INTERSTATE COMMERCE COMMISSION

REPORT OF THE DIRECTOR OF THE BUREAU OF SAFETY IN RE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE MISSOURI PACIFIC RAILROAD AT NEARMAN, KANS., ON FEBRUARY 7, 1925

APRIL 22, 1925

TO THE COMMISSION

On February 7, 1925, there was a derailment of a passenger train on the Missouri Pacific Railroad at Nearman, Kans., the derailed train afterwards colliding with a freight train standing on a passing track. The accident resulted in the death of 4 employees and 2 trespassers, and the injury of 24 passengers, 1 mail clerk, 1 express messenger, 2 employees and 2 trespassers.

LOCATION AND METHOD OF OPERATION

This accident occurred on the Atchison district of the Omaha division, which extends between Kansas City, Mo., and Falls City, Nebr., a distance of 101.33 miles. In the vicinity of the point of accident this is a single-track line over which trains are operated by time-table and train orders, with a manual block-signal system west of Nearman and a controlled-manual block-signal system east of that point. The accident occurred at the west passing-track switch, about 4,000 feet west of the station. Movements of eastbound trains approaching this switch are governed by distant and home signals, these signals as well as the operation of the switch being under the control of the operator at Nearman. There is a lock relay at the switch which prevents the supplying of energy necessary to move the switch from normal position when the detector circuit is occupied or the home signal is not in the stop position.

Approaching this switch from the west the track is tangent for more than 1 mile, while the grade is practically level. The track is laid with 90-pound rails, 33 feet in length, with an average of 20 ties to the rail length, ballasted with about 18 inches of chatts and rock and is well maintained.

The weather was clear at the time of the accident, which occurred at about 3.47 p. m.

DESCRIPTION

Westbound freight train extra 1520 consisted of 80 cars and a caboose hauled by engine 1520, and was in charge of Conductor Green and Engineman Jones It arrived at Nearman at 3 25 p m and entered the passing track at that point for the purpose of meeting train No 104, stopping on the passing track with the engine about 245 feet east of the west switch While standing at this point the head end of the train was struck by the derailed engine of train No 104

Eastbound passenger train No 104 consisted of one baggage car, one combination mail car and coach, and two coaches, hauled by engine 6437, and was in charge of Conductor Travers and Engineman Wodell The first car was of steel-underframe construction, while the others were of all-steel construction Train No 104 left Wolcott, 6 04 miles from Nearman, at 3 39 p m 55 minutes late, and was derailed at the west switch at Nearman while traveling at a speed estimated to have been about 45 or 50 miles an hour

Engine 6437 was derailed to the right, coupled engine 1520 and then turned around and came to rest on its left side, parallel with the main track, headed in a westerly direction The tender of engine 6437 was opposite the engine and about 25 feet to the left of the track, with the baggage car between it and the engine The first two cars and the forward truck of the third car in train No 104 were derailed Engine 1520 was turned over on its left side, while the second car in its train was demolished The employees killed were the two engine crews

SUMMARY OF EVIDENCE

Head Brakeman Neeley, of extra 1520, was standing on the ground on the right side of engine 1520 between the main and passing tracks and on seeing train No 104 approaching he observed that the switch target was displaying a clear indication and that the switch appeared to be in proper condition He crossed the main tracks so as not to be between the two trains and when engine 6437 was about at the frog of the switch he noticed fire flying from the left side of the engine truck and at once got out of the way Afterwards he walked around the rear of train No 104 and examined the switch but found nothing wrong, the rear coach was headed down the main track Conductor Green, of extra 1520, was in the caboose, Flagman Floberg was inspecting the train and had reached a point about 20 or 25 car lengths from the engine at the time of the accident The statements of these employees did not bring out any additional facts of importance Both of them examined the switch shortly afterwards and found it to be properly lined for the main track

Conductor Travers, of train No 104, who was riding in the combination car, estimated the speed to have been about 45 or 50 miles an hour when he felt an application of the air brakes, followed almost immediately by the shock of the collision After the accident he examined the switch and found it lined for the main track and apparently in perfect condition The only marks on the track which he noticed were a few feet east of the switch points, and he was unable to offer any explanation for their presence Flagman Elliott, who was in the rear car, thought there was a service application of the air brakes at a point about 100 feet east of the point of collision As he was starting back to flag after the accident he noticed that the switch apparently was in good condition, and while on the way back he watched the track carefully, but did not see anything to indicate that there had been any dragging equipment Train Porter Coffey, who was riding in the combination car with the conductor, had noticed that the train was approaching Nearman and went to one of the vestibules, opened the door, and looked ahead at the signals, the train then being about 100 yards from the switch He saw extra 1520 standing into clear on the passing track, noticed that the signals were displaying a clear indication, and then closed the vestibule door, at about which time there was a heavy application of the air brakes, followed immediately by the collision The statements of the flagman and train porter as to speed agreed with those of Conductor Travers

