coils are rewound, when necessary, enameled wire being used for this purpose instead of cotton or silk-covered wire, greater efficiency being thereby obtained.

The armatures are provided with bone studs to support contact springs, graphite contact posts are silver plated when so ordered, the contacts are "set," and relays are carefully tested for "pickup" and "shunt," and made to conform to the recommendations of the Railway Signal Association as far as possible. They are then dated, sealed, and returned.

The shop is supplied with both alternating and direct current from the Union Pacific power station; a storage battery set is available; and apparatus has been constructed which gives any desired range of voltage, either alternating or direct current, for testing purposes. The shop is equipped with an engine lathe, bench lathes for winding, a precision lathe for small turning work, a drill press, and an emery grinder, power being furnished by a seven-horsepower direct-current motor. Work which cannot conveniently be done in this shop is turned over to the blacksmith or machine shop of the locomotive department.

AUTOMATIC SIGNALS ON VERMILLION RIVER BRIDGE.

The line of the Illinois Traction System between Danville and Ridge Farm, 17 miles south, crosses the Vermillion River on a high and narrow single-track bridge 1,500 ft. in length. The track is laid with 70-lb. T rail, with guard rails throughout, and the 000 grooved trolley is held by flexible bracket suspension on squared wood poles. The bridge is but 8 ft. wide, without foot-way or hand-rail, and presents a sheer drop of nearly 100 ft. at the river.

At the south end the double-track approach is on a sharp down grade and curve, the view of the bridge being thereby concealed. At the north end a track diverges at right angles, and the two tracks are crossed by other tracks—yard lines and parts of loops—forming a "Y" convenient for shifting. The view is obscured here by the company's car sheds and other buildings, and frequently also by clouds of exhaust steam from the adjoining power-house. The normal direction of passenger traffic is one way on each track at the terminals, but the shifting of freight and express traffic at the north end is, of course, in both directions.

Fig. 1. Nachod Automatic Signal at Proceed. (North End of Block.)

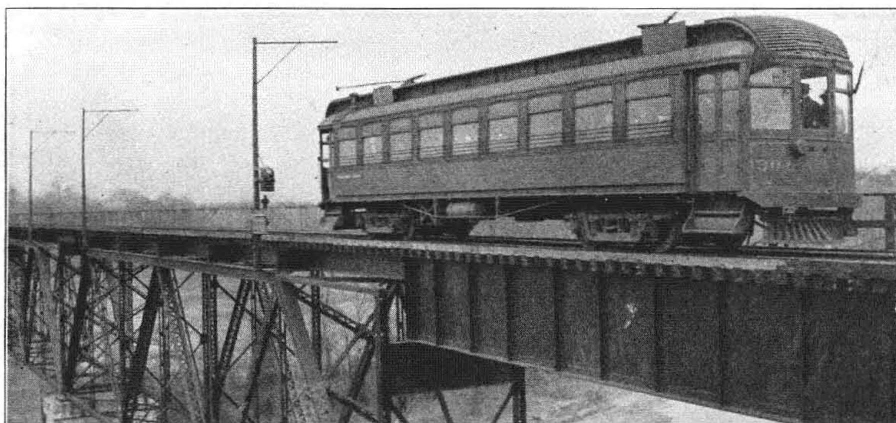

Fig. 2. Car About to Enter the Block.

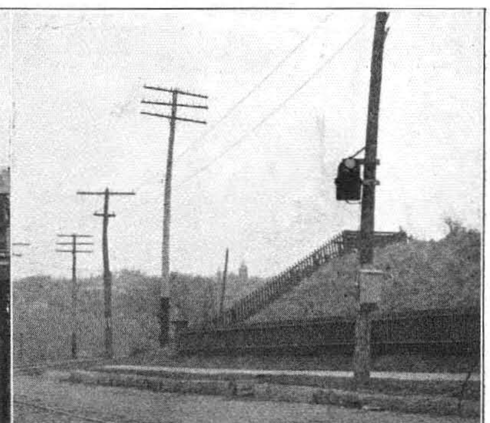

Fig. 3. Signal at the South End.

Three regular lines cross the bridge both ways: Catlin, hourly headway; and Ridge Farm and Georgetown, half-hour headway.

