Inv-2046

INTERSTATE COMMERCE COMMISSION

WASHINGTON

REPORT OF THE DIRECTOR

BUREAU OF SAFETY

ACCIDENT ON THE

CINCINNATI UNION TERMINAL

CINCINNATI, OHIO

FEBRUARY 23, 1936

INVESTIGATION NO. 2046

SUMMARY

Railroad:	Cincinnati Union Terminal		
Date:	February 23, 1936		
Location:	Cincinnati, Ohio		
Kind of accident:	Rear-end collision		
Trains involved:	Passenger	:	Passenger
Train numbers:	CCC&StL 2nd 46	:	B&O 12
Engine numbers:	6472	:	5227
Consist:	5 cars	:	8 cars
Speed:	8-40 m.p.h.	:	Starting
Track:	Tangent 510 feet, then 10° curve to left extending 652 feet to point of accident, and for short distance beyond that point; view restricted; automatic and interlocking signals		
Weather:	Clear		
Time:	8:07 a.m.		
Casualties:	1 killed; 57 injured		
Cause:	False proceed indications displayed by an automatic signal and an interlocking signal, due to error in control circuits of interlocking signal		

To the Commission:

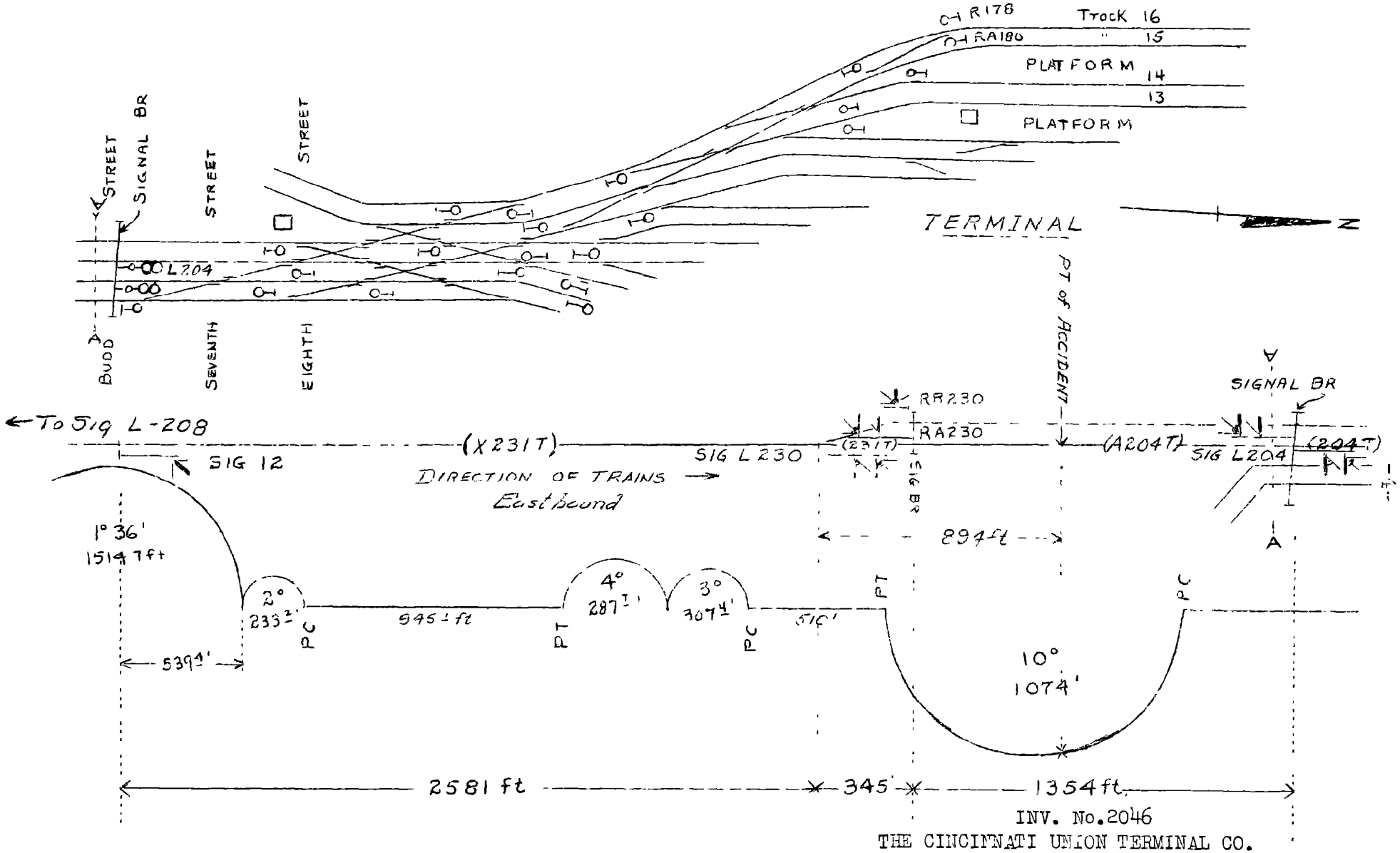
On February 23, 1936, there was a rear-end collision between a passenger train of the Baltimore & Ohio Railroad and a passenger train of the Cleveland, Cincinnati, Chicago & St. Louis Railway on the tracks of the Cincinnati Union Terminal Company at Cincinnati, Ohio, which resulted in the death of 1 railroad employee, and the injury of 41 passengers, 6 Pullman employees, 5 dining-car employees, 4 railroad employees, and 1 railway express messenger. This accident was investigated in conjunction with the Public Utilities Commission of Ohio.

