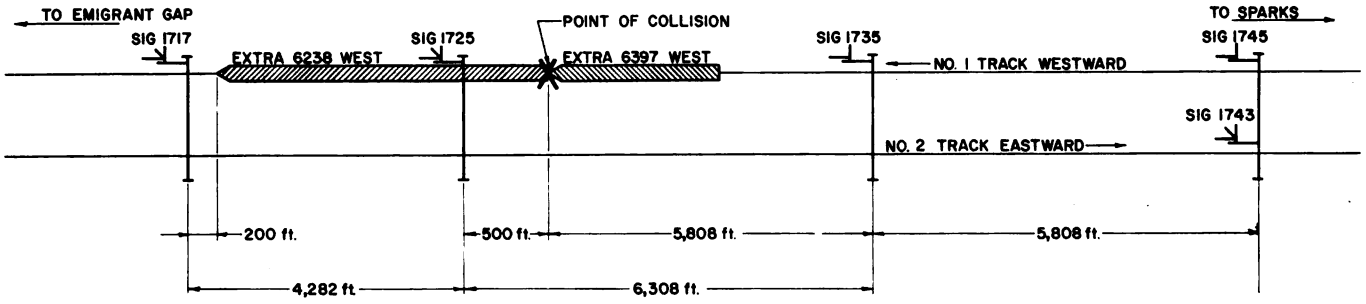

Collision due to signal failure

A rear-end collision between two westbound Southern Pacific freight trains . . . . "was caused by a false proceed signal indication due to an undesired electrical connection between control circuits of associated signals." In report No. 4035, the Interstate Commerce Commission's Railroad Safety and Service Board reported on its investigation of the accident which occurred at Emigrant Gap, Calif., on Jan. 7, 1965, about 5 pm, resulting in injuries to nine train-service employees.

In the accident area this is a double-track line over which trains moving with the current of traffic operate by signal indications of an automatic block signal system, supplemented by an intermittent inductive train-stop system. The territory is in the Sierra Nevada mountains, between Sparks, Nev., and Sacramento, Calif. In the vicinity of the accident, there are a series of short tangents and curves in the track, and the average grade for westbound trains is 1.78% descending. Because of track curvature and sidehill cuts in the accident area, the range of vision between the collision point and an approaching westbound train is materially restricted. Automatic signals involved are shown on the diagram.

Just prior to the accident, Extra 6238 West, a westbound freight consisting of 5 diesel-electric units, 83 cars, a caboose and 2 helper diesel-electric units proceeded on track No. 1. The locomotive passed signal 1745 which indicated proceed; passed signal 1735, which indicated proceed; passed signal 1725 which displayed an approach aspect; and stopped 200 ft short of signal 1717 which indicated stop, because of snow removal equipment occupying track No. 1 ahead. The rear of Extra 6238 West stopped in the block of signal 1735, 500 ft east of signal 1725.

According to the ICC report, the following train, Extra 6397 West, consisted of 4 diesel-electric locomotive units, 51 cars and a caboose. "Extra 6397 West passed signal 1745, which indicated proceed; passed signal 1735, which displayed a false proceed indication, and proceeded in the block on this signal at 31 mph, as indicated by the speed-recording tape. The engineer stated that as the train was moving on a curve, signal 1725 came into his view about 1,000 ft ahead and he saw it indicating stop. Immediately thereafter, he saw the rear end of Extra 6238 West standing on track No. 1 about 500 ft east of signal 1725 and also saw the flagman of that train giving stop signals with a red flag. Both the engineer and the front brakeman estimated that the flagman was approximately 50 ft to the rear of Extra 6238 West at this time [about 5 pm]. The engineer called a warning and applied the brakes in emergency, but the speed was not materially reduced before Extra 6397 West struck the helper locomotive at the rear of Extra 6238 West . . . .

SNOW UP TO 8 FT.

"Examination after the accident disclosed that snow on the ground in the area of the signal instrument housing at signal 1725 had accumulated to a height of 8 ft, leaving the ventilator at the top of the housing exposed. Snow had blown or drifted into the instrument housing through the ventilator and moistened the surfaces of the 19 lightning arresters carrying signal line circuits, including the controlling circuits of signals 1735 and 1743. The ground terminals of the arresters were attached to a conductor, which in turn was attached to the south rail of track No. 2 for a ground. The negative common return signal line circuit was carried back to the negative side of the signal battery through one of the lightning arresters and was grounded near the instrument housing by a rod driven into the earth.

