section foremen. All defective rails found were replaced. The division engineer and the track supervisor also made inspection of rails while passing over the territory. Detailed inspections are made at places where conditions justify such action. The division engineer said that speed tests were made occasionally and only in two instances was the speed exceeded; this was about 6 or 8 miles per hour in excess of that authorized. Records of rail failures during a period of one year between Point of Rocks and Relay are as follows:

Weight of rails	Number of failed rails	Number of miles per failure	Kind of failure
130 lbs.	30	4.84	Transverse fissure
100 lbs.	23	3.77	Transverse fissure
130 lbs.	1	146.00	Compound fissure
100 lbs.	1	86.80	Compound fissure
130 lbs.	1	146.00	Vertical split head
100 lbs.	4	21.70	Vertical split head
130 lbs.	7	20.86	Horizontal split head
100 lbs.	8	10.85	Crushed head
100 lbs.	56	1.55	Progressive fracture
130 lbs.	15	9.12	Bolt hole break
100 lbs.	36	2.41	Bolt hole break

Track Supervisor Zepp stated that he arrived at the scene of the accident about 11:15 p.m. and examined the track and equipment. At a point 702 feet east of the west end of the curve involved there was a broken rail on the high side of the curve. This rail had a small dark flaw in the head. He attributed the cause of the accident to this broken rail. The track was destroyed a distance of about 4 rail lengths west of this point. There was no mark on the roadbed, ties, or rails west of where the track was torn up to indicate that equipment had been dragging. The first mark of derailment was on a tie 8 inches inside the low rail at the location of the break in the high rail. East of the point of derailment the rails, tie-plates, spikes and ties were marked and disturbed; there were wheel marks apparently made by a wheel in canted position scraping the ties. A rail was bent toward the south, spikes were marked, tie plates bent up at their corners, and, to a point opposite where the engine stopped, bolts on the inside of angle bars were mashed. He thought that the tender was completely derailed at the broken rail involved and that it listed down the embankment and was dragged in a twisted position by the engine until the tender finally turned over and pulled the engine over with it. The indications were that the engine truck was the only part of the engine derailed until it stopped and turned over. The section of track involved is more difficult to maintain than other sections because of the curves; however, he considered it to be in safe condition for the operation of trains at the speed permitted. Speed signs, which restrict the speed to 25 miles per hour, are located at each end of the curve involved.

Section Foreman Hawkins, who was in charge of the track involved, stated that his section consists of 6 miles of double track. He has been in charge of this section since 1916. His force consists of three men, and additional help is provided occasionally to assist in maintaining the track. On August 19 he checked the gage of the curve involved and it varied between

1/4 and 1/2 inch wide. On August 24 he inspected the track in the vicinity where the accident occurred and did not see any evidence of defective rail or churning ties; the alinement and the superelevation conformed to the standard for that curve. The rail on this curve was laid new September 1932. During September 1939, he raised, realined and surfaced the track. Prior to the accident he had removed three curve-worn rails from the curve involved but none was removed because of transverse fissure. About 1 mile east of the curve involved he had replaced three rails because of transverse fissures. He said that curve-worn rails are replaced when the head is worn back to a line perpendicular to the web. Whenever a rail indicates the possibility of a crack or fissure being present a magnifying mirror is used to examine the under side of the head for defects. The broken rail involved was curve-worn as far back as the web.

Engine 4449 is of the 2-8-2 type. Its total weight is 327,400 pounds, distributed as follows: Engine truck, 22,700 pounds; first pair of driving-wheels, 60,100 pounds; second pair of driving-wheels, 62,100 pounds; third pair of driving-wheels, 62,800 pounds; fourth pair of driving-wheels, 62,000 pounds; and the trailer truck 57,700 pounds. The tender, which was of the Vanderbilt type, has two four-wheel trucks; its capacity is 20 tons of coal and 12,000 gallons of water. The gross weight of the tender is 219,000 pounds. The rigid wheel-base of the engine is 16 feet 9 inches, the total engine wheel-base is 35 feet 1 inch, and the over-all length of the engine and tender is 83 feet 9 inches.

