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ON March 4, 1921, W. P. Borland, chief of the Bureau of Safety, made a report to the Interstate Commerce Commission on the results of the investigation of the Porter, Ind., collision. This report is given in full below. A description of this accident appeared on page 88 of the *Railway Signal Engineer* for March, 1921.

from the point of accident is tangent for several miles. The distant signal for the New York Central, No. 499.1, is located about 4,500 ft. east of the crossing, the home signal about 3,900 ft. west of the distant signal, and the derail about 50 ft. west of the home signal, or about 500 ft. east of the crossing. The grade is slightly descending westward.

At the crossing, the line of the New York Central consists of three tracks, the track on the north being the westbound main track, the middle track the eastbound main track, while the track on the south is a passing siding used by trains in either direction. At the time of the accident it was dark, and the weather was clear.

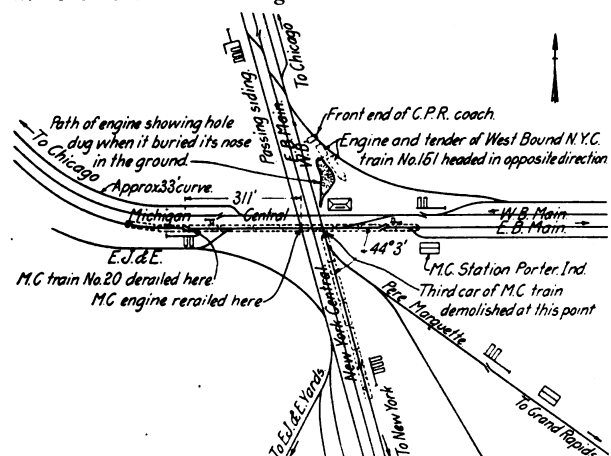
Michigan Central eastbound passenger train No. 20, known as the "Canadian," running between Chicago, Ill., and Detroit, Mich., was hauled by engine 8306 and consisted of the following cars in the order named:

Baggage car, C. P. 4164, steel center sills and ends.
Smoking car, C. P. 1556, wood and steel center sills.
Coach, C. P. 1560, wood with steel center sills.
Sleeping car Melrose, wood with steel center sills.
Sleeping car Montreal, wood with steel center sills.
Parlor car Adorea, all steel.
Dining car M. C. 121, all steel.
Parlor car Davida, steel underframe.
Coach, G. R. & I. 104, all steel.

This train, with Conductor Foote and Engineman Long in charge, left Chicago at 5:05 p. m., on time, and passed East Gary, the last reporting station, 9.1 mi. west of Porter, at 6:12 p. m., 7 min. late; it passed distant signal 2412 in the caution position, home signal 35 in the stop position and was derailed at the open derail east of the home signal. The train continued on the ties, the engine being rerailed by contact with either the frog of the passing siding switch or the frog of the crossing. The train came to a stop with the engine on the rails 400 ft. east of the crossing, with its tender derailed. The baggage car was derailed and came to rest about 75 ft. behind the engine; the smoking car stopped about 35 ft. east of the crossing and blocked both Michigan Central main tracks; coach 1560 apparently stood with its center over the westbound New York Central main track; the next four cars came to rest on the roadbed, west of the crossing, while the last two cars of the train remained on the track.

New York Central westbound passenger train No. 151, known as the "Interstate Express," running between Buffalo, N. Y., and Chicago, Ill., consisted of engine 4828 and the following cars in the order named: 1 Arms palace horse car, 1 combination baggage car and coach, 2 coaches, 1 dining car and 2 parlor cars. All cars were of all-steel construction except the horse, baggage and dining cars, which were of wood with steel underframes. The train was in charge of Conductor Roy and Engineer Johnson and left Elkhart, Ind., its initial station for the Western division, at 4:55 p. m., on time, passed Otis, the last reporting station, 8.8 mi. east of Porter, at 6:12 p. m., 2 minutes late, and while running at a speed estimated to have been 50 mi. an hr. collided at 6:22 p. m. with Michigan Central train No. 20, which had been derailed on the crossing. It was impossible to determine whether or not the latter train had come to a full stop when the New York Central crashed into it.

In the vicinity of the point of accident both railroads are double-track lines; trains are operated on both roads by train orders and automatic block-signal systems, and the crossing is protected by an interlocking plant. The line of the New York Central extends east and west, while that of the Michigan Central extends southwest



Track Layout at Point of Accident

and northeast and crosses the track of the New York Central at an angle of about 45 degrees. The interlocking tower is located in the north angle formed by the tracks of the two roads.

