INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT NO. 3669

HUDSON & MANHATTAN RAILROAD COMPANY

IN RE ACCIDENT

AT JERSEY CITY, N. J. ON

SEPTEMBER 25, 1955

SUMMARY

Date:	September 25, 1955	
Railroad:	Hudson & Manhattan	
Kind of accident:	Rear-end collision	
Trains involved:	Passenger	: Passenger
Consists:	4 electrically propelled passenger units	: 2 electrically propelled passenger units
Speeds:	Standing	: Undetermined
Operation:	Signal indications	
Tracks:	Double; tangent; 2.50 percent descending grade eastward	
Time:	1:10 p. m.	
Casualties:	62 injured	
Cause:	Failure to operate following train in accordance with signal indications	

INTERSTATE COMMERCE COMMISSION

REPORT NO. 3669

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

HUDSON & MANHATTAN RAILROAD COMPANY

February 7, 1956

Accident at Jersey City, N. J., on September 25, 1955, caused by failure to operate a following train in accordance with signal indications.

REPORT OF THE COMMISSION[1]

CLARKE, Commissioner:

On September 25, 1955, there was a rear-end collision between two passenger trains on the Hudson & Manhattan Railroad at Jersey City, N. J., which resulted in the injury of 59 passengers and 3 train-service employees. This accident was investigated in conjunction with representatives of the New Jersey Board of Public Utility Commissioners.

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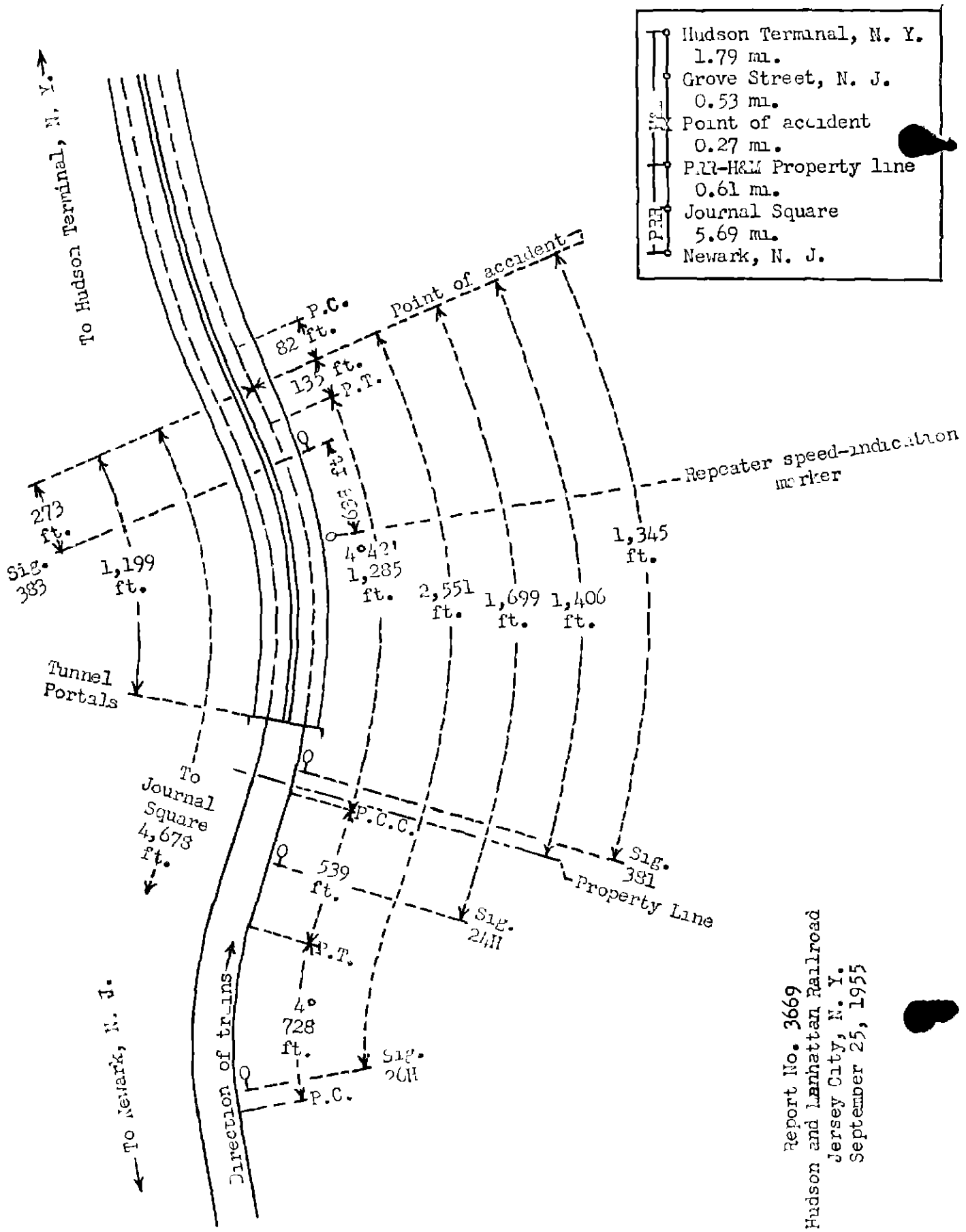
[1] Under authority of section 17 (2) of the Interstate Commerce Act the above-entitled proceeding was referred by the Commission to Commissioner Clarke for consideration and disposition.



