

INTERSTATE COMMERCE COMMISSION
WASHINGTON

INVESTIGATION NO. 2540
THE PENNSYLVANIA RAILROAD COMPANY
REPORT IN RE ACCIDENT
AT DUNKIRK, OHIO, ON
NOVEMBER 9, 1941

-2-

SUMMARY

Railroad:	Pennsylvania	
Date:	November 9, 1941	
Location:	Dunkirk, Ohio	
Kind of accident:	Derailment	
Trains involved:	Passenger	: Freight
Train numbers:	78	: Extra 8196 <i>West</i>
Engine numbers:	3874	: 8196
Consist:	8 cars	: 48 cars and caboose
Estimated speed:	70-75 m.p.h.	: 35-40 m.p.h.
Operation:	Automatic block-signal system	
Track:	Double; tangent; 0.21 percent descending grade eastward	
Weather:	Cloudy	
Time:	10:22 p.m.	
Casualties:	13 killed; 49 injured	
Cause:	Accident caused by a passenger train striking a cylinder head which had been thrown from an engine on an adjacent track	

INTERSTATE COMMERCE COMMISSION

INVESTIGATION NO. 2540

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

THE PENNSYLVANIA RAILROAD COMPANY

December 31, 1941.

Accident at Dunkirk, Ohio, on November 9, 1941, caused by
a passenger train striking a cylinder head which had
been thrown from an engine on an adjacent track.

