INTERSTATE COMMERCE COMMISSION

REPORT OF THE DIRECTOR OF THE BUREAU OF SAFETY CONCERNING INVESTIGATION OF AN ACCIDENT WHICH OCCURRED ON THE CHICAGO, INDIANAPOLIS & LOUISVILLE RAILWAY AT INDIANAPOLIS, IND., ON MARCH 2, 1932.

April 7, 1932.

To the Commission:

On March 2, 1932, there was a derailment of a passenger train of the Chicago, Indianapolis & Louisville Railway at Indianapolis, Ind., which resulted in the injury of 12 passengers, 1 Pullman porter, and 1 employee of the New York, Chicago & St. Louis Railroad. The Investigation of this accident was made in conjunction with representatives of the Public Service Commission of Indiana.

Location and method of operation

This accident occurred within interlocking limits at Massachusetts Avenue, 1.8 miles north of the Union Station at Indianapolis. The interlocking plant governs train movements at the junction of three railroads, the Cleveland, Cincinnati, Chicago & St. Louis Railway, or Big Four, the New York, Chicago & St. Louis Railroad or Nickel Plate, and the Chicago, Indianapolis & Louisville Railway or Monon. This is the Second Sub-division of the Northern Division of the Monon, extending between Indianapolis and Monon, Ind., a distance of 95.1 miles; in the immediate vicinity of the point of accident trains are operated by time-table, train orders, and an automatic block-signal system.

The route traversed by northbound Monon passenger trains, commencing at the Union Station, is over the Indianapolis Union Railway tracks for a distance of 4,200 feet, then on the eastbound main track of the Big Four for 5,000 feet to home signal 40, where keeping to the left they enter upon the track of the Nickel Plate road, which track is traversed a distance of 650 feet to the point where the Monon property rights commence. A track of the Nickel Plate parallels the Monon track on the east; the accident occurred at the beginning of the Monon line, at the south switch of a crossover connecting that track with the Nickel Plate track on the east; this is switch 14 and the north switch of this crossover is switch 13. Approaching the point of accident from the south on the Big Four, there is a series of short curves and tangents, followed by 2,480 feet of tangent track to the point where the route diverges to the Nickel Plate track, which is practically tangent to and beyond the point of accident. Beginning south of signal 40, the grade is about 1 per

