Inv-2321

INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT OF THE DIRECTOR

BUREAU OF SAFETY

ACCIDENT ON THE

CHESAPEAKE AND OHIO RAILWAY

MARMET, W. VA.

DECEMBER 30, 1938.

INVESTIGATION NO. 2321

SUMMARY

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Railway:	Chesapeake & Ohio		
Date:	December 30, 1938		
Location:	Marmet, W. Va.		
Kind of accident:	Derailment; followed by side collision with freight train or siding		
Trains involved:	Passenger	:	Freight
Trains numbers:	2	:	Extra 1455 East
Engine numbers:	480	:	1453
Consist:	12 cars	:	134 cars; caboose
Speed:	60-65 m.p.h.	:	Standing
Operation:	Timetable, train orders, and automatic block-signal system		
Track:	Double; center siding; tangent at point of accident; 0.02 ascending for east-bound trains		
Weather:	Clear		
Time:	11:33 p. m.		
Casualties:	38 injured		
Cause:	Switch opened under train due to broken switch lug		

Inv-2321

March 4, 1939.

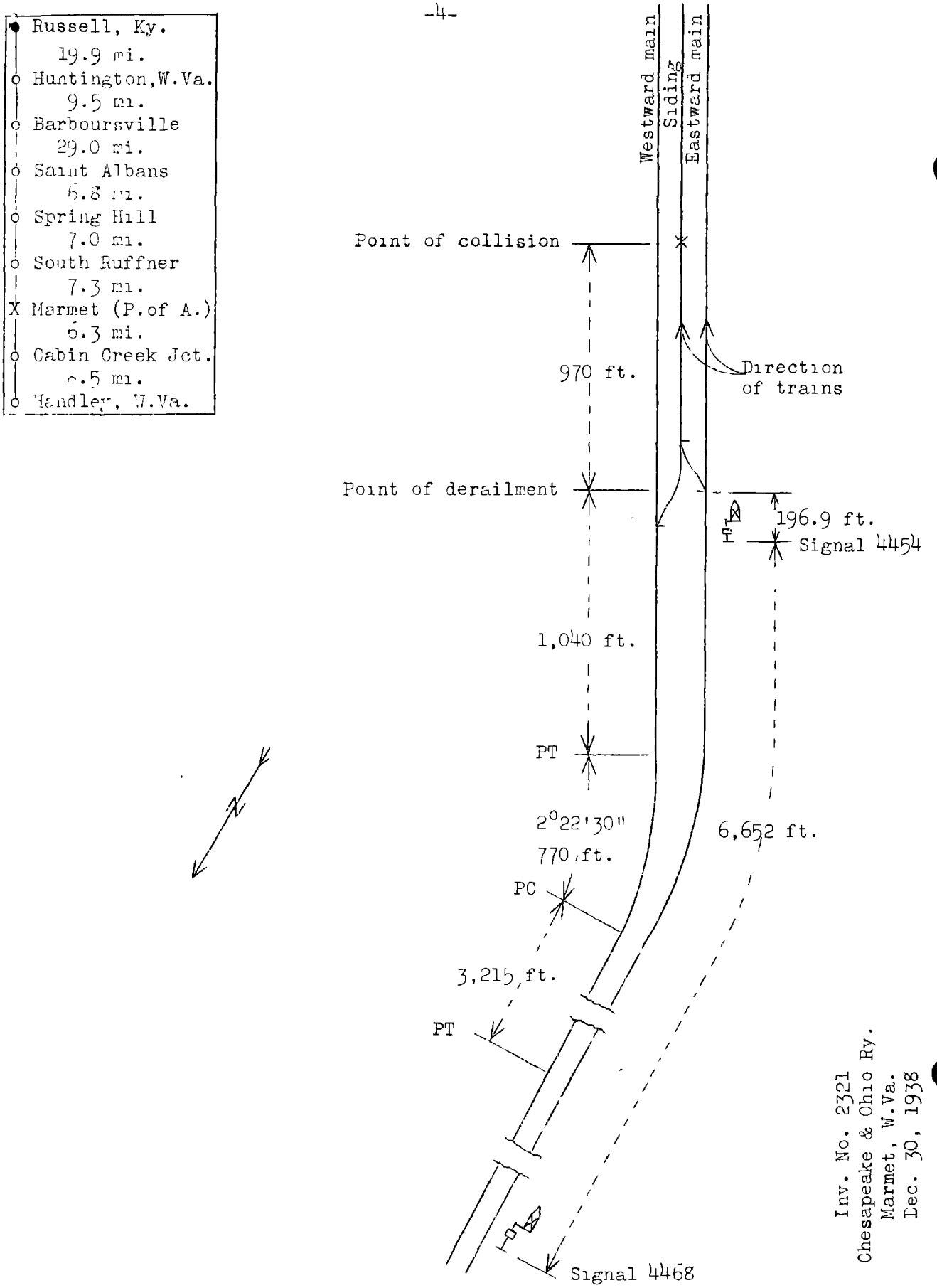
To the Commission:

On December 30, 1938, there was a derailment of a passenger train on the Chesapeake & Ohio Railway near Marmet, W. Va., followed by a side collision with a freight train standing on an adjacent track, which resulted in the injury of 35 passengers, 2 railway officials and 1 Pullman porter.

Location and Method of Operation

This accident occurred on that part of the Huntington Division designated as the Kanawha Subdivision which extends between Russell, Ky., and Handley, W. Va., a distance of 94.3 miles. In the vicinity of the point of accident this is a double-track line over which trains are operated by timetable, train orders and an automatic block-signal system. The derailment occurred at the west switch of the siding at Marmet and the subsequent side-collision occurred on this siding 970.6 feet farther east. Approaching from the west there is tangent track a distance of 3,215 feet, which is followed by a 2°22'30" curve to the left 770 feet in length, and tangent track 1,040 feet to the point of derailment and a considerable distance beyond. The grade is 0.02 percent ascending for east-bound trains.

A siding, 6,097 feet in length, parallels the eastward main track on the left; the center-to-center distance of these two tracks is 13 feet 2 inches. The switch involved, which was installed in 1931, is a facing-point switch for east-bound trains; entry to the siding is made through a No. 10 turnout having no superelevation. There is a "Duro" low, hand-operated type switch stand located on the left side of the eastward main track; it is equipped with an oil-burning lamp located on top of the stand, 27 inches above the head-block and displays a green light for main-track movements and a red light for movements to the siding. A rigid connection is used between the switch stand and the switch. The operating crank shaft is fastened to the switch connecting rod by means of an adjustable crank eye stud or fully threaded lug, 1.5 inches in diameter by 5.5 inches in length from center of the eye to end of the threads, which screws horizontally into the vertical operating crank shaft and permits adjustment of the switch point. When this switch is



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in normal position the connections are in tension with the lug at an angle of about 140° to the line of pull. The switch is equipped with a vertical rotary type switch circuit controller, connected so as to shunt the track circuit of the eastward main track when the switch is in other than normal position.

The signals in the vicinity of the point of accident are automatic signals 4454 and 4468, located on the right side of the eastward main track 196.9 feet and 6,552 feet, respectively, west of the point of the derailment; these are 3-position, upper-quadrant, semaphore type signals and are continuously lighted. Night aspects and indications of these signals are as follows:

Aspect	Indication	Name
Green	Proceed.	Clear
Yellow	Prepare to stop at next signal, train exceeding medium speed must at once reduce to that speed.	Approach
Red	Stop; then proceed in accordance with Rule 509-(a)-C.	Stop and proceed

Rule 509 (a)C reads as follows: "When a train is stopped by a Stop and Proceed Signal, it may proceed at once at restricted speed."