Location and method of operation

The Cincinnati Union Terminal is composed of 48.6 miles of track, 6.6 miles being main line trackage and the remaining 42 miles being yard tracks and sidings, together with various terminal facilities. The trains involved entered the terminal through what is known as the southwest connection; the accident occurred within interlocking limits at a point 355 feet east of the junction switch that marks the beginning of double-track for inbound trains moving via the southwest connection. These tracks, designated as tracks S3 and S4, are on a viaduct at this point. Track S3 is known as the main line and track S4 as the auxiliary track, and the accident occurred on track S3 at a point 894 feet east of signal L230. Approaching the point of accident from the west, or inbound, the track is tangent a distance of 510 feet, followed by a 10° curve to the left approximately 1,074 feet in length, the accident occurring on this curve at a point 652 feet from its western end. The grade at the point of accident is 0.8 percent ascending for inbound trains.

All train movements on the southwest connection are governed by fixed signals which are controlled from Tower A, located in the station building of the Cincinnati Union Terminal Company, with the exception of two automatic signals referred to subsequently in this report. The interlocking machine is a Union Switch & Signal Company model No. 14 machine, having a 231-lever frame. Home signals as well as signals for movements on the connection are high 2-unit signals, style R2, with a 3-color-light top unit and a 2-color-light bottom unit. A model board located at the rear of the interlocking machine shows the track layout, and is equipped with colored lights to indicate when track sections are occupied, when signals display other than stop indications, and the direction of traffic. The track and signal-indicating lights are normally extinguished and a single-stroke bell announces when a train enters or leaves approach track sections.

Track circuits are AC, the track relays or track repeating relays for all of the interlocking being located in the tower



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THE CINCINNATI UNION TERMINAL CO.
CINCINNATI, O.
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relay room. Track circuits and signal line transformers are fed through line transformers off a 2,300-volt loop, which encircles the interlocking proper.

The switch located at the end of double-track on the southwest connection is style M10, 10-second movement, operated from a 24-volt storage battery, trickle-charged by a 110-volt line run out from the line transformers at the interlocking. Signals on the connection are lighted from this 110-volt line; stand-by power is provided for both the signal lighting and circuit operation, as well as the DC track circuits, by storage battery, also trickle-charged from the 110-volt line.

Protection for operation over single-track between the terminal and the outlying interlockings is provided by traffic locking, this protection on the southwest connection being provided by traffic lever 212. The only exceptions to the signals as described above are as follows: one color-position-light signal, L208, located on a ground mast on the Baltimore & Ohio just west of the west end of the southwest connection, which governs inbound movements, and two single-unit 3-color-light style R2 ground-mast signals at a double location at a point 2,238 feet east of signal L208, the inbound signal at this point being automatic signal 12.

The signals involved in this accident are home signal L230 and automatic signal 12, both of the color-light type, continuously lighted electrically. Signal L230 governs inbound movements to tracks S3 and S4 and is located on a ground mast at a point 39 feet west of the junction switch, on the south side of the track; this signal displays green over red, indicating proceed; yellow over red, indicating proceed prepared to stop at next signal; red over yellow, indicating proceed at restricted speed, and red over red, indicating stop.

Automatic signal 12 governs inbound movements and is located on a ground mast at a point 2,581 feet west of home signal L230, on the south side of the track; it is a single-unit 3-color-light signal, and displays green, indicating proceed; yellow, indicating proceed prepared to stop at next signal; and red, indicating stop-then-proceed at restricted speed. A green aspect, indicating proceed, was displayed by automatic signal 12 just prior to the accident.