Conductor Reagan, who was deadheading on train No 104, said he felt what appeared to be an emergency application of the air brakes and had time to brace himself before the shock of the collision He thought the train might have moved a distance of 50 feet between the time the brakes were applied and the time the collision occurred

Operator Kessler, on duty at Nearman, said extra 1520 arrived at 3 25 p m and that the indicators showed it to be clear of the switches at 3 29 p m At 3 35 p m the operator at Wolcott asked for the block for train No 104 and at 3 39 p m reported the train as being in the block At this time the signal at the west switch at Nearman was in the normal or stop position, and Operator Kessler said he at once obtained the block in advance for train No 104 and then pushed the button to clear the signals at the west switch at Nearman, which he said could not have been done if extra 1520 had fouled the main track

Section Foreman Stewart said he had gauged the switch points at this switch on the day of the accident, finding the gauge to be 4 feet 8½ inches, while the track was also in good condition Shortly after the occurrence of the accident he again examined the switch, but was unable to find anything wrong Signal Maintainer Shaver also said he had made a general inspection of the switch on the day of the

accident and found it to be in good condition, which was also the case when he examined it after the accident

The inspection of the track disclosed that the first mark of any kind was a slight abrasion about 1 inch in length on the top of the switch point on the right side of the track this mark appeared to have been made by something sliding over the point The next mark was a light mark which began on top of the right rail about 14 feet east of the switch point, which might have been made by a wheel flange, this mark extended along the rail only a short distance before the wheel which made the mark appeared to have dropped off on the outside of the rail, continuing along the base of the rail until it encountered the first stop block of the frog It then struck and bent the frog spring, made a mark across the next stop-block housing, and jumped to the end wing rail, then ran along on the inside of the left passing-track rail for a distance of about 18 feet to where it apparently jumped over to the opposite side of this rail without leaving a mark of any kind on the rail There were also marks on the left passing-track rail beginning 41 feet from the switch point and continuing for a distance of 16 feet, these marks appeared to have been made by something moving eastward on the main track The first marks on the left side of the main track were at a point 24 feet east of the switch point, where two bolts were sheared off on the inside of the rail, and there were then flange marks inside of that rail continuing to where the wheel making the marks came in contact with the wing of the guard rail, then continuing on a line almost parallel with the passing track until a point was reached where the track was entirely torn up

Engine 6437 is of the 4–6–2 type, with a total weight, engine and tender loaded, of 422,000 pounds It had traveled about 4,000 miles since receiving general repairs With the exception of the engine truck nothing was found which it was thought could have had any bearing on the occurrence of the accident The examination of the engine truck showed that the male and female castings fitted properly and that the truck appeared to be carrying the proper amount of weight The engine truck boxes showed practically no wear, while there was no evidence that any of the boxes had been running hot The wheels were in good condition except that there was some wear on the left front engine-truck wheel, this wear was uniform throughout the circumference of the wheel and apparently was not the result of a slight bend which was found to exist in the axle and which is believed to have been a result of the accident rather than a condition which existed prior to its occurrence The wheels were also found to be in proper gauge with the exception of those on the bent axle The right engine-truck binder was broken at a point just back of the forward pedestal, but

the opinion of most of those who examined it seemed to be that it was not the cause of the accident

Engine 6437 had been received from the shops on October 29, 1924, and Road Foreman of Engines Leathers said that the last time he rode on the engine was in January, 1925 The flange of the left front wheel at that time was showing a tendency to wear, and he had been keeping it under observation, his last examination of it having been made either on the first or second day prior to the accident, at that time the flange was not even close to taking the gauge He was unable to account for the tendency toward wear on this particular flange After the accident Mr Leathers made a careful examination of the engine, but he said he did not know what caused the accident, while so far as the track was concerned it appeared to him to be as nearly as possible in perfect condition Master Mechanic Callender and General Mechanical Inspector Martin were among those who made very detailed examinations of engine 6437, and they stated that they had formed no opinion as to the cause of the derailment

The facts and circumstances developed by the investigation indicated that the probable reason for the derailment of train No 104 was the failure of some part of the engine truck of engine 6437, and subsequent investigation into this feature was conducted by Mr James E Howard, engineer-physicist, whose report immediately follows

REPORT OF THE ENGINEER-PHYSICIST

The circumstances attending the derailment of eastbound passenger train No 104, and the collision of its engine, No 6437, with freight engine 1520, standing on a passing track, were as follows

Freight train extra 1520, westbound, consisting of 81 cars, was at rest on the passing track, located on the south side of the main line of the Missouri Pacific Railroad, Omaha division, Atchison district, at Nearman, Kans Engine 1520, attached to its train, stood in the clear some 200 feet, more or less, from the point of the switch rail leading from the main line to the passing track The distance from the center line of the main track to the center line of the passing track was 12½ feet, as shown on a blue print furnished by the railroad company

Eastbound passenger train No 104, hauled by engine 6437, approached the scene of the accident at a speed probably of 50 miles per hour The track was straight in this vicinity Engine 6437 swerved from its course, to the right, left the main-line track, crossed over, and obliquely collided with engine 1520 on the passing track

