INTERSTATE COMMERCE COMMISSION

REPORT OF THE DIRECTOR OF THE BUREAU OF SAFETY IN RE INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE PENNSYLVANIA RAILROAD NEAR GRAY, PA, ON JUNE 16, 1926

JUNE 26, 1926

TO THE COMMISSION

On June 16, 1926, there was a rear-end collision between two passenger trains on the Pennsylvania Railroad at a point approximately 1 mile east of Gray and about 51 miles east of Pittsburgh, Pa, this accident resulting in the death of 11 passengers and 4 employees, and the injury of 82 passengers, 1 of them fatally, and 4 employees This accident was investigated jointly with the Public Service Commission of Pennsylvania

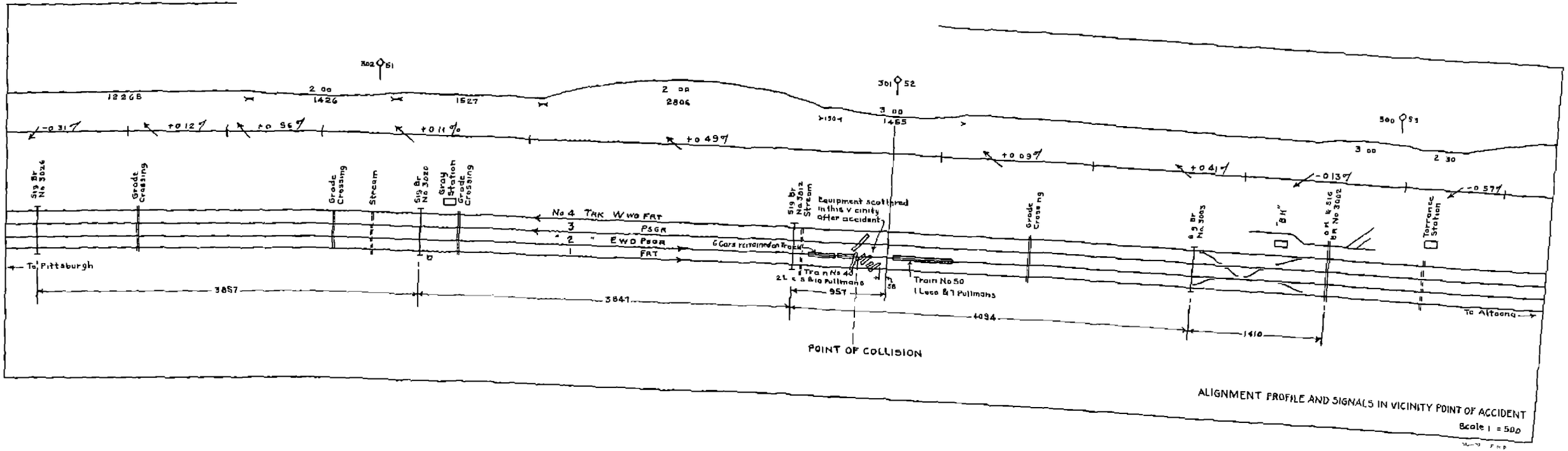
LOCATION AND METHOD OF OPERATION

The Pittsburgh Division of the Pennsylvania Railroad, on which this accident occurred, extends between Pittsburgh and Altoona, Pa, a distance of 113 8 miles At the point where the accident occurred, it is a four-track line, the tracks are numbered consecutively from south to north, and the accident occurred on track 2, which is the eastbound passenger track Approaching Gray from the west the track is tangent for more than 2 miles, then there is a 2° curve to the left 1,426 feet in length, followed by a tangent of 1,527 feet, Gray station being located near the middle of this tangent, this latter tangent is followed by a 2° curve to the right 2,806 feet in length, 130 feet of tangent, and then a 3° curve to the left 1,455 feet in length The accident occurred on this 3° curve at a point approximately 552 feet from its western end

The grade in this vicinity is generally descending eastward, being 0 56 per cent descending for a short distance west of Gray, 0 11 per cent for about a quarter of a mile, and then 0 49 per cent from a point just west of the reverse curve on which the accident occurred nearly to the eastern end of the reverse curve The track is constructed with 130-pound rails, hardwood ties, tie-plated, and rock ballasted, and is maintained in good condition Approaching the point of accident the tracks are carried through a side-hill cut, the maximum depth of which is about 15 feet on the south side and

about 10 feet on the north side, this cut extending to within about 900 feet of the point of accident; then there is a fill about 12 feet high extending nearly to the point of accident, where the track is practically level with the adjoining land on the south, while there is a fill of 3 or 4 feet on the north.

On this line trains are operated by time-table, book of rules, and block and interlocking signal indications. In normal operation, train crews do not receive train orders, the movement of trains being governed by signal indications. In this vicinity the road is equipped with automatic block signals of the three-position, upper-quadrant semaphore type, having induction motors controlled without line wires, by alternating-current track circuits and three-position polarized track relays; the signal-operating circuits use 110 volts alternating current and the signals are electrically lighted, power being supplied from an underground power line. The signals are mounted on signal bridges spanning the four tracks, the signals involved in this accident are those for track 2 on signal bridge 3020, located just west of the station at Gray, and signal bridge 3012, located 3,847 feet east of signal bridge 3020. Signal 3020 is a one-arm signal, with this signal in the 45° or caution position, displaying a yellow signal light above and a staggered red marker light below; a train passing it is required under the rules to "approach next signal prepared to stop. A train exceeding one-half its maximum authorized speed at point involved must at once reduce to not exceeding that speed." Signal 3012 is a two-arm semaphore signal, and in addition to its block signal indications it gives the distant indication for the home signal at BH interlocking, located 4,094 feet eastward. With both arms in horizontal position, staggered red lights being displayed, a train is required to stop, and then it may proceed to the next signal at a speed not exceeding 15 miles per hour, expecting to find a train ahead, broken rail, obstruction, or switch not properly set. In connection with approach locking with which BH interlocking is equipped there is an approach indicator consisting of a light on the operator's desk in BH tower, which when extinguished indicates that a train approaching from the west on track 2 has passed signal 3020, the circuit for this indicator is controlled by a contact of the polarized track relay, which is closed only when the relay is in position to permit signal 3020 to go to the clear position, and the indicator light is therefore not burning as long as signal 3020 remains in the stop or caution position. The view of signals 3020 and 3012 from an eastbound engine on track 2 is restricted by curves, cuts and trees, from the engineman's side of a cab there was a clear view of signal 3020 for a distance of 660 feet, and of signal 3012 for