According to information furnished by the railroad, inspection of engine 4449 subsequent to the accident disclosed that all driving-box wedges were free; driving-box springs and rigging, equalizers, hangers, gibs and clips were in place and in good condition. The buffer casting was in place and there was no indication of wear. The engine-truck center casting was not worn and there was no indication of fouling; the engine truck, swing hangers and radius-bar braces were in good condition. The trailer-truck frame was in good condition except that the rear of the frame was bent and cracked as a result of the derailment; the trailer-truck springs and equalizers were in good condition. After the engine was removed from the river the wheels were gaged; the results were as follows:

Wheel	Lateral	Tire wear		Flange thickness	
		Left	Right	Left	Right
Engine truck wheels	7/32"			1-5/16"	1-1/4"
No. 1 driving wheels	19/32"	None	None	1-9/32"	1-1/4"
No. 2 driving wheels	17/32"	1/32"	1/16"	1-1/8"	1-5/16"
No. 3 driving wheels	15/32"	1/16"	1/8"	1-1/16"	1-3/8"
No. 4 driving wheels	11/16"	None	3/32"	1-5/16"	1-3/8"
Trailer truck wheels	1/2"			1-9/32"	1-9/32"

	Wheel spacing		Outside
	Back to back	Throat to throat	overall
Engine truck wheels	53-5/16"	55-7/8"	64-5/16"
No. 1 driving wheels	53-1/16"	55-19/32"	64-11/32"
No. 2 driving wheels	53-1/32"	55-15/32"	64-3/8"
No. 3 driving wheels	53-3/16"	55-5/8"	64-7/16"
No. 4 driving wheels	53"	55-11/16"	64-3/16"
Trailer truck wheels	53-3/8"	55-15/16"	64-5/8"

	Tires			
	Thickness		Width	
	Left	Right	Left	Right
Engine truck (solid wheel)	2-1/16"	2-1/16"	5-1/2"	5-1/2"
No. 1 driving wheels	2-5/16"	2-3/8"	5-21/32"	5-5/8"
No. 2 driving wheels	2-1/2"	2-1/2"	5-21/32"	5-11/16"
No. 3 driving wheels	2-1/2"	2-7/16"	5-11/16"	5-9/16"
No. 4 driving wheels	2-7/16"	2-7/16"	5-1/2"	5-11/16"
Trailer truck wheels	2-3/8"	2-7/16"	5-5/8"	5-5/8"

	Diameter	
	Left	Right
Engine truck wheels	31-7/8"	31-27/32"
No. 1 driving wheels	60-5/16"	60-3/8"
No. 2 driving wheels	60-5/16"	60-11/32"
No. 3 driving wheels	60-3/8"	60-3/8"
No. 4 driving wheels	60-5/16"	60-11/32"
Trailer truck wheels	42-1/2"	42-1/2"

	Tread wear of truck wheels	
	Left	Right
Engine truck wheels	1/32"	1/16"
Trailer truck wheels	None	None

The transverse splash-plates in the tender were in good condition.

During the 30-day period prior to the day of the accident there were 697 train movements over the territory involved, or a daily average movement of 23.23 trains.

According to a statement by Engineer of Tests Hedeman, the rail involved was a 39-foot, 130-pound R. E. rail, rolled at the Maryland plant of the Bethlehem Steel Co., February 1931. The heat number was 74098, the ingot number was 4, and it was the sixth rail in the ingot. Chemical analysis at the time of rolling was as follows:

Element	Percent	Spec. No. 163-J Percent
Carbon	.82	.72 - .89
Manganese	.69 - .70	.50 - .90
Phosphorus	.017	.04 Max.
Sulphur	.025	- - -
Silicon	.25	.15 Min.

Chemical analysis of borings taken from one of the pieces of the broken rail was as follows:

Element	Gage side Percent	Outside Percent
Carbon	.77	.72
Manganese	.62	.60
Phosphorus	.022	.021
Sulphur	.015	.014
Silicon	.27	.26

Note: The carbon content is lower than the average for the specification, and is between .05 and .10 percent lower than the ladle analysis. The "A" rails from this ingot were rejected at the mill because of doubtful quality.