The force of the impact was very great The freight engine was forced backward, destroying a coal car, and was knocked over on its left side Engine 6437 had a decided list to the right at the time it

collided with the freight engine The shock of impact caused it to turn end for end, it came to rest on its left side, facing toward the rear

The main-line track approaching the passing track from the west showed no signs of injury incident to the derailment There were minor injuries to the track from the switch point eastward to a point beyond the frog The marks of blows on the switch rail, at the frog, and on the end of the guardrail were comparatively insignificant in respect to offering adequate resistance to deflect this engine, weighing 259,000 pounds, of which 47,000 pounds weight was on the engine truck, traveling at a rate of about 70 feet per second, and cause it to collide in so short a distance with the engine on the passing track Beyond the frog the rails and ties were torn up as the engine plowed into the roadbed

Some premonitory warning was given the engineman of train No 104 of impending danger, and one or two seconds of time elapsed between his application of brakes and the instant of impact with the freight engine Whatever the foreboding signs consisted of, evidence does not place responsibility upon the track, which after the derailment was found in good condition up to and immediately beyond the frog of the passing track

All circumstances attending the derailment point to the proximate cause as being some condition located at the right forward side of the engine truck, and furthermore of sufficient gravity to account for the sudden swerving of the engine from its direct course The engine encountered sufficient resistance in the bunched ties, bent rails, and plowed roadbed to account for its deflected course after it was derailed, but track conditions did not account for its leaving the rails The cause of derailment evidently was located on the engine itself, specifically at the front end, right-hand side, to meet obvious circumstances of the accident

Examination of the forward axle of the engine truck showed a bend in the left journal, representing the result of a force which apparently acted against the right end The truck frame was bent at three of its corners At the rear right-hand corner the frame was bent through an angle of 3½ degrees, at the forward left-hand corner, 2½ degrees, at the rear left-hand corner, 2 degrees These bends were upward with respect to the central part of the frame Increased weight apparently had been thrown upon these three corners of the truck frame at some stage of the derailment The forward right-hand corner not having been bent is taken to signify that the support of the truck at this corner was lost The extra weight thrown on three corners bent those of the left-hand side nearly equal amounts but caused a greater bend on the single corner of the right-hand side

Associated with the events which took place about the time the truck frame was bent was the fragmentation of the pedestals, stripping them from the truck frame, and the distortion of the binder straps The forward axle, together with its boxes and collars, was detached from the frame, wrenched apparently around to the right, subsequently the right-hand pedestal jaws being closed in at their upper ends, as shown by subsequent examination

Further evidence was presented by the details of the front right-hand corner of the truck of earlier occurrences and which from their nature are believed to represent the incipient stages of the destruction of the truck and comprise the parts which were the first to fracture

The loop of the lower leaf of the semielliptic spring, front end, which seats in a hanger suspended from the equalizer bars, was broken off, presenting in part a newly fractured surface The pocket of the hanger indicated the end of the spring had been drawn over the retaining lip, and therefore relieved of its bearing at its forward end This circumstance calls for some still earlier condition which would permit such an event to take place

It was demonstrated by test of the spring, loading it with 11 tons that the lower leaf would still retain a concave shape and therefore tend to remain in its seat in the spring hanger, notwithstanding the fracture of the loop or in its absence Measured on a chord of 30 inches from end to end of the spring, the versed sign of the arc was 1¾ inches when the spring was under 11 tons load

The antecedent incident, necessary to account for the sequence of events as they are believed to have transpired, appears to be presented in the fractured bolt from which the forward spring hanger was suspended This bolt, which secured the two equalizer bars, was broken at its inside end at the root of the thread on which a nut was used, the nut being retained in place by a cotter pin

The fracture of this bolt permitted the forward ends of the equalizer bars to spread and also bend into a warped shape, unseating them on the journal box and leading to the detachment of the forward end of the truck spring This suspension bolt is a vital member in the construction of the truck, and its fracture seems to afford an adequate explanation of the failure of the truck

The shank of this bolt was larger than its threaded end Its reduction in diameter to the size of the nut and the cutting of the thread introduced an unnecessary element of weakness The bolt did not exhibit a sheared fracture, but one in which alternate pressure on one side and then the other of the nut culminated in rupture The element of danger pertaining to the use of sharp shoulders in a sudden change in the cross section of a member is too well known to require further comment

Concerning the general condition of the equalizer bars, they were members which had been subjected to considerable wear at their ends, where they seated on the journal boxes The upper side of each journal box was recessed to receive lugs on the ends of the equalizer bars The forward right-hand journal box, the one immediately involved in the accident, showed that one of the equalizer bars had left its seat at some time and had ridden on the top surface of the box at the edge of the recess The bottom of the recess on that end of the box showed a depressed area, unlike the smooth seat of the opposite bar These unevenly worn seats were undoubtedly of long standing Their condition would account for unfavorable strains being put upon the bolt of the forward spring hanger, racking and swaying strains calculated to fracture the bolt at the root of the thread at the place where rupture actually occurred

