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INTERSTATE COMMERCE COMMISSION

Ex Parte No. 184

ACCIDENT AT UNION STATION, WASHINGTON, D. C.

Submitted January 29, 1953 Decided February 17, 1953

Accident at Union Station, Washington, D. C., on January 15, 1953, caused by a train moving out of control as a result of the brakes on the rear 13 cars being inoperative from the locomotive because of a closed angle cock at the rear of the third car.

Edward R. Brumley for the New York, New Haven and Hartford Railroad Company.
George E. Hamilton, Jr., and John L. Hamilton for the Washington Terminal Company.
A. Schroeder for the Pennsylvania Railroad Company.

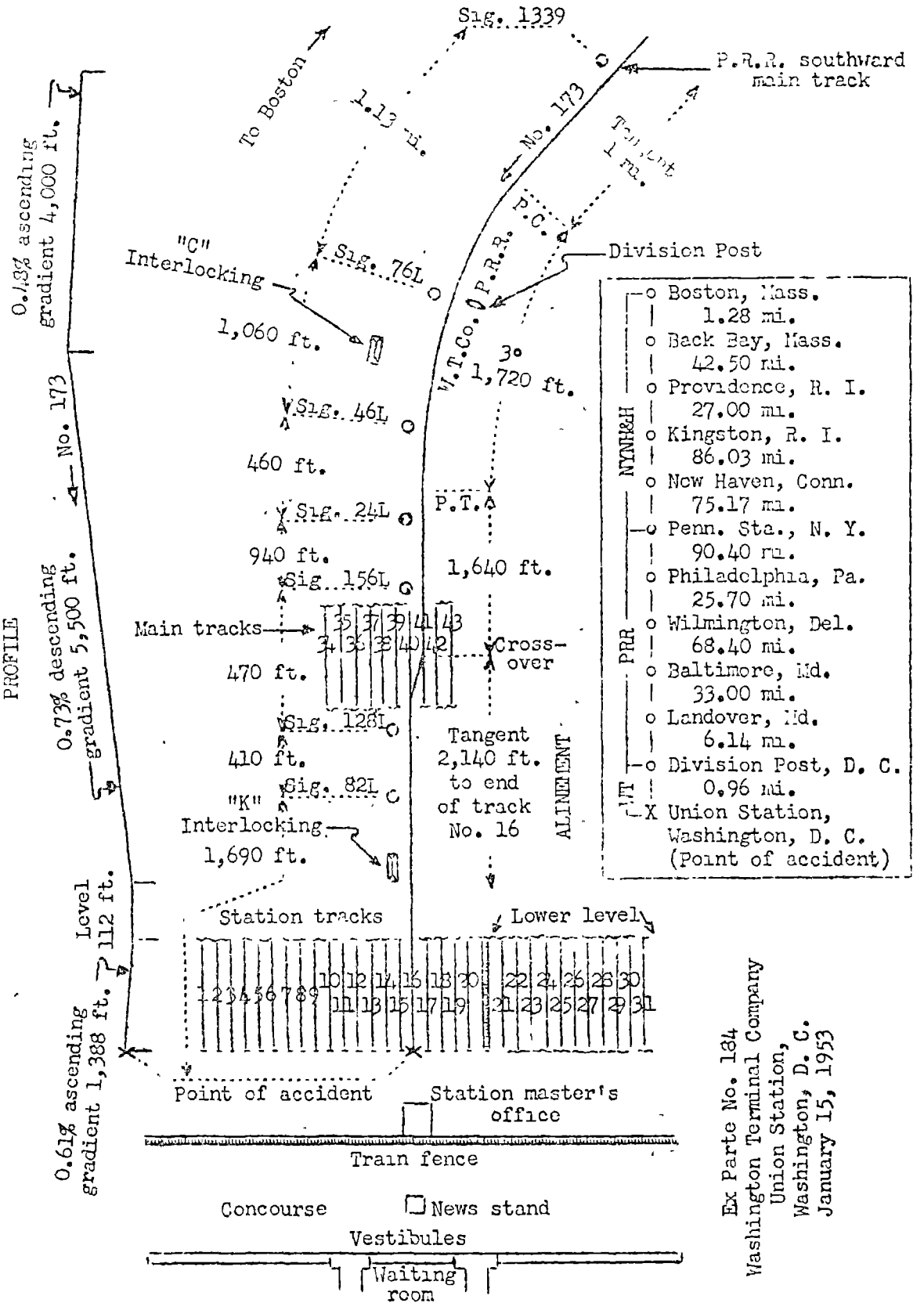
REPORT OF THE COMMISSION

DIVISION 3, COMMISSIONERS PATTERSON, JOHNSON, AND KNUDSON

PATTERSON, Commissioner:

This is an investigation by the Commission on its own motion with respect to the facts, conditions, and circumstances connected with an accident which occurred on the line of the Washington Terminal Company at Union Station, Washington, D. C., on January 15, 1953. Hearing was had at Washington, D. C., on January 26, 27, 28 and 29, 1953. The accident was a derailment of a passenger train and resulted in the injury of 62 passengers, 9 licensees in and about the station, 4 Pullman Company employees, 1 train-service employee, and 11 station employees.

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Ex Parte No. 184
Washington Terminal Company
Union Station,
Washington, D. C.
January 15, 1953

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Location of Accident and Method of Operation

This accident occurred on that part of the railroad extending between Division Post, 0.96 mile north of Union Station, and Union Station, Washington, D. C. Passenger trains of the Pennsylvania Railroad operating into and out of Union Station operate over its Maryland Division between Baltimore, Md., and Division Post, and over the Terminal Company between Division Post and Union Station. Both lines are provided with a catenary system for the electric propulsion of trains. North of Division Post, the Maryland Division of the Pennsylvania is a double-track line over which trains are operated by automatic block-signal and cab-signal indications supplemented by an automatic speed-control system. Between "C" Interlocking, located immediately south of Division Post, and the north limits of "K" Interlocking, 0.47 mile south of Division Post, the line of the Terminal Company is a 10-track line over which trains are operated by signal indications. These tracks are designated from west to east as tracks Nos. 34 to 43, inclusive. Within interlocking limits at "K" Interlocking these tracks converge with 31 station tracks which are designated from west to east as tracks Nos. 1 to 31, inclusive. The accident occurred at the south end of track No. 16. Tracks Nos. 1 to 20, inclusive, enter the station at street level and are stub end tracks. The other tracks enter the station at a lower level. A south-bound train moving on track No. 41 enters track No. 16, which is in line with track No. 40, through a facing-point crossover located 2,140 feet north of the south, or stub end of track No. 16. Each end of this crossover is provided with No. 8 double-slip switches and movable-point frogs. From the north, via the southward main track of the Pennsylvania, track No. 41, and track No. 16, there are, in succession, a tangent more than 1 mile in length, a 3° curve to the left 1,720 feet, a tangent 1,640 feet to the crossover between tracks Nos. 41 and 16, and a tangent 2,140 feet from the crossover to the stub end of track No. 16. From the north the grade is, successively, 0.48 percent ascending 4,000 feet, 0.73 percent descending 5,500 feet, level 112 feet, and 0.61 percent ascending 1,388 feet to the stub end of track No. 16.

Automatic signal 1339, governing south-bound movements on the southward main track of the Pennsylvania, semi-automatic signals 76L, 46L, 24L, and 156L, governing south-bound movements on track No. 41, and semi-automatic signals 128L and 82L, governing south-bound movements on track No. 16, are located, respectively, 2.09 miles, 5,030 feet, 3,970 feet, 3,510 feet, 2,570 feet, 2,100 feet, and 1,690 feet north of the stub end of track No. 16. Signal 1339 is of the position-light type, and the other signals are of the color-position-light type.

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The automatic cab-signal system and the automatic speed-control system in use on the Pennsylvania are so arranged that if a train passes a signal indicating "Approach" at a speed in excess of 30 miles per hour a full-service brake-pipe reduction will be made automatically unless the engineer immediately makes a service brake-pipe reduction of predetermined value. After the speed has been reduced to 30 miles per hour or less the brakes may be released, but they will again become applied if a speed of 30 miles per hour is exceeded while the train is moving on an "Approach" cab-signal indication. If a train passes a signal requiring movement at restricted speed the device functions in the same manner except that the speed is restricted to 20 instead of 30 miles per hour. The automatic speed-control equipment on a locomotive may be made inoperative by the engineer while the locomotive is operating over lines not equipped for automatic cab-signal operation.

