INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT NO. 3543

THE PENNSYLVANIA RAILROAD COMPANY

IN RE ACCIDENT

AT PHILADELPHIA, PA., ON

NOVEMBER 11, 1953

SUMMARY

Date:	November 11, 1953
Railroad:	Pennsylvania
Location:	Philadelphia, Pa.
Kind of accident:	Derailment
Train involved:	Passenger
Train number:	809
Consist:	8 cars
Estimated speed:	15 m. p. h.
Operation:	Signal indications
Tracks:	Four; tangent, level
Weather:	Clear
Time.	8:27 a. m.
Casualties.	49 injured
Cause:	Failure to operate train in accordance with a signal indication when the route for the train was being lined, resulting in movement of power-operated switch under the train

INTERSTATE COMMERCE COMMISSION

REPORT NO. 3543

IN THE MATTER OF MAKING ACCIDENT INVESTIGATION REPORTS UNDER THE ACCIDENT REPORTS ACT OF MAY 6, 1910.

THE PENNSYLVANIA RAILROAD COMPANY

December 16, 1953

Accident at Philadelphia, Pa., on November 11, 1953, caused by failure to operate a train in accordance with a signal indication when the route for the train was being lined, resulting in movement of a power-operated switch under the train.

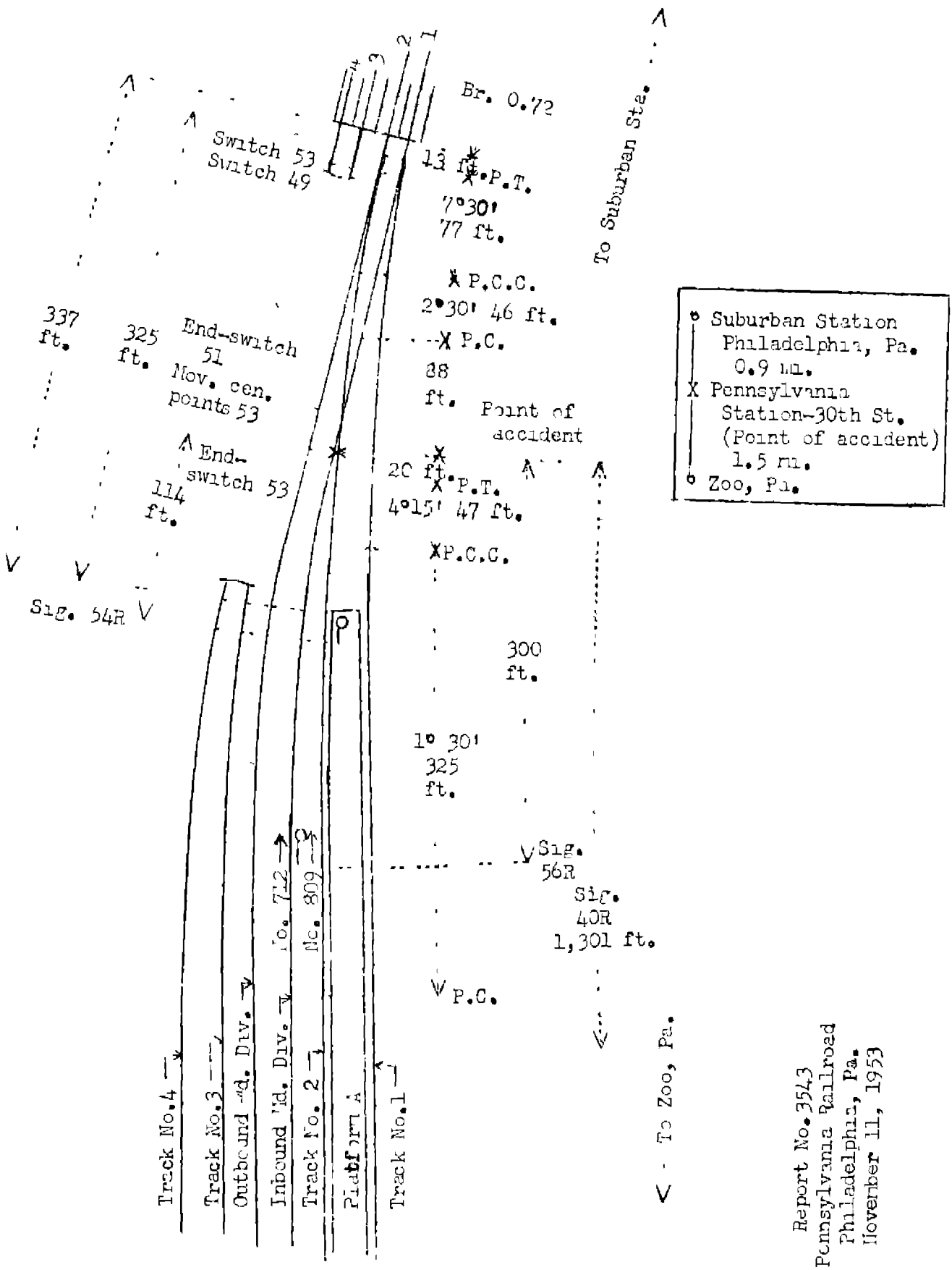
REPORT OF THE COMMISSION[1]