Lugs had been jump welded on the ends of the equalizer bars to compensate for those which had been worn in service

A group of seven cuts are presented illustrating the appearance of the track in the vicinity of the derailment the conditions of the engines after the accident the bent shapes of the equalizer bars, showing the position of the fractured spring-hanger bolt, and its relation to the forward, spread ends, of the bars, the battered seats of the forward right-hand axle box, and where one of the equalizer bars had ridden on the upper surface of the box at the edge of the recess, also showing the semielliptic spring of the right-hand side, the loop at the forward end of the lower leaf having been fractured

The essential evidence of the cause of the derailment is believed to be shown in the three photographic cuts numbered 5, 6, and 7, respectively, indicating the fracture of the spring-hanger bolt as the incipient and originating cause of the accident

This engine is stated to have been built by the American Locomotive Co Schenectady, N Y, and furnished the Missouri Pacific Railroad Co in June, 1913 In its construction through bolts were in general supplied with check nuts The check nuts were found firmly jammed against their principal ones It was noticed, however, that many of the nuts were not set up against the members they were intended to secure Some looseness could be accounted for by reason of the bending or fractures of the bolted members at the time of the derailment Independent of such overstraining, the seats of the nuts showed wear, indicating that looseness of the bolted parts had existed at the joints preceding the derailment

CONCLUSIONS

An accident of this kind presents incidents the explanation of which is likely to be in some degree speculative Tangible evidence

of what happened was concentrated in a mass of débris, in which but a few seconds of time elapsed between the incipient and final stages of the display of destructive forces

In the present derailment all known circumstances pointed conclusively to the inference that the primary cause was located in some detail of the engine and not in the condition of the track Furthermore, that trouble originated in the forward right-hand side of the engine The derailed train was moving at a high rate of speed, very properly so in respect to track conditions, and was suddenly deflected from its course The force necessary to cause this sudden change in direction was one of great magnitude

The engineer-physicist has analyzed conditions pertaining to the track and to the engine and has endeavored to discriminate between secondary and principal events leading up to the derailment Some of the fractured members could only represent secondary events

It was necessary to look for a primary cause from which other events could reasonably be supposed to follow in certain sequence Tracing events in reverse order they led apparently to the fracture of the spring-hanger bolt in the right-hand forward end of the equalizer bars The fracture of this bolt was, therefore, regarded as the primary cause of the accident The forward ends of the equalizer bars were thus permitted to spread and were somewhat warped by the weight upon them which became an oblique force They were unseated from the axle box The fracture of the hanger bolt led to the release of the truck spring, attended with the fracture of the loop at its lower leaf The right wheel of the forward axle encountered resistance of the ties and ballast, bending the axle at the left-hand journal At some stage the load on the truck frame was concentrated on three corners, bending them upward, the forward right-hand corner at the time being free from load Conditions as here enumerated would adequately explain why the engine was so suddenly diverted from a straight course to an oblique one, leading it into collision with the freight engine on the passing track The engineman of the passenger train was apparently cognizant of the initiation of some of these effects and applied the brakes perhaps earlier but not later than when the passing-track switch rails and frog were reached

The inference that the initial fracture and cause of the accident was the breaking of the right, forward, spring-hanger bolt is concurred in, since it appears consistent with the data which have been gathered pertaining to the derailment

