INTERSTATE COMMERCE COMMISSION

REPORT OF THE CHIEF OF THE BUREAU OF SAFETY COVERING THE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE PENNSYLVANIA RAILROAD NEAR EDINBURG, IND., ON SEPTEMBER 17, 1921

NOVEMBER 26, 1921

TO THE COMMISSION

On September 17, 1921, there was a derailment of a passenger train on the Pennsylvania Railroad near Edinburg, Ind., resulting in the death of 1 employee and the injury of 3 mail clerks and 2 employees. This accident was investigated in conjunction with representatives of the Public Service Commission of Indiana.

LOCATION AND METHOD OF OPERATION

This accident occurred on the Louisville Division of the Southwestern Region, extending between Indianapolis, Ind., and Louisville, Ky., a distance of 110 miles, and in the vicinity of the point of accident is a single-track line over which trains are operated by timetable, train orders, and a manual block-signal system. The accident occurred at bridge 18, located about one-half mile north of Edinburg, approaching the point of accident from the south there is a tangent, approximately one-half mile long, followed by a 1-degree curve to the left, 1,008 feet in length, and about 450 feet of tangent to the point of accident. The grade in the vicinity of the point of accident is 0.43 per cent ascending for northbound trains. The track in this vicinity is laid with 85-pound rails, 33 feet in length, with 18 or 19 hardwood ties to the rail and, approaching the bridge, the ballast is of gravel about 16 inches in depth, the track was maintained in good condition. Just in advance of bridge 18 there is a trailing-point switch for northbound trains which leads to a siding to the left of the main track, the frog of the switch is 173 feet south of the bridge.

Bridge 18 spanning the Blue River, was 259 feet in length, and was composed of two through pin-connected truss spans, each span 126 feet 3 inches long, which were erected at the point of accident in 1892. The supports consisted of a stone abutment at each end and a pier at the center, of native limestone, built about 1854, no masonry repairs have been made since new coping or top courses

were placed in 1892, except one stone placed in 1916 The center pier extends about 12 feet above normal low water, it is 22 feet long 14 feet wide at the base, and 7 feet wide at the top The weather was cloudy at the time of the accident, which occurred at about 8 55 p m

DESCRIPTION

Northbound passenger train No 327 consisted of 1 mail car, 1 combination car 1 coach, 1 Pullman parlor car, and 1 Pullman sleeping car, all of steel construction, hauled by engine 8579, and was in charge of Conductor Lott and Engineman Bennett This train left Edinburg at 8 52 p m, on time, and was derailed at bridge 18 while running at an estimated speed of 30 miles an hour

Engine 8579 was derailed to the right, turning almost bottom up as it dropped into the river, and came to rest with the center of the boiler on the riprap on the east or right side of the center pier, its right side being partly supported by the crumbled east end of the pier, the tender remained coupled to the engine and came to rest on its side, almost entirely submerged The mail car was also on its right side, the head end being entirely submerged, while the combination car was leaning to the right, with the front end extending over the south abutment and the forward trucks hanging in place The engine and mail car were considerably damaged Both spans of the bridge were demolished The employee killed was the engineman

SUMMARY OF EVIDENCE

Fireman Prinz stated that while working on the fire, at which time the train was in the vicinity of the switch located just in advance of the bridge, he noticed that the front truck of the tender was derailed He said he crossed over to the engineman's side and notified the engineman, who shut off steam and applied the air brakes in emergency Fireman Prinz said he then noticed the tender surge toward the right and thought it struck the right side of the bridge, knocking the south span off the abutment Conductor Lott and Brakeman Huckleberry found the track damaged south of the bridge, the conductor also saying the east rail had been turned over None of these members of the train crew expressed any opinion as to the cause of the accident

Trainmaster Kelly said he thought something had dropped on the track inside of the west rail, about 9 feet north of the frog of the switch, and on the gauge side of this rail there was a single line of wheel marks extending to the bridge The east rail was turned over from opposite this point to the south end of the bridge, while the east ends of the ties near the bridge were badly damaged Train-

master Kelly examined the trucks of the tender and mail car, but was unable to find anything which could have caused the accident, neither did he find anything wrong with the track He thought the derailment of the tender, due to some unknown cause was responsible for the accident, and that the right side of the steel end sill on the forward end of the mail car struck the southeast batter post of the south span of the bridge, breaking the batter post and causing the collapse of the south span There was also a mark on the right side of the wooden pilot beam of engine 8579, which indicated it had received a very hard blow, and it was Trainmaster Kelly's opinion that the pilot beam, striking the batter post of the north span and breaking it, as the engine was turning over, caused the collapse of the north span He did not think the engine had been derailed at any time prior to its turning over Supervisor Whisman said he did not find any marks of derailment on any of the bridge ties

Division Engineer Johnston said it was very unusual that the mail car should have been deflected 5 or 6 feet out of line, and thought that no ordinary obstruction, or one pair of wheels derailed, would have deflected the car in this manner He was unable to find any evidence of an obstruction, neither was he able to find any cause for the derailment of the mail car, he thought, however that this car struck the end post of the bridge

Inspection disclosed that on the west side of the track the first wheel marks appeared on a tie on the gauge side of the rail and extended from the frog of the switch to the head block tie at the south end of the bridge, to which the outer guard rails were bolted, at no point were these marks more than 8 inches from the rail On the opposite side of the track the receiving end of the rail opposite the frog remained intact, but the leaving end and the two following rails were overturned to the right, wheel marks appearing on the webs of these overturned rails The portion of track immediately adjacent to the south abutment of the bridge was pulled to the right, the ties having been moved in the ballast