Approaching the point of accident on the Michigan Central from the southwest, which by time-table direction is west, beginning at distant signal 2412, the line is tangent for 500 ft., followed by a 33-min. curve to the left 3,960 ft. in length; it is then tangent for about 600 ft. to the crossing and for a considerable distance beyond. Home signal 35 is located on this tangent, 366 ft. southwest of the crossing. A derail is placed in the south rail of the eastbound main track 55 ft. east of the home signal. Paralleling the eastbound main track on the south is a passing siding which begins just west of the distant signal and terminates at a main track switch between the derail and the crossing. In this vicinity there is a slight grade descending eastward.

The line of the New York Central in each direction

The engine of train No. 151 struck the coach of train No. 20 in the center, carrying it for a considerable distance to the west and entirely demolishing it; it was in this coach that nearly all of the fatalities and injuries occurred. Engine 4828 was turned completely around and came to rest on its left side partially buried in the ground about 75 ft. west of the crossing and a few feet north of the westbound New York Central main track. The tender was behind the engine with its rear end swung to the north. The horse car came to rest about 150 ft. west of the crossing; its trucks were missing and the body of the car blocked the eastbound track and the passing siding which adjoins it on the left. The baggage car came to rest 75 ft. west of the crossing, followed closely by the combination car; both were derailed, blocking the eastbound track. The forward end of the coach rested on the crossing, while the rear end remained on the westbound track. The remainder of the train was not derailed. The employees killed were the engineman and fireman of train No. 151.

Description of Signal Apparatus

The switches and signals at this crossing are controlled by a mechanical interlocking plant which is operated jointly by the New York Central and Michigan Central. The mechanical apparatus is maintained by the New York Central, while each road maintains its own electric apparatus. The interlocking machine is a 54-lever Saxby and Farmer machine, having 1 spare lever and no spare spaces. Electric locks are provided on all home-signal levers. Two hand screw-releases are provided for the New York Central which require about 2 min. to operate, and the Michigan Central has one clock-work release set to operate in 1 min.

Approach annunciators and indicators are in service on both roads; the New York Central uses a buzzer, the Michigan Central a bell. The westbound New York Central buzzer operates when any part of the track is occupied between signal 497.1 and the tower, a distance of 10,250 ft.; the eastbound Michigan Central bell operates when any part of the track section between signals 2422 and 2412 is occupied, beginning 9,250 ft. west of the tower.

Michigan Central distant signal 2412 is a three-position, upper-quadrant semaphore, block signal. The home signal is a three-position, upper-quadrant semaphore; mounted on the same mast below the home signal is a mechanically-operated, two-position, upper-quadrant, calling-on signal. Located opposite the tower, 9 ft. east of the Michigan Central tracks and 57 ft. north of the New York Central track, is the train-order signal governing the Michigan Central tracks. The mast is 29 ft. high and bears two three-position, lower-quadrant semaphores, one governing eastbound and the other westbound trains; this signal was destroyed in the accident. On the New York Central, flags or lights displayed from the tower are used instead of a train-order signal.

Summary of Evidence

Tower Operator Whitehead, who was on duty at the tower at the time of the accident, stated that prior to the entry of either train on the annunciator circuits all levers were in normal position; it was expected that both trains would arrive about the same time and Leverman Cook asked him which train he would line up the route for, to which he replied, "Line up for whichever hits the circuit first." Shortly afterwards the New York Central buzzer sounded, which indicated the approach of train No. 151, and the route was lined up for that train; about 20 or 30 sec. after the New York Central buzzer sounded, the bell on the Michigan Central rang, indicating the ap-

proach of train No. 20. Shortly afterwards he looked out of the window and saw train No. 20 approaching around the curve at a high rate of speed. Remarks as to the high rate of speed and the probability of that train coming to a stop passed between him and Leverman Cook. When it was discovered that train No. 20 was not going to stop, both he and Cook started for the door; the collision occurred before they reached it. He further stated that there was nothing to prevent him from throwing the New York Central home signal to stop, in the face of train No. 151, but that when he realized that train No. 20 was not going to stop there was not time to do it.

Acting Leverman Cook, who was the regular assistant signal maintainer at this tower, but was acting as leverman on the day of the accident, corroborated the statement of Operator Whitehead. He also stated that he had completed setting up the route for train No. 151 before the approach of train No. 20 was announced, and that on account of the time release it would have taken about 3 min. to change the routes.