ALIGNMENT PROFILE AND SIGNALS IN VICINITY POINT OF ACCIDENT

Scale 1 = 500

964 feet From the fireman's side, signal 3020 could first be seen at a distance of 2 002 feet, it passes out of view at a distance of 1,512 feet and again comes into view at a distance of 1,152 feet Signal 3012 can be seen from the fireman's side for a distance of 401 feet Under the rules, a train finding a fusee on or near its track must stop and extinguish the fusee, and then proceed with caution prepared to stop short of a train or obstruction The explosion of torpedoes is a signal to reduce speed and look out for a train ahead or an obstruction

When two or more engines are coupled to a train, the brakes must be operated from the leading engine and the double-heading cock on each of the other engines must be closed The equipment is so arranged, however that with the double-heading cock closed, an emergency application of the brakes can be made by moving the handle of the brake valve to emergency position

At the time of the accident, the weather was clear

DESCRIPTION

The trains involved in this accident were train No 50 known as the Washington Express, consisting of engine 299, one deadhead Pullman observation car, and six Pullman sleeping cars, with Engineman Kinkead and Conductor Pennell in charge, and train No 40, known as the Cincinnati Limited consisting of engines 3850 and 612, one Pullman combined club and baggage car, and nine Pullman sleeping cars with Enginemen Gordon and McConnell and Conductor Faust in charge All cars in both trains were of all-steel construction These trains were made up at Pittsburgh of cars from various western points destined for Washington and New York

According to the train-sheet record, train No 50 left Pittsburgh at 10 28 p m , on time, passed DR tower at Derry, 54 miles west of Gray, at 11 29 p m about two minutes ahead of its schedule time and because of a burst brake-pipe air hose was brought to a stop at about 11 36 p m at a point approximately 1 mile east of Gray, the rear end of the train being about 820 feet east of signal bridge 3012 While standing at this point, train No 50 was struck by train No 40 at about 11 44 or 11 45 p m

Train No 40 left Pittsburgh at 10 35 p m , on time, passed DR at 11 38 p m approximately on time, and collided with train No 50 while running at a speed estimated to have been between 40 and 50 miles per hour

The leading engine of train No 40 penetrated the sleeping car Mt Union the rear car of train No 50, for a distance of about 16 feet, the vestibule and end of the car being driven into the ladies' wash room, crumpling the partitions in the hallway and between the

wash room, stateroom and drawing-room to the partition between these compartments and the main body of the car This car was derailed and came to rest approximately in line with the track and leaning to the right at an angle of about 45°, it was separated from the next car, the Fieldsboro, by a distance of about 35 feet The Fieldsboro telescoped the car ahead of it, the Entriken, for nearly its entire length, the body of the Fieldsboro overrode the underframe and floor of the Entriken spread the sides and carried the rear end, roof, interior partitions, and contents forward to within about 9 feet of the head end, the Entriken being practically destroyed The Entriken remained coupled to the Neshaming, the fourth car in the train, which sustained relatively slight damage The third and fourth cars were broken apart and separated by a distance of about 10 feet, the second and third cars remained coupled, the first and second cars were also separated by a distance of about 10 feet, the forward truck of the first car being derailed, and the first car being separated from the tender by a distance of about 20 feet As nearly as could be determined after the accident, the engine of train No 50 was driven ahead a total distance of between 90 and 100 feet

The leading engine of train No 40 came to rest on its right side with its head end about 4 feet behind the rear end of the car Mt Union The front end of this engine was lying on track 1 and the rear end on the right of way to the right of track 1 The tender of the leading engine became detached and was lying across track 1 at an angle of about 30°, its forward end being against the trailer wheels of the leading engine The second engine was turned almost completely around, it was lying on its left side jammed against the tender of the first engine, with its front end on track 1 and its rear end on track 3, also at an angle of about 30° with the track The tender of this engine was lying on its right side with its front end about opposite the rear end of the second engine and its rear end opposite a point between the No 1 and No 2 driving wheels of the second engine Both engines were practically stripped of all appurtenances

Club car Watkins the first car of train No 40, was practically crosswise of tracks 1, 2, and 3 the forward or baggage end going to the right and extending approximately half the length of the car outside of track 1, the rear end being on track 4 This car was jammed between the second engine and its tender on one side, and the third car, the Finley, which was driven into the opposite side of the passenger end The Watkins was practically destroyed The second car, the Inwood, turned to the left and stopped with its forward end off the roadbed to the north, its rear end on track 3, and its right side resting against the end of the club car Watkins

The Finley was derailed, and the east truck of the fourth car was derailed, the following cars were not derailed or damaged All four tracks were considerably damaged for a distance of about 250 feet The passengers who were killed were in the Entriken and the Watkins The employees who were killed were the two enginemen, the fireman of the leading engine, and the baggagemaster, all of train No 10

SUMMARY OF EVIDENCE

H M Kinkead, the engineman of engine 299, of train No 50, has been in the employ of the Pennsylvania Railroad since 1892, being promoted as engineman in 1901 and has been in passenger service since 1913 He stated that a terminal test of brakes was made at the Pittsburgh station and the inspectors reported the brakes O K The first running test was made just west of Copeland curve and a station stop was made at East Liberty and he had no trouble with his brakes He stated he was on time leaving Pittsburgh and about one minute ahead of time passing Derry The signals in this vicinity were clear for his train and all lights burning properly He estimated that the speed of his train was about 55 or 60 miles per hour when approaching the point of accident on track 2, which he said was about schedule time Just a few car-lengths before reaching the distant signal for BII, 3012, he felt the air brakes go on gradually and also noticed the hand on the air gauge falling slowly, he then placed the brake valve in emergency position until the train came to a stop He did not whistle for the flagman to go back as he expected him to do so without any signal He ascertained that an air hose on the rear of tender had burst and he and his fireman immediately proceeded to replace the hose he estimated the time required to replace it test the brakes, and get ready to proceed as about seven minutes from time at which the train stopped The defective hose appeared to be soft and porous He stated that after his train stopped he saw the flagman going back and almost immediately after stopping the conductor came forward After the hose was replaced he released the brakes called in the flagman, and made a road test, the conductor informing him that the head brakeman was at the rear of train to signal him when the test was made, and he received a signal from this brakeman to release brakes after the test was made He said he called the flagman in at least once and possibly twice and considered calling him again when the fireman saw him coming in He thought the flagman was a little longer than usual in returning, and he looked at his watch at this time, it was 11 45 p m, and just as he was returning his watch to his pocket, the collision occurred He was unable to give the time at which his train stopped at the point of accident He

stated the weather was clear and dark at the time of the accident He thought the impact of the collision moved his train about 1½ car lengths He did not see or hear train No 40 approaching but the fireman told him he saw train No 40 approaching