At the stub end of track No. 16 an all-steel bumping post is bolted to the track rails. The bumper face is approximately 6 feet north of the ends of the rails and 2 feet 10 inches above the level of the tops of the rails. An ornamental wrought-iron train fence separates the south ends of the station platformsfrom the passenger concourse. This fence is located 61.5 feet south of the ends of the tracks and is at right angles to the tracks. The passenger concourse is 760 feet in length and 84.7 feet in width. Several vestibules at the south side of the concourse and opposite the ends of tracks Nos. 12 to 20, inclusive, afford passageway between the concourse and the main waiting room of the station.

The maximum authorized speed for south-bound passenger trains is 80 miles per hour on the main track of the Pennsylvania, 25 miles per hour between signal 76L and signal 156L, and 15 miles per hour between signal 156L and the station platformsat Union Station.

Description of Accident

No. 173, a south-bound first-class Pennsylvania passenger train designated as the Federal, consisted of electric locomotive 4876, 3 coaches, 1 combination baggage-coach, and 12 sleeping cars, in the order named. The first three cars and the sixth, ninth, tenth, thirteenth, fourteenth, and sixteenth cars were of lightweight steel construction and were equipped with tightlock couplers. The other cars were of conventional all-steel construction, and were equipped with type E couplers except the fourth, which was equipped

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with Pitt couplers. The train passed Landover, 7.1 miles north of Union Station and the last open office on the line of the Pennsylvania, at 8:30 a. m., 20 minutes late, passed "G" Interlocking on track No. 41 at 8:36 a. m., 19 minutes late, crossed from track No. 41 to track No. 16 at "K" Interlocking, and while moving at an estimated speed of 35 to 40 miles per hour it struck the bumping post and was derailed at the stub end of track No. 16.

The locomotive demolished the bumping post and a portion of the train fence and entered the concourse. It broke through the floor of the concourse and stopped with the front end suspended in the wreckage of the floor and opposite the end of track No. 15 and a few feet north of the south wall of the concourse. The rear end of the locomotive dropped to the floor of the baggage room below the concourse and stopped about 65 feet south of the stub end of track No. 16. The first car stopped with the front end against the rear end of the locomotive and the rear end suspended over the end of track No. 16. A separation occurred between the first and second cars. The second car stopped approximately in line with track No. 15, with its front end about 100 feet south of the end of that track. The front end broke through the floor of the concourse, but did not drop to the floor of the baggage room. The third car stopped with the rear end on the track structure of track No. 16. All of these cars remained upright. The fourth, fifth, and sixth cars were derailed by the force of the impact. They stopped upright and approximately in line with track No. 16.

The locomotive was considerably damaged. The entire body and underframe of the first car were twisted, and there was extensive damage to both the inside and the outside of the body and to the appurtenances below the floor level. The front end of the second car was crushed and torn, the right side of the body was bent and twisted, and there was extensive damage to the interior and to the appurtenances below the floor level. The third car was not badly damaged. The fourth, fifth, and sixth cars were slightly damaged.

The fireman of No. 173 and 11 station employees of the Washington Terminal Company were injured.

The locomotive of No. 173 was equipped with 8EL brake equipment. The regulatory devices were adjusted to supply brake-pipe pressure of 110 pounds. The first three cars and the sixth, ninth, tenth, thirteenth, fourteenth, and sixteenth cars were equipped with D22 brake equipment. The other cars were equipped with U3 brake equipment.

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The weather was clear at the time of the accident, which occurred about 8:38 a. m.