Report No. 3669
Hudson and Manhattan Railroad
Jersey City, N. Y.
September 25, 1955

Location of Accident and Method of Operation

This accident occurred on that part of the railroad extending from a point 3,272 feet east of the station at Journal Square to Grove Street Station, Jersey City, N. J., 4,173 feet. This is a double-track line over which trains are operated by signal indications supplemented by an intermittent, mechanical-trip, automatic train-stop system. A third rail is provided for the electric propulsion of trains. In the vicinity of the point of accident the tracks are laid in separate tunnels the portals of which are located 3,479 feet east of Journal Square. The tunnels are provided with electric lights. Hudson & Manhattan trains moving into and out of Journal Square operate over tracks of the Pennsylvania Railroad which extend to a point 3,272 feet east of Journal Square. Trains operating between Newark, N. J., 5.69 miles west of Journal Square, and Hudson Terminal, New York, N. Y., 3.20 miles east of Journal Square, operate over P.R.R. tracks through Journal Square to the west end of H.& M. tracks. The accident occurred at a point 4,678 feet east of the station at Journal Square. From the west there are, in succession, a 4° curve to the right 728 feet, a tangent 539 feet, a compound curve to the left, having a maximum curvature of 4°42', 1,285 feet, and a tangent 135 feet to the point of accident and 82 feet eastward. The grade for east-bound trains is, successively, 4.20 percent descending a distance of 230 feet, 4.06 percent descending 440 feet, 1.50 percent descending 245 feet, and 2.52 percent descending 546 feet to the point of accident and 111 feet eastward.

P.R.R. automatic signals 26H and 24H, and H.& M. automatic signals 381 and 383, governing east-bound movements on the eastward main track, are located, respectively, 2,551 feet, 1,699 feet, 1,345 feet, and 273 feet west of the point of accident. An automatic train-stop tripping device is associated with each of these signals. A cut-section is provided between signals 383 and the signal in advance. The insulated joints of this cut-section are located 566 feet east of signal 383. Signals 26H and 24H are of the position-light type, and signals 381 and 383 are of the color-light type. Signal 26H displays three aspects, and signals 24H, 381, and 383 each display two aspects. These signals are continuously lighted. Signals 381 and 383 are time-controlled and are provided with speed-indication markers which, when illuminated, bear the white numerals "35". A repeater speed-indication marker, which repeats the indication of the speed-indication marker of signal 383, is located on the south tunnel wall 638 feet west of signal 383. Signals 381 and 383 are each provided with a sign bearing a black letter "Z" on a white background. The track circuit of a signal provided with a sign bearing the letter "Z" extends approximately 7 to 11 feet to the rear of the signal. The aspects of the signals applicable to this investigation and the corresponding indications and names are as follows:

Signal	Aspect	Indication	Name
26H	Two white lights in diagonal position to the right over two white lights in vertical position	Proceed approach- ing signal at [illegible] speed	Approach-medium.
24H	Two white lights in diagonal position to the right	Proceed prepared to stop at next signal. Train speed limit Medium speed must at once reduce to that speed.	Approach.
381) 383)	Red-over-yellow	Stop and pro- ceed according to rule 91.	Stop and proceed.
381) 383)	Green-over-yellow	Proceed prepared [illegible] at next [illegible]	Caution.