C N Groves, fireman of engine 299, of train No 50, has been in service since 1910, and in passenger service over nine years, and had fired on train No 50 three times in about three months At Pittsburgh station a terminal test of air brakes was made and an inspector reported to the engineman the number of brakes The train departed on time and continued on time to the point of accident The weather conditions east of Derry were clear He stated that the signals on signal bridge west of Gray were clear, also that the distant signal for BH was clear and that the train was stopped east of the distant signal for BH by a burst hose at the end of the tender He first noticed the application of brakes four or five car-lengths east of the distant signal at BH This application of brakes appeared to be a service application, and he could not say whether the engineman put the brake valve in the emergency position When the train came to a stop, he got off and found a burst hose at the rear of tender He and Engineman Kinkead then replaced this hose, the brakes were released, a road test of the brakes was made, and a proper signal received from the rear of train that the brakes had applied and released

Fireman Groves stated that when the train stopped, he saw the flagman going back and thought he was several car-lengths west of the distant signal when called in He could see the flagman's lamps and after he was called in he also saw a burning fusee, the fusee seemed to be west of the distant signal He stated he thought he saw the flagman about the time he started in He could not then see the approaching train, but could hear a rumbling and he also heard a whistle which sounded like a passenger engine whistle He could see the reflection of the headlight before the train came into view around the curve and felt it was on track 1 until the first engine of train No 40 covered the fusee He could not say if the engines were using steam When he first saw train No 40 rounding the curve there was no fire flying from the wheels and nothing to indicate that the brakes were applied He thought fire started to fly from the wheels not over two car-lengths west of the distant signal for B H, and before the collision occurred he said there was a great deal of fire flying from the wheels throughout train No 40, indicating that the brakes were fully applied He thought the flagman was about one car-length away from his train when the collision occurred When he realized train No 40 was going to collide with his train, he called to the engineman He states he

did not hear the explosion of any torpedoes They received a severe shock when the collision occurred and the engine was shoved ahead a considerable distance After the collision occurred, he took his lantern and went east to protect against westbound trains He did not look at his watch at any time, but estimated they were stopped about six minutes before the accident occurred

C B Pennell, conductor of train No 50, had been in service of the Pennsylvania Railroad 26 years and had been a conductor for 16 years, the entire period being in passenger service His train was received at Pittsburgh station, a terminal test of the brakes was made, and inspectors told him brakes were O K The train departed on time, and a station stop was made at East Liberty, at which time the brakes were working properly He stated his train was on time passing Derry, and he was riding in the drawing room of the fourth car in the train approaching the distant signal for BH He estimated the speed of his train at 50 miles per hour, and thought the brakes went into emergency but the train seemed to run a long time after this application before it stopped He immediately started to the front end where he found the fireman hunting for the trouble, and was informed by the fireman that a hose had burst on the rear of tender They replaced the hose and called in the flagman The engineman then sounded the whistle signal for brakes applied the brakes for the road test, and after getting the proper signal from the rear end the brakes were released The engineman then recalled the flagman the second time Conductor Pennell stated that he then got on the train and was standing on the rear platform on the left side of the second car with the vestibule door open He stated he saw the flagman near the rear end after he was called in and could see a burning fusee He stated he did not see train No 40 approaching until just before the accident He further stated "I heard it as I was looking over the other side and was glancing around and when I looked back, I saw the fire flying from the wheels and the headlight burning, and I saw the front brakeman jump off the rear end and the flagman jump—the flagman had not reached the rear end yet" Immediately after he saw the sparks begin to fly from the wheels of train No 40 the crash came He thought the flagman was 50 or 60 feet back of his train at this time He said his train stopped at 11 36 p m , and estimated the time delayed as nine minutes He did not look at his watch at the time of the accident, but the conductor of train No 40 told him that it occurred at 11 45 p m He thought the flagman had ample time to go back a sufficient distance to protect his train He estimated the fusee placed by the flagman on track 2 was just west of the signal bridge, and in his judgment the flagman was back a sufficient distance to afford full protection He based this statement on

the time it took him to come in rather than from the position he saw him, and estimated this time as three minutes He could hear the approaching train from his position in the vestibule of the second car and stated that under these circumstances, he felt it was right for the flagman to come in, if he had proper protection, "a fusee and caps down" He did not hear any torpedoes exploded and did not know if the flagman placed any He stated the flagman should when hearing an approaching train determine upon which track it was running before coming in He stated the flagman should have been able to see the approaching train before he did from the point where he was located and possibly could also have heard it sooner Passenger trains in this vicinity regularly use track 2 eastbound, and the schedule time of train No 40 is about five minutes behind the time of his own train, he had not reported his train in trouble to the train dispatcher and had no reason to believe that train No 40 would be diverted from its regular track He stated that while they depend to a certain extent upon the signals for safety this does not relieve the flagman of any of his duties He further stated that if the flagman had placed torpedoes and fusee, regardless of hearing an approaching train and not being able to determine upon which track it was running, that he was justified in returning to his train

Thomas W Beecher, front brakeman on train No 50, had been in the employ of the Pennsylvania Railroad Company 10 years Approaching the distant signal at BH he was riding in the rear car of train No 50 with Flagman MacDonald, when the train was brought to a sudden rough stop by an emergency application of the brakes about 700 or 800 feet east of signal The flagman said "My God! I believe we are wrecked! The flagman had lamps there and they both got off the rear end He started running up toward the front end and the conductor called back to him that there was a burst hose and told him to return to the rear to test the brakes he then went to the rear and remained there When he arrived at the rear end they had already replaced the air hose and released the air brakes The brakes were then applied and the flagman recalled He sounded the whistle signal to release brakes and the engineman recalled the flagman the second time He fixed the time of the stop at 11 36 p m and the time he signalled for release of brakes at 11 40 p m He could see the flagman from the rear car and thought he was about under the signal bridge When recalled the second time, the flagman lighted a fusee and started in, and while the flagman was coming in he could hear train No 40 approaching, before it came into view When he saw train No 40 coming, it was running at full speed, but being on a curve it was impossible to tell what track it was on until the engine of the train covered the fusee When he first saw train No 40 approaching,

he thought it was on track 1, because at the rate it was going, he didn't expect it to be on the same track He heard the torpedoes explode and stated the leading engine was using steam when he first saw it, and it was still using steam when he last saw it just an instant before it struck He stated the flagman got within 50 feet or perhaps closer to the rear end He called to the flagman and at the same time the flagman began swinging his lantern, train No 40 was about 100 feet away when he jumped off the rear end of his train, and he had just struck the ground when the collision occurred, at 11 44 or 11 45 p m

