all apparently tight a heavy sledge was held against the bottom of the joint on one side and the other side tapped briskly with a light sledge at the bottom only, and vice versa.

Then the tightening process was repeated until nothing more could be gotten out of the bolts by one man with a wrench having a 30-in. handle. After a continuous joint has once been carefully made in this manner it is there to

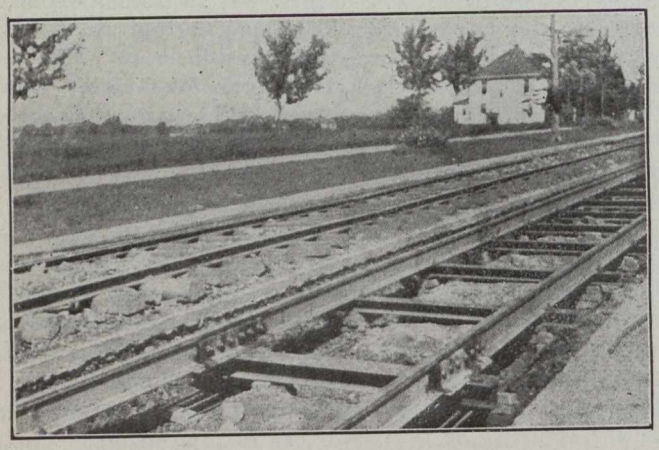

Fig. 2.—Reinforcement at Joints and General Construction.

stay, and even if the bolts were removed the joint would remain under traffic for a long period without any signs of loosening. Another feature in making a joint of this type in this manner is that no bonds were used, or considered necessary. The net area in contact has a far greater current-carrying capacity than the No. 0000 copper bond generally used on heavy lines, and a test showed no trouble with return circuits. It has also been brought to the writer's attention that a section of track put down in a similar manner showed a first-class negative return circuit after two years under traffic.

Surfacing and Preparing for Concrete.—The track, having been put together as described, was supported on small piers of old brick placed under every other tie, and centring under the rail. The final surfacing was done with oak wedges on top of these piers, and both the piers and wedges were concreted in.

Two ½-in. twisted steel rods were placed in the bottoms of the trenches about 6 in. square. These also were supported at intervals on top of a brick which held them about 2½ in. off the ground. Under each joint two extra 4-ft. lengths of these steel rods were placed, to give additional strength at this point, which is usually considered the weak spot of track construction. This is shown on Fig. 2.

The track was then given its first surfacing raise, being brought approximately to grade. Afterward, a second finishing surface and true grade was secured by driving up the oak wedges. This final surface, however, was only kept a short distance ahead of the mixer on account of the difficulty in keeping the skeleton track in correct line, variations in temperature kinking it.

Concrete.—Concreting was next started, two types of mixers being used on this particular work at different times: One was mounted on car trucks and driven with a 10 h.p. motor; it occupied the temporary old tracks which had been previously placed at one side, and was supplied by a regular work train which delivered the concrete material on flat cars. The other type was mounted on wide-tired wheels, driven with a 15 h.p., 500-volt, D. C. motor, and was equipped with a charging bucket. All materials for the latter were hauled in wagons to the streets and dumped ahead of the mixer in such manner that they were about in the right proportions. These materials were cleaned up as the mixer progressed.

Of the two methods, the latter was found to be by far the most satisfactory, as there were frequent delays in the delivery of materials to the first mixer by the work train, and the temporary track was blocked for traffic beyond the point where concreting was in progress and, on single-track work, passengers had to transfer around the obstruction.

In the second method, all material could be delivered on the street for a considerable distance ahead of the mixer, and there was no reason for the mixer to be idle at any time on this account.

The concrete was composed of 1½-in. (maximum size) crushed limestone, Kaw River sand, and chats from the Aurora Zinc Mine district, the proportions being one of cement, two of sand, two of chats, and three of crushed stone, this making a very good mixture. The concrete was mixed very wet, dumped into movable chutes from the mixer, and deposited directly by them on the track. Great care was taken at all times to keep all loose material in the excavation cleaned up ahead of the concrete and to maintain the twisted steel rods in their proper positions. The concrete was puddled carefully under and around all ties with shovels and finally crowned, when it reached grade, with a special board or templet made for the purpose.

When the material through which excavation had been made was of a very loose character, or if bad weather had caved in the sides of the trench, forms were placed where necessary to hold the concrete to the exact dimensions of the roadbed. After the concrete had set for 48 hours, and in the majority of cases longer, the brick paving was done.

Paving.—The paving was of first-class paving blocks, laid on a 1-in. sand cushion, and grouted. The method of laying it differed somewhat from the usual practice. Along each rail, and snug up against it, was laid a 2 by 4-in. piece of timber. A stretcher course of bricks was then laid against it paralleling the rail, the tops of the bricks being only ½ in. below the top of the rail. The headers across the tracks were then laid and all the bricks were thoroughly rolled and rammed.

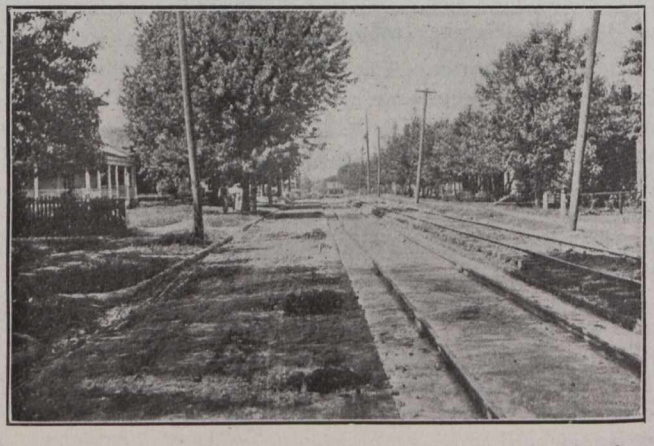

Fig. 3.—Concrete and Track Work Complete, Ready for Brick Paving.

Before grouting, the 2 by 4-in. piece was removed and the space thus left with concrete to a plane 1 in. below the top of the rail, forming the flangeway for the wheels. After this had set, the whole pavement was grouted thoroughly and carefully. When filled up, the grout remaining over the top of the pavement was allowed to stand until it had attained a set and was fairly stiff, then dry sand was sprinkled over it and the whole was swept thoroughly with