The route of the latter two coincides to Georgetown, the Ridge Farm cars running on the even hour, the Georgetown on the half hour. The distance to Ridge Farm is about 17 miles, with 92 possible stops intervening, the schedule time being 1 hour 15 minutes.

The interurban passenger cars are of 23 tons weight, 56 ft. long over all, having G. E. type M control, and geared to 45 miles per hour. On Saturdays and afternoons they are "double-headed," with five minutes clearance between sections. Four express trips are made daily, as are also about 25 trips of coal trains from the mines at Catlin, these trains being drawn by 40-ton electric locomotives, and the coal being for general sale as well as the company's use.

This varied traffic over the Vermillion River bridge is protected by Nachod automatic signals, type "CD." The length of the block between control limits is about 2,000 ft. The signal shows the condition of the block at all times—whether it is clear, or, if occupied, what is the direction of traffic thereon. No batteries or insulated rail joints are used, the power to operate the signals being taken from the trolley.

Four overhead trolley contactors, located in each track entering the single-track block, govern the display of signals by train movements under them. Every train entering or leaving the block must, therefore, pass under one of them. The trolley contactors, though without moving parts, are sensitive to direction. One span in advance of these for cars entering the block, and approximately at the point of switch, is the signal, which for the clear block indicates "neutral"—no light, no disk. A train entering the block running under the contactor changes this to "proceed"—a white light and a white disk—at the same time changing the indication at the other end to "stop"—a red light and a red disk. When this leaves the block by any of the four tracks, either by going through it or backing out, the signals will be restored to the normal neutral indication when the car passes a contactor.

The oil-immersed relay in the lower part of the signal box contains a counter which registers every car going into the block by whatever contactor, and whatever the signal indication may be at the time; it also registers each car out, the signals being restored to normal only when these registrations are equal.

The first car in the block sets the signals for the direction of traffic therein, permissive at the entering end and stop at the other, and other cars switching around the terminals cannot change this display, though each is registered; nor will the signals be released until the block is vacant. This very general operation is frequently required, as there is considerable shifting around the car sheds.

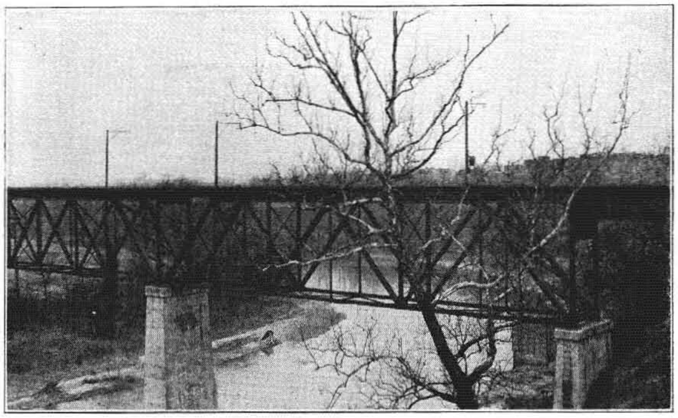

Fig. 4. The Bridge Over the Vermillion River.

Two line wires of No. 10 hard-drawn copper, with weatherproof insulation, run across the bridge connecting the signal boxes, and two local wires lead from each contactor to the signal box. There is, conveniently located lower on the same pole, a fuse and test box, locked and not accessible to the car crews, which affords a manual control of the signals. The locked fuse box is at a height accessible from the ground.