Discussion

No. 173 originates at Boston, Mass., and is operated over the New York, New Haven and Hartford Railroad from Boston to Pennsylvania Station, New York, N. Y., 231.98 miles, and over the Pennsylvania and the Washington Terminal thence to Union Station, Washington, D. C., 224.6 miles. On the day of the accident this train departed from Pennsylvania Station at 4:38 a. m., 36 minutes late. A terminal test of the brakes was made before the train departed and the brakes functioned properly when used in controlling the speed of the train at various points and in making station stops at Philadelphia, Pa., Wilmington, Del., and Baltimore, Md., 90.4 miles, 116.1 miles, and 184.5 miles, respectively, south of Pennsylvania Station. After the train departed from Baltimore, at 7:59 a. m., the engineer did not have occasion to use the brakes until the train was passing signal 1339, which indicated "Approach." At this time the speed was between 60 and 70 miles per hour. As the train passed the signal the indication of the cab signal changed to "Approach" and the cab-signal whistle sounded until it was acknowledged by the engineer. The engineer moved the controller from the tenth or twelfth notch to the fifth notch and made a split brake-pipe reduction of 17 pounds. The initial reduction was between 5 and 7 pounds, and the reduction was then increased to a total of 17 pounds. The engineer did not notice that the exhaust from the brake valve was unusually short, but when the train reached a point about 3,000 feet south of the signal he observed that the speed of the train was not being reduced in a normal manner. He then moved the controller to "Off" position and placed the automatic brake valve in emergency position. The exhaust from the brake valve was short and the emergency application apparently had no more effect in reducing the speed of the train than the service application had. He then notified the fireman that the brakes were not effective and, as the train approached "C" Interlocking, he began to sound the pneumatic horn in an effort to warn other employees that the train was out of control. The sander valve was open during this time. When the front of the train reached a point about 1,300 feet north of the stub end of track No. 16 the engineer attempted to reverse the motors, but the overload relays immediately functioned and this action did not effect any further reduction in speed. He estimated that the locomotive struck the bumping post while moving at a speed of about 35 miles per hour.

As the train passed signal 1339 the fireman heard the cab-signal whistle sound until it was acknowledged by the

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engineer. At the same time he heard the sound of the exhaust as the engineer made a brake application. He did not notice the length of the exhaust. When the train reached a point about 5,000 feet south of the signal he observed that the speed of the train was excessive and at the same time the engineer told him that the brakes were not effective. He immediately opened the emergency brake valve on the fireman's side of the control compartment. There was no exhaust from the valve. He observed that the automatic brake valve was in emergency position and the independent brake valve was in application position. He then crossed to the engineer's side of the control compartment and observed that the gauges indicated that the brake-pipe pressure had been depleted and that the brake-cylinder pressure was about 70 pounds. These are the normal indications after an emergency application of the brakes has been made. The fireman thought that the speed was between 35 and 40 miles per hour at the time the locomotive struck the bumping post.

The conductor thought there was a brake application before the train reached "C" Interlocking, but as the train was closely approaching the interlocking he became aware that the speed was excessive. He proceeded to the front vestibule of the third car and after he entered it he heard the sound of the horn of the locomotive. He immediately opened the conductor's back-up valve, but there was no exhaust and no appreciable reduction in speed. He then returned to the interior of the third car and warned the passengers to remain in their seats and to be prepared for an abrupt stop.

The front brakeman proceeded from the baggage compartment to the passenger compartment of the fourth car as the train was passing through "C" Interlocking. When he became aware that the speed was excessive he proceeded to the rear vestibule with the intention of opening the conductor's back-up valve, but because of the lurching of the car and his difficulty in keeping his footing, he was not certain whether he succeeded in opening the valve before the accident occurred. It is apparent that he did not.

The flagman was in the rear car and he first became aware that the speed was excessive when that car moved through the crossover at "K" Interlocking. At that time he was in the center of the car. Because of passengers in the aisle preparing to leave the train, he was unable to reach the emergency valve at either end of the car before the accident occurred. Neither the front brakeman nor the flagman heard the sound of the pneumatic horn of the locomotive.

An employee who was not on duty was riding in the third car of the train. As it was passing through "C" Interlocking

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he noticed that the speed was excessive. He immediately opened the emergency valve at the rear of the car. There was no exhaust from the valve.