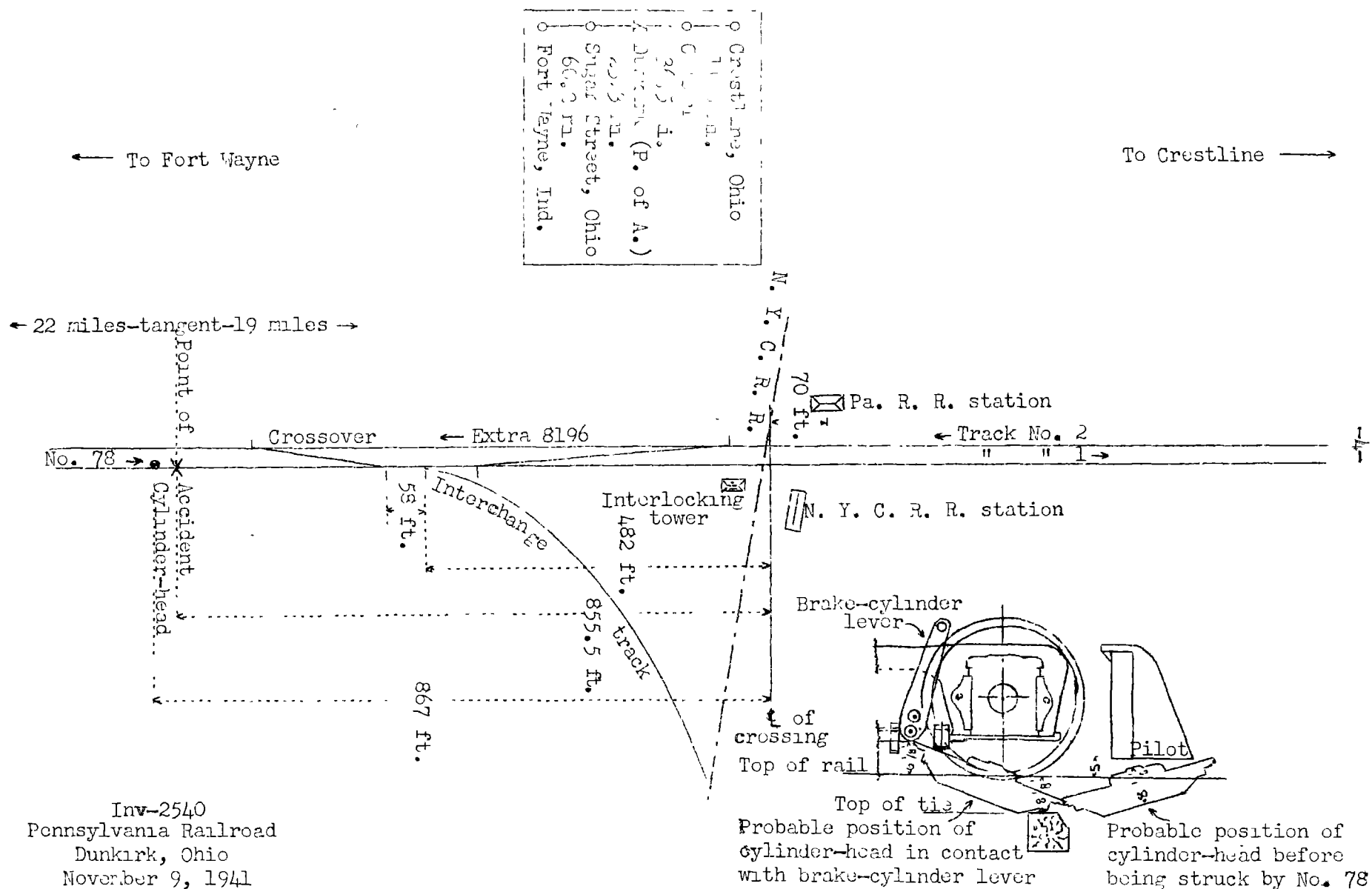
REPORT OF THE COMMISSION¹

PATTERSON, Commissioner:

On November 9, 1941, there was a derailment of a passenger train on the Pennsylvania Railroad at Dunkirk, Ohio, which resulted in the death of 10 passengers, 1 dining-car employee and 2 train-service employees, and the injury of 35 passengers, 11 dining-car employees, 2 train-service employees and 1 telegraph operator. This accident was investigated in conjunction with representatives of the Public Utilities Commission of Ohio.

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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.



Location of Accident and Method of Operation

This accident occurred on that part of the Fort Wayne Division which extends between Crestline, Ohio, and Fort Wayne, Ind., a distance of 131.6 miles. In the vicinity of the point of accident this is a double-track line over which trains moving with the current of traffic are operated by an automatic block-signal system, the indications of which supersede timetable superiority. The main tracks from south to north are No. 1, eastward main, and No. 2, westward main. At Dunkirk, a single-track line of the New York Central Railroad, hereinafter referred to as the N.Y.C., crosses the tracks of the Pennsylvania Railroad at an angle of $80^{\circ}26'$. This crossing is located 70 feet west of Dunkirk station and is protected by an interlocking controlled from Dunkirk tower, which is located in the southwest angle of the crossing. At a point 482 feet west of the center-line of the crossing, a facing-point turnout to the right connects track No. 1 and an interchange track leading to the N.Y.C. The accident occurred within interlocking limits on track No. 1 at a point 855.5 feet west of the center-line of the crossing and 373.5 feet west of the switch of the interchange track. The east switch of a trailing-point crossover, which connects tracks Nos. 1 and 2, is located at a point 58 feet west of the switch of the interchange track.