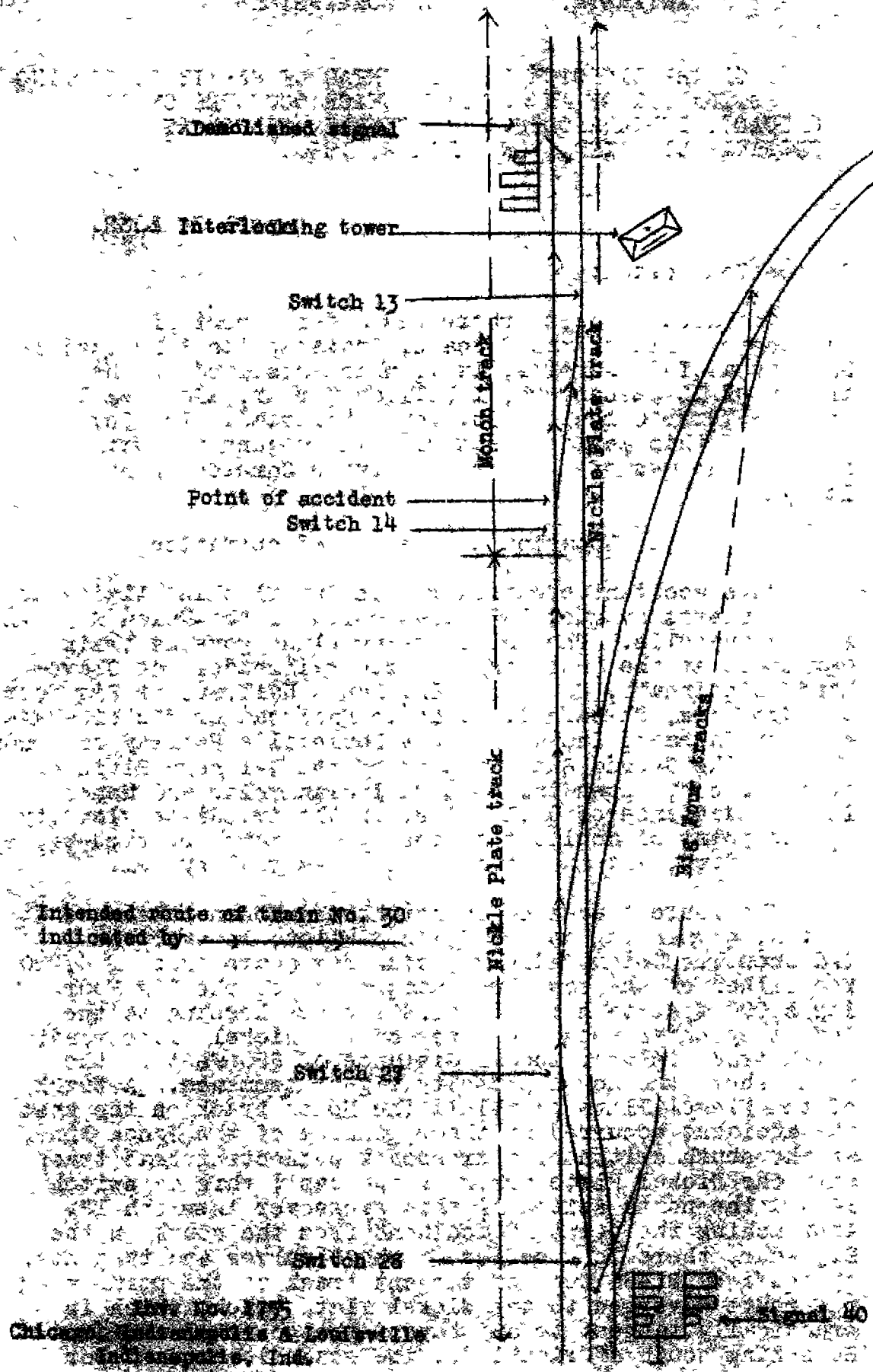

Exhibit No. 1755
Chicago, Indianapolis & Louisville
Indianapolis, Ind.
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cent ascending to Massachusetts Avenue, from which point there is a similar grade descending.

The switches and signals within the territory comprising what is known as the Massachusetts Avenue interlocking plant are operated and controlled by a 40-lever electric machine having 32 working levers. The tower is located on Massachusetts Avenue east of the Nickel Plate track. The switch involved, switch 14, is directly controlled by lever 14, and the movement of lever 14 is protected by the mechanical locking of the machine so that it can be operated only in a prescribed sequence. Protection against the movement of the points of switch 14 is provided by a detector bar of the motion-plate type, operated by the switch mechanism in the usual manner. Similar protection on the Big Four tracks is afforded by detector circuits. The signals governing movements through this plant from the south are mounted on a bracket mast, located 950 feet south of the tower; the right bottom arm, or calling-on arm, is designated as signal 40 and governs diverging movements to the Monon track. This signal is a non-automatic, power-operated, two-position, upper-quadrant signal.

It was daylight and the weather was clear at the time of the accident, which occurred at 5.08 p.m.

Description

Northbound Monon passenger train No. 30 consisted of 1 combination baggage and mail car, 2 coaches, 1 lounge car, 1 dining car, and 2 Pullman parlor cars, hauled by engine 421, and was in charge of Conductor Hull and Engineman Holmes. All the cars were of steel construction with the exception of the lounge and dining cars, which were of steel-underframe construction. This train departed from Union Station at 5 p.m., on time, and was derailed at the south switch of the crossover at Massachusetts Avenue while traveling at a speed estimated to have been 12 or 15 miles per hour.

The next to the last car in the train was derailed and stopped diagonally across the Monon and Nickel Plate tracks at a point about 325 feet beyond the south switch of the crossover, having demolished a southbound home signal located between the two tracks just beyond the crossover; this car also cornered the tender of Nickel Plate engine 95, which stood just north of the signal, headed north, resulting in the tender wheels being derailed. The rear car in train No. 30 followed the rails of the crossover and stopped about 60 feet beyond the crossover with the wheels of the front truck derailed.

Summary of evidence

Engineman Holmes stated that approaching the home signal of the Massachusetts Avenue interlocking plant he received a yellow indication on signal 40, and proceeded at a speed of 12 miles per hour until he reached the south switch of the crossover at the beginning of the Monon track; then he started to increase speed, but felt a jerk from the rear of his train and on looking back he saw one of the cars over on the Nickel Plate track. As he attempted to apply the air brakes he found that they had already been applied, due to the train breaking in two. The statements of Fireman Whitts were substantially the same as those of Engineman Holmes.

Flagman King stated that approaching Massachusetts Avenue he was standing on the observation platform of the rear car in the train, which was traveling at a speed of 12 or 15 miles per hour, when he felt a sudden jar like an application of the air brakes. He warned passengers who were standing on the platform with him, but they all were knocked down by the shock. A few minutes after the occurrence of the accident he examined the switch; it was lined for the Monon track, or in the closed position, and the points fitted closely to the rail. The first marks of derailment were on the frog just north of the switch.