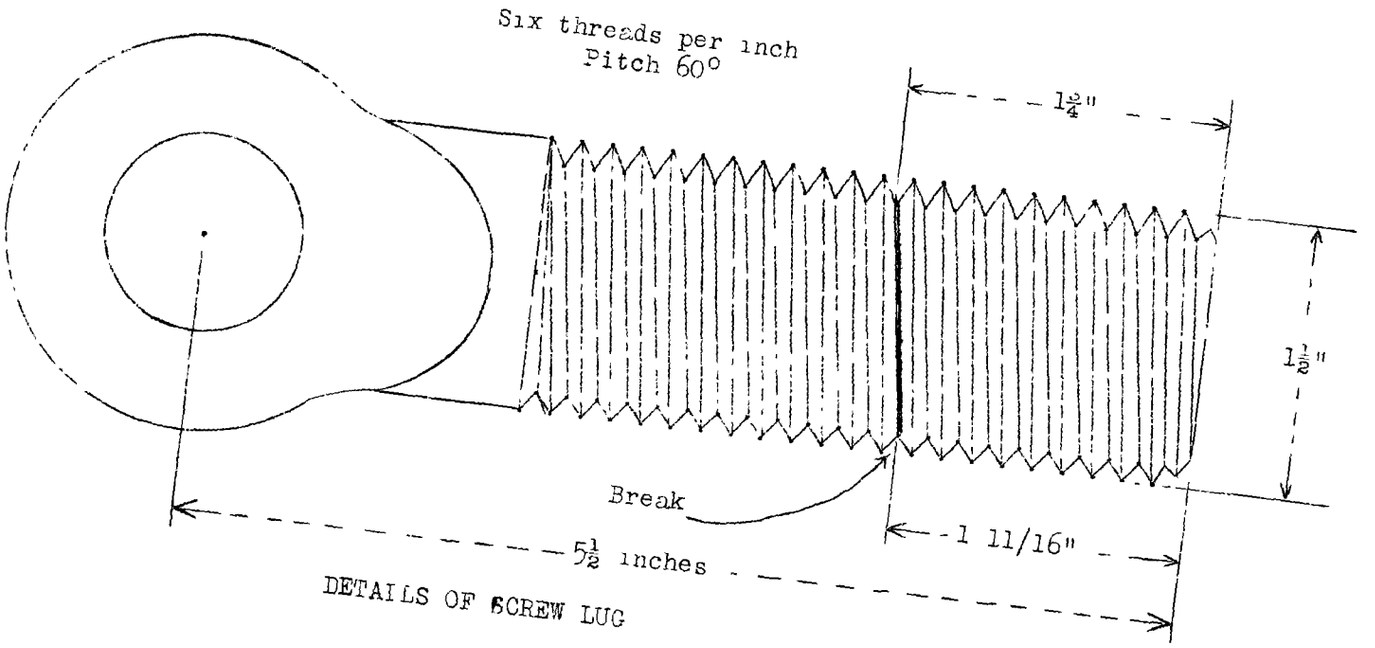
The track structure of both the eastward main track and the siding consists of 130-pound rail, 39 feet in length, laid on an average of 23 treated oak ties to the rail length; it is double-spiked, fully tieplated, and has two plate-holding lag screws per tie, 6-bolt angle bars, and 8 anchors to the rail length; the tracks are ballasted with crushed rock to a depth of 24 inches. The track is well maintained.

The maximum authorized speed for passenger trains is 65 miles per hour.

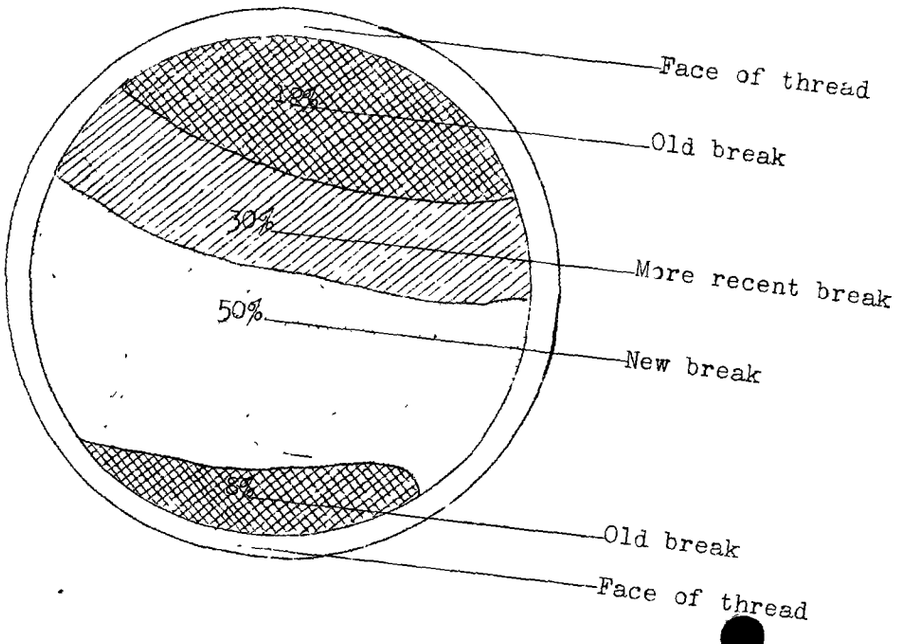
The weather was clear at the time of the accident, which occurred at 11:33 p. m.