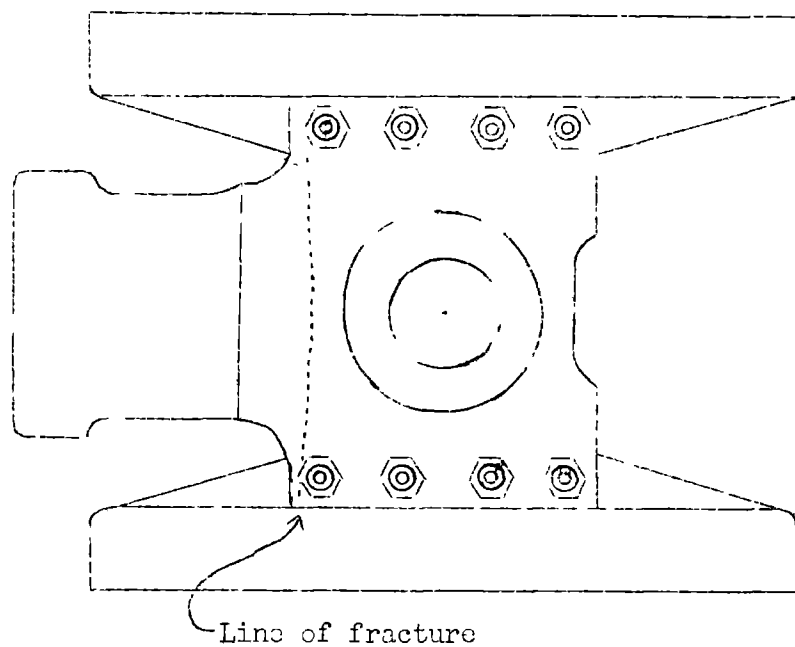
As the point of accident is approached from the west there is a tangent a distance of 22 miles to the point of derailment and 19 miles beyond. The grade for east-bound trains varies between 0.06 and 0.21 percent descending a distance of 5,050 feet to the point of accident and is 0.21 percent at the point of accident.

On track No. 1, the track structure consists of 131-pound R. E. rail, 39 feet in length, laid in 1940 on an average of 22 treated hardwood ties to the rail length; it is fully tieplated with double-shoulder tieplates, spiked with 2 rail-holding spikes and 2 plate-holding spikes per tieplate, and is provided with an average of 6 rail anchors per rail length; it is equipped with 6-hole angle bars, ballasted with crushed stone to a depth of 12 to 16 inches, and is well maintained. Throughout a distance of 310 feet west of the point of derailment the greatest variation in cross-level was $1/8$ inch, and the gage varied between 4 feet $8-3/8$ inches and 4 feet $8-1/2$ inches.

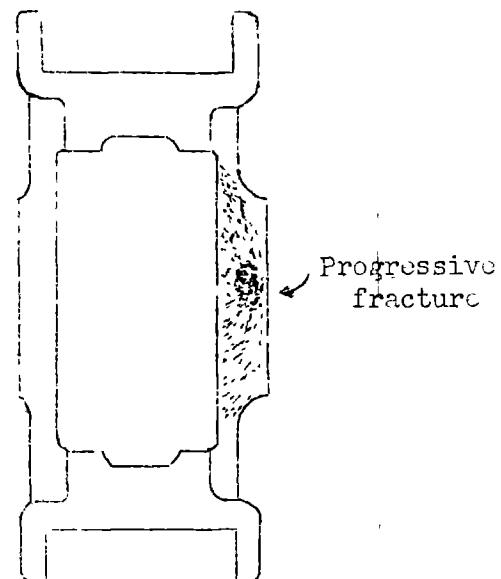
The interchange switch was a No. 10 turnout having a curvature of $7^{\circ}32'24''$ to the right; there was no superelevation. It was provided with switch points 20 feet in length, one-piece guard rails, and a No. 10 frog of the spring type.

Crosshead of engine 8196

Side view showing fracture
through outside web of body



Cross-section showing progressive
fracture from inside surface outward



The interchange track consisted of 130-pound rail, 39 feet in length, laid on an average of 22 ties per rail length; it was fully tieplated, single-spiked, provided with 6 rail anchors per rail length, and was well maintained.

Operating rules read in part as follows:

102. When a train is disabled or stopped suddenly by an emergency application of the air brakes or other causes, adjacent tracks as well as tracks of other railroads that are liable to be obstructed must be protected at once in both directions until it is ascertained they are safe and clear for the movement of trains.

In the vicinity of the point of accident the maximum authorized speed for passenger trains is 80 miles per hour and for freight trains, 50 miles per hour.