Engineman Long, of train No. 20, stated that the last stop prior to the accident was at Gary, at which point the brakes were operating properly. Approaching the distant signal the speed of his train was about 60 mi. an hr.; as he came in sight of the distant signal it displayed a yellow indication; before reaching it he made a service application of the brakes, reducing the speed of his train about 10 mi. an hr.; when the train had reached a point near the road crossing, about the middle of the curve, Fireman Block called to him, "All the way," which indicated to him that the home signal was clear; he released the brakes and when the engine reached the tangent he looked for the home signal and thought he saw a green light above a red one; as he got close to the home signal he looked for the signal again, but it was hidden by smoke and steam; at that time he thought the speed of his train was between 35 and 40 mi. per hr.; he did not see the train-order signal on account of the smoke and steam, neither did he see any hand signals. In discussing the indication of the home signal, in response to the inquiry: "What do you think caused those indications that you received?" Engineman Long replied: "The only thing that could be, if I did not have them, is that I mistook the order board for the green light." Engineman Long further stated that he does not depend entirely upon the fireman when he calls a signal and that he has never before had any trouble in distinguishing the signals at this point.

Fireman Block, of train No. 20, stated that approaching Porter the distant signal was in the caution position; when about a mile from the home signal he observed the indication of that signal and the train-order signal, two green lights and a red light; at this time there was some steam or white smoke escaping from the engine standing at the water plug near the home signal, but he could see the signal lights through the smoke. As soon as he saw the signal indications he called "All the way" to Engineman Long, who about 30 sec. later answered "All right"; at that time the speed of his train was between 35 and 40 mi. an hour. After the engineman answered him, he got down and began to work on the fire. He did not see any hand signals given from the track; after passing the derail he knew that the tender was derailed but did not think that the engine was derailed.

Conductor Foote of train No. 20 stated that he was riding in the coach of his train and as the train was approaching the distant signal he felt the running test made and brakes released; he started to collect tickets and was at about the seventh seat from the forward end of the car at the time the collision occurred. He did not know the position of the signals as the train approached Porter.

Engineman Curtis of Michigan Central eastbound freight train extra 7849 stated that his train pulled in on the passing siding at Porter, had taken water and had just started to pull down; the locomotive was nearly opposite the home signal when train No. 20 passed him. He stated that before taking water he looked at the home signal and both blades were in the stop position, and that he looked again when he saw the reflection of the headlight of train No. 20 and at that time they were still in the stop position; he also noted that the train-order signal displayed a proceed indication. At this time smoke and steam from his engine was blowing across the Michigan Central main track, which may have obscured home signal 35 from the vision of the engineman of train No. 20. He estimated the speed of train No. 20 to have been between 30 and 40 mi. an hr. when it passed him. He further stated that it never had appeared to him that the train-order signal could be confused with the home signal at this point.

Fireman Arthur of extra 7849 stated that he observed the blades on the home-signal mast and that they were both at stop. He also observed two brakemen of his train who were standing on the track and were giving stop signals with their lanterns to the engineman of train No. 20 as it approached.

Brakeman Wise and Kubbernuss of extra 7849 stated that they were standing near the head end of their train, west of home signal 35, and saw that the signals were at stop when their train stopped, which was at about 6:15 p. m.; as they saw train No. 20 approach around the curve at a high rate of speed they began to give "ease off" signals with their white lanterns; receiving no acknowledgment to their signals, they began to give violent signals to stop; at this time one of them was standing on the fireman's side and one on the engineman's side of the eastbound track, but no response was received to these signals. They stated that it was dark and clear and there was no reason why the engineman of train No. 20 could not have seen their signals had he been looking for signals at this point. They also corroborated the statement that there was some smoke and steam from their engine blowing across the Michigan Central main track.

Conductor Roy, of train No. 151, stated that approaching Porter he thought he felt a running test made of the brakes of his train and that the speed of his train was about 50 mi. an hr. when it collided with Michigan Central train No. 20.