CLARKE, Commissioner:

On November 11, 1953, there was a derailment of a passenger train on the Pennsylvania Railroad at Philadelphia, Pa., which resulted in the injury of 47 passengers and 2 train-service employees. This accident was investigated in conjunction with a representative of the Pennsylvania Public Utility Commission.

---

[1] Under authority of section 17 (2) of the Interstate Commerce Act the above-entitled proceeding was referred by the Commission to Commissioner Clarke for consideration and disposition.



Report No. 3543
Pennsylvania Railroad
Philadelphia, Pa.
November 11, 1953

Location of Accident and Method of Operation

This accident occurred on that part of the Philadelphia Division extending between Zoo and Suburban Station, Philadelphia, Pa., 2.4 miles, a four-track line, over which trains are operated by signal indications. A catenary system is provided for the electric propulsion of trains. West-bound trains from the New York Division and east-bound trains from the Philadelphia Division operating from Zoo to Suburban Station move from west to east by compass directions, and these directions are used in this report. From south to north the main tracks are designated as No. 1, eastward passenger, No. 2, eastward passenger, No. 3, westward passenger, and No. 4, westward passenger. At Pennsylvania Station-30th Street, 1.5 miles east of Zoo, station platform A is located between tracks Nos. 1 and 2, and two additional tracks, designated from south to north as inbound Maryland Division and outbound Maryland Division, are located between tracks Nos. 2 and 3. East of the station, tracks Nos. 1 to 4, inclusive, span tracks of the Baltimore and Ohio Railroad at Bridge 0.72. The west end of the bridge is 337 feet east of the east end of station platform A. Between the station and Bridge 0.72, and within Broad interlocking limits, the inbound Maryland Division track crosses track No. 2 at double slip switch 53-51 and connects with track No. 1 at switch 49. Slip switch 53-51 is provided with movable center points. End-switch 53 at the west end of this slip switch and switch 49 are located, respectively, 113 feet and 325 feet east of the east end of station platform A. The outbound Maryland Division track connects with track No. 2 at switch 53, located 325 feet east of the east end of station platform A. The accident occurred at end-switch 53. From the west on track No. 2 there are, in succession, a 1°30' curve to the right 325 feet in length, a 4°15' curve to the right 47 feet, a tangent 20 feet to the point of accident and 88 feet eastward, a 2°30' curve to the right 46 feet, a 7°30' curve to the right 77 feet, and a tangent 13 feet to the west end of Bridge 0.72. The grade is level at the point of accident.