Description of Accident

Extra 8196 West, symbol FW-33, a west-bound freight train, consisted of engine 8196, of the 2-10-2 type, 31 loaded and 17 empty cars and a caboose. After a terminal air-brake test was conducted at Crestline, 48.1 miles east of Dunkirk, this train departed at 8:18 p.m., according to the dispatcher's record of movement of trains. At Colsan, 36.5 miles east of Dunkirk, 10 cars were added to the train, an air-brake test was made, and the brakes functioned properly at all points where used en route. This train, moving on track No. 2, passed Dunkirk at 10:19 p.m., according to the station record of train movements, and while it was moving at a speed estimated as from 35 to 40 miles per hour at a point about 750 feet west of the center-line of the crossing the left crosshead broke and the cylinder head was torn loose from the left cylinder.

The cylinder head fell between tracks Nos. 1 and 2 at a point 835 feet west of the center-line of the crossing, struck the north end of a tie in track No. 1 at a point 32 feet farther west, bounced over the north rail of track No. 1 and stopped in the center of track No. 1 at a point 867 feet west of the crossing. The time was then 10:20 p.m., according to statements of the crew. The cylinder head was struck by No. 78 at 10:22 p.m.

No. 78, an east-bound first-class passenger train, consisted of engine 3874, of the 4-6-2 type, one passenger-baggage car, one coach, one dining car and five Pullman sleeping cars, in the order named. All cars were of standard steel

construction, except the sixth which was of light-weight steel construction. After a terminal air-brake test was conducted at Fort Wayne, 83.5 miles west of Dunkirk, this train departed at 9:01 p.m., according to the dispatcher's record of movement of trains, 1 minute late. Soon after it departed from Fort Wayne a running test of the brakes was made; the brakes were used to control the speed at various points en route and they functioned properly. This train passed Sugar Street, 23.3 miles west of Dunkirk and the last open office, at 10:01 p.m., and while approaching Dunkirk and moving at a speed estimated as from 70 to 75 miles per hour it struck the cylinder head and became derailed.

Engine 3874 was in good mechanical condition and there was no indication of defective track. The No. 1 pair of engine-truck wheels were the first wheels to be derailed. The first mark on the track structure was a small cut on the east edge of the top of a tie 22 inches inside the south rail and 867 feet west of the center-line of the crossing. The top of the next tie eastward was gouged to a depth of 4 inches, starting at a point 15 inches inside the south rail and extending to the north rail. The next 7 ties were gouged near the center. On the ninth tie east of the first mark, a flange mark appeared on the top of the tie 8 inches outside the gage side of the south rail. On the tenth tie there was a flange mark on the tieplate 5-1/4 inches inside the gage side of the north rail. Throughout a distance of 373.5 feet eastward, flange marks appeared intermittently on the tops of the ties at an average distance of 7 inches outside the south rail and 9 inches inside the north rail. The tops of the ties were gouged intermittently near the center-line of the track. At a point 236.5 feet east of the point of derailment, the frog of the trailing-point crossover was damaged. Track No. 1 was destroyed throughout a distance of 362 feet immediately west of the N.Y.C. crossing. The crossing frogs on tracks Nos. 1 and 2 were destroyed. About 50 feet of track No. 2 east of the crossing was badly damaged. At a point 373.5 feet east of the first mark of derailment the engine-truck wheels encountered the switch to the interchange track and the general derailment occurred.