Description

Extra 1457, an east-bound freight train, consisted of 134 loaded cars and a caboose, hauled by engine 1453, and was in charge of Conductor Lett and Engineman Lycan. This train passed South Ruffner, the last open office, 7.3 miles west of Marmet, at 9:33 p. m., according to the train sheet. Approaching Marmet, a yellow aspect was displayed on signal 4468 and a red aspect on signal



DETAILS OF SCREW LUG



CROSS SECTION

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1454 and Extra 1453 stopped just west of the west switch of the siding at Marmet; after receiving instructions from the dispatcher to take siding at that point, it cleared the main track about 10:10 p. m., and stopped with the caboose 970 feet east of the west switch. After standing in the siding approximately 1 hour 23 minutes its rear was side-swiped by No. 2, part of which was on the main track, part derailed and part on the siding.

No. 2, an east-bound passenger train known as the "George Washington," consisted of one postal car, one baggage-passenger car, three coaches and seven Pullman sleeping cars, in the order named, all of all-steel construction, hauled by engine 480, of the 4-6-2 type, and was in charge of Conductor Huffman and Engineman Nalle. This train passed South Ruffner at 11:26 p. m., according to the train sheet, 56 minutes late, and was derailed at the west switch at Marmet while traveling at a speed estimated to have been between 60 and 65 miles per hour, and collided with Extra 1453.

Engine 480 and the first two cars of No. 2 stopped, coupled together, on the eastward track with the pilot of the engine 2,019 feet east of the west switch with the rear end of the second car leaning against the freight train, the north side of this car being considerably scraped and badly damaged about one-half its length. The second and the third cars became separated but the rear ten cars remained coupled; the third car stopped on an embankment south of the tracks at a point approximately 450 feet west of the rear of the second car, leaning at an angle of about 10 degrees, with its front end about 11 feet and the rear end about 23 feet from the south rail of the eastward track; the north front corner of this car and the sheathing below the windows were badly damaged. The fourth car stopped against the embankment with its front end about 23 feet and the rear end about 8 feet from the south rail of the eastward track, leaning at an angle of about 70 degrees; the northeast corner of this car was demolished. The fifth car stopped with the front end 8 feet south of the eastward track and the rear end 6 feet south of the siding, leaning at an angle of about 20 degrees; the northeast corner of this car was badly damaged. The sixth car, slightly damaged on the north side, stopped at an angle of about 10 degrees leaning to the south and fouling the eastward track and siding. The seventh car, with the lead truck derailed and the rear trucks on the siding, stopped directly south of where the caboose had been located. This car sustained slight damage. The remaining five cars were neither derailed nor damaged and stopped on the siding with the rear of the twelfth car about 525 feet east of the west switch.

The caboose of Extra 1453 and the three rear cars loaded with coal were derailed and badly damaged; the caboose and the rear car were turned over, fouling the westward track, while the other two cars remained in upright position.

Summary of Evidence

Engineman Lycan, of Extra 1453, stated that when passing South Ruffner, 7.3 miles west of Marmet, the operator handed up a message instructing them to head in at Cabin Creek Junction, 6.3 miles east of Marmet, to clear No. 2 on time. Approaching Marmet, signal 4468 was displaying a yellow aspect and signal 4454 was displaying a red aspect; he stopped the engine at the latter signal about 9:50 p. m. The brakeman immediately communicated with the train dispatcher by telephone through the operator at South Ruffner, and received instructions to head in at Marmet siding; he estimated that they were in the clear 30 minutes or more before No. 2 was due. The engineman knew nothing of the accident until some time after its occurrence.

The statement of Fireman Lee, of Extra 1453, corroborated that of the engineman. He further stated that the weather was clear and he observed the brakeman when the latter handled the entrance switch; as the switch lamp was not burning the brakeman lit it and it showed the proper indication.

Brakeman Cunningham, of Extra 1453, stated that after receiving instructions to take siding he went to the main track switch, found it locked and properly set for the eastward main track, threw this switch, placed the lock in hasp and saw that the points fitted properly; the switch functioned normally. The light was not burning and he lit the lamp, which displayed a red aspect when the switch was lined for the siding. He said that his train cleared the main track between 10 and 10:15 p. m. After the accident occurred he proceeded to protect the westward main track and did not have an opportunity to make any further examination of the west switch.