The single line of marks on the gauge side of the left rail constituted the only wheel marks on all of these ties, the east ends of the ties were bunched and badly scraped When the combination car came to rest, the cellar containing the batteries was resting on the south abutment, and apparently this cellar had caused the damage to the ties Of the bridge ties, the first and second ties beyond the head block tie could not be identified, while a short section from the center of the span was still in the river, with the exception of the head block tie, no wheel marks were found on any of the bridge ties which would indicate that any part of the train was off the track while on the bridge, prior to the collapse of the bridge

Apparently none of the equipment which was on the bridge when it collapsed was derailed until that collapse took place, throwing the engine, tender, and mail car to the right, and causing the shifting of the track and the turning outward of the right rail An investigation into the reason for the collapse of this bridge was conducted by Mr James E Howard, engineer-physicist, whose report immediately follows

REPORT OF THE ENGINEER-PHYSICIST

The accident to train No 327 at bridge 18 near Edinburg, Ind, on the night of September 17, 1921, is believed to have been due to the failure of the center pier of the bridge The engine tender, and first car of the train were precipitated into the bed of the Blue River, carrying with them both spans of bridge 18 The easterly and upstream end of the center pier was demolished Reasons which support the deduction that the accident was caused by the failure of the pier due to the crumbling of a portion of it will later be presented

Officially, the Pennsylvania Railroad reached a different conclusion namely, that "the accident was due to a derailment of the tender from cause unknown" The reasons for entertaining this deduction, so far as they are known, will be presented

Those who were among the first to reach the scene of the accident found conditions, briefly, as follows

The engine was lying on its right side on the débris and riprap of the upstream end of the center pier, the tender, still coupled to the engine, was partially submerged in the creek, the mail car, the first car of the train, had its forward end submerged, while its rear end was above water, the combination car, second car of the train had its forward end overhanging the south abutment of the bridge, with trucks derailed, the third car was derailed, the fourth car had its forward truck derailed, the fifth car remained with its wheels on the rails

The derailed portion of the train was thrown or dragged to the east of the center line of the track Both spans of the bridge fell and were partially overturned toward the east, that is, on the side of the demolished part of the center pier The combination car stood at an angle with the center line of the track with its forward end several feet to the east The mail car was on its side, still farther to the east The mail car and tender were somewhat enmeshed in the trusses of the south span of the bridge The engine occupied the space between the batter posts of the north and south spans of the bridge

Concerning the cause of the accident as it was reached by the officials of the Pennsylvania Railroad (that the accident was due to

a derailment, cause unknown), supporting evidence seems to be primarily wanting in respect to there really being a derailment prior to the overturning of the bridge

Officials of the railroad expressed themselves as follows

The superintendent of the division (assuming there had been a derailment) said he had no opinion as to what caused the derailment

The division engineer was unable to find any cause for the cars leaving the track He did not believe the engine was off the track stated that the mail car in passing over a distance of 160 feet got off the center line of the track to the east some 5 or 6 feet, that the first four bridge ties were either badly chewed up or missing, and that ties beyond the fourth showed no wheel marks

The trainmaster was not able to discover the cause of the accident

The supervisor found no marks of wheel flanges on ties of the south span of the bridge He did not know what caused the accident

The wreck master tried to find a cause for the accident but was unable to do so

The master carpenter found the two south panels of the bridge smashed a little, but with no wheel marks on them

The testimony of these officials confirm the deduction that the cause of the derailment was unknown, provided there was one, and go still further appearing to show there was no derailment On the other hand the fireman of the train involved in this accident testified that the front truck of the tender was off the track The absence of wheel marks on the bridge ties refutes the statement of the fireman

Apparently the masonry support of the bridge spans at the east end of the pier gave way and the engine, tender, and mail car slid off into the water as the trusses partially overturned, and in doing so dragged the cars of the rear portion of the train easterly with them While being dragged over eastward, the mail car, it is believed, came into contact with the southeast batter post of the south span and destroyed it The forward end of the combination car was also dragged easterly, coming to rest in overhanging position on the south abutment with its forward end some 5 feet from the center line of the track The east rail of the track approaching the bridge was overturned in an easterly direction The dragging of the train easterly as the bridge overturned accounts for this condition of the east rail

It is believed that events during the period of the accident occurred substantially as above described and in relative sequence as enumerated

Concerning the structural condition of the center pier prior to the accident, it appeared to have reached a state of partial disintegration, which weakened it and led to its failure

This pier and the abutments of the bridge were built in the year 1854 of native limestone During the long intervening period of time certain of the ashler face stones, in both the abutments and pier were broken into small fragments by exfoliation Stones thus partially broken are deficient in strength, attended with a loss in bonding power between courses In advanced stages of exfoliation the stones practically lose all supporting power and value for engineering purposes Deficiency in strength due to this cause is believed to have prevailed in the center pier when train No 327 entered upon the bridge

In addition to the structural state of the ashler masonry occasioned by its exfoliation the upstream end of the pier showed other unsoundness An interior pocket filled with mud was exposed to view, located above the mean level of the water of the creek but below that of high water Within this pocket of mud there were angular stones Apparently mortar originally used in the interior of the pier had been washed away and replaced by alluvial silt, brought down during high stages of water Beyond this pocket solid masonry seemed to exist