D S MacDonald, flagman of train No 50, stated he observed air-brake tests made on the train before leaving Pittsburgh, and the brakes were O K They made a stop at East Liberty for about two minutes and he went back and flagged until called in The next stop was an emergency stop, which in his judgment was about three-fourths mile from the home block signal at BH, and the rear end of his train was about 700 feet east of the distant signal for BH When this stop was made, he was riding in the rear end of the rear car He stated he picked up fusees and had torpedoes in his pockets Getting off on the left side he noticed some one up ahead with a torch and thought they must be having trouble at the head end He ran back over the ties to flag, and tripped over a surveyor's stake He then put a fusee on track 1 for protection and continued to go back until the engineman recalled him He thought he was about 700 feet from the rear of his train when called in and just east of the distant signal for BH He stated his engineman recalled him twice, after calling the first time, he called for a brake test and very shortly afterwards he again sounded the signal for him to come in When recalled, he put down a lighted fusee and also put down two torpedoes, quite close together, and started in, when about half way in toward his train, he heard the roar of an approaching train, he immediately looked around and saw the train rounding the curve, but he could not tell whether it was on track 1 or track 2 He thought from the roar of the train that it was on track 1 Just a minute after that, when the train came under the signal bridge, he realized it was on track 2 and immediately began to swing him down, and kept on swinging He stated that the engineman did not answer his signal The fusee was burning when the train ran over it and he heard the torpedoes explode He did not notice any fire flying from the wheels of train No 40 The headlight on train No 40 was burning full strength, the markers on rear of his train were in good condition He did not notice signal indications back of his train at any time prior to the accident After the accident, he went back and then the distant signal for BH on track 2 was red and the signal at Gray was yellow and slightly moving, but not enough to change its indication

He stated there was nothing unusual in the operation of the train previous to stop because of the burst hose He thought it was about four minutes from time his train came to a stop until his engineman called him in, and he had continued to go back until recalled the second time He understood passenger trains ordinarily run on track 2 and knew his train had been stopped for some little time, and that train No 40 was scheduled close behind his train and might overtake them He stated that he understands that when he hears an approaching train, it is his duty to ascertain what track it is on before returning to his train, he also stated that to give full protection to an approaching train, it would be necessary to go back around the entire curve at the locality of the accident As he had his torpedoes and fusee down, he thought he had provided full protection for his train He said he did not hear train No 40 whistle at Gray, and when he heard the rumble of the approaching train, indicating that it was running at high speed, he thought it must be on track 1, as he would not expect a train to be roaring that way on a track his train was on and running under yellow signal

W S McConnell, fireman of engine 612, the second engine in train No 40, stated the signal at Gray was clear, he could not say as to the indication of the signal for track 1 at this point as he remembered seeing only one signal there and he was positive that was clear He did not remember whether he saw the signal for track 2 on the distant signal for BII just previous to the accident, but had just gotten up on his seat box when he saw the rear end of train No 50 He remembered hearing torpedoes explode and seeing the rear end of train No 50, and at about this time his engineman put his brakes on in emergency He stated that the engineman of the leading engine sounded his whistle for a crossing at Gray and he also noticed a test of the air brakes being made at Pittsburgh just before leaving, he also noticed the brakes being applied by the head engineman at Copeland and around Edgewood He thinks if the brakes had been applied from the leading engine just previous to the accident he would have noticed it Previous to the accident, he had noticed nothing unusual in connection with his train He thought they were making about schedule time

L Faust, conductor of train No 40, stated the brakes on his train were tested at Pittsburgh station by car inspectors, and his train departed on time No stops were made but he noted the application of air brakes at R tower and at Swissvale and the brakes were working all right His train was on time passing Derry Approaching the point of accident he was riding in the rear of the fourth car, when an emergency application of brakes was made, this knocked him down and immediately thereafter the collision occurred He

estimated the speed of his train when the collision occurred at 50 miles per hour He had worked with Engineman Gordon before this trip and thought him to be a very good engineman He noted a fusee burning behind his train after the accident occurred

W E Penfield, flagman of train No 40, was riding in the drawing room at the front end of the rear car of his train He noted nothing unusual throughout the trip until when approaching the distant signal at BH an emergency application of the brakes was made which knocked him down He got up and started toward the rear of the car and had reached about the middle of the car when another crash again knocked him down, and he slid to the end of the car He then got up got his lanterns and started back to flag His train was stopped about two car-lengths east of the signal bridge and he stated a fusee was burning about at the signal bridge When going back he noted that the signal for track 2 was "red" He went on back to the signal just west of Gray station and stated that the signal on track 2 was bobbing from red to yellow He noted its action for a period of 45 minutes, moving from red to yellow, when its action was stopped by a signalman He stated Flagman MacDonald was with him and also observed the action of the signal near Gray The lights on both signals were burning properly and at no time did he see the signal go to the clear position

William F Balla, a fireman in the employ of the Pennsylvania Railroad but not on duty at the time of the accident, stated he arrived at the scene of the accident in company with a doctor about 12 35 a m He stated he found Engineman Gordon dead in the right-hand corner of the cab on the right side of his overturned engine, lying on his back, with his hands folded across his chest

F A Dauer, gang foreman, stated train No 50 was assembled on track 5 in the Pennsylvania station at 10 13 p m, and that he personally observed the inspectors' work and knew that the brakes were tested and the engineman notified that all brakes were operating properly This work was completed seven minutes before leaving time, and he notified the conductor that his train was O K to go

Inspector Macris stated he did not find any leaks in the air hose of train No 50 While he did not have occasion to examine the hose between the tender and first car, he did not notice any leaks