Conductor Hull stated that he examined the south crossover switch after the accident and found it lined for a movement on the Monon; he saw no indication of anything dragging, but there was a mark on the first guard rail north of the switch points, and his observation led him to believe that the switch must have been thrown under the train.

Towerman Hendricks, of the Big Four Railroad, who was on duty at the interlocking plant at Massachusetts Avenue, stated that after receiving the report of train No. 30, from IU tower, located near Washington Street, he operated the levers controlling signal 40 and switches 28 and 27 to line up the route through the crossover from the Big Four track to the Nickel Plate track; he then received report from the conductor of a Monon cut which was following train No. 30, after which he received a report of a southbound engine on the Nickel Plate, and this latter engine was the first to reach the tower. The route, however, was lined for train No. 30; when he saw train No. 30 clear the crossover at signal 40 he restored switch 27 and signal 40 to normal; but before he could restore switch 28 he said the phone rang from IU tower again, reporting the Monon house cut. He then restored switch 28, with the intention of holding the Monon cut and allowing the Nickel Plate engine to pass through the plant as soon as train No. 30 cleared it and he was standing at his desk

by the phone when the derailment occurred. Towerman Hendricks had been in the employ of the Big Four Railroad since 1901, and during the last 13 years he had been stationed at Massachusetts Avenue.

Signal Maintainer Taylor, of the Big Four Railroad, stated that he arrived at the scene of the accident about 5.35 p.m., and on going to the tower to ascertain the condition of the machine he found all the levers in proper position, with none of them reversed. He then went out on the ground and found the switch at the south end of the crossover, switch 14, to be in good condition, but the switch at the north end was torn up and the signal pole located about 300 feet north of this switch had been knocked down. He stated that when signal 40 is restored to its normal position switches 13 and 14 may be opened, although detector bars are provided to prevent the switch points from being thrown while a train is moving over them. Signal Maintainer Taylor further stated that no trouble had been experienced with switch 14 of its detector bar since his assignment to this point except on one occasion when the point got out of adjustment. He also said the rules require the towerman to leave the signal alone until the train has passed through the plant.

Supervisor of Signals Kelley, of the Big Four Railroad, stated that he arrived at the scene of the accident on the morning following its occurrence. He conducted tests to determine the condition of the detector bar at switch 14 and by placing a device on the track to simulate a wheel it was found that there were 10 or 12 points at which the detector bar permitted the switch to be moved. He attributed the failure of this detector bar to function properly to lost motion or looseness in the clips, cranks and pins, and thought that had the signal maintainer tested the detector bar at different points throughout its length he could have detected this condition. He further stated that within the limits of this detector bar, 50 feet 7 inches in length, two different weights of rails were used, a 90-pound section and an 80-pound section, and tests showed that the detector bar was less effective on the 80-pound rail than on the 90-pound rail, as the bar normally can not fit as closely to a rail of one size as it does to one of another size. The detector bar when fitted new is placed $\frac{1}{4}$ inch below the top of the rail and in using one size clip on one rail and another size on the next rail there would be a little drop in the bar. He noticed marks or abrasions on the detector bar indicating an attempt to move the switch when a train was passing over it. Supervisor of Signals Kelley further stated that he made a test to ascertain whether or not it would be possible for the switch to move under a train without any operation or effort on the part of any one and

it was found that it could not be done, the lever on the machine had to be operated before the switch could be moved, for the reason that polarized relays are used to prevent a movement of the switch in the position opposite to that of the lever. Should current accidentally be applied for such a movement, the action of the polarized relay would open the circuit controller and take power off the machine. A check made to determine the effectiveness of this arrangement developed that the switch operated on 7 amperes; when 5.6 amperes were applied for the reverse movement of switch 14 with the lever in the normal position, the circuit controller opened and the power was cut off from the machine in the tower, preventing the movement of switch 14. A check made for movement in the opposite direction, developed that the circuit controller opened when 5.4 amperes was applied. A check for grounds developed that the plant was practically clear of grounds.