The control circuits are so arranged that when the blocks of signals 26H, 24H, 381, 383, and the [illegible] in advance of 383 are unoccupied, signal 26H indicates Approach-medium, signal 24H indicates Approach, signals 381 and 383 indicate Stop-and-proceed, the speed-indicating mechanisms of signals 381 and 383 and the repeater speed-indicating mechanism of signal 383 are illuminated, and the automatic train-stop tripping devices of signals 381 and 383 are in tripping position. The timing device of signal 381 is energized when a train enters the block of signal 24H and is so timed that when a train moves through the block of signal 24H at a speed of approximately [illegible] miles per hour the indication of signal 381 changes from Stop-and-proceed to [illegible] position and the automatic train-stop device moves to [illegible] position as the train closely approaches signal 381 provided the block of signal 381 and the section of track between signal 383 and the cut-section are unoccupied. The timing device of signal 383 is energized when a train enters the block of signal 24H and is so timed that when the train moves through the block of signal 381 at a speed of approximately 35 miles per hour or less the indication of signal 383 changes from Stop-and-proceed to [illegible] automatic train-stop tripping device moves to [illegible] position as the train closely approaches signal 383, provided the block of signal 383 and the signal in advance are unoccupied, and the section of track between signal 383 and the cut-section [illegible] signal 26H indicates

Approach-medium, signal 24H indicates Approach, signal 381 indicates Stop-and-proceed, with the speed-indication marker dark and the automatic train-stop tripping device in tripping position, the repeater speed-indication marker of signal 383 is dark, and signal 383 indicates Stop-and-proceed, with the speed-indication marker dark and the automatic train-stop tripping device in non-tripping position. In order to pass a signal bearing a "Z" sign when the signal indicates Stop-and-proceed and the automatic train-stop device is in tripping position, the train must be stopped with the front end of the train approximately opposite the signal. The track circuit of that signal is then shunted and the automatic train-stop tripping device moves to non-tripping position.

P.R.R. 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.

H.& M. operating rules read in part as follows:

AUTHORIZED SPEEDS

86. (A) MAXIMUM SPEED--40 M.P.H.

(B) RESTRICTED SPEED--Not exceeding 8 M.P.H. to the next signal prepared to stop short of train, obstruction or broken rail.

SPEEDS FOR OPERATING IN ACCORDANCE WITH

FIXED SIGNAL ASPECTS

AUTOMATIC BLOCK SIGNALS:

* * *

(I) CAUTION--Reduce speed prepared to stop at next signal.

SIGNAL SYSTEM RULES--AUTOMATIC BLOCK SIGNALS

90. * * *

(f) A STOP AND PROCEED SIGNAL is a signal indicating STOP AND THEN PROCEED at RESTRICTED speed in accordance with Rule No. 86 (B).

(g) A CAUTION SIGNAL is a signal indicating PROCEED WITH CAUTION. See Rule No. 86 (I).

91. To pass an Automatic Block Signal at Stop and Proceed position, the Motorman must stop the front end of head car in line with face of signal to clear the stop arm. * * * The train may then proceed at restricted speed to the next signal * * *

* * *

93. When a train is tripped by an automatic train stop at an Automatic Block Signal, the tripper valve on the cars must be reset at once by the Motorman and train may then proceed in accordance with Rule No. 86 (B).

MOTORMEN

209. * * * When passing a signal at "CAUTION" they must govern their speed so that there may be no possibility of running by the next signal in "STOP" position.

211. When running between time signals they must control their train so as to maintain the designated speed indicated by the signals.