H W Lehr, general foreman, passenger car inspectors, stated he arrived at the scene of the accident about 3 a m, and made such inspection of the air-brake equipment of train No 40 as could be made, and was unable to find any angle cocks closed, or brakes cut out or irregularities that would interfere with operation of the air brakes At about 3 30 a m the six rear cars were tested, with an

engine attached, and no air-brake defects were found The triple valves of the remaining four cars were removed and forwarded to Pittsburgh for special inspection Such parts as were not damaged in the accident did not disclose any defective conditions Train No 40 was made up in the Pennsylvania station on track 15 from western connections both off the Panhandle and the Eastern Divisions, and the air brakes were found to be in good condition The piston travel for the cars in train No 40 was from 6 to 7½ inches All cars in train No 40 were equipped with the UC type of brake equipment except the second car from the rear, which had PM equipment with two brake cylinders After the accident the air brake equipment of engines 3850 and 612 was taken to Pitcairn shops and such tests of it as could be made did not disclose any defects that would have a bearing on the accident The double-heading cock on the second engine of train No 40, engine 612, was in good condition and was found closed

Examination of the engines of train No 40 made at the scene of the accident shortly after it occurred indicated that the throttle of engine 3850, the leading engine, was slightly open, and the throttle of the second engine, 612, was closed The reverse gear of engine 3850 was in or very nearly in full forward motion, and while the reverse gear of engine 612 was badly damaged, it appeared to have been approximately in full forward motion at the time of the accident Examination of the wheels of both engines did not reveal evidence of excessive braking, no brake burns or flat spots were found

The hose which burst bore a manufacturer's label indicating that it was manufactured in October, 1924 It burst near the middle of its length, the rupture being about 1½ inches in length

Operator Little, who was on duty at BH tower at the time of the accident, stated that train No 50 was reported by DR at 11 29 p m, and he promptly cleared the signal for that train The approach indicator went out, indicating that train No 50 had passed signal 3020 at Gray at 11 35 p m, and this indicator did not clear up again Train No 40 was reported by DR at 11 38 p m He stated he heard the crash of the collision, at which time the approach indicator for track 1 went out, the advance signal for track 4 went to danger position, and the telephone line to the west failed, and he said it was then 11 44 p m

Assistant Signalman Shean stated he was notified of the occurrence of the accident at about 12 15 a m, June 17, and he immediately started for the scene When he arrived at Gray, signal 3020 displayed a yellow or caution indication At that time the flagman of train No 40 was there and called his attention to the fact that the

signal was moving and he then noted that it was moving slightly toward the stop position He got up on the bridge, raised the blade fully to the caution position, and then it held properly He thought it had been pumping between the 40° and 45° positions He then went to the signal 3012, which was displaying a red indication, and after Maintainer Miller arrived the wires were disconnected from the relays controlling the signals for tracks 1 and 2 for the purpose of holding those signals in stop position, and the signal equipment was locked with special locks

Signal Maintainer Miller stated he arrived at the scene of the accident at about 1 10 a m, June 17, found signal 3012 for track 2 displaying a red indication, and he and Assistant Signalman Shean opened the track circuit at the feed end at signal bridge 3012 in order to place signal 3020 in stop position and thereby provide greater protection for the work of clearing the tracks He stated the signal equipment was locked and the signals were placed under constant observation He said he had been maintainer on this section for about 12 years and did not recall ever having had any dangerous trouble with signals on his section

After the track had been repaired so as to permit operation to be resumed, the signal cases were opened and the wires which had been disconnected were replaced, then the cases were again locked and not reopened, nor were tests made until June 19, when representatives of the Interstate Commerce Commission and Public Service Commission were present Signals 3020 and 3012 were under continuous observation from 2 30 a m, June 17, until 7 a m, June 20 and no irregular operation was observed, except that on one occasion signal 3020 again started to pump between caution and stop positions

Under the conditions which existed on the night of this accident, with train No 50 standing east of signal 3012, train No 40 should have received a caution indication at signal 3020 and a stop indication at signal 3012 In order to ascertain whether any condition existed which could have caused the display of a more favorable indication by either of those signals and also to determine the cause and effect of signal 3020 pumping, observations and tests of the signal apparatus involved were made on June 19 and 20 Torque tests of signals 3020 and 3012 were made which disclosed that both signals were operating freely The insulation of the signal-circuit wires between the track relays and the signal mechanisms, and of the pole-changing wires for track circuit 3020, was tested, which tests disclosed no defects and demonstrated that these circuits were in proper operating condition Tests of the pick-up, drop-away, and working voltages of the track relays were made, as well as

tests of the track circuits, which disclosed no improper or abnormal condition

Tests of the approach indicator for track 2 at BH tower were made by shunting in succession each of the two track circuits which control it, and the indicator, track relays, and signals all operated properly With a shunt on the track circuit for signal 3020, the track relay opened, signal 3020 went to stop position, and the approach indicator light went out, with the shunt on the track circuit for signal 3012, the track relay for this circuit opened, signal 3012 went to stop position, signal 3020 went to caution position, and the approach indicator light remained out

Examination of signal 3020 disclosed that this signal would pump between caution and stop positions due to insufficient tension on a contact spring and because of carbon contacts which were somewhat glazed While this pumping of the signal would result in displaying a somewhat poorer yellow or caution light indication, it could not cause the signal to display a clear indication, but tended to move it from caution toward stop

The signal system in use in this vicinity was placed in service in 1912 The motor in the signal mechanism for signal 3020 was replaced by a new one on May 21, 1926, the other motor being removed for shop test, inspection, and repairs, and in April, 1926 the track relays for both signals 3020 and 3012 were replaced by new relays of a different type which are being used to replace the relays of the original installation The records showed that a periodical inspection and test of all signals on bridges 3020 and 3012 was made by the railroad company's signal forces on June 11, 1926, which disclosed that these signals were in proper operating condition The records for the past five years disclose that there have been one failure of signal 3012 and three failures of signal 3020, in all of which the signal involved indicated stop

As will be apparent from the foregoing, the investigation and tests did not disclose or indicate that any condition existed which could have caused the display of a false clear or a false caution signal indication, on the contrary, these tests definitely established the fact that the signals involved in this accident were in proper operating condition at the time these tests were made There is no question that they were operating properly prior to the accident and it is known by direct observation that they operated properly as soon as the tracks were repaired after the accident Furthermore, the statement of Operator Little furnishes direct evidence that the signals were operating properly at the time of this accident According to his statement, the approach indicator light went out when train No 50 passed signal 3020 and remained out until after

the accident The fact that this light went out indicates that the track relay which controls signal 3020 operated properly when train No 50 passed that signal, and the fact that is remained out after train No 50 cleared that section indicated that the track relay controlling signal 3012 had also operated and that the track relay controlling signal 3020 had not improperly moved to a position which would permit signal 3020 to be operated to clear position It is therefore established beyond reasonable doubt that the signals were operating properly just prior to and at the time of this accident, and that a caution signal indication was displayed by signal 3020, and a stop signal indication by signal 3012 for train No 40