As No. 173 was passing "C" Interlocking the assistant train director observed that it was moving much faster than usual. Because of other movements between the interlocking station and the track on which No. 173 was moving, he was unable to determine whether there were any indications that the brakes of the train were applied. He immediately informed the train director at "K" Interlocking that it appeared doubtful that the engineer of No. 173 would be able to stop the train short of a stop signal at "K" Interlocking. The train director at "K" Interlocking instructed the leverman to line the route for the train to enter track No. 16, the regularly assigned track for this train. The leverman lined the route for movement from signal 156L to signal 128L and lined the switches beyond signal 128L for movement to track No. 16. No. 173 passed signal 128L before the leverman had had time to clear the signal. When the train director observed the speed at which No. 173 was approching, the locomotive had already entered the crossover and there was insufficient time to change the positions of any of the switches beyond signal 128L. He immediately warned the employees in the station master's office, which is located near the stub end of track No. 16, that the train appeared to be out of control. He observed that sparks were flying from the wheels and brake shoes of the locomotive but was unable to determine whether the brakes were applied on the cars of the train.

Examination of the equipment after the accident occurred disclosed that the engineer was successful in obtaining an emergency application of the brakes on the locomotive and the first three cars of the train but no effective brake application was obtained on the other cars. The treads of the wheels of the locomotive showed numerous skid marks and considerable built-up metal, indicating that the wheels had received very heavy braking shortly before they stopped. The wheels of the first three cars were extremely hot when the train stopped. When the wheels were examined between 1 hour and 1 hour 30 minutes later they were found to be unusually hot considering the length of time which had elapsed after the accident occurred. There was evidence of built-up metal on the treads and at the rims of the wheels, and a number of the brake shoes were worn almost to the shoe heads. Globules of cooled molten metal hanging on the brake shoes and heads indicated that the brake shoes had been very hot. The fact that there was no exhaust when the conductor's valve in the third car was opened also indicates that the

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brake-pipe pressure had been depleted and an emergency application of the brakes from the front of the train to and including the third car had been obtained at that time. The wheels and brake shoes of the fourth car and the cars behind the fourth car showed no indications of recent abnormally heavy braking. The flagman of No. 173 inspected the brakes of the fifteenth and sixteenth cars immediately after the train stopped and found that they were in release position.

Shortly after the accident occurred a yard engine was coupled to the rear of the train, the air hose between the engine and the rear end of the rear car were coupled, and the angle cocks between the engine and the rear car opened. The angle cocks between the sixth and seventh cars were then closed and the seventh to the sixteenth cars, inclusive, were removed. No test was made to determine the extent to which the air-brake system of the rear portion of the train was charged prior to the time the angle cocks between the yard engine and the rear car were opened.

Between 20 and 30 minutes after the yard engine departed with the rear cars an employee attempted to separate the air hose between the third and fourth cars. He found that there was a considerable amount of air pressure in the hose and the hose could not be separated easily. In order to release the air pressure, he opened the emergency valve at the front end of the fourth car. There was a forceful exhaust when he opened the valve, and the brakes of the fourth, fifth, and sixth cars became applied. He then discovered that the handle of the angle cock at the rear end of the third car had been moved about 80 degrees from fully open position.

Another employee cut off the end of the brake pipe and the "U" bolt securing the angle cock to the supporting bracket and removed the angle cock from the car in an attempt to maintain the handle in the position in which it was found. However, he dropped the angle cock to the ground in the process of removing it from the car, and apparently the handle was moved either when the angle cock was dropped or when it was handled after being removed. Tests of the angle cock after it was removed disclosed that the port opening was sufficient to permit the charging of the air-brake system of several cars through the angle cock and to obtain both service and emergency brake applications on these cars. Before No. 173 stopped, an emergency brake application was obtained on the first three cars, but no effective brake application was obtained behind the third car. After the yard engine and the rear 10 cars were detached, the air-brake system of the fourth, fifth, and sixth cars remained charged during a period of between 20 and

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30 minutes. During this time the brake pipe ahead of the third car was open. These facts indicate that the angle cock at the rear of the third car was closed before the train stopped and that the handle was moved between the time it was first observed and the time the angle cock was tested after it was removed. Tests of a similar angle cock disclosed that a slight change in the position of the handle made a considerable difference in the port opening. With the handle moved 50 degrees from fully open position an emergency brake application could be obtained through the angle cock, and with the handle moved 65 degrees from fully open position the port was completely closed.