In the vicinity of the point of accident the track structure consists of 140-pound rail, varying from 20.5 feet to 39 feet in length, laid on an average of 24 ties per 39-foot rail length. It is fully tieplated with double-shoulder tieplates and is spiked with two rail-holding spikes and two anchor spikes per tieplate. It is provided with 6-hole 36-inch joint bars and an average of eight rail anchors per 39-foot rail. It is ballasted with crushed rock to a depth of 18 inches below the bottoms of the ties. The switches are constructed with 20-foot reinforced switch rails,

140-pound rail section, No. 10 rail-bound manganese steel frogs, and manganese steel guard rails 9 feet 1 inch in length. The movable center points of slip switch 53-51 are reinforced and are 14 feet 3-3/16 inches in length. The switches and the movable center points are operated by electro-pneumatic switch-and-lock movements.

At Bridge 0.72, through girders extend the length of the bridge between each of the adjoining tracks. The girder cover plates are 2 feet in width and are from 5 feet 8 inches to 5 feet 10 inches above the level of the tops of the rails. The tracks on the bridge are spaced approximately 16 feet between track centers.

Semi-automatic signal 40R, governing east-bound movements on track No. 2, and semi-automatic signal 54R, governing east-bound movements from track No. 2 to either track No. 1 or track No. 2, are located, respectively, 1,301 feet and 114 feet west of the point of accident. Semi-automatic signal 56R, governing east-bound movements from the inbound Maryland Division track, is located 300 feet west of the point of accident. These signals are of the position-light type and are continuously lighted. Aspects applicable to this investigation and the corresponding indications and names are as follows:

Signal	Aspect	Indication	Name
40R	Two white lights in diagonal position to the right	Proceed prepared to stop at next signal. Train exceeding Medium speed must at once reduce to that speed.	Approach.
54R	Two white lights in vertical position	Proceed, Slow speed within interlocking limits.	Slow-clear.
54R	Two white lights in horizontal position	Stop.	Stop-signal.

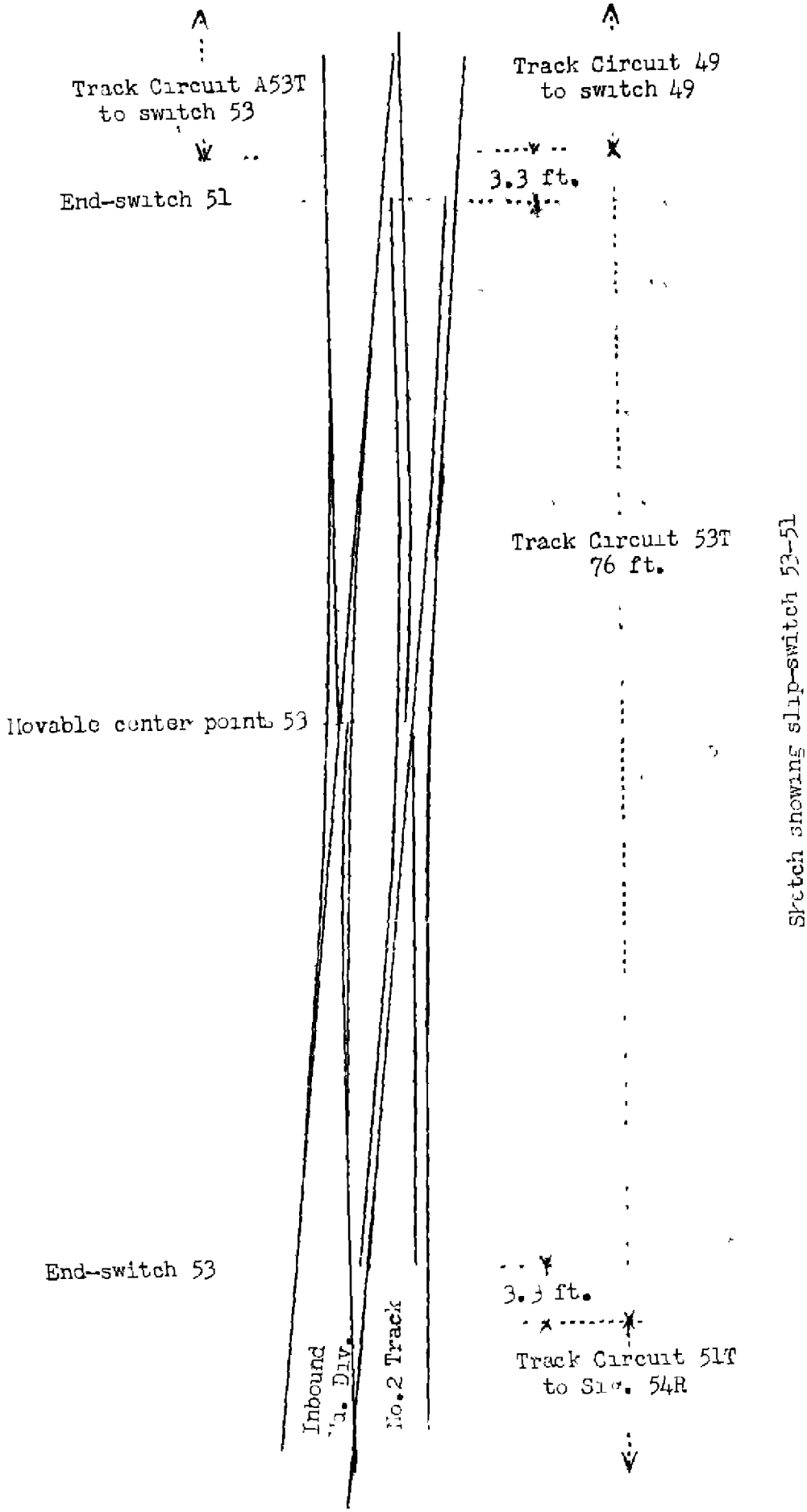
The controlling circuits are so arranged that signal 40R indicates Approach when signal 54R indicates Stop, the block of signal 40R is not occupied, and lever 40 is in "R" position.