Examination of the broken rail disclosed that there was an old, progressive crack, located from 7/16 to 5/8 inch below the top of the head, and extending horizontally a distance of 5-3/4 inches and across the full width of the head. At one end of the horizontal crack there was another old crack 1 inch wide extending downward about 1/4 inch; at the other end of the horizontal crack there was another crack the width of the head and extending downward 7/8 inch; a section about 4 inches from the break showed a "pipe" condition and segregation of metal. The rail was curve-worn but not to the condemning limit.

Several transverse and longitudinal sections were prepared by breaking or sawing, polishing, and etching. Examination of these sections showed longitudinal streaks of bright metal indicating a segregated condition in the head, about 1/4 inch below

the horizontal crack, over which the upper part of the head was missing. A section about 4 inches from the break showed a small pipe in the lower part of the head and streaks of bright metal in the head and web and a continuation of the horizontal crack into the head. A section made by separating the head along the horizontal crack showed extensive separation of the metal, which condition was probably also present in the piece of the head which was missing.

Observations of the Commission's Inspectors

The broken rail involved was on the outside of the curve. The break occurred at a point 6 feet 10 inches east of the receiving end of the rail and extended almost vertically downward through the web and base. A chip 7/16 inch deep and 2-1/2 inches long extending across the entire head was missing from the head of the rail at the break. Beneath this missing chip there was a horizontal fissure 5 inches in length which extended to the break, then rounded over the outside portion of the head and continued vertically downward; this section of the fissure was about 1 inch in diameter; it was also in evidence on the receiving end of the break and from its lower edge the failure extended to the base of the rail. In the central portion of the head there was a vertical split which measured 1/2 inch. The rail was considerably curve-worn. The inspectors found the track to be in the condition described by the division engineer.

The inspectors examined the eastward main track for a considerable distance west of the point of derailment but did not find any indication of defective or dragging equipment. They did not find any indication that the engine wheels had been off the rails prior to the time the engine began to turn over.

Discussion

According to the evidence, the derailment occurred on a 9°45' curve to the left; the superelevation was 3 inches and the maximum authorized speed for the train involved was 25 miles per hour. Extra 4449 was moving at an estimated speed of 25 or 30 miles per hour at the time of the derailment. Marks on the track indicated that a rail failed under the engine, and the tender becoming derailed resulted in the overturning of the engine.

Subsequent to the accident, examination disclosed that a rail on the high side of the curve at a point 702 feet east of the west end of the curve had failed on account of a compound fissure; this break was 6 feet 10 inches east of the receiving end of the rail and extended downward through the head, web, and

base. A piece 7/16 inch deep and 2-1/2 inches long was broken from the head of the rail. Beneath the chipped-out piece there was an old, progressive crack about 5/8 inch below the head extending horizontally a distance of 5-3/4 inches. At one end of this crack there was another crack 1 inch wide extending downward 1/4 inch; at the other end of the horizontal crack there was a crack the width of the head extending downward about 7/8 inch. The gage of the track varied between 4 feet 8-3/4 inches and 4 feet 9 inches. The rail on the high side of the curve was worn 1-1/8 inches inward from its original contour; however, it was not worn to the railroad company's condemning limit. Regular inspection of track in this territory is conducted by the maintenance-of-way force and several rails had been taken out recently because of transverse fissures.

A chemical analysis made subsequent to the accident disclosed a deficiency of carbon which varied between .05 and .10 percent lower than the analysis of the ladle at the mill. The evidence also disclosed that all "A" rails from the same ingot as that of the broken rail had been rejected at the mill. The broken rail contained a "pipe" condition adjacent to the point of break and there was segregated metal in the head just below the horizontal crack. It is apparent that the metal of the rail was not according to specifications, was probably segregated, and the "pipe" condition developed into a compound fissure. From these facts it is apparent that the rail was of poor quality when first laid.

Conclusion

This accident was caused by a broken rail, resulting from a compound fissure.

Respectfully submitted,

S. N. MILLS,

Director.