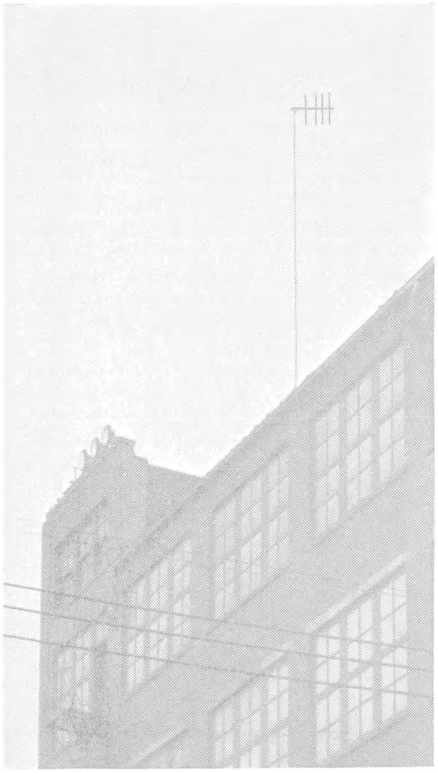


The antenna on top of the building

The antennae on the locomotives are 36 in. tall and are located on the front end, so that the metal cab will not act as a reflector, 12 ft. from the top of the rail. They are ½-wave vertical types with a ¼-wave horizontal matching stub.

Land Wires Connect Remote Points

The unit at Fourteenth street is connected by wire to three remote control points including the office of the assistant superintendent of the Chicago division, which is located on the first floor of the warehouse containing the radio unit; the office of the yardmaster at Western avenue, 3½ mi. west of the radio unit; and the office of the trainmaster at Morton Park, 8½ mi. southwest of the radio unit. Each of these offices contains a loud speaker and its amplifying unit, a relay switch, and a standard cradle-type telephone set containing a microphone and a receiver. All instruments are connected to the wires from the radio unit at Fourteenth street through the relay switch. This switch activates a relay on the radio unit which throws either the transmitter or the receiver of the unit in circuit with the head set or the loud speaker. The three microphones at the control stations are Westinghouse Electric and Manufacturing Company F-1 transmitters. All loud speakers are in circuit during idle time so that all can receive calls from the locomotives and other stations. The same equipment and circuits are used in the cabs except that electro-dynamic microphones are employed.

When one of the remote-control points wishes to call a locomotive, the operator presses the foot-relay switch which places the transmitter in the telephone set in circuit with the transmitter of the radio unit at Fourteenth street and calls the number of the locomotive. He then releases the switch so that his loud speaker and receiver in the telephone set will again be connected with the receiving unit. The call is heard over the loud speakers in the three cabs and over the loud speakers at the other remote-control points. The operator of the locomotive called answers, first pressing his relay switch in order to connect the transmitter in his telephone set with the transmitter of the radio unit on his locomotive. The same procedure is followed when the engineer of a locomotive calls one of the control points.

Tests Show Possibilities of Saving Switching Time

The tests thus far, have been confined to a 15-mi. area but communication has been maintained as far as LaGrange, a distance of 20 mi. They have shown possibilities for speeding up operations by a direct and continuous contact between locomotives and train and yardmasters and a saving in locomotive hours.

Increased efficiency of operations resulting from the use of radio is due to the constant contact with the locomotives. Without radio, the only contact while the locomotive is away from its terminal is through the yardmaster, who has to search for the locomotive or through industries which can be prevailed upon to call the engine foreman to the telephone. Under this arrangement it is difficult to alter the routine of the locomotive. When radio is employed, the location of and the work being performed by the locomotive can be determined in a few seconds and the engine foreman directed to perform a pick-up at an industry or some other switching operation in the immediate territory. A few actual examples show the value of radio communication:

On one occasion, two shippers called to request switching service. The yardmaster knew that a radio equipped locomotive should be in the Chicago & North Western's potato yard at Western avenue and Sixteenth street, and could perform the switching requested. A radio call disclosed that the crew had completed its work in this yard and was headed east to Union avenue. The yardmaster directed the crew to stop en route at an industry at Racine avenue to pick up a car of perishables and then return west to do switching for a company on Ashland avenue.

