IN RE INVESTIGATION OF ACCIDENT ON THE BOSTON & MAINE RAILROAD, February 20, 1912.

June 4, 1912.

On February 20, 1912, there was a rear end collision between a freight train and a passenger train on the Boston & Maine Railroad in Hoosac Tunnel, near North Adams, Mass., resulting in the death of four employes and the injury of two passengers.

This accident was reported by telegraph by the Boston & Maine Railroad Company on February 21, 1912, and after investigation the Chief Inspector of Safety Appliances reports as follows:

The Fitchburg Division of the Boston & Maine Railroad on which this accident occurred is a double track road, equipped with automatic block signals. Between North Adams and Hoosac Tunnel Station, a distance of 7.6 miles, the tracks are electrified. Hoosac Tunnel, which is 4.8 miles in length, is located between these points. Trains are hauled to the ends of this electric zone by steam locomotives and there electric motor locomotives are coupled on ahead of the steam locomotives and haul the trains through the electric zone. A propulsion current of 2200 volts, 25 cycles, is furnished by a local power house. The track throughout the tunnel is straight, with an ascending grade of about one and one-half per cent for east-bound trains until the central shaft is reached; from this point the track is level for about 600 feet, and then there is a descending grade of about one and one-half per cent to the eastern portal.

On this division most of the automatic block signals are of the normal clear, direct current, electric motor semaphore type. Between North Adams, 1.9 miles from the west portal, and Hoosac Tunnel Station, .9 miles from the east portal, alternating current signal and track circuits are used. Outside the tunnel normal clear, electric motor semaphore signals are installed, and inside the tunnel normal clear, tunnel type automatic block signals are installed. These signals consist of electric lights located in an iron case, with a lens of the proper color in front of each lamp, red indicating stop, yellow indicating caution and green indicating clear. These lamps are controlled by an alternating current relay of the galvanometer type, which is controlled by an alternating current relay of the vane type, which, in turn, is controlled by the alternating current track circuit.

Inside the tunnel there are two block signals governing the movement of east-bound trains. The first signal, H-1392, is located 7013 feet from the west portal; the second signal, H-1376, is located 8031 feet beyond the first signal. The next signal is outside the east portal of the tunnel, approximately 9500 feet beyond signal H-1376. As the view of this signal is obstructed, a distant signal, located in the tunnel aproximately 400 feet from the east portal, is provided, but the track circuits are not cut at this point, the distant signal being controlled by a line circuit and working in conjunction with the home signal outside the tunnel.

The automatic block signals in the tunnel are located about 150 feet beyond the entrance of the block, in order that the engineman may see the signal give the danger indication as his train enters the block and know that the signal is operating properly. This arrangement is standard on the Boston & Maine Railroad. The stop indication thus displayed remains until the train has passed out of the block; then the home signal indicates clear and the distant signal remains at caution. When the train has passed out of the second block, clear home and distant signals are displayed. In the tunnel a white light is fixed at the end of each block as a marker.

A 2200 volt, 60 cycle, single phase current is carried through the electric zone by cables and line wires for the operation of track circuits and signals. Transformers located at the middle of each track section step down the current from 2200 volts to approximately 10 volts for track circuit feeds; the current delivered at track relays is approximately 3½ volts. Cut-section track circuits are used, and current is fed at the middle of each track circuit. There are four relays to each block, designed to operate at 60 cycles only, all of which must be energized to give a clear indication. Impedance bonds are furnished at the ends of track circuit sections to carry the return propulsion current around insulated joints. Transformers are also supplied at signal loca-

tions, where the current is stepped down from 2200 volts to 110 volts for the signal lights. All control circuits are properly fused.

A number of telephones are installed in the tunnel.

On the date of the accident, east-bound freight train extra No. 2633, consisting of steam locomotive No. 2633, 37 cars and a caboose, entered Hoosac Tunnel at 3:45 p. m., drawn by electric motor No. 5001. Just after passing the central shaft in the tunnel, the train broke in two, the forward section running about ten car lengths before coming to a stop. After being again coupled up, the train proceeded eastward until it came to the signal located outside the eastern portal of the tunnel, which was in the stop position. The train came to a stop with its rear end about 1000 feet back in the tunnel, 25 or 30 cars standing inside the tunnel. In less than half a minute, just as the employes were about to uncouple the electric motor from the train, the rear end of the train was struck by east-bound passenger train No. 2.

Passenger train No. 2, en route from Troy, N. Y., to Boston, Mass., consisted of steam locomotive No. 2124, one milk car, one baggage car, two coaches and one Pullman car. This train entered the tunnel at 4:15 p. m., drawn by electric motor No. 5004, and was stopped at the first block signal inside the tunnel. After a short delay

the train proceeded, and after passing the central shaft it was flagged by the flagman who had been sent back when the freight train broke in two and who had put down two torpedoes and a fusee. After picking up the flagman the train did not wait for the red fusee to burn yellow, as required by the rules, but ran slowly until within about 500 or 600 feet of the second east-bound block signal. According to the statement of Engineman Blackall of steam locomotive No. 2124, the indications of this signal were red and yellow, changing to double green within a few seconds. Fireman Tidd, of engine No. 2124, Flagman Wing of extra No. 2633, who was riding on engine No. 2124, and Engineman Simpson, who was also riding on the engine for the purpose of acquainting himself with this portion of the road, all stated that Engineman Blackall called "double green" as the train approached this signal. All the employes on electric motor No. 5004 which was hauling this train were killed, but no doubt they also read this signal indication as clear since the speed of the train was increased just as Engineman Blackall called "double green". After the train passed the white light at the entrance of the block the signal indications were red and yellow; Engineman Blackall stated that he saw the indications change from double green to red and yellow. Engineman Blackall stated he thought the train ahead had entered a side track beyond the east portal, leaving the track clear for two blocks ahead, thus explaining why the signal

indications changed from red and yellow to double green without first showing yellow and green. The freight train did not enter a siding but was standing in the first block ahead of the passenger train, and if signal H-1376 was in proper working condition it could not have given the double green indication.