As the wreckage was being removed, it was found that the angle cock was broken off the rear end of the first car and that the handle was latched in fully closed position. However, it is evident that this angle cock was closed as a result of being struck by wreckage during the derailment. The rear end of the first car was considerably damaged, and both the body and the handle of the angle cock bore marks indicating that they had been struck several severe blows. If this angle cock had been closed before the derailment occurred, the engineer would not have been successful in obtaining an emergency brake application on the second and third cars.

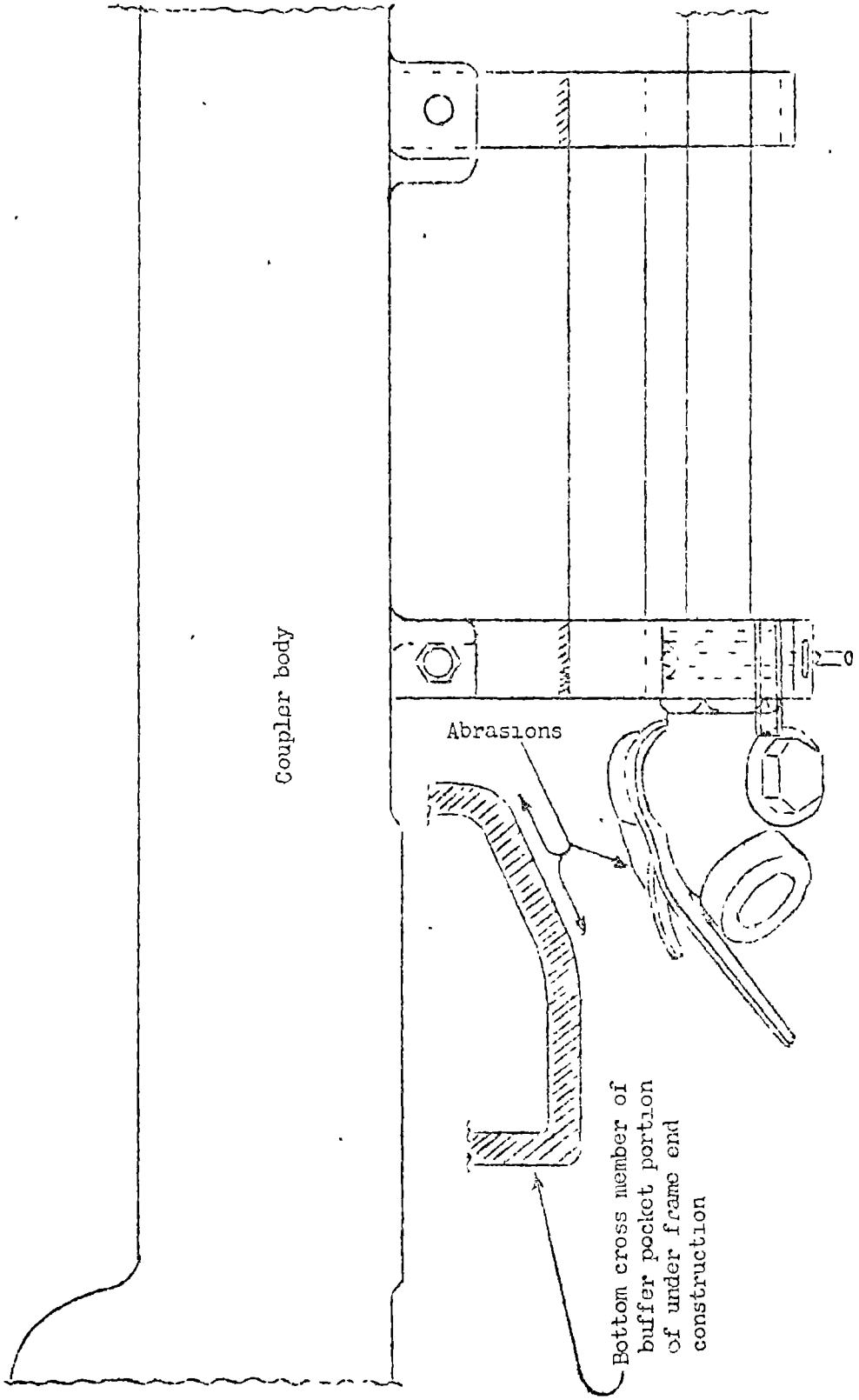
After the fourth, fifth, and sixth cars were derailed, the rear 13 cars of the train were assembled in the order in which they had been assembled in No. 173. In order to complete a 16-car train, three coaches similar to the first three cars of No. 173 were substituted for the original first three cars. The angle cock which had been removed from the rear end of the third car was placed at the rear end of the new third car with the handle in what was thought to be the position in which it was found following the derailment. There was no difficulty in charging the rear portion of this train through this angle cock nor in making service and emergency brake applications. After the air-brake system was charged to 110 pounds pressure, a leakage test showed that the leakage was approximately one pound per minute. Single-car tests then were made of each of the rear 13 cars, and the brakes were found to function properly. After these tests were completed, the air hose, the armored brake-pipe hose, and the brake-cylinder hose were removed from each of the rear 13 cars, and the hose which were not damaged as a result of the derailment were removed from each of the original first three cars. Inspection disclosed that all of these hose were in good condition and free of obstruction. The automatic brake valve, the feed valve, the independent brake valve, the rotair valve, the distributing valve, and the governor were removed from locomotive 4876 and placed on another locomotive of similar type. They were then tested and were found to function properly.