Briefly described, the circuit plans showed the H control of signal L230 through front contacts of relays 231TPS and A204TP, among other selections; and the D control through front contacts of relays L204H and L230H. Relay 231TPS is a track repeating stick relay controlled through track relay 231TR, and relay A204TP is a repeating relay for A204TR relay, both of

these repeating relays being located in Tower A relay room. Track relay 231TR is connected in the track circuit extending from signal L230 to a point 345 feet east, and track relay A204T is connected in the track circuit which adjoins track circuit 231T and extends 1,354 feet east to signal L204, these track relays being located in a housing at signal L230. Signal 12 is operated by a polarized relay which is controlled through L230H relay, acting as a pole-changing relay, and 231TR and X231TR relays, the last-named relay being connected in the track circuit extending between signal L230 and signal 12. With the above-described circuit arrangement, signal L230 should display a red-over-red aspect with the lever normal; a yellow-over-red aspect with the lever moved to the left, track circuits 231T and A204T unoccupied, and signal L204 indicating stop; a green-over-red aspect with the lever moved to the left, track circuits 231T and A204T unoccupied, and signal L204 displaying a yellow-over-red aspect; a red-over-yellow aspect with the lever moved to the left, push button in, and track circuit 231T occupied; and a red-over-yellow aspect with the lever moved to the left, track circuit 231T unoccupied and track circuit A204T occupied. Automatic signal 12 should display a red aspect when either one or both of track circuits X231T and 231T are occupied; a yellow aspect when track circuits X231T and 231T are both unoccupied and signal L230 displays a red-over-red aspect; and a green aspect when track circuits X231T and 231T are both unoccupied and signal L230 displays a yellow-over-red or green-over-red aspect.

A view of signal 12 and signal L230 can be had from the engineman's side of the cab of an inbound train for distances of 1,050 feet and 1,500 feet, respectively; however, on account of the 10° curve involved, the view of the rear end of a train standing at the point of accident is restricted to about 70 feet from the engineman's side of the cab, and to approximately 600 feet from the fireman's side across the inside of the curve, the fireman's view being restricted on account of an overhead railway bridge, while on account of the track curvature and the high side girders of the bridge upon which the first train stood, it is difficult to determine upon which track a train is standing until it is only a short distance away.

The weather was clear at the time of the accident, which occurred about 8:07 a.m.

Description

Train No. 12, an east-bound passenger train of the Baltimore & Ohio Railroad, consisted of 1 coach, 2 express cars, 1 combination passenger-baggage car, 1 coach, 2 Pullman cars, and 1 observation car, in the order named, all of steel construction, hauled by engine 5227, and was in charge of Conductor Ross and Engineman James. This train passed signal 12, which was displaying a green

aspect, indicating proceed; passed signal L230, which was displaying a yellow-over-red aspect, indicating prepare to stop at next signal, and was stopped before reaching the next signal, L204, located on the signal bridge at Budd Street, which was displaying a red-over-red aspect, indicating stop. The stop made was only momentary, however, and the train had just started ahead when its rear end was struck by Train Second No. 46.

Train Second No. 46, an east-bound passenger train of the Cleveland, Cincinnati, Chicago & St. Louis Railway, consisted of 1 baggage car, 1 coach, 2 Pullman cars, and 1 dining car, in the order named, all of steel construction, hauled by engine 6472, and was in charge of Conductor Stiles and Engineman Bieri. This train passed signal 12, which was falsely displaying a green aspect, indicating proceed, passed signal L230, which was falsely displaying a green-over-red aspect, indicating proceed, passed the flagman of the train ahead, who had gotten back only 87 feet behind his train when it stopped for signal L204, and collided with Train No. 12 while traveling at a speed variously estimated to have been between 8 and 40 miles per hour.

Train No. 12 was moved ahead by the force of the impact, the rear end of the last car in that train, which was considerably damaged, stopping at a point 37 feet beyond the point of collision; the train broke in two at two places, namely, between the rear car and the car ahead of it, this separation measuring 24 feet, and between the first and second cars, this separation measuring 130 feet. The rear truck of the car ahead of the last car was the only portion of the train to be derailed, but all of the cars were considerably damaged. The front end of CCC&StL engine 6472 was considerably damaged, and the front pair of driving wheels, the booster truck, and one pair of wheels in the forward truck of the third car in the train were derailed. The employee killed was the baggageman of Train No. 12, while the employees injured were the conductor of that train, a car foreman who was deadheading thereon, and the conductor and a brakeman of Train Second No. 46.

