leading to down-spouts and into street gutters beneath bridge. Asphalt beneath flash angle and against web. The nipple is a bad detail. Asphalt will break loose from web of girder and allow water to seep through along web at stiffeners and gussets when flash angle is not continuous.

The cost of such work, including concrete and all drainage, is about $0.25 per sq. ft.

Fig. 2 shows half-through plate girder, with trough floor. Troughs filled with 1:3:6 concrete and water-

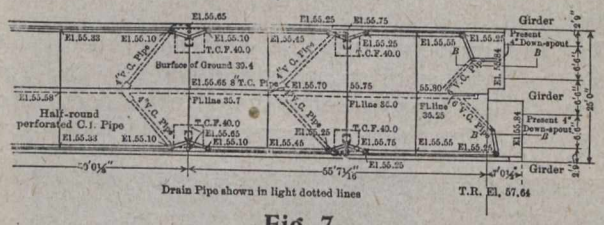

Fig. 7.

proofed with rock asphalt mastic. Drainage to one end of bridge, or, with light or level grades, to both ends, leading to dry stone packing placed against backs of abutments. No special precaution to make asphalt adhere to girder web—will crack and let water through. Difficult to make good detail at back wall, causing water to back up, especially after freezing weather, and run on bridge seat and down abutment.

The cost of such work, including concrete and drainage, is about $0.35 per sq. ft.

Fig. 3 shows half-through plate girder, with trough floor. Very shallow girder shown in drawing, but same principle applicable to girders of greater depth. In case of proportions shown, probably it would have been wiser to have encased and waterproofed entire top flange of girder. Before applying concrete to fill troughs, all openings between girders and ends of floor sections are carefully caulked with burlap dipped in a low-melting-point asphalt. Drainage is over back wall with specially prepared, sealed joint. Waterproofing is 1½ in. of rock asphalt mastic applied in two ¾-in. layers. A V-shaped opening left along the girder web, and around stiffeners and gussets. The sides of this opening cleaned with wire brushes, bellows, and gasoline, and then painted with

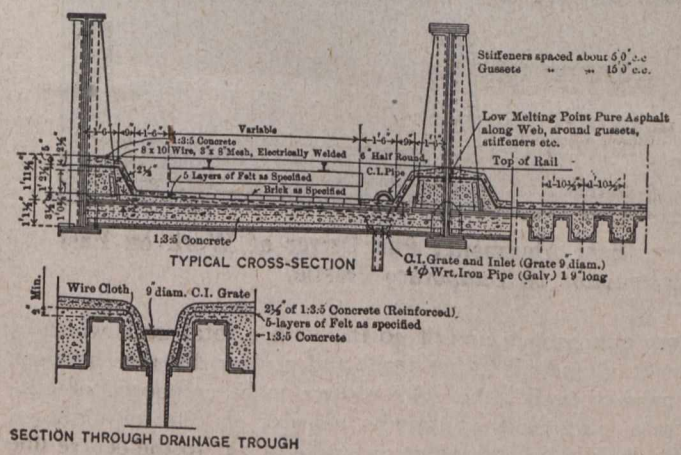

Fig. 8.

asphalt dissolved in gasoline. The V then filled with low-melting-point, ductile, pure asphalt.

This type of floor has been very successful, and costs, complete, about $0.45 per sq. ft.

Fig. 4 shows half-through plate girders with floor-beams and with I-beam and plate floor. Bridge on a level grade. Concrete filling of 1:3:5 mix, sufficient to produce drainage grades. Waterproofing consists of five layers of surfaced felt and asphalt compound. Waterproofing carried up under top flange of girders, protected by layer of hard brick, laid flat, with joints filled with asphalt compound. Water drains to inlets placed near ends of bridge and graded so as to prevent any water from flowing over the back walls. Drainage through grates and clean-outs into down-spouts to sewer. Half-round, perforated, cast-iron pipe placed on top of brick to assist flow of water if ballast becomes dirty. Another detail of back-wall drainage, shown in Fig. 5, has been very successful.

Costs about $0.75 per sq. ft. High on account of grade of track being level, requiring additional concrete and inlets to provide proper drainage.

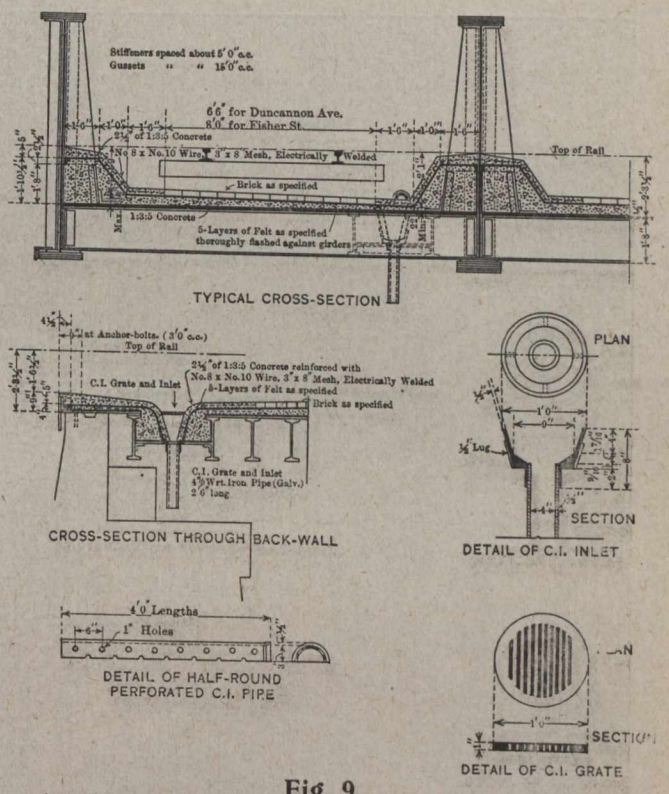

Fig. 9.

Figs. 6 and 7.—Deck viaduct with shallow-trough floor. Tracks level. Troughs filled with 1:3:5 concrete and waterproofing of same character as in Fig. 4. Drainage shown in Fig. 7. Only improvement suggested is use of cement mortar in place of asphalt for brick protection. Very successful.

Cost, $0.65 per sq. ft. High on account of level grade on viaduct, requiring additional concrete and inlets to provide proper drainage.

Figs. 8 and 9.—Half-through plate girders. Fig. 8 with trough floor and Fig. 9 with I-beams and plates. Filling with 1:3:5 concrete. Waterproofing, five layers of surfaced asphalt felt with asphalt compound, and protected with hard-burned brick in 1:3 cement mortar on flat floor and 1:3:5 concrete, reinforced with No. 8 and No. 10 wire, 3 by 8-in. mesh, electrically welded in gutters and over haunching. Pocket of low-melting-point, pure asphalt, carefully put in as seal against girders and around stiffeners and gussets before protection is placed. Drainage to inlets. No water going over back walls. Water removed from copings by special inlets built in masonry.

Cost, about $0.62 to $0.80 per sq. ft., including all drainage details.