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The angle cock at the rear end of the third car, which was found to be in closed position after the accident occurred, had previously been found in closed position while the train was en route from Boston to New York on the New Haven. The train departed from Boston on January 14 at 11 p. m., on time. A terminal test of the brakes was made before the train departed, and the brakes functioned properly when used in controlling the speed at various points and in making station stops at Back Bay, Mass., and Providence, R. I., 1.28 and 45.78 miles west of Boston, respectively. The train was stopped a short distance west of Kingston, R. I., 70.78 miles west of Boston, because the brakes were sticking on the rear two cars. When it was found that the brakes could not be released from the locomotive, the engineer made an inspection of the train and discovered that the angle cock at the rear of the third car was in fully closed position. He opened the angle cock and latched it in that position and the brakes then functioned properly. Locomotives were changed and three cars added to the rear of the train at New Haven, Conn., 156.81 miles from Boston. The brakes were tested before departure and functioned properly when used between New Haven and Pennsylvania Station. There was no change in the consist of the train at Pennsylvania Station except that the locomotives were changed. Car inspectors who inspected the train at Pennsylvania Station found no defective condition. They made a routine inspection of the train and were certain that they would have noticed any angle cock on which the handle was unlatched or moved from fully open position.

After the accident occurred the angle cock and air hose at the rear end of the third car were removed before the car was examined thoroughly. Upon examination of the second car, New Haven 8643, which was of the same construction as the third car, it was found that the angle cocks were located directly under the bottom cross members of the buffer pocket portions of the underframe end construction. The angle cock supporting brackets are rigidly attached to and follow the longitudinal, vertical and lateral movements of the coupler bodies. With the car uncoupled and the coupler at the undamaged end in normal coupling position the clearance between the top of the angle cock handle and the bottom of the bottom cross member of the buffer pocket was 2 inches and that between the top of the coupler head and the bottom of the top cross member was 3-5/8 inches. Because of this difference in clearance the angle cock handle was permitted to come in contact with the bottom cross member on upward movement of the coupler before the coupler head would come in contact with the top cross member. The angle cock was located directly under the bottom cross member instead of 4-1/8 inches back of the inside face of that member as specified by the

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Sketch showing location of angle cock

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New Haven. The coupler, angle cock bracket, and underframe end construction at this end of the second car were not damaged during the derailment and there were no indications that the angle cock had been moved as a result of the accident.

