the lamps being lighted on approach control.

The interlocking control relays are housed in a large-size, sheet-metal case located near the crossing, as shown in one of the views. This case has a door on each side with a partition dividing the case, except that the lower section of the partition is cut away to allow space for the larger relays, such as the time-element relay. The underground cables are brought in through a hole in the foundation and are terminated on the lower section of the board, from which point jumpers are run through bridle rings to the terminals of the relays. On account of the extremely low temperatures experienced in this territory, it was considered desirable to provide some heat in this housing, during the winter season, that could be utilized to prevent frost from affecting the relays if it was found to be needed. For this purpose, a 100-watt, 110-volt lamp is mounted on the lower shelf and is kept burning whenever it is considered necessary. The ventilators are then sealed and the case is not opened during the winter except if trouble arises.

From this central case the circuits are distributed to each home signal in 14-conductor, No. 14 parkway cable made to A.A.R. Signal Section specifications, the make-up of which includes lead sheath and two wraps of the steel tape. This cable is laid in a trench 36 in. deep and is surrounded with 3 in. of sand. Beyond the home signals, the line circuits are No. 10 Copperweld wire, with double-braid weatherproof covering, run on the pole line.

The connections to the rail are No. 9, single-conductor parkway. The make-up of this cable includes two wraps of steel tape but no lead. At the rail, the cable is brought up through a cast-iron riser and into an outlet box. The end of the cable conductor is joined and soldered to two No. 9 Copperweld bond wires. This joint is left in the head of the outlet so as to be readily inspected. The two bond wires extend out through a hole, so arranged with a duplex channel pin and a split fibre tube that the wires are held firmly when the cover is bolted on.

Power Supply

A 110-volt a-c. power circuit is extended from the crossing to each of the home and approach signals, where transformers and rectifiers are used to charge storage cells. At each signal there is a set of five 85-a.h. lead storage cells used for the operation of the signal and control circuits. Two cells of the same type in multiple are used for each track circuit within the approach signal limits. A three-cell set of 500-a.h. primary battery is used to feed the track circuit on each of the four approach sections.

This automatic interlocking was planned and installed by signal forces of the Canadian National. The operation of trains by the automatic plant has been entirely satisfactory, with no complaints as to train delays; in fact, train movements under most circumstances are facilitated.

Accident in Automatic Block Signal Territory

ON JULY 5 there was a rear-end collision between a passenger train and a freight train on the Michigan Central near Wayne Junction, Mich., which resulted in the death of one employee and the injury of three passengers, one mail clerk and one employee. This accident was investigated by the Bureau of Safety, Interstate Commerce Commission, in conjunction with a representative of the Public Utilities Commission of Michigan. An abstract of the report of the investigation follows.

Track Layout

In the vicinity of the point of accident this is a double-track line, over which trains are operated by time-table, train orders, an automatic block-signal system and an automatic train-stop system of the intermittent-inductive type. Under the rules, trains move with the current of traffic by block signals whose indications supersede time-table authority. The accident occurred a little more than one mile west of Wayne Junction, on a passing track which is 6,000 ft. in length and is located on the south side of the main track, the point of accident being 687 ft. from the west switch of this passing track, this being a facing-point switch for eastbound trains. Approaching from the west, the track is tangent for more than 8 miles; the grade for some distance is slightly descending and is 0.16 per cent at the point of accident.

The signals directly involved in this accident are automatic signals 192, 202 and 214, located 404, 6,098 and 12,107 ft., respectively, west of the passing-track switch. These signals are of the upper-quadrant, three-position, semaphore type, approach lighted. In addition, these three signals are equipped to display three-block indications by the addition of a yellow light to the left of the signal mast, below the semaphore arm. The indications displayed by these signals are as follows: Red, stop then proceed at restricted speed; single yellow, prepare to stop at next signal, train exceeding medium speed (a speed not exceeding 30 m.p.h.) must at once reduce to that speed; double-yellow, prepare to stop at second signal; green, proceed. The additional yellow light to the left of the signal mast is referred to as a "double-distant signal;" at signal 202, under this double-distant signal, there is a take-siding signal, controlled from the interlocking tower at Wayne Junction, and arranged to display a flashing-red light. Turnout switches are equipped with switch circuit controllers adjusted so as to open the contacts when the switch point, controlling both sides of the signal control circuits, is open ¼ in. Automatic train-stop inductors are located approximately 70 ft. in the rear of the signals, or the point at which a train will shunt the track circuit in advance. The inductor circuits are so arranged that an inductor will cause the brakes to be applied automatically only when a restrictive signal indication is displayed.

Operation of Trains

Train second JS-2, an eastbound freight train, consisting of 53 cars, stopped and then headed in on the passing track at Wayne Junction at about 3:20 a.m. The train was standing on the passing track, with the switch open and the caboose 687 ft. from the switch, when it was struck by train No. 40. Train No. 40, an eastbound passenger train, passed Ypsilanti at 3:13 a.m., one minute ahead of time, and was approaching Wayne Junction when it entered the open passing-track switch and collided with the rear of train second

JS-2, while traveling at a speed variously estimated to have been between 15 and 50 m.p.h. The employee killed was the engineman of train No. 40 and the employee injured was the fireman of that train.