The maximum authorized speed for passenger trains on the P.R.R. east of Journal Square and on the H.& M. is 40 miles per hour.

Description of Accident

Trains operating between points on the H.& M. are not assigned numbers but are designated by the departure time from the initial terminal. At the time the accident occurred eastern daylight saving time was used by the H.& M., and this time is used in this report.

The 12:54 p. m. train from Newark, an east-bound passenger train, consisted of four electrically propelled passenger units, coupled in multiple-unit control. These units were of all-steel construction. This train departed from Journal Square at 1:04 p. m., on time, passed signal 26H, which indicated Approach-medium, passed signal 24H, which indicated Approach, passed signal 381, which indicated Caution, with the speed-indication marker illuminated, passed the repeater speed-indication marker of signal 383, which was illuminated, passed signal 383, which indicated Stop-and-proceed, with the speed-indication marker illuminated, and was stopped by an application of the brakes. While an attempt was being made to move the train forward, it was struck by the 1:06 p. m. train from Journal Square. The accident occurred 4,678 feet east of Journal Square.

The 1·06 p. m. train from Journal Square, an east-bound passenger train, consisted of two electrically propelled passenger units, coupled in multiple-unit control. These units were of all-steel construction. This train departed from Journal Square at 1:06 p. m., on time, passed signal 26H, which indicated Approach-medium, passed signal 24H, which indicated Approach, passed signal 381, which should have indicated Stop-and-proceed with the speed-indication marker dark and the automatic train-stop tripping device in tripping position, passed the repeater speed-indication marker of signal 383, which should have been dark, passed signal 383, which indicated Stop-and-proceed with the speed-indication marker dark and the automatic train-stop tripping device in non-tripping position, and while moving at an undertermined speed it struck the rear end of the preceding train.

The preceding train was moved eastward a distance of 54 feet as a result of the collision. The front wheels of the front truck of the rear unit of the preceding train were derailed. Both ends of this unit were telescoped, and the unit was destroyed. The control compartment at the front end of the first unit of the following train was crushed inward, and the unit otherwise damaged. The other units of both trains were considerably damaged.

The flagman of the preceding train, and the motorman and the conductor of the following train were injured.

The accident occurred about 1:10 p. m.

Each unit of each train is provided with electro-pneumatic and automatic brakes, a control compartment at each end, an MC-35-B controller with safety-control feature in each control compartment, and an L-2-G triple valve. None of the units is provided with a speed-indication device or sanding devices. The first unit of the following train was provided with an ME-17-A brake valve in each control compartment, an M-3 feed valve for supplying air to the brake pipe, and a C-6 feed valve for supplying air to the brake cylinder in electro-pneumatic brake operation.

Each unit operating between Newark and Hudson Terminal is equipped with two automatic train-stop valves, one of which is mounted on the shoe-beam beneath each control compartment of the unit. The automatic train-stop valve is provided with a plunger to actuate the valve mechanism, and a timing reservoir. It is so constructed that brake-pipe air is vented to the atmosphere at an emergency rate when the plunger is moved upward by a vertical force. The length of time that the venting valve remains open is governed by the volume of the timing reservoir, and in the instant case is

22 seconds. Guards are provided at the front and rear of the plunger to prevent the operation of the plunger by any force not directed vertically upward. The automatic train-stop valve is so located that the plunger will engage the tripper of the automatic train-stop tripping device when the device is in tripping position. The 12:54 p. m. train from Newark consisted of units of this type.

Units operating only over the H.& M. are not equipped with this type of automatic train-stop valve. At the time of the accident each of these units was equipped with two self-resetting trip cocks, one of which was mounted on an extension of the inside truck equalizer on the opposite side of the unit from each control compartment. The self-resetting trip cock consists of a body, a rotary valve with attached handle, a valve spring to hold the rotary valve on its seat when there is no air pressure on the valve, and a return spring. In closed position the handle extends vertically downward. The self-resetting trip cock is so located that the handle will engage the tripper of the automatic train-stop tripping device when the device is in tripping position. The chamber containing the rotary valve is connected to the brake pipe. The self-resetting trip cock is so constructed that when the handle is turned, ports in the rotary valve vent brake-pipe air to the atmosphere at an emergency rate. Friction between the rotary valve and its seat holds the valve in open position. As brake-pipe pressure decreases, friction between the rotary valve and its seat decreases until the force exerted by the return spring is sufficient to return the rotary valve to closed position. The self-resetting trip cock is not provided with a means of delaying the resetting of the cock for a predetermined time interval. The 1:06 p. m. train from Journal Square consisted of units of this type.