The most plausible explanation of the accident places the responsibility upon the condition of the upstream end of the center pier Its failure would account for the series of events which followed The condition of the masonry of the abutments and the standing portion of the center pier lead to the conclusion that the cause of the accident was the structural weakness and failure of the upstream end of the center pier

Illustrations from photographic prints follow the text of the report, on which are shown the positions of the engine, tender, and portions of the train as they existed immediately after the accident Also there are cuts showing the exfoliation of the stones of the abutments and the location of the mud pocket in the center pier

SUMMARY

Differences of opinion arose in respect to the cause or causes which led to this accident, whether due to a derailment of the train destroying the bridge or failure of the center pier, causing the precipitation of a portion of the train to the bed of the Blue River On the part of the officials of the Pennsylvania Railroad it was generally attributed to a derailment of the train No explanation was advanced as to the cause of a derailment, and, indeed evidence was very scant of there having been one prior to the collapse of the bridge An official of the railroad remarked that he did not believe the engine was derailed It is difficult to see how a remark to the contrary could be made concerning the engine, and also the tender since there were

no wheel marks exhibited by the ties on the south span of the bridge, which of course would have been present had a derailment occurred as the primary cause of the accident

The fractured batter post, at the southeast corner of the bridge, seemed in the minds of the railroad officials to unravel the question concerning the manner in which the bridge fell, and was accepted by some as the primary cause of the accident It had been struck by the mail car without doubt and destroyed by the blow In the sequence of events which attended the accident the thought does not seem tenable, however, that the forward car of the train could have been diverted several feet from the center line of the track with the engine and tender still on the rails There was no evidence that the train separated and emergency brakes automatically applied in consequence of the separation, nor was there any obstruction found which would divert this car to such an extent

Examination of the testimony does not permit concurrence with the views of the officials of the Pennsylvania Railroad in that a derailment was the cause of the collapse of the bridge The position of the train, together with the condition of the track approaching the bridge, the overturned spans and the crumbled upstream end of the center pier lead to another explanation as to the primary cause of the accident

The engineer-physicist has presented an analysis of the case in which the failure of the masonry of the center pier appears as the primary cause a deduction based upon evidence presented and consistent with known circumstances of the case, and also in harmony with the probable sequence of events as they are believed to have occurred

Parts of the standing masonry of the center pier and the abutments are in a crumbled state It is fair to believe that the upstream end of the center pier prior to the accident was also in a partially crumbled state Built of native limestone, exfoliation and disintegration, due to long exposure to the elements, had resulted The masonry was built 67 years ago It also appears that, due to successive stages of high water in the Blue River some of the mortar of the interior of the pier had been washed away and a deposit of alluvial silt taken place in a pocket located in the upstream portion of the pier

The explanation which is in harmony with known facts places the responsibility for the accident upon the failure of the center pier The probable sequence of events attending the accident, briefly enumerated, are as follows That crumbling of the upstream end of the center pier occurred when the train involved in this accident entered upon the bridge the channel support of each span on

the easterly side of the bridge was thus impaired each span of the bridge was partially overturned to the eastward, the floor system rotating almost 90° toward a vertical plane, the engine and tender virtually slid off the bridge sidewise, photographs not made a part of this report show the west rail of the track spiked in normal place on the bridge ties while the east rail was stripped from the ties, the engine in falling dragged the train eastwardly, accounting for the impact between the mail car and the southeast batter post, also causing the deflection of the combination car to the eastward and the overturning of the east rail of the track in its approach to the south abutment of the bridge

In conclusion, it is therefore believed that this accident was due to the failure of the upstream end of the center pier, the masonry of which had been weakened by the partial disintegration of the limestone ashlar masonry, successive high stages of water also having washed away some of the mortar from the interior of the pier, and in this weakened state failure occurred