The reason that these signal indications were not properly observed and obeyed by the engine crews of train No 40 can not be positively determined The evidence discloses that not only were the brakes not applied from the leading engine as should have been done in order to control the train as required by the caution and stop signal indications but even after the flagman and rear end of train No 50 came into view, the fusee passed, and torpedoes exploded no brake application was made or call for brakes sounded from the leading engine, and steam was still being used by that engine when it was last observed, only an instant before the collision occurred

After the accident an autopsy was held upon the body of Engineman Gordon for the purpose of determining, if possible, his physical condition just prior to the accident In a preliminary report the doctor who performed this autopsy stated that he could not tell definitely but he thought that Engineman Gordon was alive at the time of the accident He was quite sure that if he was not alive then he had not been dead more than a few moments He said he had known of cases with the same arterial lesion, and moderately advanced, to suffer angina In formal report as a result of the autopsy the following statement was made

"Coronary sclerosis while present, was only moderately advanced While angina pectoris has occasionally been associated with lesions of the degree found in this instance, it is far more common to find lesions of a similar degree in individuals who have at no time complained of attacks of angina In the absence of conclusive evidence the theory of an attack of angina can be given little more than theoretical consideration"

The autopsy therefore revealed conditions which might at any time have resulted in sudden physical incapacity or death Engineman Gordon was 57 years of age Each year for the past three years he had undergone the physical examination required of enginemen by the railroad company, his last examination being on September 11, 1925, the record of which indicates that he was con-

sidered to be in proper physical condition to continue in engine service Locomotive Dispatcher Plummer stated that Engineman Gordon signed the register at 8 45 p m on June 16 and while conversing with him at that time he did not see anything wrong with him, from his actions and talk he appeared to be the same as usual Conductor Faust also said that he spoke to Engineman Gordon just prior to starting on this trip and he noticed nothing unusual in his condition

The evidence indicates that Engineman Gordon sounded a crossing whistle signal as his train was approaching Gray, but from that time onward he took no action whatever and he was found lying on his back with his hands folded across his chest, his position suggesting a peaceful rather than a violent death The conclusion, therefore, appears to be well founded that Engineman Gordon was dead or physically incapacitated before this accident occurred

It does not appear that Engineman McConnell of the second engine of train No 40 took any action to assume control of the train until after the fusee and rear end of train No 50 came into view and about the time the torpedoes were exploded just east of signal 3012 That he was in possession of his faculties is evidenced by the fact that he then made an emergency application of the brakes, but his delay in assuming control of the train, which may have been due to failure or inability to see the signals because of smoke or steam from the leading engine, or to confidence that Engineman Gordon would himself control the train as required, rendered futile his efforts to avert the accident

Fireman McConnell of the second engine of train No 40 stated that he saw a clear signal indication at signal bridge 3020, but he did not remember seeing the other eastbound signal on that bridge The condition of the track ahead was such that a clear signal indication should have been displayed at that point for track 1 and a caution signal for track 2 It therefore appears probable that in rounding the curve approaching this signal bridge, Fireman McConnell saw the clear signal on track 1 and accepted it as the indication for track 2, on which his train was running From his statement, it appears that he did not see signal 3012, and the first intimation he had of impending danger was when the rear end of train No 50 came into view, the fusee and torpedoes were passed, and his engineman applied the brakes in emergency It was then too late to avert the accident

Both the time at which train No 50 came to a stop at the point of accident and the time that the accident occurred are quite definitely fixed by the statements of several of the employees, the vari-

ations between their statements not exceeding two minutes According to these statements, train No 50 came to a stop at the point of accident from seven to nine minutes before the collision occurred, and it is apparent from the evidence that Flagman MacDonald of train No 50 had at least four minutes in which to go back and protect his train before he was recalled Rule 99 provides that when a train stops under circumstances in which it may be overtaken by another train, the flagman must go back immediately with flagman's signals, a sufficient distance to insure full protection, placing two torpedoes, and when necessary, in addition, displaying lighted fusees, when recalled, and the safety of the train will permit, he may return to his train When train No 50 stopped at the point of accident, the attending circumstances required that Flagman MacDonald exercise the utmost diligence in providing flag protection for his train The stop, as he was fully aware, was an emergency stop, and he thought an accident to his train had already occurred The stop was made at a point where trains are commonly operated at high speed, and at a point where the view from a following train was obstructed by a cut and trees on the inside of a curve, moreover, the rear end of his train was scarcely emergency-braking distance from block signal 3012, and he knew that train No 40 was scheduled only a few minutes behind his train While Flagman MacDonald stated that he thought he went back as far as he could before being recalled, measurements made during the investigation of the accident showed that he actually went back a distance of only about 720 feet from the rear end of his train The point which he reached was marked by the burned-out fusee, which he placed on the track 99 feet east of signal 3012 During the investigation of the accident, Flagman MacDonald was asked to repeat, as nearly as he was able, his movements when he went back to protect his train on the night of the accident, starting from a car which was standing at the point of accident He did this three times, and the time consumed to reach the point where the fusee was placed varied from 2 minutes and 5 seconds to 3 minutes Several of the observers then walked back, in a leisurely manner, from the point of accident and in four minutes reached a point 27 rail-lengths back (39-foot rails), or 8 rail-lengths farther than the flagman had gone It is therefore apparent that Flagman MacDonald, by exercising reasonable diligence in furnishing flag protection for his train, could have gone back a considerably greater distance than he did before being recalled Had he done so and there placed his fusee and torpedoes, the accident might have been averted, or at least the force of the collision reduced

CONCLUSIONS

This accident was caused by the failure of Engineman Gordon, of train No 40, to control his train as required by caution and stop indications of automatic block signals and the stop signals placed by the flagman of train No 50, which failure it is believed was due to sudden death or physical incapacitation Had Engineman McConnell, of the second engine of train No 40, realized a few seconds earlier that train No 40 was not being properly controlled by Engineman Gordon, of the leading engine, he could have brought this train to a stop in time to avert the accident, and had Flagman MacDonald gone back as far as he was able to go in the time available after his train came to a stop and before he was recalled, his fusee and torpedoes placed farther back would probably have given Engineman McConnell warning in time to have enabled him to stop his train before striking the preceding train, or at least in time to mitigate the disastrous consequences of the collision

