Derailment Results From Trouble in Interlocking Machine

ON July 25, there was a derailment of a freight train on the Pennsylvania at Baltimore, Md., and according to the report of the Bureau of Safety I. C. C. this accident was caused by a false-clear interlocking signal. An abstract of the report follows:

The switch and signal involved in this accident are controlled and operated by the interlocking at Union Junction Tower. Movements from the north-bound freight track to the main track are made through crossover 85 in reverse position, while movements to the spur track are made with crossover 85 in normal position. Signal 84 is a two-arm, upper quadrant semaphore signal; the top arm, a three-position signal, governs movements from the freight track to the main track, while the bottom arm governs movements to the spur track. The 95-lever electro-pneumatic machine was installed about 1913. Normal and reverse indication magnets are installed on the switch levers, and the arrangement between magnets and segments on the levers is such that levers cannot be moved to full normal or full reverse position until an electrical indication is received from the switch, that the switch has assumed the desired position and is locked. A visual indication is provided in the tower, so arranged that, while the switch is in the act of being moved, an electric lamp is lighted, the light being extinguished when the switch has reached its full-reverse or full-normal position. In addition, in the event that a switch fails to operate as intended, visible and audible alarms are provided to inform the operator and leverman of such failure. This latter arrangement is not provided for all switches, but switch 85 was so equipped. The signals are controlled from the levers, but do not check the position of the switch points, as all routes through this plant were considered slow-speed routes; the only locking between signal 84 and switch 85 being the usual mechanical locking.

North-bound freight train BP-2, consisting of 86 cars and a caboose, passed signal 84, displaying a clear indication; however, the crossover was not in reverse position and the train entered the spur track, being derailed at the end of the spur track while traveling at a speed estimated to have been between 12 and 15 m.p.h.

Block Operator Yeagy, on duty at Union Junction tower at the time of the accident, stated that when the levers were operated to set the route from the north-bound freight track to the main track through crossover 85, the warning whistle, controlled by the SS relay, and located on the second floor of the tower, sounded, and the three red SS lights, two on the machine and one on the operator's table, were burning. He asked the leverman what the trouble was. Leverman Miles stated that as the lamp on crossover 85 was not lighted, no action was taken, although he understood that when the warning signal sounded train movements should be discontinued.

Supervisor of Telegraph and Signals Spangler stated that following the accident he made an inspection and found the lever governing crossover 85 in the reverse position while the crossover itself was in the normal position, set for a movement to the spur track. The reverse control wire and magnets at the switches were energized with current coming into the tower from the switches on the normal indicating wire, and SS polar relay 85 in the tower was energized in the normal indicating position. There was no current on the reverse indicating wire. He said that if the lever was moved quickly from one position to the other without being stopped at the indicating point, the valves at the switch would not have time to shift, and consequently the switch would not change position. During his investigation after the accident, on releasing the reverse magnet, which was energized, and energizing the lock magnets both switches of the crossover immediately changed from normal to reverse position to correspond with the position of the lever; this was done before the lever position was changed. The crossover was then operated many times by means of the lever without displaying any tendency toward failure. During the operation of the crossover the reverse indicating latch, which is intended to prevent the operation of the lever from normal to reverse without stopping at the indicating point, was also watched, and it was found that the latch could be made to jump numerous times to within one-fourth the distance of the top of the tooth, and about four times it came within one one-hundredth of an inch of going over the tooth. Supervisor Spangler stated that this led him to believe that with certain conditions it would jump entirely over. He stated that his theory of the latch jumping was due to the fact that the latch was chattering slightly when riding on the surface of the segment prior to the time the safety tooth passed the under part of the latch. While the chattering was not of sufficient intensity to cause the latch to jump over the indication tooth, it at times did strike the under part of the safety tooth with such violence as to force it downward, resulting in a rebound which caused it to jump over the indication tooth after it had passed the safety tooth. He knew of five previous instances of latches of this type having jumped when moving a lever from one position to another. During several days after the occurrence of this accident the levers in Union Junction tower were tested and attempts to reproduce the condition on lever 85 failed; however, on lever 27 the latch jumped over the top of the tooth twice during these tests. While Supervisor Spangler considered the plant to be as safe as when it was installed he said additional protection could be provided by the installation of SS relays on the switches which are not now equipped, and by controlling the signal circuits through the SS relays, so as to provide protection through the switch points.

Conclusions

Observations and tests were made by the Commission's representatives a few days after the occurrence of the accident: The segment which had been in place on lever 85 had been removed on the day of the accident; this segment was replaced, but after a long period of operation, no failure resulted. Tests were continued, using lever 27, and after a period of operating the lever, the latch jumped the tooth on the normal indication segment when moving from reverse position with the lever normal. This segment was not at once removed and this action was repeated later in the day. The segment was then removed, and examination of this segment as well as the one removed from lever 85 failed to disclose any reason for its failure. A careful check was made of the indication magnets on levers 85 and 27 and no indication of foreign current was found in either one, indicating the failures were entirely mechanical.