Respectfully submitted

W P Borland,
Chief, Bureau of Safety

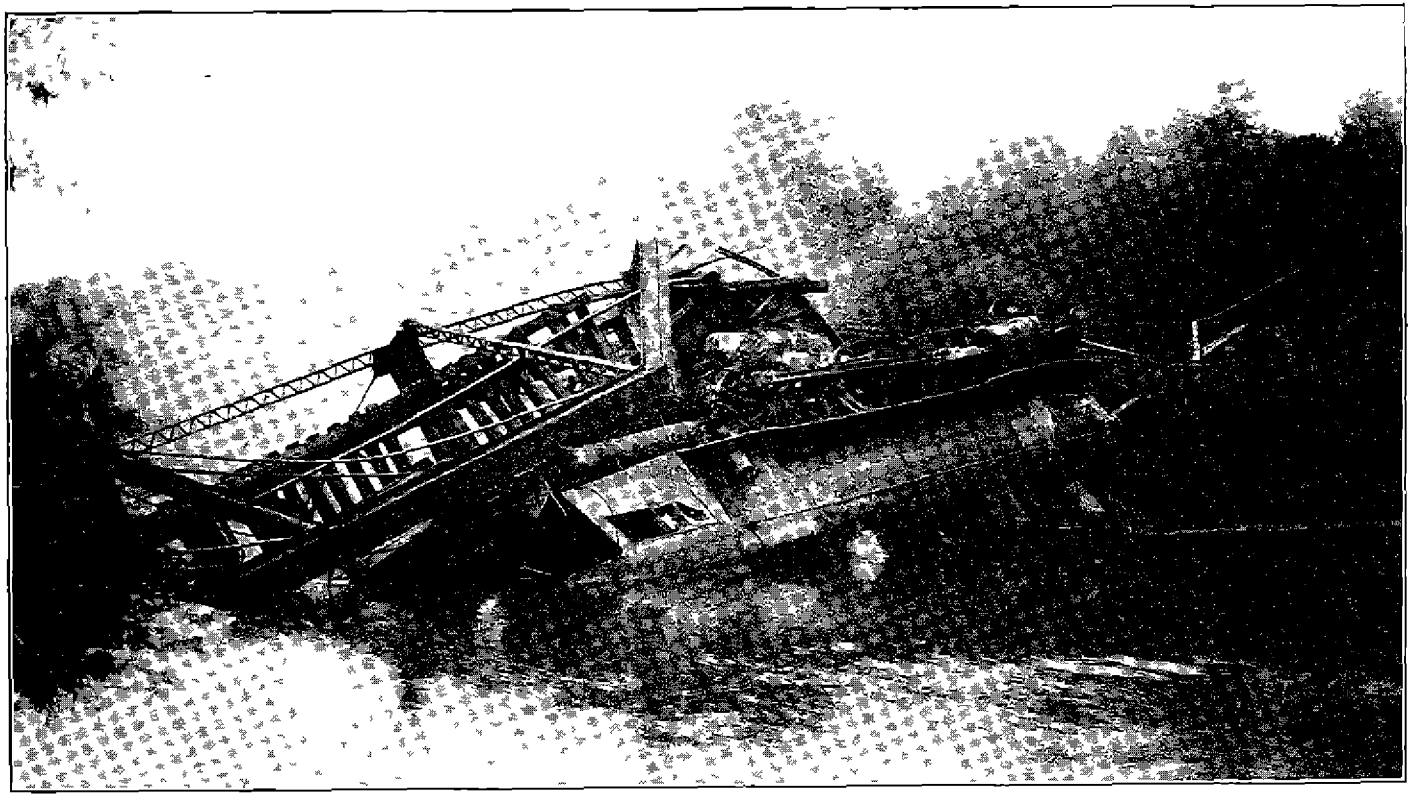

FIG 1—VIEW OF OVERTURNED ENGINE RESTING ON PARTIALLY DESTROYED CENTER PIER OF BRIDGE AND RIPRAP FOUNDATION SHOWING ALSO OVERTURNED TRUSSES OF BOTH SPANS FLOOR TIES NEARLY IN VERTICAL PLANE