Respectfully submitted

W P Borland, *Director*

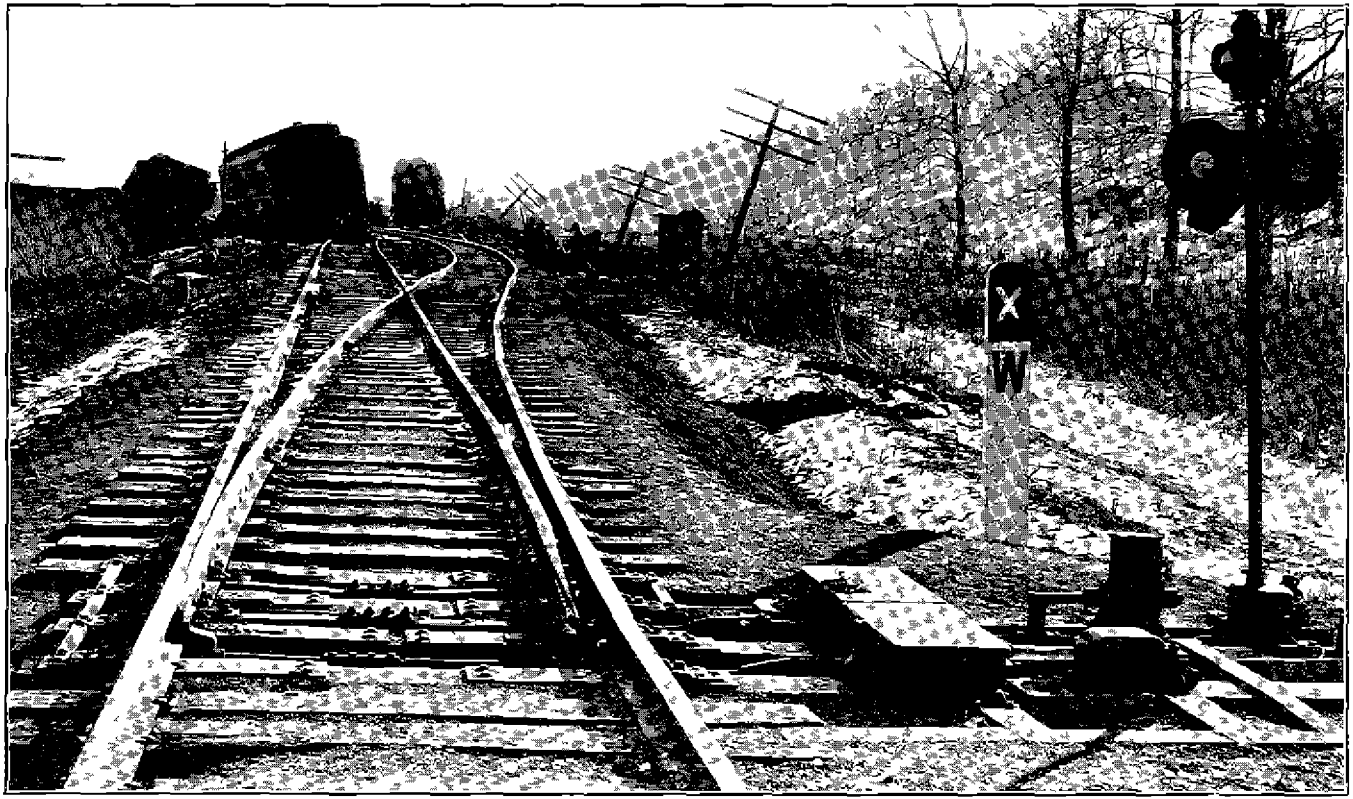

Fig. 1.—View of track at scene of derailment. Passing track arranged as short detour to main line. Photographed after removal of last coach of passenger train which was not derailed. Main line and passing tracks including switch rails and frog, not being injured by derailment

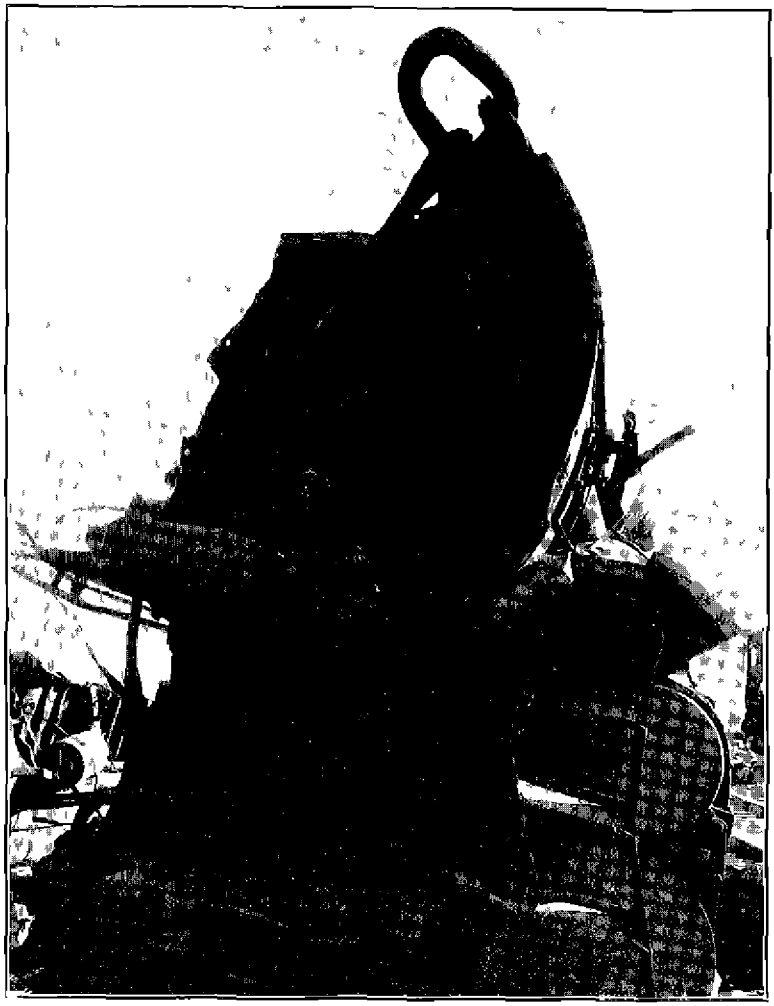

FIG 2.—View of front end of passenger engine 6437 after collision with freight engine 1520 Engine leaned to the right at time of collision Force of impact turned passenger engine end for end it coming to rest on its left side