Signal Engineer Stoltz, of the Big Four Railroad, in explaining how switch 14 could be operated while a train was passing over it, stated that the detector bar is applied to two sections of rail where the track of the Nickel Plate joins the track of the Monon. The rails of the two companies being of different section, they necessitated the use of offset joints within the limits of the detector bar. The detector bar clips on the Nickel Plate rail, which is an 80-pound rail, require the bar to rise to a higher elevation above the top of the rail than in the case of the 90-pound rail north of the joint; the latter rail, being 7/64 inch higher in the head, allowed the bar to lie that much more below the top of the head than on the 80-pound rail. In addition to this, loose ties in the vicinity of the switch machine to which the T-crank is attached, permitted a movement of about ¼ inch when an attempt was made to operate the bar with a test device to simulate a wheel on it. The lost motion between the machine and the bar, together with the fact that the bar was normally approximately ¼ inch lower than it should have been, permitted the movement of the bar and switch machine with the test device on the detector bar, and the switch points could thus complete their movement without the detector bar performing its intended function at certain points along its length. Instructions are that the maintainer make weekly tests of the bar, but Mr. Stoltz said that apparently there were points along the bar which had not been tested on which were sufficiently low to permit of the movement of the bar under a wheel under the conditions existing at the time. Signal Engineer Stoltz stated that 4 by 6 inch wooden blocks were subsequently driven tightly between several ties on each side of the crank tie, at both ends, to prevent it from shifting when the switch was operated. Signal Engineer Stoltz further stated that this interlocking plant was installed in 1908, and with the exception of improvements made by the Big Four no changes

had been made other than necessary replacements from time to time. In 1930 detector circuits were installed on the Big Four tracks and in 1931 further improvements were made on the Big Four, including complete approach and detector locking. The Big Four changed from detector bars to detector locking because the locking provided more adequate protection and also because the 105-pound rail laid by the Big Four in 1930 had a wider head and increased the possibility of a detector bar failing to engage the wheels of a passing train and thus permitting a switch to be opened under a train. Mr. Stoltz said that in correspondence with the other roads, started in 1927, the Big Four endeavored to have complete detector locking installed; he said the reason given by the other roads for not adopting detector locking was because of expense. Mr. Stoltz thought the accident here under investigation would not have occurred had switch 14 been protected by detector locking.

Tests by the Commission's signal engineer indicated that protection against crosses in the electric circuits was operating as intended, that foreign current applied to reverse the switch points while the lever was in normal position would result in operating the circuit breaker, and that the plant was free from grounds. Further tests of the detector bar were made in a manner similar to those made by Supervisor of Signals Kelley, but inasmuch as wood blocks had been inserted between certain ties so as to provide a more rigid foundation, and also as the lost motion between various operating rods, cranks, etc., had been eliminated, the result was that the switch points could not be operated when the top of the detector bar was held level with the top of the rail. During all of the tests no method was discovered whereby this switch could be operated other than by means of the lever in the tower.

Upon being further questioned subsequent to these tests, Towerman Hendricks admitted that he had inadvertently or unintentionally operated the lever controlling switch 14 before the Monon train cleared it, resulting in the switch being thrown under the train.

Conclusions

This accident was caused by a switch being opened under the sixth car of train No. 30 within interlocking limits; a contributing cause was the fact that the detector bar which should have prevented the operation of this switch under a moving train failed to perform its intended function, due to improper maintenance.

The evidence indicates that the route was properly lined for Monon train No. 30 to make the diverging movement from the Big Four track to its own line. Towerman Hendricks stated that after having lined the route for that movement

he received several telephone calls reporting a Monon cut which was following train No. 30, and a southbound Nickel Plate engine, and it was his intention after train No. 30 had passed through the plant to allow the Nickel Plate engine to pass through, holding the Monon cut at signal 40. As soon as train No. 30 had passed through the crossover from the Big Four track to the Nickel Plate track he restored signal 40 and the switches at the crossover, the restoring of signal 40 making it possible for the switches at the crossover at Massachusetts Avenue, between the Monon and Nickel Plate tracks to be operated, and it is believed that between answering the telephone and restoring the signal and switches he either became confused or in his haste to move the southbound Nickel Plate engine he inadvertently pulled the lever governing switch 14, the facing-point switch at the second crossover, while train No. 30 was passing over it.

The rules of the Big Four provide that signals must be restored so as to display their most restrictive indication as soon as the train or engine for which they were cleared has passed and is clear of the fouling points of its route. Towerman Hendricks should not have restored signal 40 until train No. 30 had cleared the interlocking plant, in which event the unintentional operation of switch 14 could not have occurred.

Inspection and tests clearly showed that the detector bar at the switch involved, which was intended to prevent the operation of the switch under a moving train, failed to function. There was lost motion between the switch machine and the bar, the bar was $\frac{1}{2}$ inch lower than it should have been, and the result was that it was possible to move the switch points under a train without the detector bar preventing such action. The condition of this detector bar and its application to the rail was such that it was not reliable to prevent the very kind of an accident for which it was installed. This condition was one which adequate inspection and maintenance should have corrected. At other switches in this plant detector bars had been replaced by detector circuits, because of the greater reliability of such circuits as a means of protection against accidents of this character. It is believed that consideration should be given to the need for detector locking at all switches in this plant which are not now so equipped.

All of the employees involved were experienced men and at the time of the accident none of them had been on duty in violation of any of the provisions of the hours of service law.

Respectfully submitted,

W. P. BORLAND,
Director.