Summary of evidence

Engineman James, of Train No. 12, stated that signal 12 was displaying a green aspect, signal L230 a yellow-over-red aspect, and signal L204 a red-over-red aspect. At this last signal his train was stopped and he started to whistle out a flag, but the aspect changed to yellow over red and he therefore sounded two blasts of the whistle and started ahead; the engine stalled, slack was taken, and the train then was started, but the accident occurred after the train had moved about 10 or 12 feet. The engineman estimated that it was about 50 seconds from the time his train stopped at signal L204 until he took slack and started

again, and he thought about 5 or 6 seconds elapsed from the time his train stopped until the signal indication changed.

Flagman Boone, of Train No. 12, stated that when approaching Budd Street he was on the rear platform of the last car and got off before his train stopped and started back with a red flag, but got back only a short distance when the following train passed him at a speed he estimated to have been about 40 miles per hour; he saw the engineman leaning out of the cab window and shouted to him. The flagman did not notice whether the air brakes were applied, and thought the speed had not been reduced when the collision occurred.

Engineman Bieri, of Train Second No. 46, stated that signal 12 was displaying a green aspect and that signal L230 was displaying a green-over-red aspect, but that after the engine passed under the overhead railway bridge the fireman gave warning of danger and he shut off steam immediately and applied the air brakes in emergency. Engineman Bieri said that the fireman was on the seat box looking ahead and that at the time he gave warning of the train ahead, their own engine was about 110 to 120 feet from the rear of the B.& O. train, at which time the speed was about 20 miles per hour, and he thought it was reduced to about 9 or 10 miles per hour when the collision occurred; engineman Bieri also said that when he was about 60 or 80 feet from the point of collision, he was flagged with a red flag. After the accident, in company with two other men, he went back and looked at signal L230, and at that time it was displaying a red-over-red aspect. The air brakes had been tested, and worked properly en route.

Fireman Hogenmeyer, of Train Second No. 46, stated that he did not see the rear end of the B.& O. train until his engine passed under the overhead railway bridge and was only a short distance from the preceding train. When he saw that it was on the same track as his own train he shouted a warning of danger to the engineman, at which time the speed was about 18 or 20 miles per hour, whereupon the engineman applied the air brakes in emergency, reducing the speed to about 8 or 10 miles per hour at the time of the collision; Fireman Hogenmeyer did not see the B.& O. flagman prior to the accident.

Leverman Martin, on duty in Tower A, stated that he was working the levers on the southwest connection. He said Train No. 12 came in as usual; he gave Train No. 12 signals L208 and L230, which advanced that train to signal L204. Southern Train 1st No. 5 was going out of track 9 to track 86; as soon as this train cleared he gave Train No. 12 signal L204 and other signals to advance that train into the terminal on track 14, but when indicator lights did not appear on the model board as usual he notified the assistant train director that Train No. 12 must be

stopped; shortly afterwards the signal maintainer called by telephone reporting the accident. In the meantime he had given Train Second No. 46 signals L208 and L230 to permit that train to follow Train No. 12. He did not know what indications were displayed by signals L308 and L230 for Train Second No. 46, his only information that the signals had operated being the display of green lights on the model board.

Signal Foreman Rogers, of the Cincinnati Union Terminal Company, stated that on arriving at the scene of the accident he heard that the engineman of Train Second No. 46 had stated that he received a green indication at signal L230; he went to that signal and got in communication with the tower on the telephone and told them to display the signal for a movement in against the equipment that still was occupying the track. This was done, but the signal displayed a yellow-over-red aspect, which was a false indication under the circumstances, and he then checked the position of 231 track relay and A204 track relay, both of which were located in the signal case at signal L230; both of these relays were functioning properly, 231 being up, or energized, and A204 being down, or deenergized. He also checked the repeater circuit for A204 track repeater relay; this circuit breaks over A204TR and operates the repeater relay which is located in the tower. The circuit was found to be all right and the signal foreman then left the maintainer at the signal and proceeded to the tower and had the north end signalman join him, after which he checked the position of A204 track repeater relay and found it to be down as it should have been, but on checking further for L230H circuit, he did not find it over the relay as should have been the case. Foreman Rogers had the signalman start running the circuit back from the terminal board while he checked the circuit on the wiring diagrams, and they found that L230H signal control circuit, instead of breaking over A204TP, as the circuit plan showed it, was breaking over 204TR. The breaks were shown on the wiring diagram as being over 204 track relay and this was the circuit, to the best of his knowledge, as originally installed; the circuit plans, however, showed the signal control circuit over the proper relay and the signal foreman, by taking the break out of the wrong relay and putting it through the right relay, corrected the improper signal operation. A check was then made by shunting both of the track circuits which control the home indication of signal L230, and it functioned properly. Signal Foreman Rogers was on the job at the time the plant was constructed, and he said the southwest connection signaling was not completed at the time the terminal went into operation under emergency conditions, due to high water; this was on March 19, 1933, and the signals were placed in operation several days later. At this time the plant was checked in the field by representatives of the Union Switch & Signal Construction Company and himself, and he could not explain why the condition in question was not discovered, unless it was because of the fact that