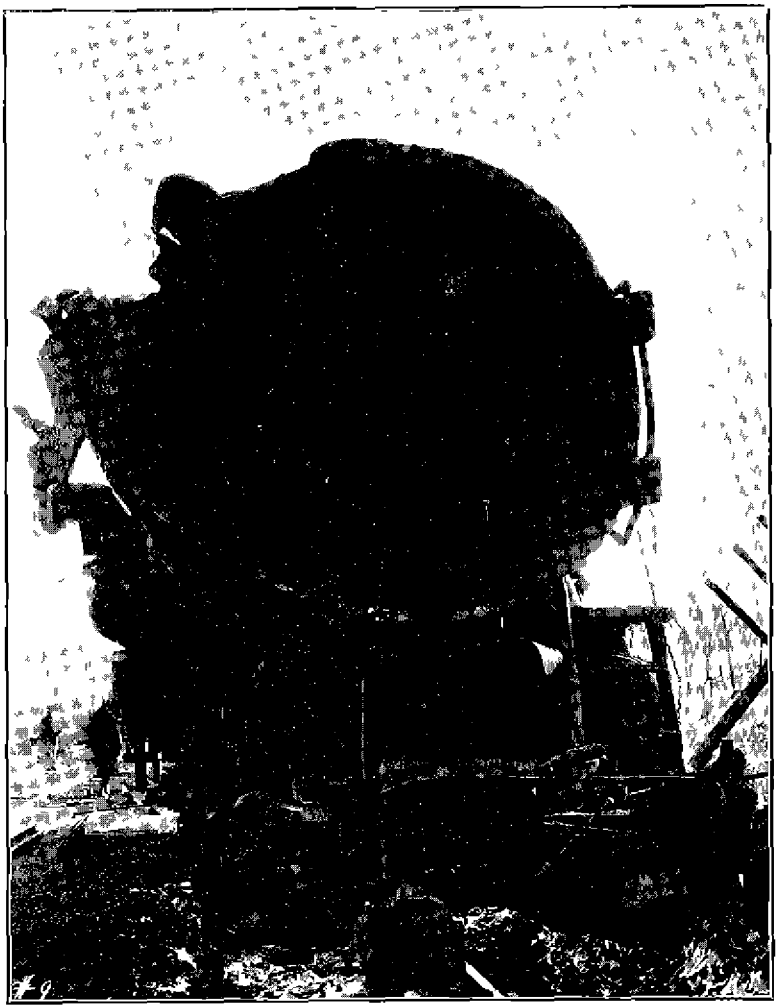

FIG 3.—View of front end of freight engine 1520. Force of impact of passenger engine drove this engine to the rear, destroying a coal car behind it, forcing this engine over on its left side.