THE FOLLOWING ITEM from a Massachusetts newspaper calls to mind the fact, obvious enough when one thinks of it, that fusees are not the only thing that a train can leave behind for the purpose of warning the following engineman to be on his guard: "A train of 10 cars runs every night during the winter from Toulon to Paris, bearing cut flowers to the Paris markets. America has not got to this state of superrefinement as yet, but one New England railwa; used to run a fish train every evening, which bore from 12 to 15 carloads of fish from Boston to the terminus of one of the Long Island Sound steamer lines, and scented the country for half an hour or so after its passing." Whether the railway referred to ever made use of this inexpensive device for preventing rear collisions does not appear. It cannot be denied that it would have served the purpose in a most effective manner, for after some little experience it might be easily determined how far away the train actually was. In one respect it would be superior to fusees, for it would readjust itself automatically at every foot of the way, if not every inch, whereas fusees are so costly that it would be extravagant to use them oftener than once in 60,000 inches. Within its limit the fish-train-feature would provide a way to put in use the "continuous," or continually changing, plan of maintaining a space interval. Signal engineers have spent untold amounts of brain power in striving to devise a system by which a given block-length—say a mile—would follow a train, whatever the irregularities of speed, with the precision of a shadow. Here you have it. Old readers of this journal will recall another olfactory system, the asafœtida block signal, proposed by one of our correspondents in the early days of automatic signal rivalry. That, however, was crude and simple. The New England codfish has possibilities of varied adaptation which the drug store cannot even attempt to match. Who knows but that we have here the happy discovery that will compose the East-and-West controversy that has lately been raging in our columns—Railway Age Gazette.

THE EFFECT OF TREATMENT ON THE ELECTRICAL RESISTANCE OF TIMBER.

The results of an extended series of tests on the electrical resistance of timber, made by J. T. Butterworth, a student in the School of Electrical Engineering at Purdue University, were included, as an appendix, in the report of the Committee on Wood Preservation presented at the last annual convention of the American Railway Engineering Association. The subject is of interest to signalmen on account of its bearing on the operation of track circuits; and its importance is shown by the fact that Committee X on Signals and Interlocking of the A. R. E. A. has been instructed to make further investigation and report at the next annual convention.

In the tests the principal elements which cause the resistance to vary were determined and investigated in the following order: (1) amount of moisture present; (2) kind of wood; (3) treatment; (4) direction of grain; (5) contact pressure; (6) temperature; (7) amount and time of current flowing; and (8) dimensions of specimen.

The tests of the effect of moisture were made on two sets of ties, one treated and one untreated, and covered percentages of moisture varying from 15 to 50 per cent. For an increase in moisture over this range it was found that the resistance was decreased approximately 3,000 times in the case of the treated ties, and 1,000 times with the untreated ties, the variation between these limits being not quite uniform. It was plainly shown that under normal conditions an enormous resistance existed at the end of a tie, due to the drying out of the wood.

Tests on three species of pine, red oak and red gum showed that red oak and red gum have the lowest resistance, the resistance of the pines averaging about 20 times as much. Comparative tests on ties treated with various preservative processes and ties of similar grade untreated, showed that in general the resistance is decreased by treating, but in a few instances a slight increase was noted. The greatest effect of a preservative was found to be that of the Ebano crude oil process, which decreased the resistance of the specimens tested on an average about 60 per cent. Ties treated with zinc chloride showed that the resistance varies approximately inversely as the amount of the salt present. Treatment with a soluble salt of this kind did not change the behavior of the resistance with respect to the percentage of moisture present. Only the amount of the resistance was changed. Treatment of timber by different creosote processes did not greatly change the natural resistance of the timber.

The resistance of wood was found to be least when measured parallel with the grain, and greatest when measured tangentially to the growth rings, an intermediate value being obtained when the measurement was taken radially with the growth rings. Resistance was found to decrease rapidly with an increase in contact pressure, and in a nearly direct proportion to the increase of temperature, between the limits of zero and 50 deg. Centigrade.

The tests seem to show that, due to an electrolytic effect, the resistance increases rapidly when the current is first applied and gradually becomes constant. On opening the circuit the reverse phenomenon is observed, as the resistance falls off rapidly at the instant the circuit is broken, and gradually approaches the value that existed before the current was applied. All the tests go to show that the conductivity of wood is due primarily to the presence in the pores of an electrolyte formed by an aqueous solution of the salts found in the natural timber, or of these salts and others artificially introduced. The resistance of timber varies directly with the length and inversely with the cross section, which is the law that applies to all conductors.

Assuming the worst conditions for leakage covered by this test; i. e., red oak ties treated with zinc chloride, laid in wet ballast and with wet rail bearings, the resistance between the rails of a block one mile in length would approximate 30 ohms. This would permit a leakage current of .05 ampere to flow, with the battery voltage 1.5 volts (four gravity cells, each .75