This accident again forcefully calls attention to the need of an automatic train-control appliance which will cause a train to be brought to a stop in case an engineman for any reason fails to obey the stop indication of an automatic block signal Had an adequate automatic train stop or train-control system been in use on this line, this accident would have been prevented

During this investigation employees who were questioned in regard to the flagging rule stated that they are instructed that block signals do not in any way relieve them of the duty of fully observing the requirements of this rule Nevertheless, in describing the practices followed when flagging, it appears they depend upon the speed of the train flagged being controlled in accordance with signal indications which should be displayed by the block signals In this case Flagman MacDonald maintained that he went back a sufficient distance to protect his train, but then virtually admitted that this was contingent upon the speed of the following train being controlled in conformity with the block-signal indications While no comprehensive check-up of the flagging practices on this line was made during the investigation of this accident, on one occasion when the train upon which the investigators were riding was unexpectedly stopped between stations, it was observed that the flagman went back at a slow walk, and on another occasion when a train had been standing for several minutes at a station the flagman did not go back at all and was not even out at the rear end of his train If the action of Flagman MacDonald of train No 50 in this case is an example of the common practice of flagging on this line, it is apparent that the provisions of rule 99 with respect to flagging are not being properly

observed and enforced This is a condition which should be given immediate and thorough consideration by responsible operating officers

All of the employees involved in this accident were experienced men with good records Engineman Gordon had been on duty 2 hours and 40 minutes after an off-duty period of 35 hours and 50 minutes Engineman McConnell had been on duty 2 hours and 40 minutes, after an off-duty period of 1 hour and 30 minutes, prior to which he had been on duty 4 hours and 44 minutes, after an off-duty period of 9 hours and 1 minute Flagman MacDonald had been on duty 2 hours and 17 minutes after an off-duty period of 37 hours and 22 minutes

Respectfully submitted

W P BORLAND *Director*

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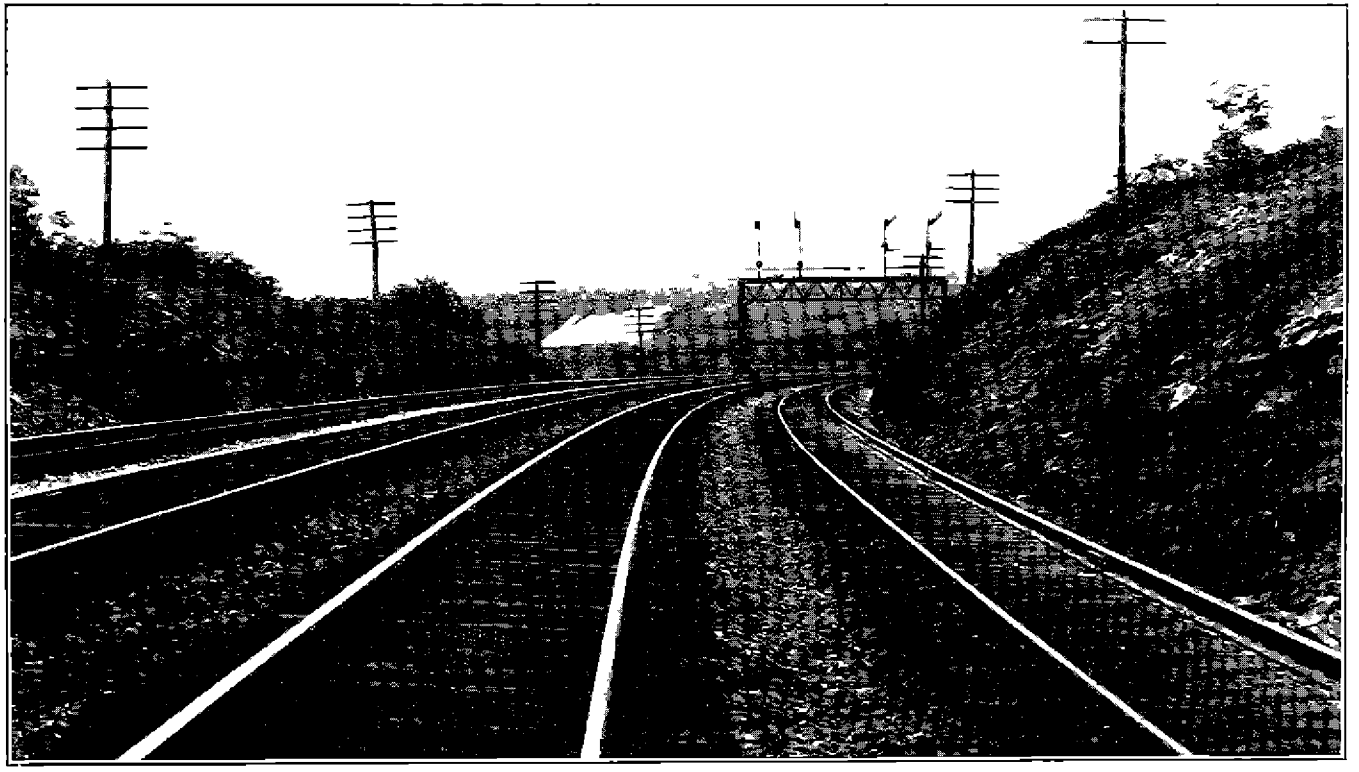

FIG 1—View of signal bridge 8012, taken on track 2 from point 16 rail lengths west of signal bridge