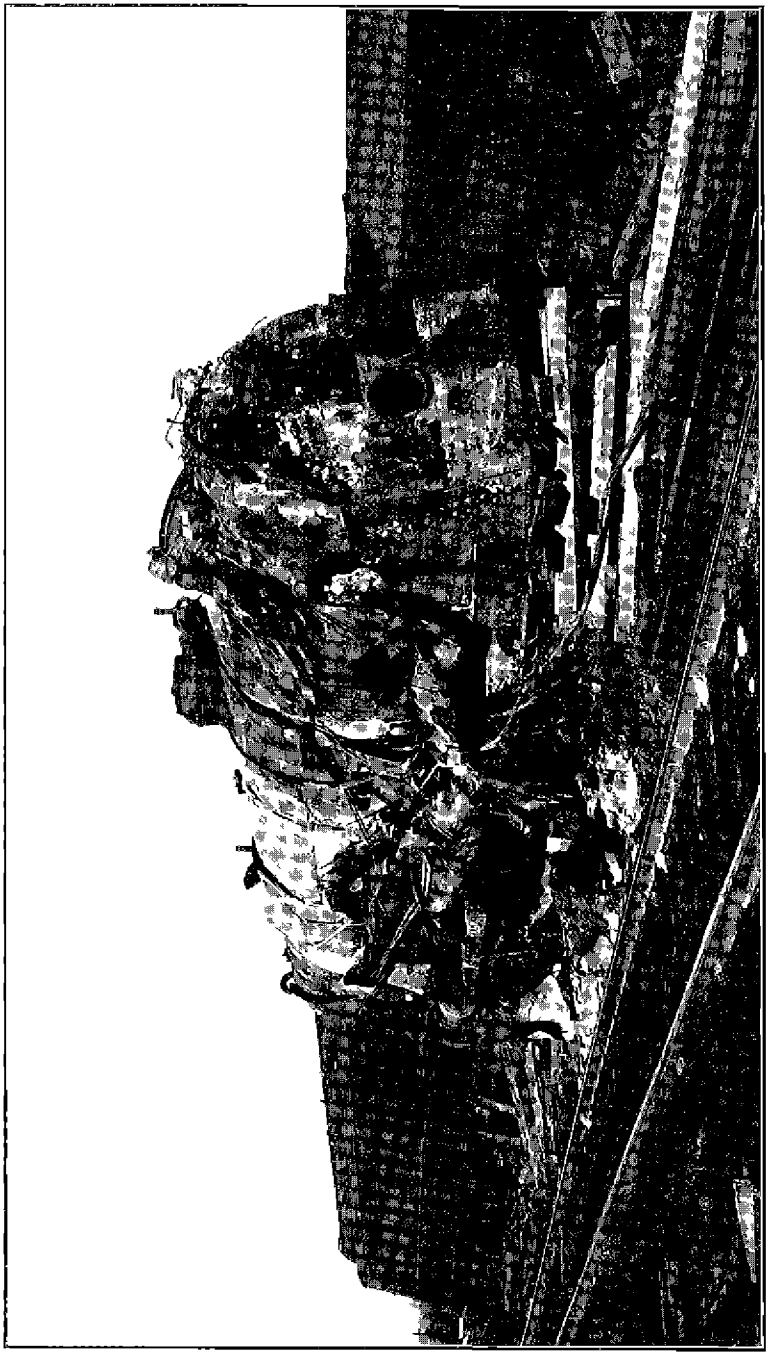

FIG 4.—Appearance of passenger engine 6437 left side, after it was picked up

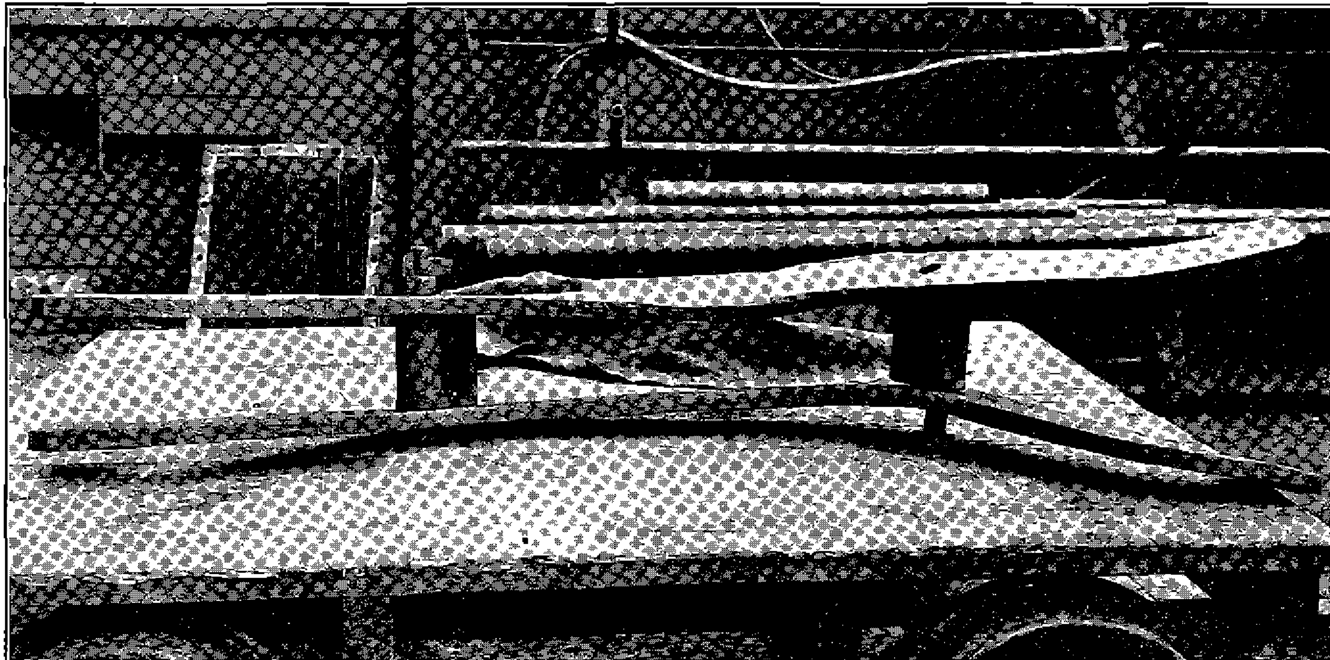

FIG 5—Right engine truck equalizer bars Bolt carrying forward spring hanger broken Forward ends of equalizer bars spread and twisted