Rules Governing the Use of the Plant

The timetable rules of the Michigan Central permit first-class trains to pass through interlocking plants at a rate of 40 mi. an hr., while the rules of the New York Central permit a speed of 50 mi. an hr. The speed of train No. 20 is variously estimated to have been from 35 to 55 mi. an hr. There is no variation in the estimates of the speed of train No. 151; it is stated that its speed was about 50 mi. an hr. According to the statements of Operator Whitehead and Acting Leverman Cook, the lapse of time between the announcement of train No. 151 and train No. 20 was 20 or 30 sec., and as the distance between the announcing points on the two roads and the crossing is about 1,000 ft. longer on the New York Central, this time interval would place train No. 151 about the same distance from the tower as was train No. 20 when it was announced. Therefore, if train No. 151 was running at 50 mi. an hr. it is obvious that train No. 20 was running at a still higher rate of speed as it arrived at the crossing before train No. 151.

A careful examination of the interlocking plant and the signals governing the routes involved indicated that it had been in proper condition, and failed to disclose any

defect or condition that could have resulted in any improper operation of the signal system. A physical check or test of the circuits was impossible on account of the destruction of a large amount of trunking and wires. A careful check of the circuit plans, locking sheet and dog chart indicates that this crossing is adequately protected as far as signaling is concerned, and inasmuch as the investigation indicates that the signal system was operating as intended, a detailed description of the circuits is unnecessary in this report.

The statements of eye witnesses who observed the home signal at the time train No. 20 was approaching, together with the investigation of the signal system, indicate that both blades of the home signal were in the stop position and displayed red indications when train No. 20 approached and passed it.

Observations made from an engine similar to that on train No. 20, approaching the crossing on the Michigan Central from the west, disclosed that from the fireman's side of the engine the home signal could be seen a distance of approximately 4,000 ft., while by leaning out of the window on the engineman's side the home signal could be seen a distance of about 1,980 ft.

The locations of the train-order and home signals were such that it would have been possible for the fireman to have mistaken the green indication of the train-order signal for a clear indication of the top blade of the home signal if the light on the latter was out or obscured by steam or smoke; however, with both blades of the home signal in the stop position, as is shown by the evidence, it would have been impossible for Fireman Block to see the indication he claims to have seen, two green lights above a red light. The possibility of a confusion of the signals from the engineman's side of the engine is much less than from the fireman's side, on account of the signals being much closer when they first come within the engineman's range of vision.

Conclusions

The direct cause of this accident was the failure of Engineman Long of Michigan Central train No. 20 to observe and obey the signal indication of the home signal governing the movement of trains over this crossing. A contributing cause was the failure of Fireman Block, also of Michigan Central train No. 20, properly to observe the home signal indication and convey the correct information to Engineman Long.

The evidence indicates that Engineman Long relied practically if not entirely upon the announcement by Fireman Block of the indication of the home signal instead of observing it himself. The location of the signals is such that it was both possible and convenient for him to observe the signals personally, and for his failure to do so there is no excuse. Even if he did confuse the train-order signal with the top blade of the home signal, as he stated he must have done if the home signal was in stop position, he still did not receive a proper indication to proceed at normal speed, as his movement was also governed by the train-order signal opposite the tower, the indication of which he was required to observe before passing it.

According to his own statement, Engineman Long received a caution indication at the distant signal; this informed him that the home signal governing the crossing was then in the stop position, and required him to "proceed under such control as to be able to stop before reaching the next signal." The evidence discloses that Engineman Long observed and heeded this caution indication, as he made a brake application and slightly reduced the speed of his train. It was then necessary for him to ascertain the indication of the home signal and be governed by

that signal indication in the further operation of his train.

Under these circumstances, knowing the arrangement of signals at this point, Engineman Long should have exercised particular care, after having received a caution indication at the distant signal, to see that the signals governing his train were clear, indicating that the route was properly lined up and that it was proper for his train to proceed, before passing the home signal and starting over the crossing at high speed. In addition to his failure to observe and obey the stop indication of the home signal, Engineman Long failed to see and be governed by stop signals given with lanterns by two trainmen of the freight train standing on the siding. These hand signals were in no way obscured, and had Engineman Long been on the alert and maintaining a proper lookout ahead, he could not have failed to observe them.

The failure of Engineman Long in this case properly to observe and be governed by signal indications, together with the appalling loss of life resulting therefrom, adds another to the already long list of accidents resulting from the fallibility of enginemen, upon whom the safety of passengers depends. In this instance Engineman Long was probably misled by the incorrect information given him by the fireman who called the signal clear when it was, as a matter of fact, in the stop position. But this does not relieve Engineman Long of responsibility in any degree, as there was ample opportunity after the home signal came within his range of vision for him properly to control his train in accordance with its indication.