Head brakeman McNamara of train second JS-2 said the switch light was burning when his train reached the passing-train switch. On opening the switch, he found it difficult to operate, but he did not see anything to prevent the switch from being operated and after he had opened it, the points seemed to fit properly. Flagman Henderson of train second JS-2 stated that he got off the caboose and tried to close the switch, and then set down his lantern and tried again to close the switch but was unable to do so. He then opened the switch, at which time it seemed to work freely, and stepped over and looked at the points, but did not see any indication that it had been run through, nor did he see any stone or other foreign object in the points. Altogether, the flagman said he made seven or eight attempts to close the switch and finally, when train No. 40 was a short distance west of signal 192, which at that time was in stop position, he left the switch securely fastened in open position, and lighted a fusee and flagged the approaching train from the engineman's side of the track. He said the brakes had been applied and that fire was flying from the wheels when the head end of the train passed him at a speed he estimated to have been 35 or more m.p.h.

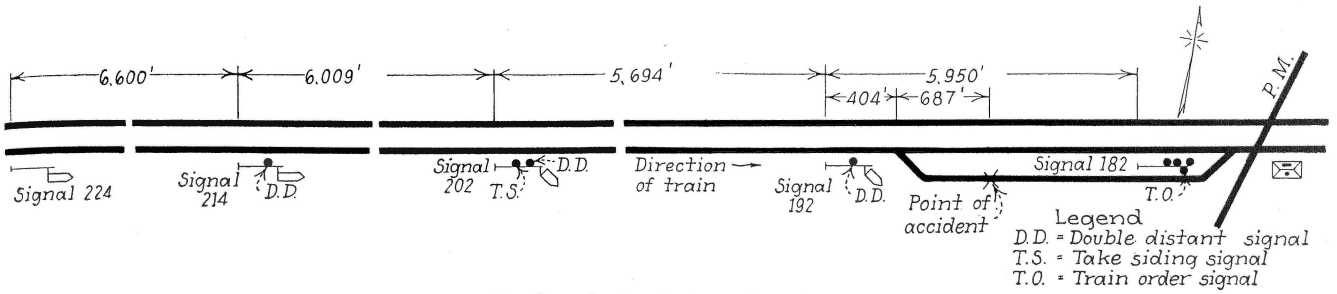
Observation of Signals

Fireman Dennis of train No. 40 said signal 214 was displaying green and that signal 202 first displayed double-yellow, and then bobbed back and forth from double-yellow to green, doing this on three different occasions. Engineman Smeed reached for the forestalling lever of the automatic train-stop device, but the whistle did not blow, indicating to the foreman that the signal was green when the engine passed it. When approaching signal 202, the engineman had made a light application of the brakes, about a 7 or 8-lb. reduction, but after passing that signal the fireman said signal 192 lighted up and displayed a green indication and the engineman then released the brakes, and that the maximum speed of the train between these two signals was 70 or 75 m.p.h. Fireman Dennis could not say positively that he watched signal 192 continuously, as he thought he might have reached for the blower, shut off the stoker, or turned around to look at something, but he was positive that the signal was displaying green or proceed at all times while he was watching it, looking through the front window, until his view was cut off by the front end of the engine, and it was about this time that he saw someone light a fusee. He was satisfied that the engine then had passed the signal. The speed was about 60 m.p.h. and he said the engineman immediately applied the air brakes in emergency. The fireman did not think that this application resulted from the operation of the automatic train-stop system.

Location of Fault

General Superintendent Margetts reached the scene of the accident about 4:30 a.m., and after the rear end of train No. 40 had been pulled back on the main track, he instructed Trainmaster Campbell to close the switch, which at that time was lined and latched for the passing track. The trainmaster was unable to close the switch, the points being open at least ½ in., while the switch point was raised as if something might be under it. The switch then was opened again, and about 5 ft. from the end of the switch point a bolt was found which had fallen out of the reinforcing bar and was on a tie between the switch point and the south rail. This bolt measured 3¼ in. in length and was nearly ¾ in. in diameter. After the trainmaster had tried again, unsuccessfully, to close the switch, the general superintendent picked up the bolt, examined it and located the point where it had worked out of the switch joint. The washer was lying on a tie plate and the nut and cotter key were on the ballast between the second and third ties east of the switch tie.

Subsequent examination and tests were made in which the commision's representatives participated. In making these tests the switch was operated in a manner similar to that described by the flagman of train second JS-2, with a bolt placed as nearly as possible in the position in which the bolt was found after the accident. From these tests it was believed possible that the flagman's efforts to close the switch caused the bottom portion of the switch point, to which the switch controller is connected, to become so nearly closed that the signal line control circuit was completed long enough for the signal to move from stop to proceed, which movement would require between eight and nine seconds, but this position would be held only as long as maximum pressure was exerted on the switchstand lever. It did not appear that there was anything wrong with the signal system.



Track and signal plan of territory

Conclusion

The accident was caused by an open switch, due to a reinforcing-bar bolt having become lodged between the normally closed switch point and the stock rail in such manner as to make it impossible to close and lock the switch and to permit the improper display of proceed signal indications. The reason for the failure of this bolt to be in its proper place, secured by its washer, nut and cotter key, was not determined.