The automatic train-stop tripping devices are operated electro-pneumatically. The operating mechanism of each device is located between the rails. A shaft extends at right angles to the track, and to the outside of each rail. The tripper arms for the automatic train-stop valve are attached to one end of the shaft, and the tripper arm for the self-resetting trip cock is attached to the opposite end. They are located, respectively, on the right and left sides of the track relative to the direction of the current of traffic. The tripper arms are so located that the tripper for actuating one type of valve will not come in contact with the other type. In non-tripping position the tripper arms are at an angle of approximately 45 degrees. In moving to tripping position the shaft turns through an angle of approximately 45 degrees, placing the tripper arms in vertical position.

The tripper arms for the automatic train-stop valve are provided with a tripper head pivoted between the tops of the arms. The tripper head has three lugs projecting radially. The middle lug is held in alignment with the tripper arms by a helical spring. The lugs are so spaced that when the automatic train-stop valve of a car passes over the tripper, the front guard of the automatic train-stop valve strikes the middle lug and forces the head to revolve about its pivot. The rear lug of the tripper head then engages the automatic train-stop valve plunger and forces it upward. After the automatic train-stop valve of a car passes over the tripper, the tripper head is restored to its original position by the helical spring.

The tripper arm for the self-resetting trip cock is provided with a bar three inches in length, extending across the top of the tripper arm, and at right angles to the tripper arm and the rail.

Discussion

The speed-indication marker of a signal, when illuminated, indicates the allowable speed to the next signal, and that the block of that signal and the section of track between the signal in advance and a cut-section, if used, are unoccupied. A repeater speed-indication marker repeats the indication of the marker of the signal in advance. When a signal indicates Stop-and-proceed and an illuminated speed-indication marker is displayed, the signal is indicating Stop-and-proceed because of the influence of the timing device of the signal and not because of track occupancy. Under the rules of this carrier, when a train passes a signal indicating Caution, the speed of the train should be so governed that there may be no possibility of the train passing the next signal while the signal indicates Stop-and-proceed. The rules also provide that when a train passes a signal indicating Caution, if an illuminated speed-indication marker is displayed the train should be operated in such manner that the speed of the train is maintained in the block of that signal at the speed indicated by the illuminated marker. According to the interpretations of the carrier, when a train is proceeding in a block at the speed indicated by the illuminated speed-indication marker of the signal at the entrance of that block, and the signal in advance indicates Stop-and-proceed and an illuminated speed-indication marker is displayed, the motorman is required to approach the signal expecting the action of the timing device to change the indication to Caution and to move the automatic train-stop device to non-tripping position as the train closely approaches the signal.

As the preceding train was approaching the point where the accident occurred the motorman was in the control compartment at the front of the first unit. The other members of the crew were in various locations in the rear of the train. The brakes of the train had functioned properly when used en route. The marker lights were lighted. The motorman said that when the train passed signal 381 the signal indicated Caution and the speed-indication marker was illuminated. He said that the repeater speed-indication marker of signal 381 was illuminated, that signal 383 indicated Stop-and-proceed, and that the speed-indication marker of that signal was illuminated. He estimated that the speed of the train was about 50 miles per hour. He said that the indication of signal 383 did not change from Stop-and-proceed to Caution and that he stopped the train at the signal. He said that the automatic train-stop tripping device moved to non-tripping position and he then started the train. After the train had moved a short distance the brakes became applied in emergency. He made two or three attempts to proceed, but each time the train was started it was stopped by an undesired emergency application of the brakes. The conductor said that the train was stopped in the vicinity of signal 383 by a service application of the brakes, and was then stopped by two or three emergency applications while the motorman was attempting to move the train forward. One of the trainmen said that the train was stopped by a service application of the brakes and that the emergency applications occurred after the train had stopped. Another man said that the speed was reduced by a service application of the brakes and that the first emergency application occurred after the train had stopped. The conductor said that he heard an air leak over the front control compartment of the second unit while the motorman was attempting to move the train forward. The noise occurred before the conductor or the motorman could investigate the leak.