Broad Interlocking Station is located in Suburban Station. It was placed in service on September 28, 1930. The interlocking is of the electro-pneumatic type. It is equipped with

95 working levers. It is provided with mechanical, indication, time, and electric switch locking. Mechanical locking prevents the manipulation of a signal lever unless a route governed by that signal is established, and prevents the manipulation of a lever controlling any switch within that route while the signal lever is in position for the signal to display a proceed indication. Route locking operates through the electric switch locking. It prevents the manipulation of the lever of any switch in a route which has been established and for which a proceed indication has been displayed after a train occupies the first track section of the route. If a train passes a signal in stop position, route locking does not become effective. However, each switch lever will be locked by electric switch locking as the track section or sections controlling the electric switch locking are occupied by the train. Time locking prevents a route which has been established and for which a proceed signal has been displayed from being changed until the train for which the signal was displayed has passed the signal or until a predetermined time interval has elapsed after the signal has been caused to display a stop indication.

The operation of a switch lever from normal to reverse position is performed in two movements. In the first movement the lever is moved to a position where the switch mechanism operates and places the switch in reverse position. The lever is released from that position by the indication circuit after the switch is reversed. The second movement can be made after the lever is released. The second movement consists of moving the lever to the extreme reverse position. Movement of a switch lever from reverse to normal position is accomplished in the same manner.

Visual indicators are provided under each lever of the interlocking machine. The visual indicator under a switch lever when lighted indicates that the controlling track sections are not occupied, the electric switch locking is released, and the switch lever may be manipulated to change the position of the switch. The visual indicator under a signal lever when lighted indicates that the routes governed by the signal are not occupied and that a proceed indication will be displayed if the lever is manipulated to the proper position. A model board showing a diagramtic layout of the tracks of the interlocking is provided. Track occupancy is indicated on the model board by visual indicators which become lighted when a train enters a track section. Two lights are provided on the model board for each signal. These lights become lighted when the signal displays an indication authorizing a train to proceed.