Engine 3874 became derailed, overturned to the left, and slid on its left side throughout a distance of about 300 feet practically parallel to track No. 1 and 40 feet south of it, then struck the interlocking tower, skewed at right angles to the track, collided with the second car of its train, and stopped with its front end telescoping the second car and across track No. 1 at a point 12.5 feet west of the N.Y.C. crossing. The rear end of the engine was 32.5 feet south of

the center-line of track No. 1. The engine truck was torn loose from the engine. The engine-truck wheels were badly damaged and the boxes and the frame were broken. The pilot and the front-end corner casting were broken and the cab was demolished. The trailer truck was torn loose and badly damaged. The tender was torn loose from the engine and the underframe stopped on track No. 1 at a point 262.5 feet east of the engine. The center-sill and end-sills of the tender were bent and broken, and both trucks were torn loose. The cistern stopped across tracks Nos. 1 and 2 at a point 812.5 feet east of the engine. The first car was derailed and stopped upright and in line with the track and 235 feet east of the engine. The side-sill and the belt rail on the right side were bent and broken at the middle of the car. Both trucks were badly damaged. The second car was derailed and stopped upright across tracks Nos. 1 and 2 and at an angle of 15 degrees to them. The front end was 25 feet east of the N.Y.C. crossing. The right side-sheets, posts, floor and roof were torn out from the front end to a point 15 feet from the rear end, as a result of colliding with the front end of the derailed engine. The center-sill was bent downward 4 inches and to the left 4 inches. The body of the car was out of square. The third car was derailed and stopped on its right side, badly damaged, practically at right angles to track No. 1. The front end was on the track and the rear end was 77 feet south of it. The left front corner-post, the rear end-sill, and the left side-sill at the rear were broken. Both trucks were damaged. The right side-sheets were torn and the side-sill was broken. The fourth car was derailed and stopped upright, at right angles to track No. 1, and west of the third car. The front end-sill and the right front corner-post were broken. The skirting on both sides under the side-sills was torn. The body of the car was out of square. The fifth car was derailed and stopped on its right side across both main tracks and at an angle of 40 degrees to them. The right front corner-post and vestibule corner-post were broken. The left body plates were bent throughout the length of the car. The upper deck was bent to the right a distance of 8 inches. Both trucks were damaged. The sixth car was derailed to the right but remained upright, with the front end 12.5 feet south of the center-line of track No. 1 and the rear end on the roadbed. The left front corner-post was bent. One side-sheet at the front end and one side-sheet at the rear of the right side were bent and cut. Both trucks were damaged. The seventh car was derailed to the right but remained upright. The front end was 7 feet south of track No. 1 and the rear end was on the roadbed. The right belt-rail, the side-sill and the side-sheets were bent. Both trucks were damaged. The front truck of the eighth car was derailed and damaged.

The weather was cloudy at the time of the accident, which occurred at 10:22 p.m.

The train-service employees killed were the engineer and the fireman of No. 78, and the train-service employees injured were the conductor and the front brakeman of No. 78.

Mechanical Data

After the accident an inspection of engine 3874 disclosed that no condition of the engine existed prior to the accident that might have contributed to the cause of the derailment. The throttle was slightly open, the automatic brake valve in emergency position, the independent brake valve in running position and the reverse lever in position for forward motion at short cut-off.

In working order, the total weight of engine 3874, of No. 78, is 308,890 pounds, distributed as follows: Engine truck, 53,640 pounds; driving wheels, 201,830 pounds; and trailer truck, 53,420 pounds. The tender is rectangular in shape and has two 4-wheel trucks. The weight of the tender loaded is 212,725 pounds. The diameters of the engine-truck wheels, driving wheels and trailer-truck wheels are, respectively, 36, 80 and 50 inches. The rigid wheelbase is 13 feet 10 inches in length and the total length of the engine and tender is 82 feet 11-3/4 inches.

Engine 8196 has a total weight of 380,700 pounds. The maximum working steam pressure is 190 pounds per square inch. The bore of the cylinders is 30 inches and the stroke of the pistons is 32 inches.