As the train was approaching the point where the accident occurred the motorman was in the control compartment at the front of the first unit. The conductor was in the first unit. The brakes of the train had functioned properly when used en route. The motorman said that the signal 381 was Stop-and-proceed and that the speed of the train was about 15 miles per hour in the block of this signal, that the speed-indication marker of signal 381 was illuminated, that the indication of signal 383 changed from Stop-and-proceed to Caution as the train passed the signal, and that he did not make any emergency applications in the vicinity of this signal. He said that the repeater speed-indication marker of signal 383 was illuminated and that the train was operated at a speed of not over 15 miles per hour to the next signal, which was red. He said that

signal 383 indicated Stop-and-proceed and that the speed-indication marker was dark, and that when he first observed the signal he immediately placed the brake valve in emergency position. When he saw the markers of the preceding train he placed the controller handle in reverse position in an effort to stop the train before the collision occurred. He was unable to estimate the speed of the train at the time of the collision. The conductor said that he did not notice a brake application in the vicinity of signal 381. He said that he was unaware of anything being wrong until the brakes of the train were applied in emergency.

Before the accident occurred the motormen of four eastbound trains observed that the timing device of signal 383 was slow. This condition was reported, and a signalman was assigned to check the device. He arrived at the portals of the tunnels about 1:10 p. m., after the accident had occurred. He said that at this time signal 381 indicated Stop-and-proceed, the speed-indication marker was dark, and the train-stop tripping device was in tripping position. He said that as he proceeded eastward he saw that the repeater speed-indication marker of signal 383 was dark, and that when he reached signal 383 the signal indicated Stop-and-proceed, the speed-indication marker was dark, and the train-stop tripping device was in non-tripping position. These are the proper aspects of the signals and positions of the tripping devices when the block of signal 381 is clear and the track is occupied between signal 383 and the cut-section.

There was no damage to the signal equipment as a result of the accident. Inspection and tests of the signal apparatus in the vicinity of the point of accident were begun by forces of the carrier's signal department about 7 hours after the accident occurred. With the exception of the defective timing device of signal 383, no condition was found which would have caused an improper operation of the signal system.

The specified time interval for the operation of the timing device of signal 383 is 17 seconds. After the accident occurred it was found that the timing device of the signal was erratic and that the shortest time interval required for the operation of the device was 27 seconds. Tests disclosed that the automatic train-stop tripping device of the signal moved from tripping to non-tripping position 2 seconds after the track circuit of the signal was shunted. The engineer of the preceding train said that he stopped before passing this signal. However, the signal is visible from the west throughout a distance of only 307 feet, and tests made after the accident occurred indicate that unless the speed of the train was considerably less than estimated by the engineer it is improbable that the train could have been stopped

short of the signal after the signal became visible to the engineer. Examination of the equipment of this train after the accident occurred disclosed that the plunger of the automatic train-stop valve on the second unit was broken and there was dirt under the pilot valve. From the facts that the conductor of this train heard air escaping from underneath the front end of the second unit and that the brakes of the train became applied in emergency several times after the train passed signal 383, it appears that the second unit passed the tripping device of the signal while the device was in tripping position and that because of the defective and dirty condition of the automatic train-stop valve of the second unit the brakes of the train could not be maintained in release after the valve was actuated. No obstruction was found on the track structure which might have tripped the valve.