Conductor Lott, of Extra 1453, stated that after clearing the main track he instructed his flagman to go back and carefully examine the switch, and also to see if signal 4454 had changed to display a proceed indication. The flagman later advised him this signal was clear and everything was in good shape. He stated that his train stopped on the main track at 9:46 p. m., and that the accident occurred about 11:32 p. m., at which time he was walking toward the head end of his train. He made no inspection of the west switch at any time.

Flagman Gilbert, of Extra 1453, stated that after his train cleared the main track he restored the west switch to normal position, locked it and the points fitted properly, and he observed that signal 4454 displayed a proceed indication. Later, upon instructions of his conductor, he made an examination of the switch and found it properly set and the signal displayed a proceed indication. Shortly after he returned to the caboose a signal foreman arrived and he assisted the latter in making some adjustments to the switch and was advised by the signal foreman that it was all right. When No. 2 approached, the flagman was on the rear platform of the caboose and after the engine of No. 2 passed on the main track he saw fire flying from under the rear of the second car of that train; he then went to a point of safety.

Engineman Nalle, of No. 2, stated that an air-brake test was made before leaving Huntington, 59.6 miles west of Marmet, and a running test was made after departure from that point; the brakes functioned properly en route, and there was nothing wrong with the engine. Approaching Marmet at a speed of between 60 and 65 miles per hour he observed signals 4468 and 4454 displaying proceed indications. Just after his engine passed over the west switch he felt a jerk in the train and, looking back, saw fire coming from under the train at about the second car; he applied the brakes in emergency, immediately after which the signal whistle on the engine sounded, indicating that the train had parted, and he saw the cars turning over. He estimated that the engine ran about 15 or 16 car lengths after the emergency application was made. After the engine stopped he made an examination of wheel flanges on the engine and the first car and found no marks indicating that they had struck the frog of the switch.

The statement of Fireman Watt, of No. 2, contributed nothing in addition to the statement of Engineman Nalle.

Conductor Huffman, of No. 2, stated that his train was approximately 57 minutes late when approaching Marmet and it was running at the usual speed of between 60 and 65 miles per hour. He was standing in the aisle of the fifth car and felt the car hit the ground and there seemed to be a run-in from the rear; the car then began to turn over. He was of the opinion that this car was not derailed at the switch but headed in the siding before becoming derailed. He estimated that the accident occurred at 11:33 or 11:34 p. m. His examination of the west switch after the accident disclosed that the points were lined for a siding movement but the lamp on the stand displayed a green light which was for a main track movement.

Assistant Conductor Poore, of No. 2, was in the ninth car at the time of the accident; his statement was similar to that of Conductor Huffman.

Train Baggageman Hall, of No. 2, who was in the baggage end of the second car, stated it was his opinion that the second car was the one that knocked the caboose over.

Flagman Luck, of No. 2, stated that when approaching Marmet he was in the west end of the rear car and felt the train slow down as though an emergency application of the brakes had been made, and the car lurched and surged three or four times as it went through switch and into the siding. He at once went back to flag and looked for marks on the track between the rear car and the west switch and, reaching the latter, he saw that it had been run through. The target, the lamp and the points were as described by Conductor Huffman. He continued going back but did not see anything which would indicate dragging or derailed equipment.

Car Inspector Perry, who was on No. 2 at the time of the accident, stated that about 20 minutes after the accident he examined the west switch and it was locked with the points lined for the siding and the switch lamp displayed a green aspect; a broken lug was lying underneath the edge of the stand.

General Air Brake Inspector Anderson, who was in the observation end of the tenth car of No. 2, estimated that approaching Marmet this train was traveling at a speed of 60 miles per hour when he felt the slack run in, followed by an emergency application of the brakes, and 3 or 4 seconds later there were several lurches and a shock, and then the car stopped.

Road Foreman of Engines Bess stated that he was in the front vestibule of the sixth car in No. 2. He examined the switch about 30 or 40 minutes after the accident and found that the lug had broken and it and the switch rod were lying on the ground. The switch points were lined for the siding, while the switch was locked for the main track; it was his opinion that the accident was caused by the switch lug breaking.