a thorough check was not made on the southwest connection owing to the confusion due to the unusual operation in putting the terminal into service; since the plant had been in operation he had not received a report from anyone that would indicate there was any defect in the signal system. Signal Foreman Rogers also said that he did not reproduce the situation claimed by Engineman Bieri to have existed, because after he found a false approach indication on signal L230 there was no need of any further test, it being evident the signal could have displayed a proceed indication under the conditions which existed immediately prior to the accident. Since the accident Manager Kellogg, of the Cincinnati Union Terminal Company, advised under date of April 9 that a complete check of the entire interlocking plant had been started.

This terminal was placed in service on March 19, 1933, but the signals on the southwest connection were not placed in operation until several days afterwards. A plan of the terminal interlocking furnished in connection with this investigation indicated that it was revised on November 2, 1934, in order to show changes for tracks 15 and 16.

Discussion

The evidence in this investigation shows that B.& O. Train No. 12 received a stop signal at signal L204, and that just as the train had been brought to a stop the signal changed to display a yellow-over-red aspect, authorizing the train to proceed prepared to stop at the next signal; it was necessary, however, to take slack and the train had just started to move ahead when it was struck by C.C.C.& St.L. Train Second No. 46, the engineman of the latter train saying that the signal in the rear of Train No. 12, signal L230, was displaying a green-over-red aspect and that automatic signal 12, next in rear of signal L230, was displaying a green aspect, each of which constituted a proceed indication for his train. Signal Foreman Rogers was summoned to the scene and while a portion of Train Second No. 46 still occupied track circuit A204T, the signal foreman had the leverman operate lever 230 and then observed signal L230 improperly display a yellow-over-red aspect, and his subsequent investigation disclosed that the control of signal L230 was not broken through relay A204TP, as shown by the circuit plan, but was erroneously broken through relay 204TR, the track relay for the track section in advance of signal L204. After changing the circuit to conform to the circuit plan, a check demonstrated that the signal operated as intended.

It further appeared from the investigation that the terminal was placed in service in advance of the intended date, due to high-water conditions which necessitated the abandonment of the old terminal, and that the check of signals on the southwest

connection was made under traffic shortly after the terminal was placed in operation. No records of this check were available during this investigation, and although the wiring corresponded with the detail plans and Signal Foreman Rogers said that to the best of his knowledge this was the original construction, it was not definitely established whether this error was made in the original installation or in connection with subsequent changes in the plant. It appears that the defective condition which was disclosed in this case, and which was the cause of this accident, had not been discovered previously in connection with the operation of trains because of the fact that relatively precise spacing and movement of trains was required to cause the display of improper signal indications. The investigation forcibly emphasizes the fact that signal facilities should receive thorough and accurate tests, in order to eliminate any irregularities and to insure that these facilities are in safe and suitable condition to afford adequate protection for the movement of trains.

Signal L230 is located in terminal territory where a speed of 30 miles per hour is authorized. The restricted-speed, or red-over-yellow aspect, may be displayed when a train occupies the first track section, by moving the lever in the tower to the left and operating the push button; with the first track section unoccupied and the second track section occupied, the aspect may be displayed by moving the lever to the left, without using the push button, the latter arrangement being known as an automatic call-on, and levermen are not required to know that a train has stopped before displaying this aspect. If a rule had been in effect requiring levermen to know that a train has stopped before displaying a signal for its movement into an occupied section, this accident might have been prevented.

Conclusions

This accident was caused by interlocking signal L230 and automatic signal 12 displaying false proceed indications, the false proceed indication displayed by signal L230 was caused by an error in its control circuit, while as a result of this error automatic signal 12 also displayed a false proceed indication through the normal operation of its circuit.

Respectfully submitted,

W. J. PATTERSON,

Director.