An abrasion mark was found on the top of the handle just above the thumb release of the double-locking angle cock on the undamaged end of the second car. Abrasion marks were also found on the bottom side of the bottom cross member, showing that the handle of the angle cock had been coming in contact with the cross member. Examination of the rear end of the third car disclosed abrasion marks on the bottom cross member similar to and in approximately the same location as those on the second car. Examination of the angle cock which had been removed from the rear end of the third car after the accident disclosed an abrasion on the top of the handle similar to that found on the angle cock of the second car. There were also abrasion marks showing that the coupler heads of the second and third cars had been coming in contact with the top cross members of the buffer pockets.

The fourth car was equipped with conventional type couplers having a vertical clearance of 5/8 inch in the coupler carrier assembly. The spring assembly in the 4-wheel trucks of this car had a total deflection of 3.67 inches. The third car was equipped with tightlock couplers requiring a minimum vertical clearance of 3 inches above and 3 inches below the coupling line and was equipped with 4-wheel trucks having a spring assembly with a total deflection of 7-15/16 inches. This contrast in design of couplers and truck-spring assemblies of New Haven cars 8665 and 6103 undoubtedly resulted in a considerable increase in the frequency and intensity of oscillations and vibrations transmitted to the coupler body and the attached angle cock at the rear end of car 8665 while the train was in motion.

The abrasion marks on the handle of the angle cock and the bottom cross member at the rear of car 8665 show that the handle had repeatedly come in contact with the cross member. As the angle cock was so located that contact could be made while the coupler body and the angle cock were moving vertically and either longitudinally or laterally, it is apparent that as a result of these contacts the handle was unlatched and moved toward closed position a sufficient distance to close the angle cock. Tests were made on a car of similar construction by manually manipulating the coupler with a bar, and the handle of the angle cock was moved toward closed position as a result of contact between the handle and the cross member.

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If an angle cock is closed after the air-brake system of a train is fully charged, leakage in the air-brake system frequently will cause the brakes of the cars behind the closed angle cock to begin to apply after a period of several minutes. However, if the rate of leakage is very low, it is possible that the brakes of the cars behind the closed angle cock will remain in release position during a considerable period of time. After an angle cock is closed, except on trains equipped with electro-pneumatic brakes, the brakes of the cars behind the closed angle cock cannot be applied from the locomotive, either by manipulation of the engineer's brake valve or by the functioning of a speed-control system. If this should occur while the brakes of a train are released, the engineer would not be aware that the brakes behind the closed angle cock could not be applied from the locomotive unless a brake test was made after the angle cock was closed or he attempted to reduce the speed of the train by use of the brakes. When operating as intended, electro-pneumatic train brakes permit the locomotive engineer to apply the brakes behind a closed angle cock as service application is controlled on each car simultaneously by application and release magnets which are energized by current transmitted from car to car through cables.

We find that:

1. The angle cocks on New Haven car 8665 and other cars of similar construction are so located that the handles of the angle cocks are permitted to come in contact with the bottom cross member of the buffer pocket portion of the underframe end construction.

2. Between the time the brakes of No. 173 were released after the train stopped at Baltimore and the time the engineer attempted to apply the brakes as the train approached Washington the angle cock at the rear of car 8665, the third car of train No. 173, became closed, obviously as a result of contact between the handle and the bottom cross member, and after this occurred the brakes of the rear 13 cars of the train could not be applied from the locomotive.

3. The engineer was not aware of the condition of the air-brake system until he attempted to reduce the speed of the train by the use of the air brakes.

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4. Because the air brakes of the rear 15 cars could not be applied from the locomotive after the angle cock became closed, the engineer was not able to stop the train short of the end of station track No. 16.

5. The two train-service employees who were in cars behind the third car did not become aware of the necessity of making an emergency brake application until it was too late for them to take effective action.

Recommendation

We recommend that all passenger train cars equipped with tightlock or similar type couplers operated over any railroad subject to the Interstate Commerce Act be inspected immediately, and that such cars on which any angle cock is so located that the handle can come into contact with any other portion or appurtenance of the car be withheld from service until such condition is corrected.

HUDSON, Commissioner, concurring:

I approve only the statements of fact and the findings in this report.

By the Commission, Division 5.

(SEAL)

GEORGE W. LAIRD,

Acting Secretary.

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