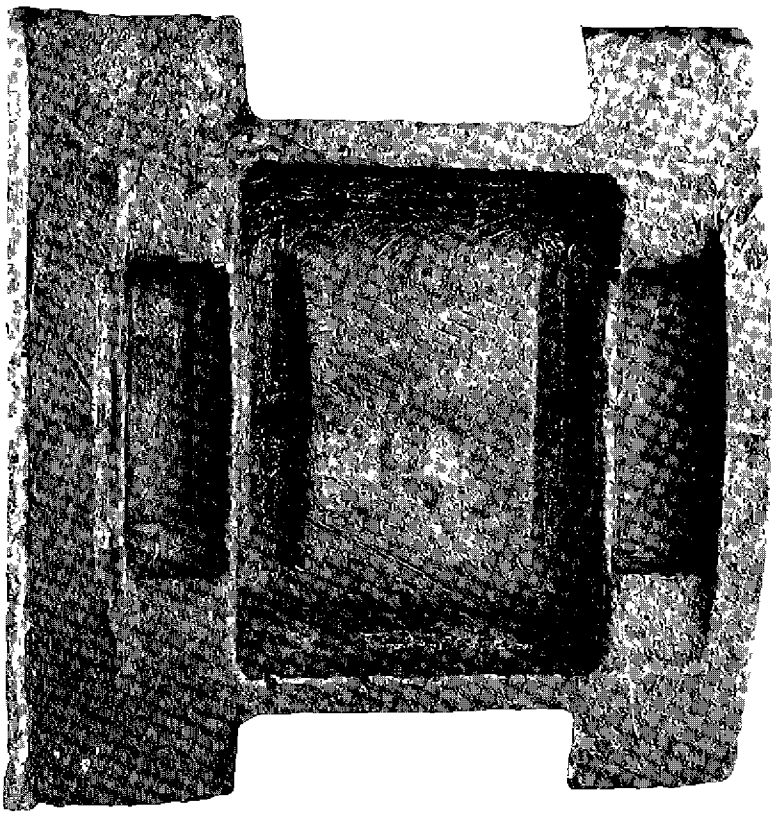

FIG 6.—Appearance of top of axle box, forward axle right hand side showing where equalizer bar had ridden on top surface of box at edge of one recess

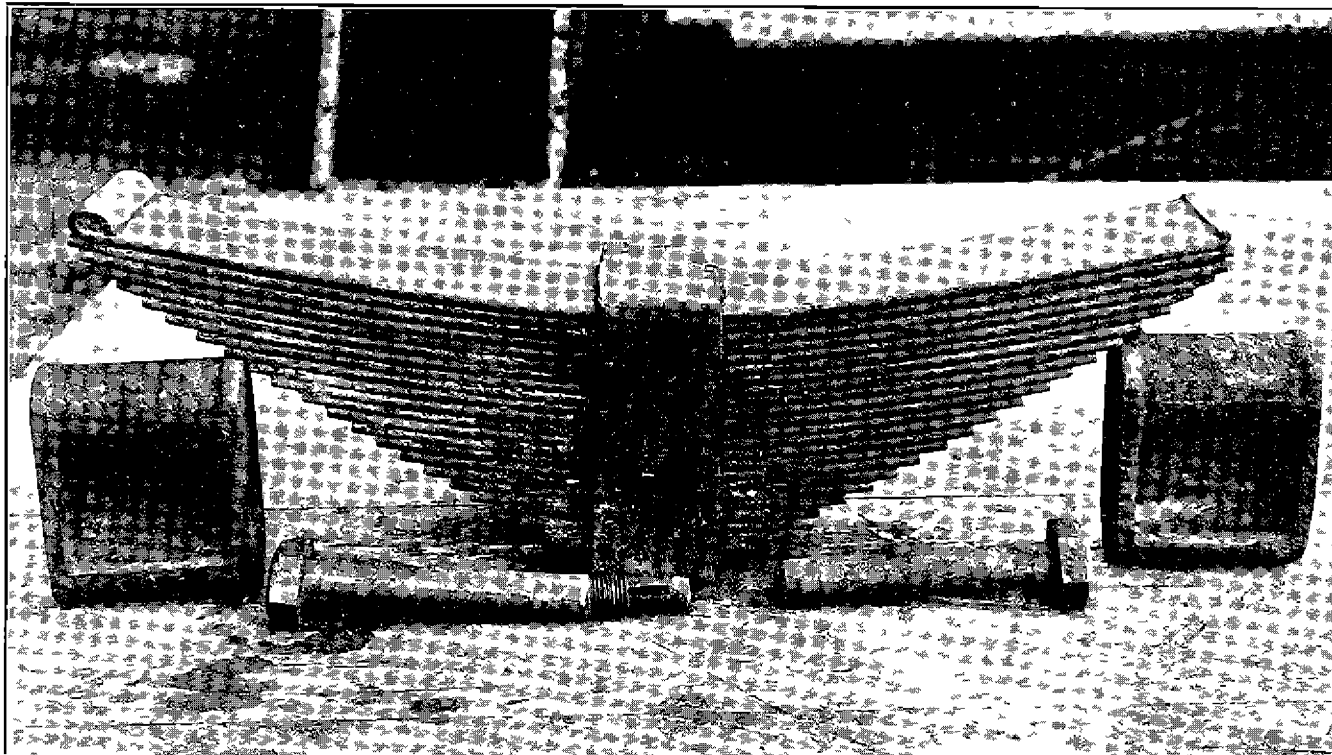

FIG. 7.—Right semielliptic spring of engine truck photographed bottom side up. Loop of lower leaf of spring, forward end broken; evidence that forward end of spring was dislodged from its hanger. Broken bolt of forward hanger, shown in cut. Rear right spring hanger not injured; bolt of same slightly bent.

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