On another occasion, a yardmaster upon learning that a switching movement would tie up the line leading from a foreign yard and cause one of his locomotives to be tied up 1½ hr., made arrangements to delay the operation a few minutes until his crew could pick up some cars and leave the foreign yard.

Besides saving engine-hours and speeding up the movement of cars, the radio has served other purposes. On one occasion a car was derailed when dirt filled the flangeway at a street crossing. The engineman of a radio equipped locomotive notified the yardmaster who immediately arranged for a derrick to re-rail the car.

The installation and operation of the radio is supervised by T. W. Wigton, supervisor of electronics, under the direction of H. H. Hasselbacher, superintendent of telegraph.

In the locomotive cab, X marks the case containing the electronic equipment

A Collision Despite Automatic Signals

The immediate cause of the head-on collision on the Chicago & Eastern Illinois near Terre Haute, Ind., on September 14, in which members of the Army Air Forces were among those killed, was failure to obey a meet order and to control the speed of a train in conformity with automatic block signal indications, according to the report of the investigation by the Interstate Commerce Commission under the supervision of Chairman Patterson.

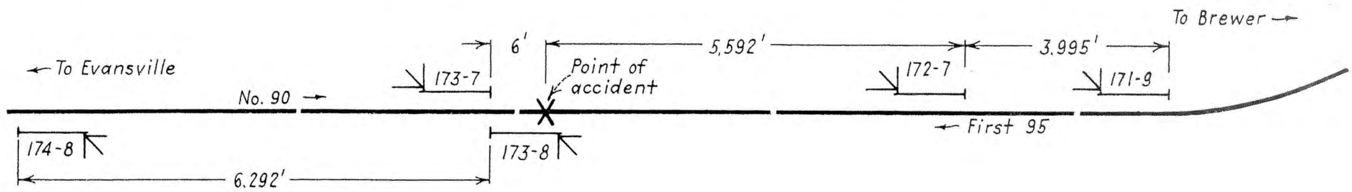
Supplementary findings pointed out, however, that a rule in effect in the territory concerned, as modified by special timetable instructions, "practically nullified the protection intended to be provided by the block system for opposing first class trains within yard limits," and that "the block signal system in use on this line was not adequate for authorized speeds."

As a result of these findings, the report recommended that the road install an automatic train stop, train control or cab signal system on the line on which the accident occurred.

29 Lives Lost—This collision resulted in the death of 26 passengers and 3 employees and the injury of 32 passengers, 4 railway mail clerks, and 6 employees. It brought about a vigorous denunciation of railway managements and the commission by Senator Wheeler of Montana, chairman of the Senate committee on interstate commerce, in which he stated that "our railroad systems have not adequately installed available safety devices" and that the commission's actions to require the railroads to make such installations have been "inadequate."

These remarks were reported in *Railway Signaling* for October, page 580, while Chairman Patterson's reply, pointing to the continued improvement in the railroads' safety record, was noted in the issue of October, page 578.

The accident occurred at 2:20 a.m. in a dense fog. The trains involved, No. 90, a standing northbound 15-car express and mail train, and First 95, a section of the southbound "Dixie Flyer," (made up of a locomotive, one baggage car, one baggage-mail car, one Pullman tourist car, two Pullman sleeping cars, five coaches, and four Pullman sleeping cars, in the order named) were operating on single tangent track by timetable, train orders, and an automatic block signal system. The point of collision was within yard limits 0.13 mile north of the station at Dewey and 3.83 miles north of Terre Haute.