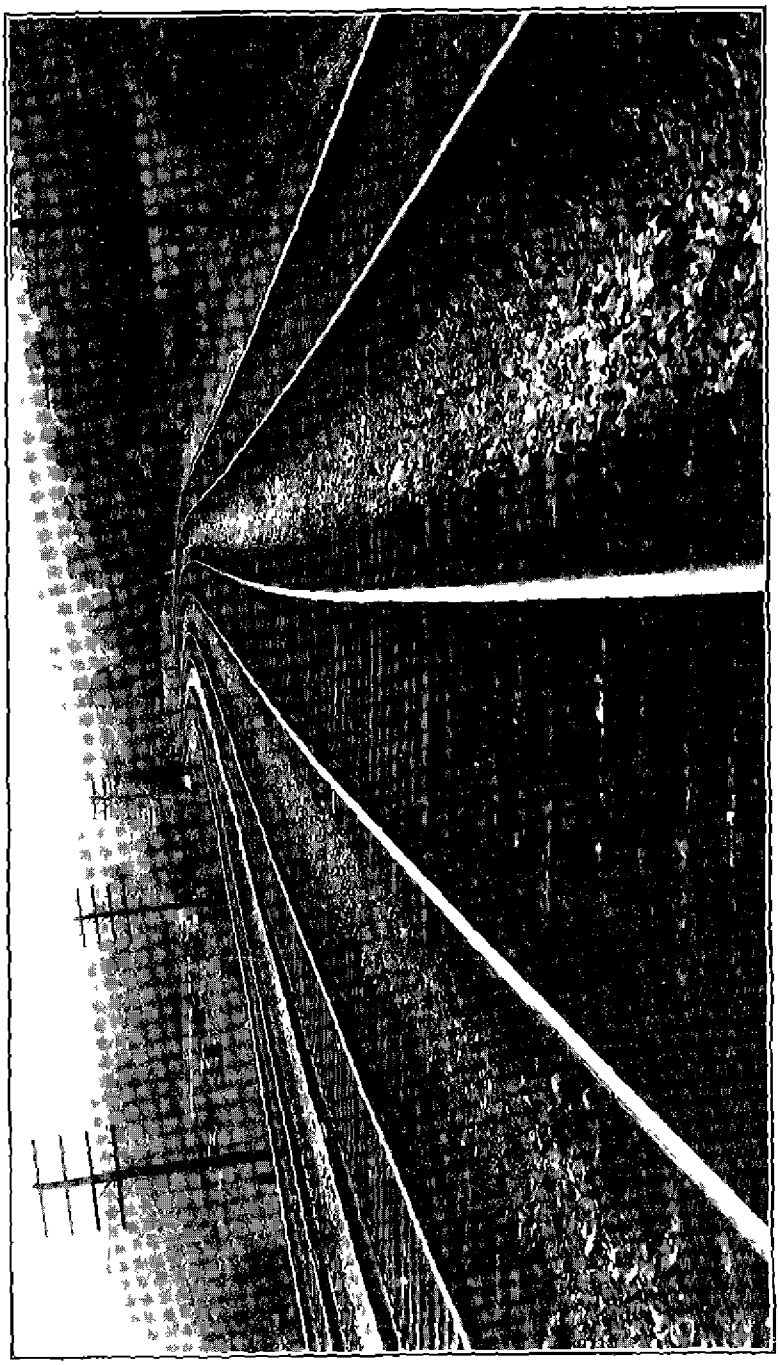

FIG. 2.—View approaching curve to left on which accident occurred taken on track 2 from point under signal bridge 3012

FIG. 5.—Steps on rear Mount Union coal car of train No. 50, showing extent to which this car was penetrated by lead engine of train No. 40

FIG 4.—Sleeping car Fieldsboro, next to rear car of train No 70 which telescoped the Pittsburgh

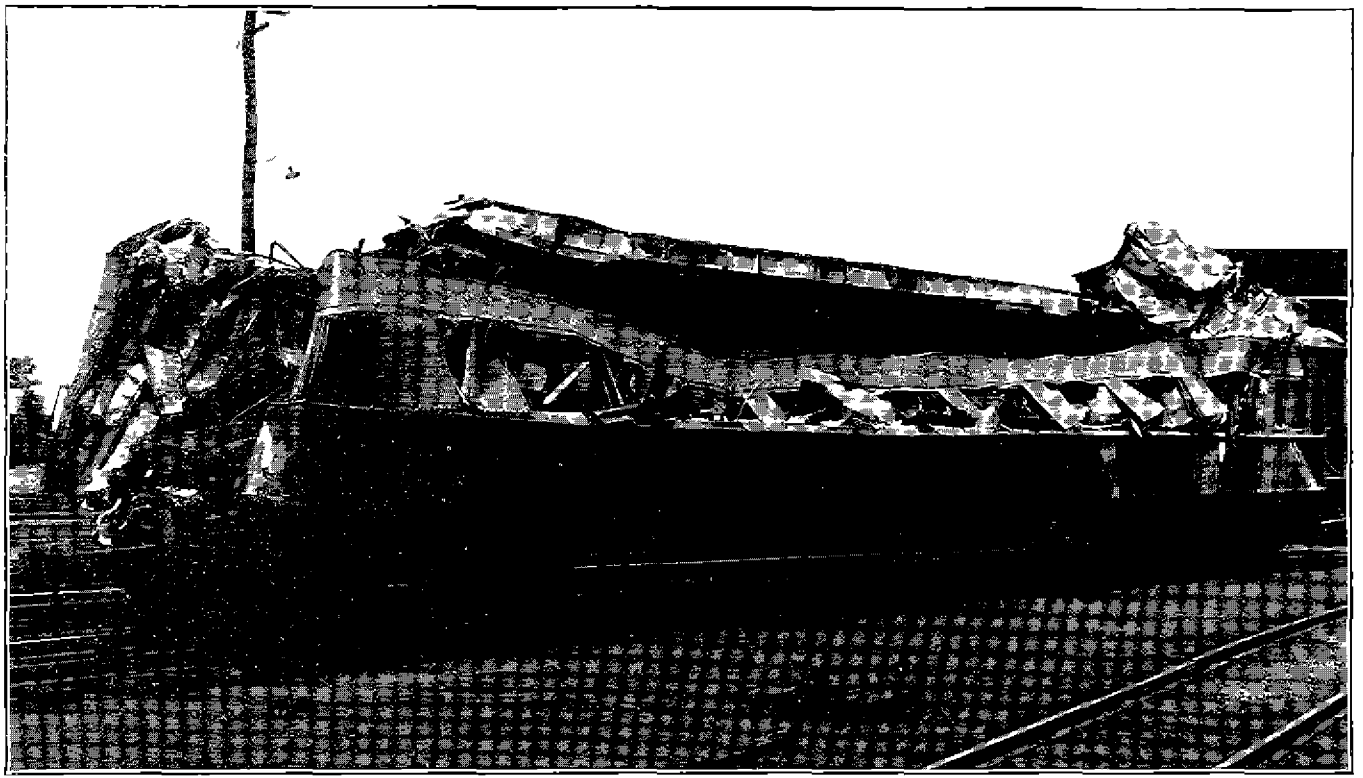

FIG. 5.—Sleeping car Eutuken fifth car in train No. 50, telescoped nearly its entire length by the Fieldsboro

FIG. 6.—Remains of club car Watkins first car in train No. 40