This accident again calls attention to the necessity for an automatic train-control device to be used in connection with existing signal equipment for the purpose of automatically controlling the speed of a train in case the engineman for any reason fails properly to observe signal indications and to operate his train accordingly. Signal Engineer Wiegand of the New York Central, in response to an inquiry as to what means could be provided to prevent similar accidents, stated that in this case as far as signaling was concerned ample protection had been provided, and the only thing he knew of that would provide further protection was the installation of an automatic stop or train-control system; he stated, however, that he was not at present prepared to recommend any particular device of this character.

The investigation disclosed that Fireman Block misread the home signal indication, and consequently conveyed incorrect information concerning it to the engineman. A signal should not be called by a fireman until he is absolutely certain of its indication. In this case he called the signal when, according to his own statement, it was nearly a mile away and partially obscured by smoke. For his error in incorrectly reporting the signal as being clear, a portion of the responsibility for this accident rests upon him.

Investigation disclosed that the home signal was more or less obscured by steam or smoke, and its location is such that similar conditions may frequently exist due to the relative location of a water plug nearby; also, that the position of the train-order signal was such that there was possibility of confusing it with other signals. If the home signal was in this instance obscured to such an extent that the approaching engineman was unable to see it, then it was his duty to reduce speed, or to stop if necessary, and determine its indication before passing it, and it was necessary for him to receive clear indications from both the home signal and the train-order signal before passing them; nevertheless, every effort should be made to so locate signals that they are not likely to become obscured by steam or smoke from engines or to be confusing to employees required to observe their indications. It is believed the location of both the eastbound home signal

and the train-order signal on the Michigan Central at this point should be improved.

The intended function of the derail used at this point was to derail a train and thereby prevent it from proceeding upon the crossing in case the engineman failed to obey the stop indication of the home signal. From the evidence in this case, although the estimates as to the rate of speed of train No. 20 vary, it is believed that with a train running at the maximum prescribed speed limit of 40 mi. an hr., the derail located 311 ft. from the crossing does not afford the protection intended, and that in order actually to provide the protection intended the maximum speed limit at this point should accordingly be reduced or the location of the derail changed.

It is noted that the coach in the Michigan Central train which was struck by the New York Central locomotive was of wooden construction, with steel center sills, and that it was demolished by the impact. While it has been proven that steel passenger cars generally are safer than wooden cars, nevertheless, with the tremendous impact in this case, which was applied to the center of the side of the car, it is doubtful whether greater protection would have been furnished the occupants had the car been of all-steel construction.

Engineman Long entered the service of the Michigan Central as a fireman in 1890, was promoted to yard engineman in 1900 and to road engineman in 1901. His service record contains the following entries:

October, 1901—Suspended 10 days for running of interlocking signals against him.
September, 1907—Suspended 10 days for failure to stop for telegraph signal not burning.
December, 1907—Suspended 10 days for failure to stop for block signal not burning.
February, 1909—Taken out of service account defective vision.
June, 1909—Restored to service account improved vision.
April 1, 1914—Observed surprise test light out on telegraph signal.
April 25, 1918—Record suspension 30 days account collided with caboose car, flag out.

Fireman Block entered the service of the Michigan Central as a fireman in December, 1915, was promoted to road fireman in February, 1916; in military service from May, 1916, to January, 1919; promoted to switch engineer in March, 1920; April, 1919, given suspended sentence of 30 days, which was later modified to reprimand, for disregarding fixed signal in stop indication.

At the time of the accident Engineman Long and Fireman Block had been on duty 1 hr. and 47 min., prior to which they had been off duty 7 hr. and 50 min.

THE METAL MARKET

THE non-ferrous group of metals are at bottom prices. No further reduction in quotations for metals of this group seems possible. On the other hand, higher quotations seem not only probably but likely in the near future. Mine labor conditions in Europe make even normal productions impossible. Stocks are dwindling daily so that shortages in available stocks of unfabricated as well as fabricated copper and tin are inevitable. Lead will undoubtedly follow the lead of copper and tin in the upward trend. Zinc is in a peculiar position. The future tariff will largely govern the future price of this metal. The foreign shortages of copper will largely affect domestic prices. Metals listed are not fabricated and are from basic production points:

Copper	
Average price electrolytic, per lb.....	\$0.13½
Tin	
Average New York price, per lb.....	.29
Lead	
Average East St. Louis price, per lb.....	.04¾
Zinc	
Average Western price, per 100 lbs.....	4.60