Train Dispatcher Leist stated that about 10 p. m. he received information that Extra 4453 East had been stopped at Marmet by a red signal and he instructed this train to clear at that siding if it could not make Cabin Creek Junction for No. 2 on time; he estimated that it cleared the main track about 10:10 p. m. He immediately called the signal maintainer at South Ruffner to look after signal 4454 and at 10:14 p. m. gave a line-up for the maintainer's motor car to go to that point; about 11 p. m. he was advised by the signal foreman that the signal was all right. He was notified of the accident at 11:40 p. m.

Signal Foreman Dunn stated that on the night of the accident he was at South Ruffner and owing to the regular signal maintainter being ill he was called to go to Marmet. He made the trip by motor car on the eastward main track, and found all signals displaying proceed indications; he arrived at Marmet about 10:45 p. m. The signals at that point were clear, but he found that the switch points were open about 3/16 inch; as it requires but ¼ inch opening to throw the signal he assumed this was the cause of the reported failure. He first attempted to adjust the switch by unscrewing the lug to give the switch more throw, but as the back end of the lug was flush with the shaft he did not make the adjustment that way but instead moved the No. 1 rod one hole farther east in the transit clip, placing the points about 1/8 inch nearer the stock rail. He threw the switch twice thereafter; it was not adjusted too tight and there was no abnormal tension. His examination of the switch and the switch stand disclosed nothing indicating a break in the lug, but he thought that had this existed he would have discovered it. As No. 2 approached he was standing opposite the switch and signal 4454 displayed a proceed indication; the first he was aware of the train being derailed was when he saw fire flying from the wheels. His inspection of the switch after the accident developed that the points were set for the siding with the stand locked for a main track movement; the broken end of the lug attached to the connecting rod had fallen to the ground under the stand, and the other end was still attached to the vertical shaft. He said that he thought the broken lug was the cause of the accident. Foreman Dunn stated that he was called in this instance because the maintainer was sick, and he did not know whether the maintainer had been called recently because of previous trouble at this signal.

Signal Maintainer Ruby, who is regularly assigned to this territory, stated that on December 28 he was called from South Ruffner by the section foreman to look after signal 4454; approaching Marmet he found all signals in clear position. The section foreman told him that he had spiked the stock rail in, which partly closed the contacts on the controller, and as the contacts were just barely open he adjusted the circuit controller to the proper specifications. This was the only occasion in the past 12 months that he could remember when he was called upon to make adjustments to this signal due to displaying an improper indication.

Section Foreman Payne stated that on December 28 during his regular weekly inspection of switches he found the point of the switch involved about 1/8 inch open. He pulled the spikes in the first and third ties west of the switch point, plugged the holes and spiked the stock rail inward to "neat" gage which fitted the point snugly to the rail; he did not examine the mechanism under the stand. He afterward threw the switch and the action of the lever indicated no abnormal tension; it was not too tight. The signal did not function properly after this work was done and it was necessary to call the signal maintainer to adjust the controller contacts. The section foreman thought that changes in temperature probably caused a movement in the members of the switch some time after he had spiked the stock rail inward. For more than six months prior to this work the switch or the gage at that point had not required any adjustment.

Track Supervisor Bowles stated that he arrived at the scene of the accident about 1:20 a. m., December 31, and found the lamp on the west switch stand displaying a green aspect and the points lined for the siding. Between this switch and the point of collision the eastward track was knocked out of line and from this latter point the track was destroyed a distance of 250 feet and the rails and ties were badly damaged a distance of 750 feet beyond. At the point of the collision the siding was practically destroyed. It was his opinion that the broken lug on the switch stand was the cause of the accident.

Assistant Engineer Shepherd stated that he arrived at the scene of the accident at 3 a. m., December 31. His examination disclosed that the north switch point of the west switch was marked on the point, but it did not have the appearance of a heavy blow; 14 feet 10 inches east of the switch point there was a deep mark on the west end of an angle bar on the north side of the north rail of the eastward track. The switch ties in general were out of line 1½ inches to the south from the heel of the switch to the point of the switch; 22 feet 10 inches east of the point of the switch there was a mark on the base on the north side of the north rail, and 25 feet east of the switch point a wheel had dropped off the south rail of the eastward track. From this point to a point 192 feet east of the switch the marks indicated that there was one truck on the ground moving diagonally towards the north. At a point 108 feet 8 inches east of switch point the first south wheel crossed north rail of the eastward track; 100 feet 6 inches to 109 feet 8 inches from the point of switch a deep scar showed on the top gage face of the south rail of the cross-over. From this point eastward there were indications of two trucks being off; these marks extended between the eastward track and the siding, marking the north

ends of the ties on the main track and the south ends of the ties of the siding. The distance between these scars was approximately 5½ feet, which showed they could not have been made by opposite wheels of the same truck, the indications being that they were made by two trucks. His examination of the switch stand disclosed that the lug was broken; he estimated about 10 percent old defect in the break.