"Tests and examinations revealed that current from the energized circuits apparently leaked over the damp surfaces of the 19 lightning arresters from their circuit terminals to their ground terminals. Because of this current leakage and the damp surfaces of the lightning arresters, electrolytic action occurred between the arrester circuit terminals and ground terminals. This caused a conductive substance to form on the surface of the arresters, bridging the arrester spark gaps and establishing an undesired circuit between the circuit terminals of adjacent arresters carrying the circuits for signal 1735 control relay and signal 1743 control relay.

"Since there was no train movement on track No. 2 in the Emigrant Gap area at the time involved, signal 1743 control relay circuit was energized as Extra 6397 West approached the accident point. It is apparent that because of the frozen ground condition that existed at the time of the accident, the ground resistance of the lightning arrester ground was increased to the extent that protection intended by the grounded negative battery common did not exist and there was enough current leakage from the energized signal 1743 control relay circuit to the signal 1735 control relay cir-

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cuit to energize the signal 1735 control relay circuit. This caused signal 1735 to indicate proceed for Extra 6397 West although the block of that signal was occupied by the rear portion of Extra 6238 West.

"Because signal 1735 displayed a false proceed indication, the associated automatic train stop magnet was not conditioned to actuate the automatic train stop apparatus on the locomotive of Extra 6397 West when the locomotive passed over the magnet.

"As a result of the accident, the practice in the territory involved of using rails to ground ligthning arresters was discontinued and only earth grounds are now used for this purpose."

As part of its findings, the Commission's report states: "As a result of the control circuits of signals 1743 and 1735 being bridged by the conductive substance in the signal instrument housing at signal 1725, signal 1735 displayed a proceed aspect for Extra 6397 West although its block was occupied by the rear portion of Extra 6238 West. When Extra 6397 West entered the block of signal 1735, it was authorized by the proceed indication of signal 1735 to proceed in the block at not exceeding 30 mph, the maximum authorized speed in this territory as prescribed in the timetable . . . .

"In this case, it is evident the damp condition of the surfaces of the lightning arresters in the signal instrument housing at signal 1725 caused an improper connection between the control circuits for signals 1743 and 1745, resulting in signal 1735 displaying a false proceed indication and causing the accident."

In the appendix to the ICC report, the following is of interest: "Automatic signals 1745, 1735 and 1725 are of the color-light type and are approach lighted. Signals 1745 and 1735 display two aspects: signal 1725 displays three aspects. The blocks of signals 1745 and 1735 are divided into four and three track circuit sections, respectively. The cut sections in the block of signal 1735 are 3,500 ft, 5,744 ft, and 6,044 ft, west of that signal.

"The controlling circuits are so arranged that when the block of signal 1717 is occupied and the blocks of signals 1735 and 1725 are unoccupied, signal 1735 indicates proceed, signal 1725 indicates proceed-not-exceeding-medium-speed . . . and signal 1717 indicates stop. The circuits are normally so arranged that when the block of signal 1745 is unoccupied and the block of signal 1735 is occupied at any point more than 3,500 ft west of that signal, signal 1745 indicates proceed and signal 1735 indicates stop.

"The automatic train stop magnet associated with signal 1735 is between the rails of track No. 1 a short distance east of that signal. This magnet will not actuate the automatic train stop device of a locomotive approaching signal 1735 when the signal is indicating proceed." **RS&C**

A look ahead in C&S

In a recent interview in ***Railway Age***, W. M. Keller, vice-president of research, AAR, discussed topics of interest to signaling and communications men. Herewith is an abstract of that interview.

Q. With higher train speeds and, perhaps, heavier loadings, what's the outlook as regards the hotbox problem? Or, to put it another way, what's the next step forward from the hotbox-detection equipment we have today?

A. Phenomenal progress has been made by the ARR Research Center in reducing hotboxes to about one-sixth the number experienced as recently as five years ago. Even with this reduction in hotboxes, there is a continuing problem with hot journals —which might be likened to the flat-tire problem of the automobile. It doesn't happen often, but it is troublesome when it does. The real problem is not the overheated bearing—it's when the bearing that is overheated runs to the extent that the journal is burned off, and when this happens it occasionally results in a derailment, although the occurrence is really relatively small. The use of infrared detection devices to sense overheated bearings is now being expanded rapidly. The Research Center, however, feels that this monitoring for overheated bearing should be continuous rather than intermittent as is now the case with hot box dectectors located at wayside points. It is expected that the next decade will add to the present wayside detectors a continuous monitoring of all journals on the train. When this is accomplished, the trouble with train delays from overheated journal bearings will be minimized, and the burned off journal will be practically eliminated. The AAR Research Center has, as one of its active proj-

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