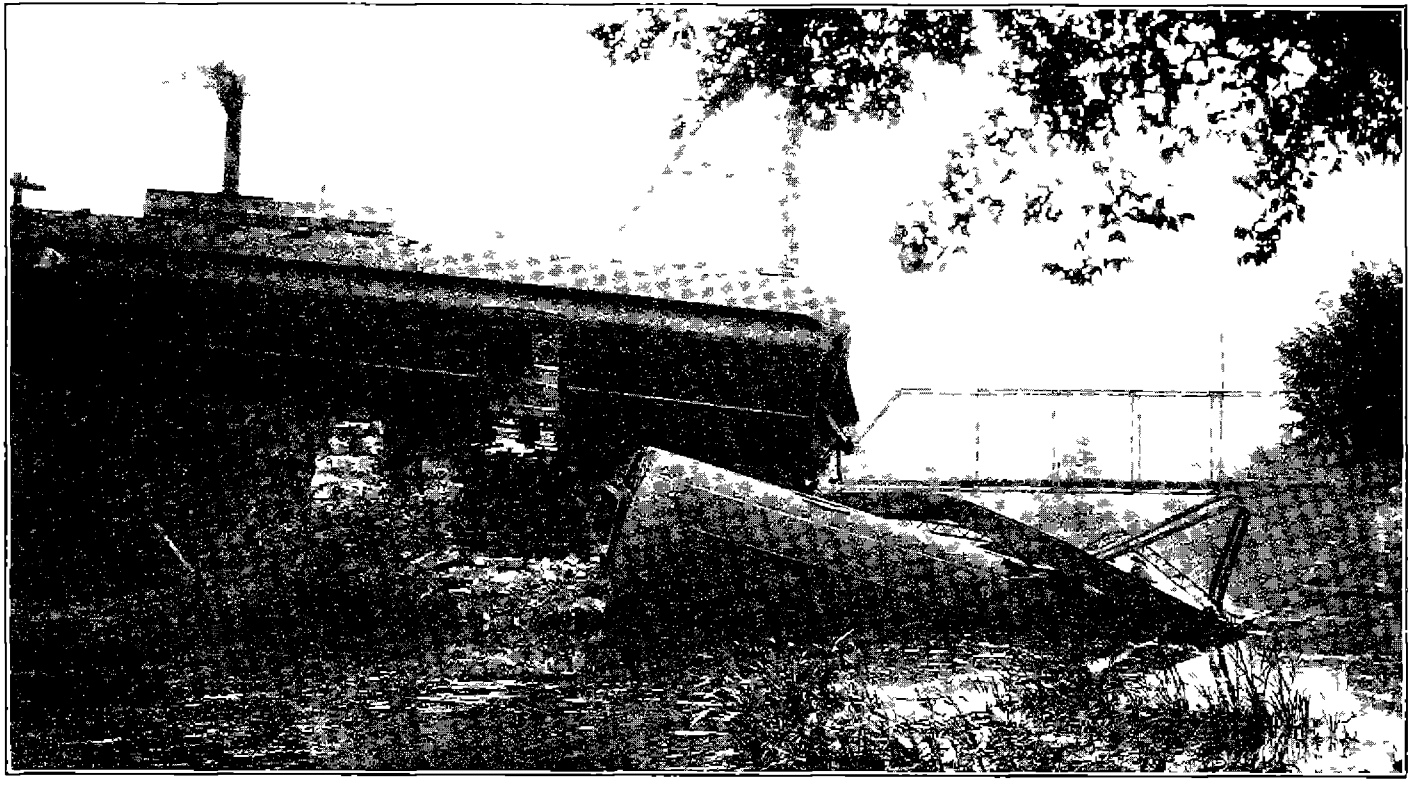

FIG 2—VIEW OF PARTIALLY SUBMERGED MAIL CAR WITH COMBINATION CAR OVERHANGING THE SOUTH ABUTMENT OF THE BRIDGE

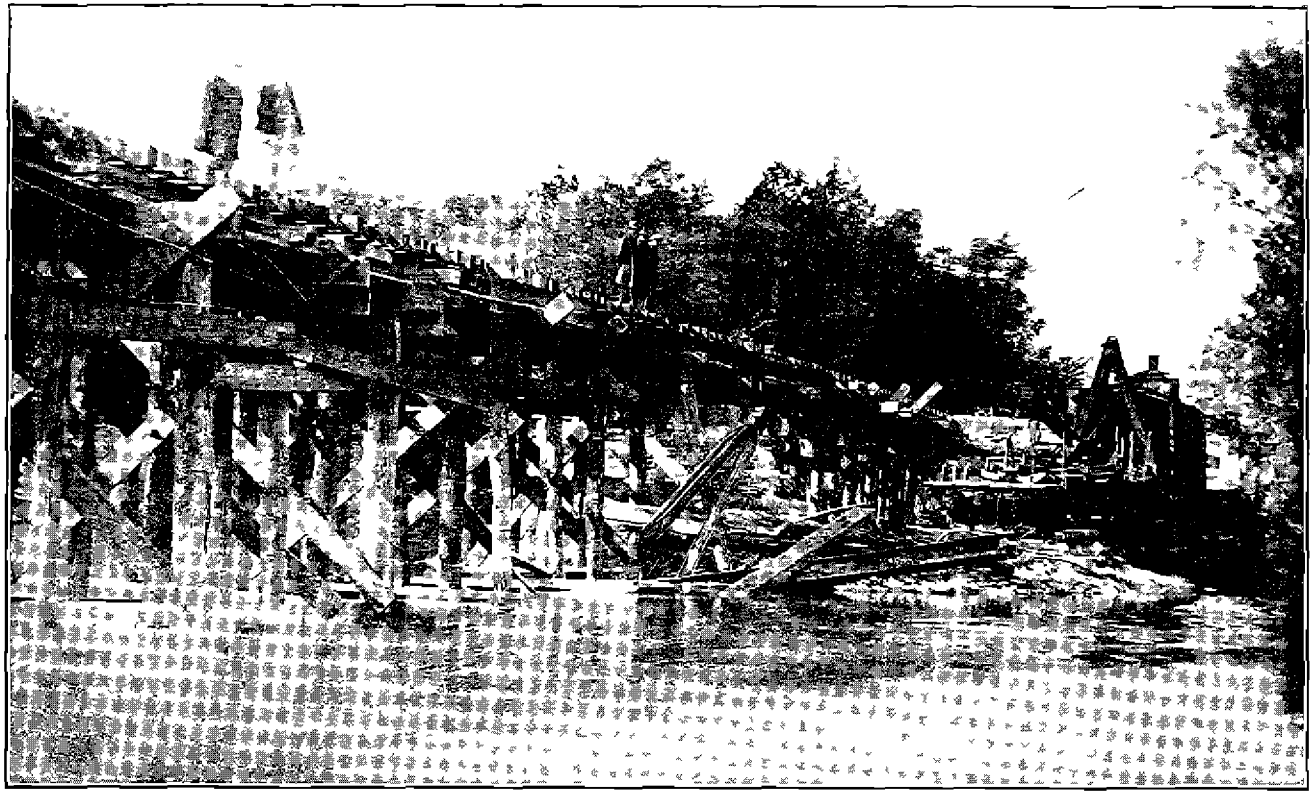

FIG 3—VIEW CENTER OF CUT OF PARTIALLY DESTROYED CENTER PIER UPSTREAM END OF PIER DESTROYED DOWN STREAM END USED WITH TEMPORARY PILE BENTS FOR CARRYING TRAFFIC FAILURE OF THE UPSTREAM END OF THIS PIER REGARDED AS THE PRIMARY CAUSE OF THE ACCIDENT