Examination after the accident disclosed that the left crosshead of engine 8196 was broken and the left cylinder head was missing. The crosshead involved was of the 3-piece, alligator type and had a cast-steel body and cast-iron shoes. Each shoe is secured to the body by four 1-inch bolts spaced 3 inches from center to center. At the crosshead pin location, the inside web of the body is 1-3/8 inches thick and the outside web is 1-7/8 inches thick. Both webs are 1-1/4 inches thick at the shoes. The inside web was fractured in an irregular line, which extended between the top and the bottom shoes at a distance of 1/2 inch to 2-1/2 inches back of the boss; this fracture was entirely new. The outside web was fractured from the top shoe to the bottom shoe in practically a vertical line, which extended between the front bolts of both shoes, and was about 2-1/2 inches ahead of the crosshead pin hole; this was a progressive detail fracture.

The center of the arc of the fracture was parallel to the longitudinal center-line of the crosshead pin, and the fracture had progressed from the inner surface of the web until it broke through the outer surface at the time of the failure. The metal indicated a faulty condition near the center-line of the web. The boss remained attached to the back end of the piston rod.

The cylinder head involved was of cast steel, 35-3/4 inches in diameter and from 1-1/8 inches to 1-7/8 inches in thickness. It was dished in such manner that the outer surface at the center extended 8-7/8 inches beyond the innermost surface. The cylinder wall was 1-3/4 inches thick and the cylinder head was attached to it by 34 1-inch studs. A clearance of 3/8 inch was provided between the cylinder head and the front end of the piston rod. After the accident it was found that the cylinder head had pulled from the cylinder at 13 studs and the cylinder wall was broken a distance of 47-1/2 inches in its circumference at the bottom. This break extended into the cylinder wall a maximum distance of 7-7/8 inches. At the top of the cylinder the wall was broken a distance of 16 inches along its circumference and the fracture extended back to the steam port.

The lateral motion of the crosshead was 0.1875 inch and the vertical motion was 0.0937 inch. The bore of the front-end main-rod brass was 0.0625 inch greater than the diameter of the crosshead pin. The lateral motion of the back end of the main rod was 0.199 inch, and the lost motion between the main bushing and the main pin was 0.063 inch.

Class 3 repairs on engine 8196 were completed at Panhandle Shops, Columbus, Ohio, on May 17, 1941. The last monthly certificate was filed at Crestline, Ohio, enginehouse on October 21, 1941. The accumulated mileage since the last class repairs was 16,596 miles. During the class repairs the crosshead involved was removed and all grease and dirt were removed by metal-cleaning chemicals. The crosshead was whitewashed and hammer tested for cracks. The shoes were removed for rebabbiting so that the body would not be subjected to heat.

Work reports filed on November 7 and 8 at Fort Wayne, Ind., enginehouse and work reports filed on November 8 and 9 at Crestline enginehouse bore notations that the left crosshead pin was loose. In each instance the crosshead-pin nut was tightened.

Discussion

Extra 8196 West passed the tower at the N.Y.C. crossing at Dunkirk at 10:19 p.m. The engineer and the fireman were maintaining a lookout ahead from their respective sides of the cab. The throttle was half-open, the reverse lever was in position for forward motion at 50 percent cut-off and the speed was from 35 to 40 miles per hour. Soon after the engine passed the tower the engineer felt an unusual pounding on the left side of the engine and thought the brass at the back end of the main rod had broken. He immediately made a full-service brake-pipe reduction and the train stopped in a distance of about 2,300 feet. About the time the engineer applied the brakes he observed No. 78 approaching about 1-1/2 miles distant and he dimmed his headlight. Extra 8196 stopped about 10:20 p.m., according to statements of the crew, and the enginemen immediately alighted from the engine to inspect it and had reached the front end before the arrival of No. 78; however, before they could determine the extent of damage they were forced to move out of the way of No. 78. Neither of the enginemen saw any unusual emission of steam nor heard any roar of escaping steam, such as is customary when a cylinder head is knocked loose; therefore, until after No. 78 had passed they were not aware that the left crosshead was broken and that the left cylinder head was missing and had fallen upon the eastward main track. About 10:22 p.m. No. 78 struck the cylinder head at a point 867 feet west of the center-line of the N.Y.C. crossing and became derailed.