After the accident occurred tests were performed with trains consisting of two units similar to the units of the 1:06 p. m. train from Journal Square. A running test was made to determine whether the automatic brake application produced by the tripping of the self-resetting trip cock by the automatic train-stop tripping device could be released before the train stopped. Signal 381 was caused to indicate Stop-and-proceed, and the automatic train-stop device was set in tripping position. The test train then approached the signal at an estimated speed of 35 miles per hour. When the train was about 20 feet west of the signal, the handle of the brake valve was moved to emergency position and the controller handle was held in full parallel position. When brake-pipe pressure was depleted, as indicated by the brake-pipe gauge, the brake-valve handle was immediately moved to release position. It was found that the self-resetting trip cocks on both units of the train were tripped, and that they automatically reset as the brake-pipe pressure approached zero. The speed decreased momentarily to an estimated speed of 37 miles per hour, at which time the brakes were fully released. Standing tests disclosed that an automatic train-stop brake application can be released in the same manner if the brake-valve handle is moved to emergency position either immediately before or immediately after the self-resetting trip cock is operated, and then moved to release position immediately after brake-pipe pressure is depleted. Because of curvature of the track and the wall of the tunnel, signal 383 first becomes visible from the west at a distance of 307 feet, and the markers of a train standing at the point of accident first become visible at a distance of 371 feet. Two tests were made to determine stopping distances in the immediate vicinity of the point of accident. In each test the train was moving at an estimated speed of 35 miles per hour, and an emergency application of the brakes was made at the point from

which the markers of a train at the point of accident could first be seen. In the first test the train stopped in a distance of 632 feet, and in the second test it stopped in a distance of 566 feet.

The signal system is so designed that when the track circuit of the section of track between signal 383 and the cut-section is shunted, the track relay will be de-energized. Under this condition, signal 381 indicates Stop-and-proceed. A circuit independent of the signal circuits is provided for the speed-indication marker of signal 381, and the marker is not illuminated when the track circuit between signal 383 and the cut-section is shunted. A multiple circuit is provided for the speed-indication marker of signal 383 and the repeater speed-indication marker of this signal, and if the speed-indication marker of the signal is not illuminated the repeater speed-indication marker is not illuminated. While the track relay of the section of track between signal 383 and the cut-section is de-energized, three separate defects of the signal system would have to occur in order for signal 381 to display a green-over-yellow aspect, for the speed-indication marker of signal 381 to be illuminated, and for the repeater speed-indication marker of signal 383 to be illuminated. Tests of the signal system disclosed no condition, other then the defective timing device of signal 383, which would cause the system to function other than as intended. These tests indicated that signal 381 should have indicated Stop-and-proceed, the speed-indication marker of this signal should have been dark, the automatic train-stop tripping device at this signal should have been in tripping position, and the repeater speed-indication marker of signal 383 should have been dark at the time the following train passed them. Train movements in the tunnel in which the accident occurred are frequent, the tracks in the tunnel are not exposed to the weather, and the passenger units operating on this line are not equipped with sanding devices. Under these track conditions, the possibility that a four-unit train would fail to shunt a track circuit is extremely remote.

The tests which were made with the type of equipment used on the following train disclosed that, after the brakes were applied by the action of the automatic train-stop tripping device, the self-resetting trip cock on this equipment did not prevent the brakes from being relased before the train had stopped. Section 136.506 of the Commission's order of October 1, 1950, in Ex Parte 171, Rules, Standards and Instructions, requires in part that the automatic train-stop apparatus shall prevent release of the brakes after automatic application until a reset device has been operated.

The reset device shall be arranged so that the brakes cannot be released until the train has been stopped, or it shall be located so that it cannot be operated by an engineman without leaving his accustomed position in the cab. The automatic train-stop equipment on H.& M. cars using the self-resetting trip cocks did not, at the time of the accident, comply with the requirements of this Section of the Commission's order. Since the accident occurred a program has been undertaken to modify the self-resetting trip cock in such manner that the brakes of a train cannot be released after an automatic train-stop application until the train has stopped and the handle of the trip cock has been reset manually. The carrier plans to have all trip cocks of this type so modified by March 1, 1956.

Cause

It is found that this accident was caused by failure to operate a following train in accordance with signal indications.

Dated at Washington, D. C., this seventh day of February, 1956.

By the Commission, Commissioner Clarke.

(SEAL)

HAROLD D. McCOY,

Secretary.