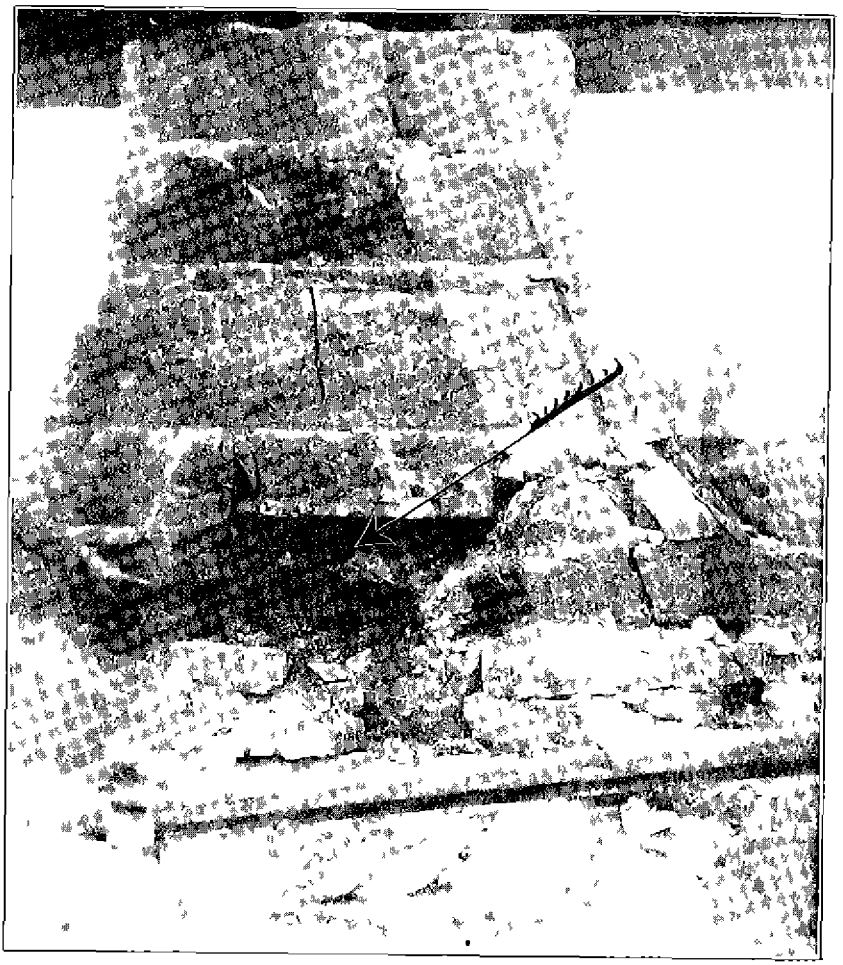

FIG 4—VIEW OF BROKEN FACE OF CENTER PIER ARROW POINTS TO LOCATION OF MUD POCKET IN THE INTERIOR OF THE MASONRY

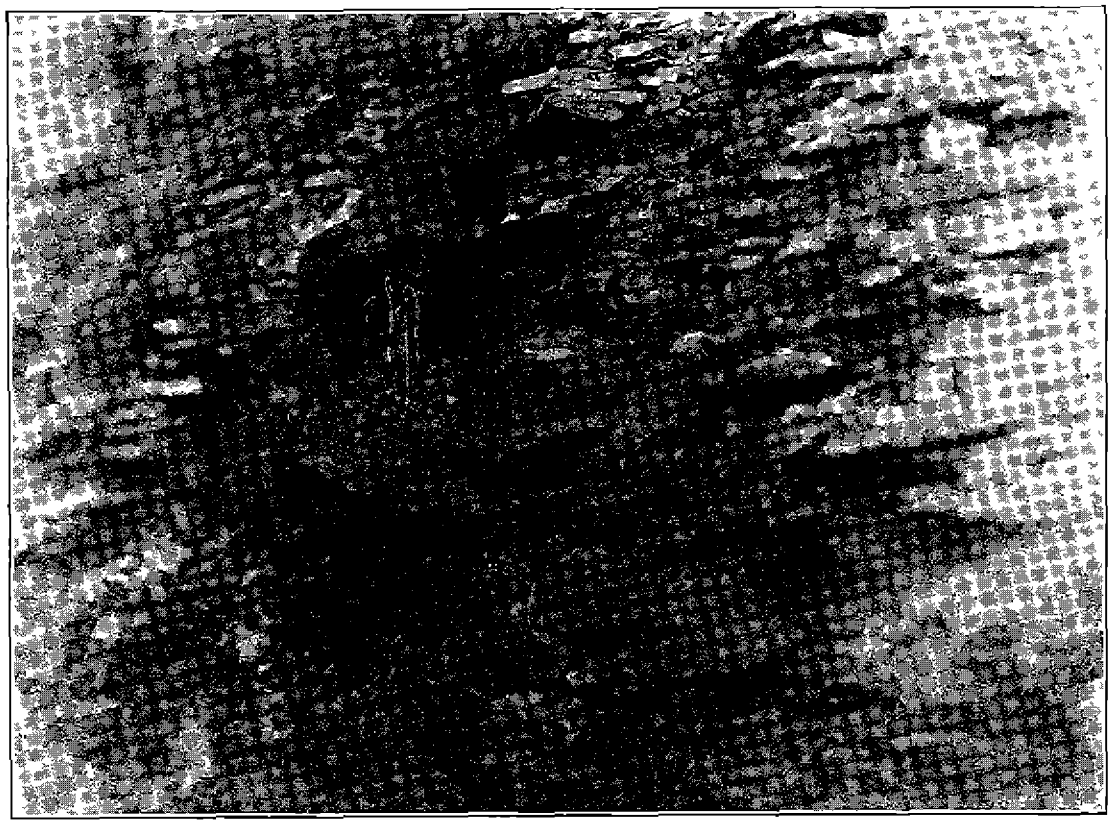

FIG 5—VIEW OF FACE OF SOUTH ABUTMENT SHOWING DISINTEGRATION OF LIMESTONE ASHLER MASONRY