This accident was caused by a false-clear indication of an interlocking signal, and by the failure of Block

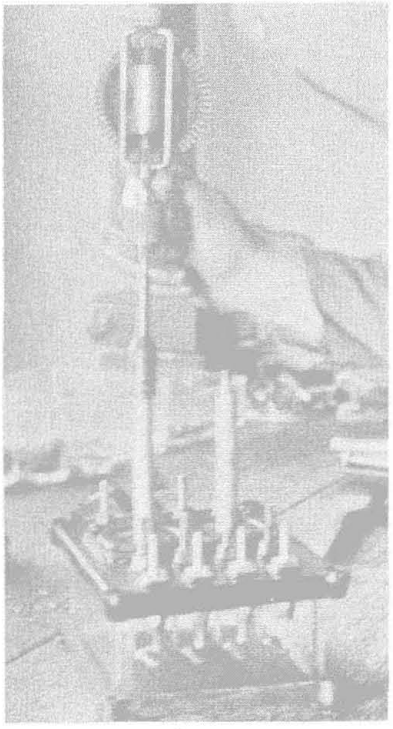
(Continued on page 38)

the bench and fastened to the bottom bracket. Directly above each conduit a swivel pulley is mounted, allowing the leads to be pulled in any direction. Small fuse clips, fastened in notches of the upper bracket, hold the test prongs upright while not in use. The flexible leads are threaded through pulleys attached to the counter-weights, which consist of two-inch pipe caps filled with lead.

Hollow End Mill

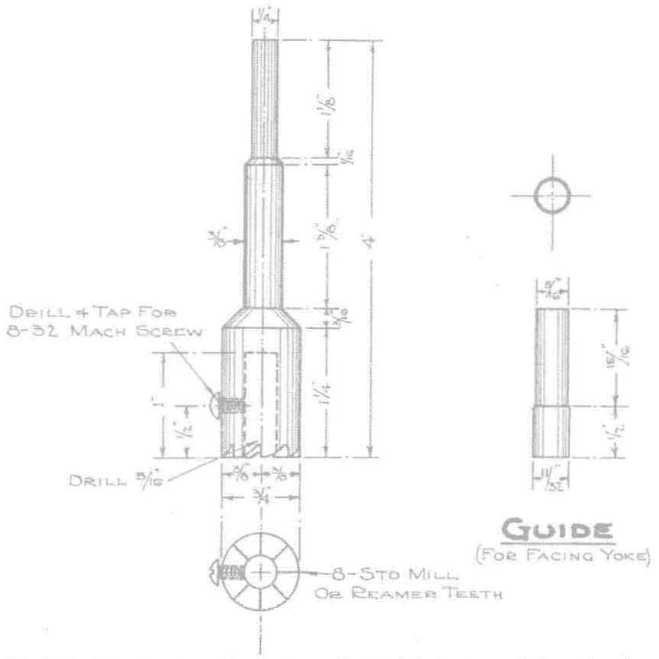
By F. C. Larson
Relay Shopman, Great Northern, St. Paul, Minn.

AS A RULE, nearly all the work encountered in the general overhauling and repairing of relays must be done by hand. For that reason, any tool or device that can be made to assist and improve these many hand operations is welcomed by the signal-shopman. The drawing shows what I have termed a hollow end mill. This tool is used for cleaning and truing up the shoulders on a relay magnet core and also for cleaning the surfaces, on the back yoke, that make magnetic contact with the cores. With the use of this hollow end mill it is not necessary to remove the magnet cores from the relay to do a perfect job of cleaning rust and other substance from the magnetic contact points between the cores and back-yoke of relay.



Close-up view of the hollow end mill, chucked in a breast drill, being used for cleaning and truing the shoulders of a magnet core . . . . When the corresponding back-yoke surfaces are being cleaned, the guide (see detail sketch) is locked in the mill with the machine screw.

The tool has eight end-mill or reamer teeth, with a hole in the center, so that the tool fits exactly over the top, threaded, end of the core. The shank can be made either square or round to fit into an ordinary brace or breast-drill. A few revolutions with the tool will clean rust or any other foreign matter from the point of magnetic contact, leaving the core shoulder machined smooth and true. The back-yoke can be machined by inserting the pin or guide into the hole in the center of the tool and clamping same by tightening up on the small machine screw provided for that purpose. The back-yoke can be held in the vise for this operation, and, as with the cores, after a few revolutions with the tool, the surface that contacts with the cores are cleaned perfectly.



Detail sketch showing dimensions of special tool used for cleaning and truing shoulders of relay magnet cores and the back-yoke surfaces that make magnetic contact with the cores.

The tool should be made from a good grade of tool steel. This particular tool is especially made to fit the G. R. S. 9-A, 9-D, 9-E and 10-A relays.

▼ ▼ ▼

Derailment on Pennsylvania

(Continued from page 24)

Operator Yeagy and Leverman Miles to take the required measures to protect movements through the interlocking plant after warning devices had been operated which indicated that some part of the plant was not functioning properly. Neither the signal itself, nor any part of its mechanism or controlling circuits, failed; the failure was in the interlocking apparatus controlling the switches of crossover 84. When the lever controlling these switches was operated from normal to reverse the switches did not move to reverse position, due to the fact that the electrically-operated latch slipped over the locking tooth on the reverse-indication segment of the machine.

The evidence indicated that while failures of interlocking from this cause occur only rarely, the railroad company was familiar with this condition and had knowledge of such conditions as far back as the year 1914. However, the only action taken to guard against the consequences of such failures was following a similar failure at B. & P. Junction tower in 1930 when an alarm circuit was developed and installed on certain switch levers in B. & P. Junction and Union Junction plants. At Union Junction interlocking plant there were 16 levers on which the alarm circuit was installed and 20 levers which were not afforded this protection. Installation of this alarm should be extended to all levers.

Had the signal control circuits been arranged to check the position of the switch points, the leverman would have been prevented from giving train BP-2 a clear signal indication when the switches were not operated to reverse position. In order to insure that signals can be cleared only when the route is properly lined, signal control circuits should be arranged to check the position of switch points on the route.