Signal Arrangement—The automatic block signal system in this territory was arranged on the overlap principle. From south to north the signals involved were, in order, No. 174-8, 173-8 (northbound) and No. 173-7, 172-7, and 171-9 (southbound); these were, respectively, 6,298 ft. south, 6 ft. south, 6 ft. south, 5,592 ft. north, and 9,587 ft. north, of the point of collision. Signal 174-8 was continuously lighted, while the others were approach lighted; all were of the upper-quadrant semaphore type. The controlling track circuits were so arranged that signal 172-7 would display approach and signal 173-7 would display stop when a northbound train passed signal 174-8, while No. 174-8 would display approach and No. 173-8 would display stop when a southbound train passed No. 171-9. Signals 173-7, 173-8 and 174-8 were located within yard limits. The maximum authorized speed for the trains involved was 50 m.p.h.

At Terre Haute the crew of the northbound train received three train orders; one giving First 95 superiority over it from Clinton (10.9 miles north of Dewey) to Terre Haute; one establishing a meet at Dewey with First 95, which was directed to take the siding; and a third directing First 95 to take siding and meet No. 90 at Atherton (a station 6.5 miles north of Dewey) instead of Dewey. First 95 had received the order giving it superiority from Clinton to Terre Haute, and at Clinton, among other orders, it received a clearance form and an order directing it to take siding and meet No. 90 at Atherton. The words "instead of Dewey" were omitted from this order at the dispatcher's direction, and the preceding order, establishing a meet at Dewey for First 95 and No. 90, was annulled and not delivered to First 95.

According to the report, when No. 90 passed signal 174-8 it was displaying proceed. Soon afterward the engineman observed signal 173-8, a considerable distance ahead, displaying approach, and the engineer made a service brake reduction. The aspect of this signal then changed to stop, and the engineer stopped No. 90 at the signal, then proceeded, since the signal was within yard limits and the rules there effective permitted a train, after it had stopped short of a block signal displaying stop, to proceed immediately but with caution to the next signal. When No. 90 had moved a few feet, however, the headlight of First 95 was seen a few hundred feet ahead, and the northbound train was stopped immediately, with its front end about 6 ft. north of signal 173-8.

Orders Not Given to Conductor—The southbound train passed Clinton about 14 min. before the accident occurred, and a member of the engine crew and the front brakeman, who was in the sixth car, caught copies of a clearance form and train orders from a train order delivery device there. The front brakeman read the orders and understood that his train was to take siding at Atherton to meet No. 90. He made no effort to deliver the orders to the conductor, however, but proceeded toward the front of the train to be in position to open the switch when the train stopped. Because of darkness and fog, he was not aware that his train passed Atherton without stopping and made no effort to bring it to a stop before the collision occurred. "The conductor and the flagman were in the rear car when First 95 passed Clinton," the report pointed out. "They knew that copies of train orders had been received by other members of the crew, but they made no attempt to ascertain the requirements of the orders."

First No. 95 passed Atherton, continued past signal 172-7, which displayed approach, and was moving at a speed of about 35 m.p.h. when it collided with No. 90 about 6 miles south of Atherton and about 6 ft. north of signal 173-7, which displayed stop.

Too Fast on a Yellow Board—The approach indication of signal 172-7 required the speed of First 95 to be not over 30 m.p.h. and required it to approach signal 173-7 prepared to stop, and the stop indication of signal 173-7 required that the train be stopped before passing it. The investigation did not disclose why the enginemen on First 95 failed to stop at Atherton or why its speed was not controlled as required by rule after it passed the approach signal, as both the engineer and fireman were killed. The enginemen's copies of the train orders received at Clinton (where a train order signal was displayed) had not been found when the investigation was made, but the rules required that a train be stopped immediately if a train order signal was passed without a clearance form being received. The operator at Clinton saw a member of the engine crew take the orders from the delivery device.

The force of the collision moved the standing train backward about 68 ft. Both engines, the first car of No. 90 and the first four cars of First 95 were derailed and badly damaged, and several other cars in each train were considerably damaged. The second car of First 95 telescoped the third car (both were of all-steel construction) and the later was "sheared practically its entire length diagonally from the floor on the right side to the juncture of the roof and side sheets on the left side." The passengers killed were occupants of this car.