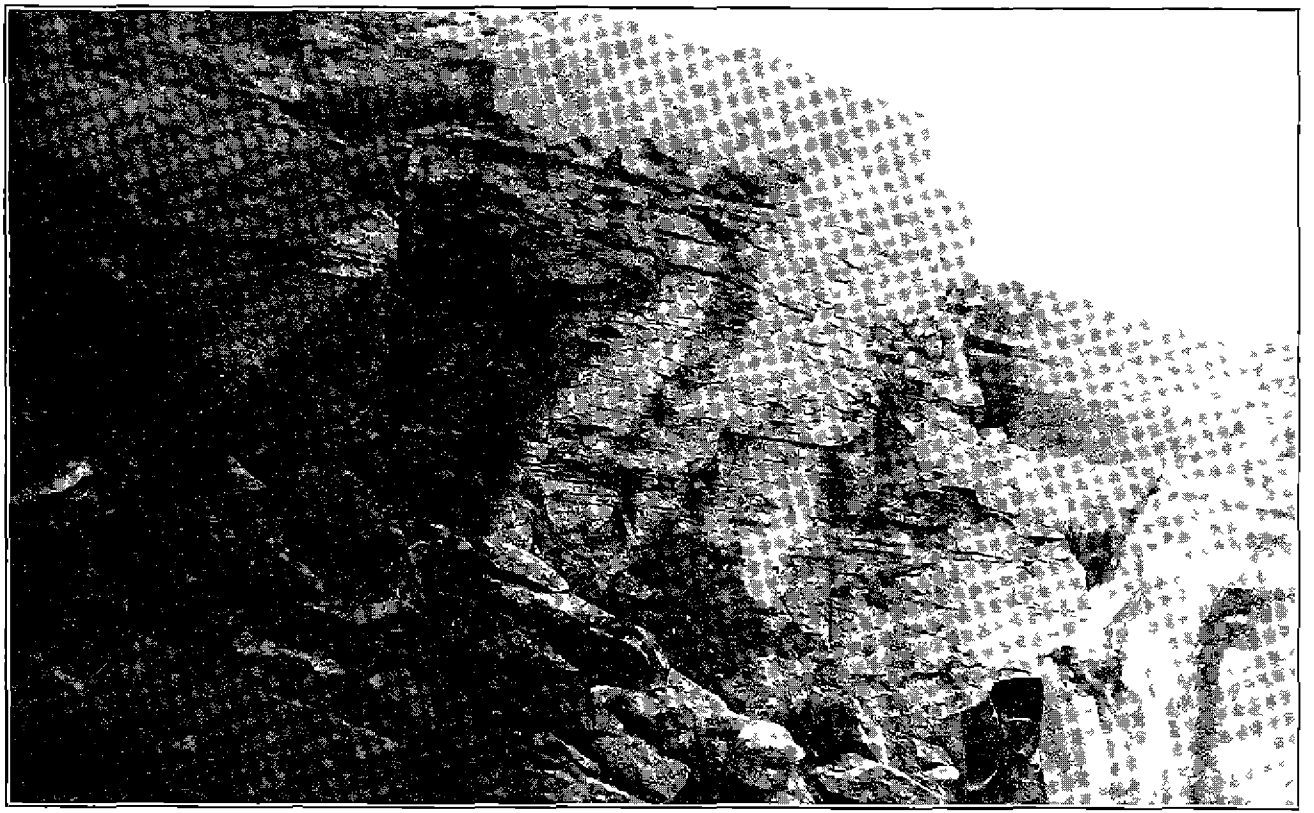

FIG 6—VIEW OF UPSTREAM END OF SOUTH ABUTMENT SHOWING DISINTEGRATED LIMESTONE ASHLER BLOCKS

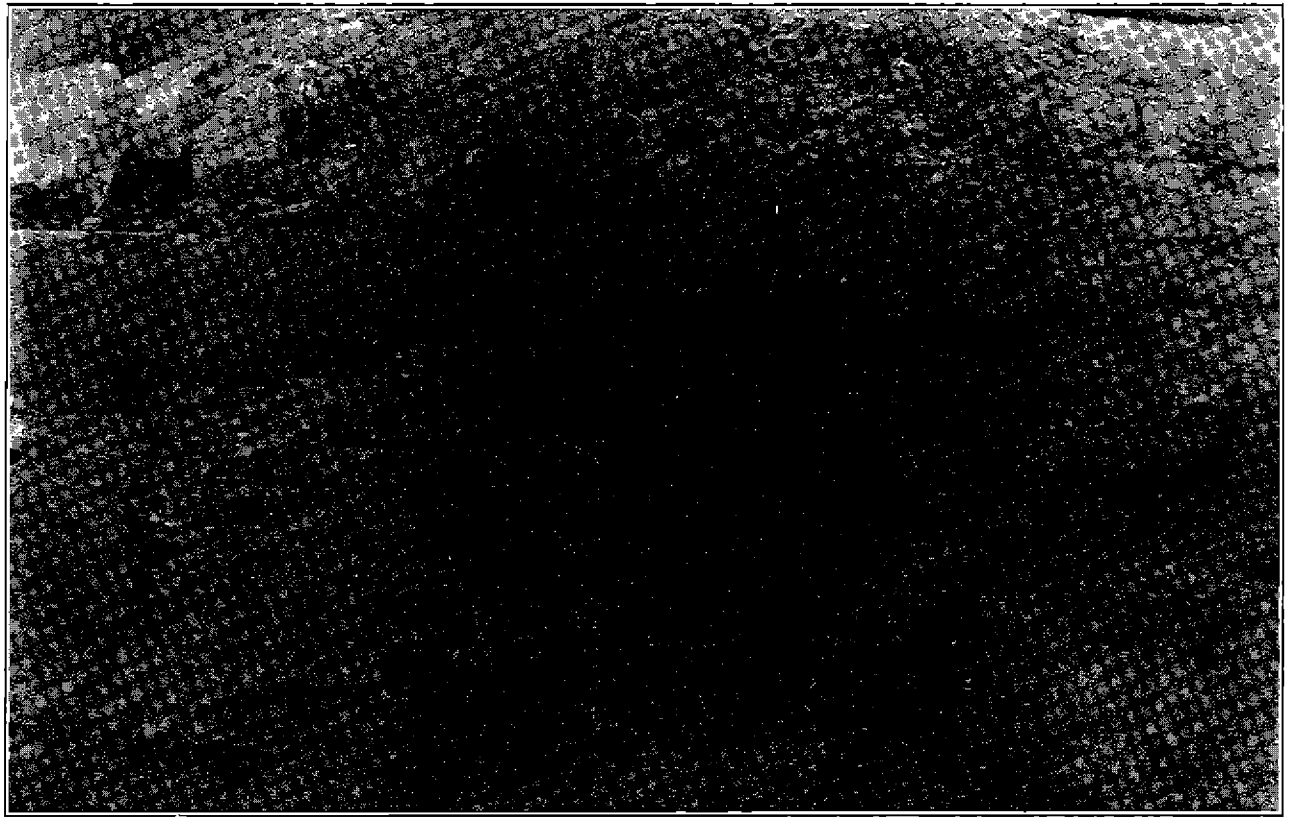

FIG. 7—VIEW OF UPSTREAM END OF NORTH ABUTMENT SHOWING DISINTEGRATED LIMESTONE ASHLER BLOCKS

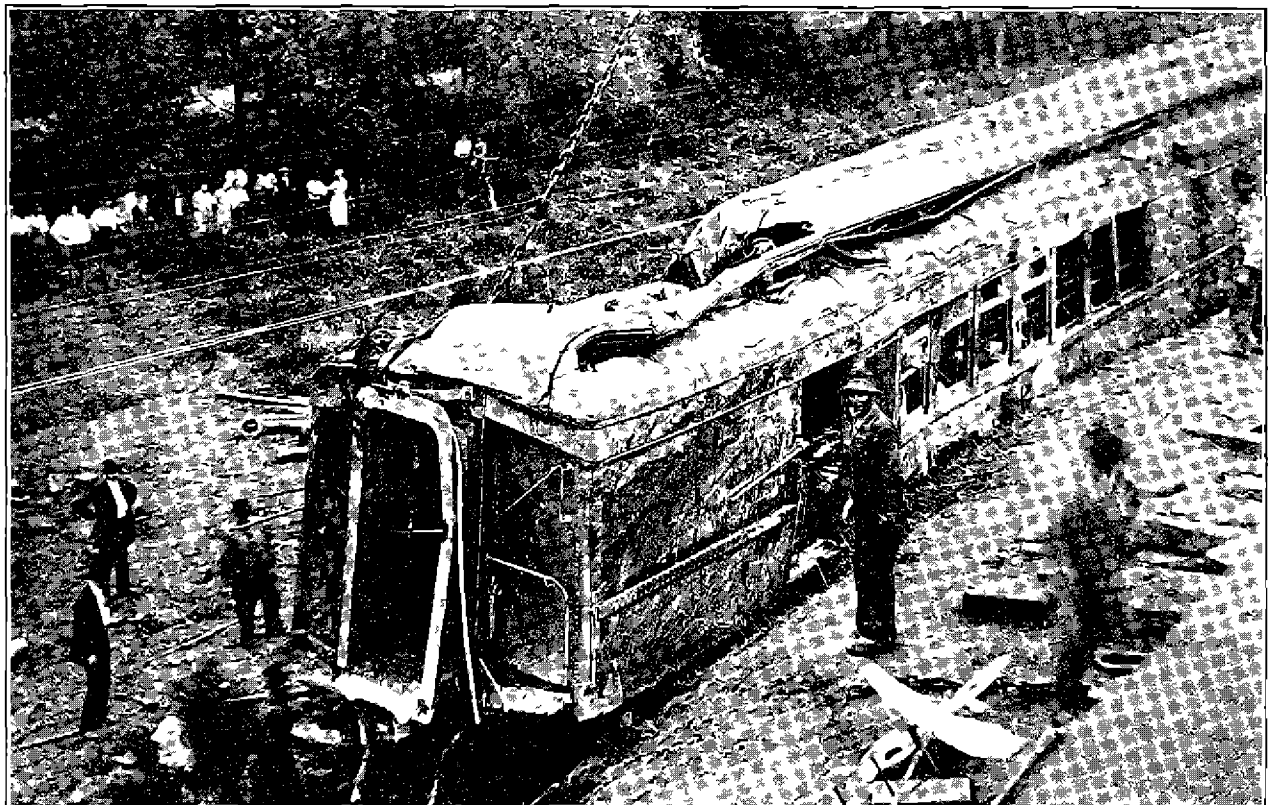

FIG 8—VIEW OF TOP OF MAIL CAR AFTER REMOVAL FROM BED OF CREEK

FIG. 9—FRACTURED BATTER POST SOUTHEAST POST OF SOUTH SPAN RUPTURE OF THIS POST HELD TO BE A SECONDARY FRACTURE INCIDENT TO LOCOMOTIVE PULLING MAIL CAR EASTWARD AGAINST UPSTREAM TRUSS OF SOUTH SPAN

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