Sketch showing slip-switch 53-51

Lever 53 controls the operation of end-switch 53, the movable center points of slip switch 53-51, and switch 53. Levers 49 and 51 control the operation of switch 49 and end-switch 51. Track circuit 51T, controlling the electric switch locking of lever 51, extends between a point approximately opposite signal 54R and a point 3.3 feet west of end-switch 53. Track circuit 53T, controlling the electric switch locking of levers 51 and 53, extends 76 feet east of the east end of circuit 51T through slip switch 53-51. Track circuit 49 extends eastward from the east end of circuit 53T through switch 49, and track circuit A53T extends eastward from the east end of circuit 53T through switch 53.

This carrier's operating rules read in part as follows:

DEFINITIONS

Speeds

Medium Speed--Not exceeding one-half the speed authorized for passenger trains but not exceeding 30 miles per hour.

* * *

Slow Speed--Not exceeding 15 miles per hour.

* * *

The maximum authorized speed for the train involved was 30 miles per hour.

Description of Accident

No. 809, a first-class passenger train, designated as west-bound by timetable, consisted of eight multiple-unit cars. The first to the fourth cars, inclusive, and the sixth to the eighth cars, inclusive, were motor cars. The fifth car was a trailer car. All cars were of all-steel construction. This train passed Zoo, the last open office, at 8:23 a. m., 1 minute late, passed signal 40R, which indicated Approach, and stopped on track No. 2 about 8:26 a. m. with the front of the first car approximately 128 feet west of signal 54R, which indicated Stop. This train departed from 30th Street Station about 8:27 a. m., and while moving at an estimated speed of 15 miles per hour, the front truck of the first car proceeded on track No. 2,

and the rear truck of the first car, both trucks of the second to fourth cars, inclusive, and the front truck of the fifth car were diverted toward track No. 1 at slip switch 53-51. The train stopped before the rear truck of the fifth car reached this switch. The side of the first car struck the girder of Bridge 0.72 between Nos. 1 and 2 trucks. This car was derailed and stopped on the bridge with the center of the car on the top of the girder. A separation occurred between the first and second cars. The second car was derailed and stopped approximately in line with track No. 1. None of the other cars of the train was derailed. The first and second cars were badly damaged.

The engineer and the conductor were injured.

The weather was clear at the time of the accident, which occurred about 8.27 a. m.

Discussion

As No. 809 was approaching 30th Street Station the engineer was in the control compartment at the front end of the first car. The other members of the crew were in various locations in the cars of the train. The engineer said that signal 40R indicated Approach, and that signal 54R indicated Stop when the train stopped at the station. The front brakeman of the train said that he operated the train-ready indicator on station platform A before the train departed from 30th Street Station. He said that immediately afterward he observed that signal 54R indicated Slow-clear. He then gave a hand signal to the conductor to indicate that the train was ready to depart. The conductor said he observed that signal 54R indicated Slow-clear both before and after the brakeman gave the hand signal. He said that after he received the hand signal he boarded the train and sounded the train-communication signal for the train to proceed. The engineer said that he did not observe the indication of signal 54R change but that after the train-communication signal sounded he observed that the signal indicated Slow-clear. The train proceeded eastward immediately. The engineer said that the first he became aware of anything being wrong was when the car lurched. He released the controller handle and the brakes became applied in emergency. Immediately afterward the first car struck the girder.

Prior to the accident the leverman who operates the portion of the interlocking involved in this accident had lined the route for movement of No. 712, an east-bound passenger train, from the inbound Maryland Division track to track No. 1. In order to line and lock that route levers 51 and 53 are required to be in normal position, lever 49 in reverse position, and lever 56 in position for signal 56R to display a proceed indication. Before No. 712 cleared the route the train director instructed the leverman to line the route for movement of No. 809 over track No. 2 after No. 712 departed. In order to line and lock that route levers 51 and 53 are required to be in reverse position, lever 49 in normal position, and lever 54 in position for signal 54R to display a proceed indication. The leverman said that after No. 712 cleared the route, he placed lever 49 in normal position and lever 51 in reverse position. The next operation in this sequence would be the operation of lever 53. However, he said he then observed that the visual indicators under several of the levers had become extinguished and the visual indicators on the model board indicated that No. 809 had departed from the station. The accident occurred immediately afterward. The leverman said that when he observed the visual indicators he became aware that something was wrong and he did not attempt to operate lever 53 or lever 54. He said that he did not operate a time release mechanism at any time prior to the accident. Other employees in the interlocking station confirmed the statement that a time release mechanism was not operated. The train director said that he did not at any time observe the visual indicators for signal 54R displaying lights to indicate that the signal was displaying a proceed indication while No. 809 was in the station.