Engineer Maintenance of Way Geyer stated that the Duro switch-stand is equipped with a threaded, screw-type lug and it is used in a rigid connection between the switch and the switch-stand. Between 1932 and 1936 a number of failures of the threaded type lugs developed due to fractures. These failures occurred generally in yard switches and a few main-track switches within yard limits and it was impossible to determine definitely whether these fractures were caused by the switch having been wholly or partly run through, or otherwise. However, this condition caused some doubt as to the safety of the threaded type lug and in April, 1936, action was taken to remove and replace all such lugs in main track switches, as an extra precaution; approximately 3,000 new lugs were installed. At the same time a switch-stand of the non-threaded lug type was adopted because of the trouble experienced with the threaded lugs and because the latter type was more economical and embodied a more efficient arrangement for switch-point adjustment. During the period from April, 1936, to the date of the accident, approximately 700 non-threaded lug switch-stands had been installed. Prior to the date of the accident, there had been no fracture of a threaded type lug in a main track switch-stand outside of yard limits. It was his opinion that the threaded type lug, when used in the rigid connected assembly, is more susceptible to incipient cracks and progressive fractures than the non-threaded type; however, excluding this factor, they are of sufficient cross-sectional area to afford an ample factor of safety.

Records submitted by officials indicated that the broken screw-eye lug was new when applied to the west switch-stand at Marmet in April, 1936.

Observations of Commission's Inspectors

The Commission's inspectors found conditions to be practically as described by Assistant Engineer Shepherd. There was sufficient tension in the switch to cause it to spring to reverse position when freed from the connecting rod in normal position; it was obvious that this condition was caused by damage due to a derailed truck having passed between the switch-point and the stock rail and by the lateral thrust of the following trucks entering the siding. Their examination disclosed that the crank-eye

stud or screw lug had two distinct cracks in the metal at the bottom of the threads 1 3/4 inches from the end; the metal was badly discolored, indicating old breaks; on one side the crack covered approximately 8 percent of the cross-sectional area, and the one directly opposite about 12 percent of the area; adjacent to this there was a more recent crack of approximately 30 percent of the cross-sectional area, and the remaining 50 percent of the area was a new break. The above mentioned defects could not have been detected by casual inspection.

After the switch and the track had been repaired a check was made of signals 4454 and 4468 as well as the switch-circuit controller on the main-track switch where the derailment occurred. The signals operated as intended in all positions and the circuit controller operated properly. The signals, switch-circuit controller and the shunt wires had not been changed as none of this apparatus was damaged by the accident. A switch-point obstruction test was made and it was found that when the points were opened slightly more than 3/16 inch but less than $\frac{1}{4}$ inch, the track circuit was shunted and signal 4454 displayed stop indication and signal 4468 an approach indication. When the switch was secured in position for main track movements, both signals displayed proceed indications.

Discussion

According to the evidence Extra 1453 was proceeding eastward expecting to clear for No. 2 at Cabin Creek Junction. However, Extra 1453 was stopped at Marmet on account of signal 4454 displaying a red aspect; because of delay encountered in stopping for this signal and reporting it, the dispatcher instructed Extra 1453 to clear for No. 2 at Marmet. No. 2 approached Marmet at a speed of from 60 to 65 miles per hour; signals 4468 and 4454 displayed proceed indications and the switch was lined for the main track movement. Apparently after the engine, tender, first car and the front truck of the second car passed over the west switch on the main track, the switch opened, causing the rear truck of the second car to become derailed and the following cars to enter the siding. The engineman's first intimation of the accident was when he felt a jerk and looking back he saw fire flying from under the train at about the second car. He applied the air brakes in emergency; immediately afterward the signal whistle on the engine sounded, indicating that the train had parted; apparently the speed of the train had not been materially reduced when the north side of the second car struck the rear of Extra 1453.