Immediately after Extra 8196 stopped, the flagman proceeded to the rear to furnish protection for his train and had reached a point about 250 feet distant when he heard No. 78 strike some object and he observed fire flying from beneath the engine, which was rocking laterally. No. 78 was moving at an estimated speed of 70 or 75 miles per hour at the time of the accident. Whether members of the engine crew of No. 78 were able to see any obstruction on the track could not be determined, as both were killed in the accident.

The rules provide that under conditions where there is danger of obstructing adjacent tracks, such tracks must be protected. At the time the cylinder head became broken, No. 78 was at a point about 1-1/2 miles distant. If a lighted fusee had been dropped on the eastward track or had been displayed from the left side of engine 8196, the engineer of No. 78 could have taken action to stop the train and the accident might have been averted. All members of the crew of Extra 8196 were of the opinion that, since none was aware of the missing cylinder head, an emergency did not exist, and it was not necessary to protect adjacent tracks. The general superintendent said that, in accordance with the lack of knowledge

had by the crew of Extra 8196 concerning the missing cylinder head, an emergency could not be assumed to exist and it was not necessary to protect adjacent tracks.

Marks on the track structure indicated that after the crosshead failed, the cylinder head was knocked loose and its momentum carried it forward about 115 feet until it stopped in the center of the eastward main track. The tie-plates are 1 inch thick and the rails are $7\frac{1}{8}$ inches high; therefore, the tops of the rails are $8\frac{1}{8}$ inches above the tops of the ties. The ballast was 2 or 3 inches below the tops of the ties at the point where the accident occurred. The cylinder head was $35\frac{3}{4}$ inches in diameter and its maximum thickness was $8\frac{7}{8}$ inches. Marks on the forward edge of the lower end of the engine-truck brake-cylinder lever indicated that the lever had been in contact with the edge of the cylinder-head flange and marks on the cylinder-head flange indicated that the flange had been struck on the outer edge by some object of the same thickness as the brake lever. The lower end of the brake-cylinder lever was $6\frac{1}{8}$ inches above the top of the rail. If the cylinder head had lain flat between the rails its thickness would have cleared any portion of the engine between the wheels, as only $\frac{3}{4}$ inch of the cylinder head would have extended above the top of the rail. Apparently, when the cylinder head stopped in the center of the eastward main track, the top edge of the flange inclined toward the east and extended above the top of the rail at least $5\frac{1}{2}$ inches. The pilot of the engine of No. 78 was about 5 inches above the top of the rail and, undoubtedly, it struck the top edge of the cylinder head in such manner that the lower edge rose until it struck the lower end of the engine-truck brake-cylinder lever, then the opposite edge of the cylinder head struck against a tie, which became a fulcrum, and the cylinder head became a lever and the engine-truck wheels were raised above the rails.

The crosshead involved failed as a result of a progressive fracture in the outer web of the body. This fracture progressed from the inner surface of the web outward through the web and apparently broke through the outer surface at the time of the failure. This fracture was concealed from detection during ordinary inspection, as there was no crack in the outer surface at the time of the last inspection prior to the time of the accident; however, work reports filed after the completion of the last four trips prior to the one involved indicated that the left crosshead pin was working loose. The condition of the main-rod brasses indicated but little pounding; therefore, it is reasonable to assume that flexing of the

metal surrounding the fracture was a factor to be considered concerning the loosening of the crosshead pin. Since the crosshead pin was found loose on successive trips, it appears that the pin should have been removed for examination. Had such action been taken, it is possible the defective condition of the crosshead might have been detected.

Cause

It is found that this accident was caused by a passenger train striking a cylinder head which had been thrown from an engine on an adjacent track.

Dated at Washington, D. C., this thirty-first day of December, 1941.

By the Commission, Commissioner Patterson.

(SEAL)

W. P. BARTEL,

Secretary.