The conductor of train No. 2633 was in the caboose and heard train No. 2 coming. He picked up a fusee and jumped to the ground, but he did not have time to light the fusee before the collision occurred. The speed of train No. 2 was estimated as approximately thirty-five miles per hour. An attempt was made to pull the electric motor away from the wreck with the steam locomotive, but it could not be moved, and fire breaking out in the wreckage soon made it necessary to abandon the attempt. The passenger train was then backed out of the tunnel.

This collision resulted in the death of Motorman Simonds, Helper Greigg, Engineman Davis, who was learning to operate an electric motor, and Flagman Kent of train No. 2633, all of whom were riding on electric motor No. 5004, and the injury of two passengers. Wreckage which blocked both tracks caught fire, seventeen cars and a caboose were destroyed, motor No. 5004 was badly damaged, tons of rock fell from the roof of the tunnel, and it was more than two days before the interior of the tunnel cooled sufficiently to permit wrecking crews to reach the scene of the accident.

Motorman Wade of electric motor No. 5001 which hauled freight train extra No. 2633 through the tunnel stated that the air in the tunnel was very thick and that he could not see more than three or four car lengths; when nearing the end of the tunnel he was unable to judge where he was. When passing through the tunnel both of the block signals worked properly, changing to danger before he passed them. Baggageman Scott of train No. 2 stated that when he left his car after the collision a light could have been seen a distance of seven or eight car lengths, looking west, but toward the east the air was thicker. Engineman Simpson stated that signals in the tunnel could be seen a distance of four or five car lengths.

On March 6, 1913, a test was made in the tunnel to ascertain whether or not it was possible for the engineman of a steam locomotive to see the signals when the locomotive was being drawn through the tunnel by an electric motor. This test was conducted by representatives of the Commission, the Boston & Maine Railroad, and the Massachusetts State Railroad Commission. An electric motor and seven flat cars were placed about 700 feet from the eastern portal. Motor No. 5003, drawing engine No. 2124, operated by the same crew as on the day of the accident, entered the tunnel from the western portal and came to a stop about 600 feet west of the signal to be tested. It was found that the engineman of the steam

locomotive could see the signals at this distance by leaning out of the cab window about four or five inches.

It is apparent that one of two things caused this accident - either a false clear indication was given by signal H-1376, or the indication of this signal was not properly read and obeyed by the crew of passenger train No. 2.

The possibility of a false clear signal being given by this signal is very remote, for the reasons that the circuits employed in this installation are of the standard alternating current type.
There are four track relays in each block, through which the signal controlling circuits are run; they are designed to operate only at 60 cycles and the propulsion current which is furnished at 25 cycles would not affect the relays. Furthermore, as this is an alternating current system, any stray direct current would not affect the controlling apparatus. The signal installation was thoroughly inspected on April 15, 1912, by one of the Commission's inspectors and it was found in first class condition; and nothing was found which would indicate that the signal system was out of order on the date of the accident.

The fact that the signal operated properly when the freight train passed it, and that it displayed the danger indication when the passenger train entered

the block, indicates that the signal was in proper working condition. The conclusion is therefore reached that the crew on the passenger train misread the signal.

While it is believed that the signal system installed in Hoosac Tunnel is well designed, it would furnish a greater degree of protection if the blocks were shorter and the signals were properly overlapped, so that a train approaching an occupied block would receive two danger indications before reaching the obstruction. But even then there is a possibility of signal indications being incorrectly read, as it is believed was the case in this instance, and to eliminate possible danger from this source automatic train stops should be installed in connection with the signals in the tunnel.

It has been suggested that this section of track should be operated as one absolute block. During the years 1907 to 1910 inclusive, and the first three months of 1911, the tunnel was operated as one block, with steam motive power; the average monthly east-bound movement was 23,113 loaded freight cars. For the last nine months of the year 1911, when electric power was used and the tunnel was divided into blocks, the average monthly east-bound movement was 22,767 loaded freight cars. Thus, more loaded cars were formerly moved through the tunnel when it was operated as one absolute block than are moved through it at present with the track in the tunnel divided into a number of blocks. Were this section of track operated as one absolute block and no ~~an~~ train permitted to enter the tunnel until the preceding train had cleared it, absolute safety of train movement would be insured.

All the employes involved in this accident were experienced men with good records. The members of the crew of passenger train No. 2 had been on duty for periods varying from nine hours and two minutes to twelve hours and seventeen minutes, after periods off duty varying from fourteen hours and forty-five minutes to forty-nine hours and thirty-two minutes. The members of the crew of freight train extra No. 2633 had been on duty for periods varying from one hour and thirty-two minutes to ten hours and thirty-two minutes, after periods off duty varying from fourteen hours to thirty-seven hours and forty minutes.