Signals Not Obeyed—The brakes of First 95 had functioned properly when tested, and no condition was found to prevent their proper application. No action was taken to apply them, however, until about 30 seconds before the accident occurred, when they were applied in emergency, the train speed then being estimated at 55 m.p.h. The report pointed out that, "if the speed of First 95 had been reduced to not exceeding 30 m.p.h. as required, and so controlled that the train could be stopped short of signal 173-7, which displayed stop, the accident would either have been prevented or its disastrous consequences would have been averted."

Continuing, the report explained that signal 172-7, which displayed approach for the southbound train, was equipped with an oil lamp that had been converted to electric lighting and which emitted rays of much less intensity than other signal lamps in the vicinity, with the result that "it is possible that the engineman did not see the indication because of the dense fog and the relatively low intensity of the signal light."

While the engines of the trains involved were equipped with automatic train stop devices, there were no roadway elements of this system installed in the vicinity of of the accident, train stop territory terminating 11.47 miles north. If the system had been in operation, the report stated, the train stop device on the engine of First 95 would have been actuated about 5,600 ft. north of the point of the accident, "and this accident probably would have been averted."

Referring to the requirements of the

commission's order establishing standards for automatic signal installations, the report pointed out that a train is intended to pass one signal displaying approach before it reaches one displaying stop. Here, however, the track circuits were so arranged that signals 174-8 and 173-8, governing the northbound train, displayed, respectively, proceed and stop, as No. 90 passed signal 174-8 before the opposing train entered the limits of its control circuit. While the engineman did see signal 173-8 displaying approach, and then stop, in time to stop before their train passed that signal, if they had not seen the indication until the engine was in the vicinity of the signal No. 90 would have passed it and would have collided with First 95 a considerable distance beyond, the report observed, and "the accident might have been more disastrous."

Signal Rules Need Changing—Attention also was called in the report to the rule under which No. 90 was authorized to proceed immediately after stopping at signal 173-8, even though First 95 was authorized to enter the other end of the same block at the same time by the approach aspect displayed by signal 172-7 so long as No. 90 had not passed signal 173-8. Thus each train was authorized to proceed through the block while it was occupied by an opposing train, No. 90 under control and First 95 at not exceeding 30 m.p.h. "This condition should be corrected immediately," the report said, although under the circumstances in this case the collision would have occurred even if the rule had not permitted No. 90 to proceed, since First 95 was not prepared to stop at the stop signal, as required by the rules.

"This investigation disclosed that the signals involved did not provide an adequate margin of safety in stopping distance for trains operated at maximum authorized speeds," the report concluded. "Pending such modifications of the signal system as may be required to provide adequate protection for trains being operated at presently authorized maximum speeds, the carrier should at once reduce the maximum authorized speeds to the limits for which the existing signaling will provide adequate stopping distances."

Bonding a Consideration In Accident Caused by Broken Rail

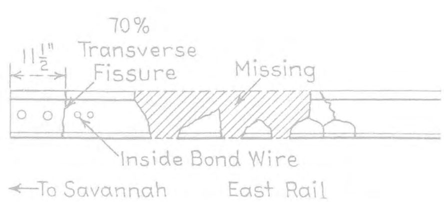
A TRAIN accident, caused by a broken rail, occurred on the Atlantic Coast Line near Hortense, Ga., on November 18, about 8:50 a.m. The following information concerning this accident was furnished by C. McD. Davis, president of the Atlantic Coast Line.

The train involved was the southbound West Coast Champion, operating between New York and Tampa, Fla., and consisted of 18 all-steel cars hauled by a three-unit Diesel-electric locomotive. In the accident, the rear truck of the third Diesel unit and 15 cars following left the rails. There were no fatalities, and although a number of passengers received minor injuries, none were serious.

