



Typical pole illustrating point-type transposition bracket used in the 30-kilocycle transposition

with other circuits, 30-kilocycle transposition layouts were installed on some of the lines.

To compensate for the loss in volume that occurs in the operation of telephone circuits of any appreciable length, amplifiers, or repeaters were installed at appropriate points varying from 100 to 200 miles apart. Over long distances such as are involved in the circuit between Chicago and Los Angeles, wide variations in temperature and weather conditions exist at all times, and to compensate therefor, repeaters and terminals of the multi-channel systems are equipped with automatic regulating devices which insure the voice being maintained at a uniform and efficient level throughout the entire length of the circuit.

The expanded communication service has proved of inestimable value in the administration and operation of the railway, speeding up trains by providing terminal and yard forces with all records of train movements in advance of arrival of the train, and meeting the added and growing requirements imposed by extraordinary handling of telephone and telegraph matter pertaining to the operation of high-speed trains and other changed conditions brought about by the modern tempo of railroading, necessitating that matters of importance be discussed and decided upon in the course of minutes, rather than hours or days.

The engineering and installation of these carrier systems were handled by the telegraph department of the Santa Fe, under the jurisdiction of T. P. Brewster, superintendent of telegraph, in collaboration with engineers of the Western Electric Company, the West-

ern Union Telegraph Company and the Bell Laboratories. The telephone carrier equipment was developed in the Bell Laboratories and was manufactured by the Western Electric Company. The equipment for the voice-frequency telegraph channels on the carrier system is being manufactured by the Western Union Telegraph Co.

Accident at Interlocking

ON September 11, at Odin, Ill., an eastbound Baltimore & Ohio freight train occupied a crossing and was struck by a southbound Illinois Central passenger train. A summary of the report of the Bureau of Safety concerning this accident follows:

The crossing involved is protected by an interlocking. After an I. C. southbound train has entered the approach circuit, the route cannot be lined for a B. & O. train until the time release has operated an interval of 3 min. 40 sec. The route was lined for the I. C. train involved at 5:42 p.m., the time it entered its approach circuit. The B. & O. train passed its approach signal, which was displaying Approach, passed the home signal, which was displaying Stop, and had just stopped with the second car standing across the I. C. southward main track when this car was struck by the engine of the I. C. train at 5:45 p.m.

According to the statement of the engineer of the B. & O. train, both the approach signal and the home signal were displaying Approach. The speed of his train was 40 m.p.h. as his engine passed the approach signal and he

partially closed the throttle. The engineer and the fireman kept the home signal under constant observation throughout a distance of about 4,400 ft. As the home signal was approached, the engineer called at least twice its indication as Approach. No one observed whether the marker light on the home signal was displayed. The engineer said that if the marker light was not displayed, the yellow aspect which he saw displayed by the home signal would be an imperfectly displayed signal. When the engine reached a point about 200 ft. west of the home signal, the speed of his train was 25 or 30 m.p.h., and he observed that the indication of this signal was Stop. He immediately moved the brake valve to emergency position but the distance was not sufficient for stopping short of the crossing. Had the speed of the B. & O. train been controlled in accordance with the Approach indication of the approach signal, it is probable this accident would have been averted.

The investigation disclosed that the B. & O. home signal, as seen from the engine of the approaching B. & O. train when it was in the vicinity of the approach signal, displayed a yellow light, which was caused by a combination of the sun's rays being reflected by the signal background and the red rays from the signal lamps, and which was interpreted as an Approach indication. This indication continued to appear to be displayed until the engine reached a point 950 ft. west of the home signal, then the Stop indication was observed.

Three months previous, the B. & O. home signal was painted with black paint of the glossy type instead of the dull type generally used. When the sun was low in the western horizon and the red lamps of the Stop aspect were lighted, the reflection of the sun's rays from the glossy surface of this signal, together with the red rays from the signal lamps, resulted in the display of a yellow light, which gave the effect of a phantom indication.

If the members of the crew on the B. & O. engine had been able to see the true indication displayed by the home signal when it first came into their view, it is probable this accident would have been averted. It is found that this accident was caused by failure to operate the B. & O. train in accordance with interlocking signal indications. It is recommended that the Baltimore & Ohio take necessary measures to insure that the home signal involved in this accident is brought into conformity with Section 42 of the Commission's order of April 13, 1939, "Action shall be taken when necessary to prevent phantom indications from reflected external sources."