The switch stand involved was installed new in 1929, and a new crank-eye stud or screw lug was applied to the stand in April, 1936. After the accident it was found that this lug was broken and one part of it and the connecting rod were lying on the ground under the switch-stand. The breaking of the lug apparently allowed the switch-point to open sufficiently to cause the derailment of the rear truck of the second car which forced the switch point to the south, permitting the following cars to enter the siding.

The investigation disclosed that for more than six months prior to December 28, two days before the accident occurred no trouble had been experienced with the switch point or the gage at the point involved; on that date the section foreman found the switch-point open about 1/8 inch and pulled the spikes in the first and third ties west thereof, plugged the holes and drew the north stock rail inward to proper gage, fitting the point without abnormal tension. The signal did not function properly thereafter and the signal maintainer, who was called, found that the circuit controller contacts were just barely open and the switch had to be thrown rather hard to open the contacts. An adjustment of the circuit controller was made which corrected the trouble. This was the only occasion in the past 12 months that the signal maintainer had been called upon to make repairs at this signal on account of improper indications, and the section foreman had not observed it displaying improper indications previously. A second adjustment was made about one hour before the accident after signal 4454 had been reported at stop by Extra 1453. To correct the trouble the dispatcher called the signal maintainer who had previously made the adjustment on December 28, but as the signal maintainer was ill a signal foreman who was in the vicinity went out instead; the foreman had no knowledge of the adjustment previously made by the maintainer. Upon arrival he found that the switch was set for the main track and signal 4454 was displaying a proceed indication; however, examination disclosed that the switch point was open about 3/16 inch and as but $\frac{1}{4}$ inch opening was required to open the signal circuit, he thought the trouble which had been reported by Extra 1453 was caused by improper adjustment; to correct this condition he moved the bridle rod to the next hole farther east in the transit clip on the switch point, which brought the point to the stock rail with only normal tension; he then threw the switch a few times; it was not too tight and it operated normally; he left it set for a main track movement, with the signal displaying a proceed indication. His examination of the switch and the switch stand disclosed nothing wrong at that time.

He was standing opposite the switch at the time of the accident and afterwards found the broken lug. It is apparent that in the interval between December 28, when the section foreman spiked the north stock rail inward and less than one hour prior to the accident, when the point was again found open, the rail returned to its former seat which again caused a gap and set up signal trouble which necessitated calling the signal foreman.

Examination of the broken parts indicated that the fracture occurred in successive stages. There were two distinct cracks at the bottom of the threads 1-3/4 inches from the screw end, and the surfaces were discolored, indicating old breaks which covered 20 percent of the cross sectional area; a more recent break covered 30 percent of the area, while the remaining 50 percent was a new break. It therefore appears that a progressive fracture, which could not be detected by regular inspection, existed in this lug and reached the complete breaking point when subjected to the shock and stress set up by the passage of the train involved. The fractures indicated that a clean break had occurred; there was no evidence of bending or permanent deflection having existed prior to the final fracture.

The testimony of officials is to the effect that they had been using the type of switch-stand, of which the threaded lug is a part, since 1923, and they had never had a failure in a main-track switch outside of yard limits prior to the time of this accident; however, between 1932 and 1936 they had experienced such failures in yard switches and in a few main-track switches within yard limits. They were unable to determine definitely whether these failures were caused by the switches having been partially run through, or from other causes; however, this condition aroused some doubt as to the safety of these lugs and in April, 1936, as an extra precaution, they installed new lugs in all main-track switches, approximately 5,000 lugs being renewed. At the same time, because of this and other factors, a switch-stand of the non-threaded lug type was adopted as standard and prior to the date of this accident 700 such stands had been installed.

The engineer maintenance-of-way expressed the opinion that while the cross sectional area of a threaded lug affords an ample factor of safety, it is more susceptible to incipient cracks and progressive fractures than the non-threaded type lug, when used in a rigid connection. It is possible that the variation in the tension exerted on the lug involved as trains passed over the

switch, set up a vibration in the lug, which resulted in cracks originating between the threads and progressing in depth until the remaining solid metal was insufficient to withstand the stress placed upon it.

Conclusion

This accident was caused by a switch opening under a train, due to a broken switch lug.

Respectfully,

W. J. PATTERSON,

Director.