A formal investigation to determine the cause of the accident was held at Waycross, Ga., on November 24, attended by representatives of the Bureau of Safety of the Interstate Commerce Commission, and the general manager, chief engineer, general superintendent and the superintendent of motive power of the Coast Line. The investigation developed that the accident was caused by a rail breaking due to a 70 per cent transverse fissure, the fracture occurring 12 in. from the receiving end of rail immediately at the end of the rail joint bar and inside the bond wires.

The track at the point of accident is laid with 100-lb. RE section rail connected by four-hole continuous-type joint bars 24-in. long, with 24 ties to the rail, is fully tie plated and is supported under the ties by nine inches of slag ballast over three inches of gravel ballast and is dressed out to the top of the ties with crushed granite. The roadbed is an 8 ft. fill, 24 ft. wide at the top.

The broken rail was rolled in the year 1929 and was laid in track on June 5, 1929. Inspection of the rail in the track at the point of accident had been made by a Sperry rail detector car on November 11, 1944, (seven days prior to the date of the accident) which inspection did not disclose any defect in this rail. However, because of the attachment of the joint bars to the rail the Sperry car will not locate a fissure immediately at ends of the joint bar or throughout the length of the joint bar.



Sketch showing rail breaks

The track in this vicinity is equipped with three-position semaphore-type d-c. automatic signals, and the joint at the point where the rail broke was bonded with two No. 8 galvanized iron bond wires separately connected to the web of the rail, the inner bond wire being attached 1½ in. and the other 2½ in. from the ends of the joint bars, so that break was within the points of attachment of the bond wires to the rails. Following the initial failure at the transverse fissure, the rail broke into a number of pieces. Nine pieces were found, and one section 45-in. long is still unlocated. A sketch showing the assembled portions of the broken rail is attached.

Train Communication in U.S. Military Railway Service in Italy

A test run featuring end-to-end radio communication—first ever attempted on a train hauling war freight in an overseas theater of operations—has been accomplished somewhere in France by an operating Battalion of the Military Railway Service, with encouraging results.

Railroad soldiers overseas with the M.R.S. have been hearing and reading considerable comment in recent months about the added safety and convenience to be gained by having train and engine crews in constant communication with each other by telephone or radio. So a couple of them decided to try it out.

Instigators of the 713th test run were S/Sgt. Ray Welker, Portland, Ore., who formerly worked for the Southern Pacific, and T/4 Charles H. Sample, Jr., Altoona, Pa., an ex-Pennsylvania Railroad employee.

"We reasoned that if end-to-end communication has proven so highly valuable in the States, it ought to help us out a lot over here, too," the men explained. "When train and engine crews are able to talk to each other, running or standing, that is a big step toward elimination of many hazards such as derailments and wrecks due to hot boxes, shift in loads, etc. The train can be stopped immediately by merely telling the engineer the trouble, rather than waving an arm off trying to flag him down. It also facilitates the shifting of a train, since all concerned can co-operate in making the necessary moves without even having to leave their posts or control vantage points.

"In setting up our system we had to differ from commercial operations so that communication could be accomplished without any type of permanent installation on rolling stock, and the expense had to be practically zero. This we accomplished by the use of radio. We borrowed two 'walkie-talkie' sets, weighing four pounds each, from C.B.S. Signal Section. These we installed on the front and rear of a train and set out for the test run."

Sergeant Welker rode in the cab during the run, while Sergeant Sample took the position of flagman at the other end.

"We made a 90-mile round trip and were in perfect communication all the time, except for a few moments while passing through a tunnel.

"At one station where we had to make a layover, we tried out the possibilities of radio for yard operations. It was found to be of great value in a classification yard, since car numbers could be given directly to the operator as they were read off, eliminating the written tabulations and delay in carrying them from the yard to the operator. Now the yard men are clamoring for quick adoption of the plan.

"On the return trip we invited the French train crew members to try out the radio. This caused quite a commotion, and one cheminot was so impressed he could only stutter."

Results of the test were reported to the commanding officer of the battalion, with a recommendation that radio be regularly adopted for both train and yard operations as soon as possible.