After the accident occurred it was found that lever 54 was in position for signal 54R to display a stop indication, levers 49 and 53 were in normal position, and lever 51 was in reverse position. When lever 53 is in normal position end-switch 53 is lined for movement from track No. 2 to track No. 1. Examination of the track structure disclosed that the positions of the switches corresponded to the positions of the levers. No marks were found to indicate that any of the equipment was derailed at the slip switch. The first marks of derailment were found in the vicinity of switches 49 and 53.

Inspection and tests of the signal apparatus at Broad Interlocking were begun by signal forces of the carrier immediately after the accident occurred. Switch valves for switches 49 and 53 were damaged by the derailment and were replaced. The mechanical locking of the control machine and

the controlling circuits were found to be operating properly. The operation of relays and electric locks were within the limits in which they were designed to operate. All circuits were tested for grounds, and no ground or other condition was found that would have caused an improper operation of the signals or switches of the interlocking system. About six minutes after the accident occurred signal 54R was observed to be indicating Stop, its proper indication under the circumstances.

On November 13, a test train consisting of two multiple-unit cars was operated over the routes of the interlocking governed by signal 54R. The easterly car of the test train was of the same type as the first car of No. 809. The tests disclosed that the interlocking functioned in the manner in which it was designed to function. When a route was established, route locking was effective after the train passed signal 54R, provided that signal displayed a proceed indication for that movement. Electric switch locking was effective as the train occupied each track circuit after the train passed signal 54R when that signal indicated Stop, provided the switch levers were in normal or reverse position. During one test the route was lined for movement over track No. 2. Lever 54 was in position for signal 54R to display a stop indication. Lever 53 was then moved from reverse position a sufficient distance to release the electric locking but not a sufficient distance to operate the switches to normal position. The train was then moved eastward beyond signal 54R, which indicated Stop, and was stopped with the front wheels of the front truck occupying track circuit 53T, which controls the electric switch locking of levers 51 and 53. It was found that lever 53 could be operated to the position to move the switches from normal to reverse, or to the position to move the switches from reverse to normal, provided the switch lever was not moved either to extreme normal or reverse position. When the switch lever was moved to extreme normal or reverse position, electric switch locking became effective.

In normal operation the train involved would remain at the station platform until the route was lined and an indication to proceed was displayed by signal 54R. Then when the train proceeded past the signal the switches would be electrically locked, which would prevent a switch from being moved under a train. From the manner in which the accident occurred it is clearly established that end-switch 53 was

moved after the front truck of the first car passed over it. Electric switch locking is ineffective for lever 53 if a train passes signal 54R when that signal indicates Stop and when lever 53 is not in extreme normal or reverse position. As a result of this investigation it is apparent that signal 54R indicated Stop when No. 809 passed that signal, that before No. 809 occupied track circuit 53T, the leverman, who was engaged in lining the route, moved lever 53 to the position where the switches controlled by that lever were in reverse position but electric switch locking was not effective, and that he returned the lever to normal position after the wheels of the first truck of the first car of No. 809 passed end-switch 53.

Cause

This accident was caused by failure to operate a train in accordance with a signal indication when the route for the train was being lined, resulting in movement of a power-operated switch under the train.

Dated at Washington, D. C., this sixteenth day of December, 1953.

By the Commission, Commissioner Clarke.

(SEAL)

GEORGE W. LAIRD,

Secretary.