EXPANSION OF CONCRETE.

THE following notes relate to proper provision for expansion and contraction in concrete structures, together with provisions for waterproofing such arrangements. They have been abstracted from a report to be presented by one of the committees at the San Francisco convention of the American Electric Railway Engineering Association:

Restrained Structures.—When a reinforced concrete structure is restrained by outside forces and when that structure contains steel reinforcement that is not evenly distributed throughout a large mass of concrete (heavy reinforced concrete wall where practically all the steel is concentrated on the tensile side of wall) then the stresses

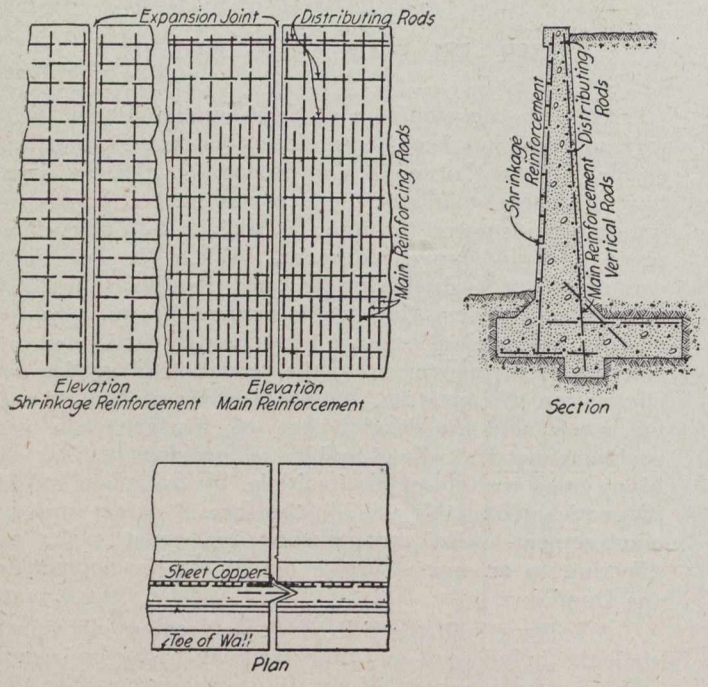

Fig. 1.—Expansion Joint in a Reinforced Concrete Retaining Wall of the Cantilever Type.

resulting from a drop in temperature equal to about 15 deg. F. will stress the concrete sufficiently (in tension) to cause excessive cracks in the opposite side of the wall to that containing the main reinforcement. To prevent these contraction or shrinkage cracks from being noticeable (minute cracks will still be there) about 0.4 per cent. of steel reinforcement placed near the exposed face of the wall will suffice. In practice this amount of steel will do the work but theoretically almost twice this percentage is required.

As an example of finding the amount of steel necessary to minimize the shrinkage cracks assume a wall or slab to be 12 in. in thickness. Then the amount of steel required in the wall would be 12 in. (thickness) x 12 in. (width or length) or 144 sq. in. x 0.004 = 0.576 sq. in. of steel per foot width or length of slab or wall.

No amount of steel will entirely eliminate cracks but the more steel used the smaller will be the cracks. The steel should be placed about 2 in. from the surface that is exposed to the temperature changes to be effective. Small rods spaced close together or a mesh should be used rather than large rods spaced far apart that would give the same area of steel. (See Fig. 1.)

Unrestrained Structures.—In reinforced concrete structures which are free to expand and contract the stresses from shrinkage and temperature changes are due

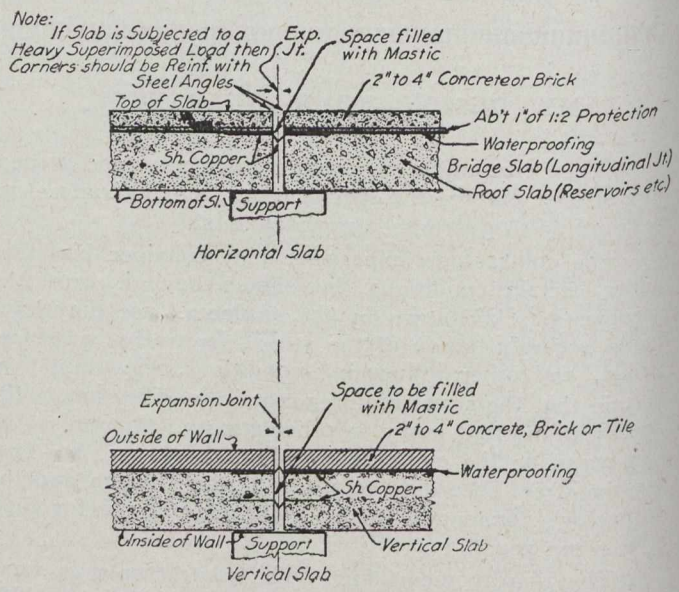

Fig. 2.—Waterproofed Expansion Joints for Plain and Reinforced Concrete Slabs.

to the mutual action of both the concrete and steel. These stresses have been proven to be of so little importance that they may be ignored in practice. In this type of

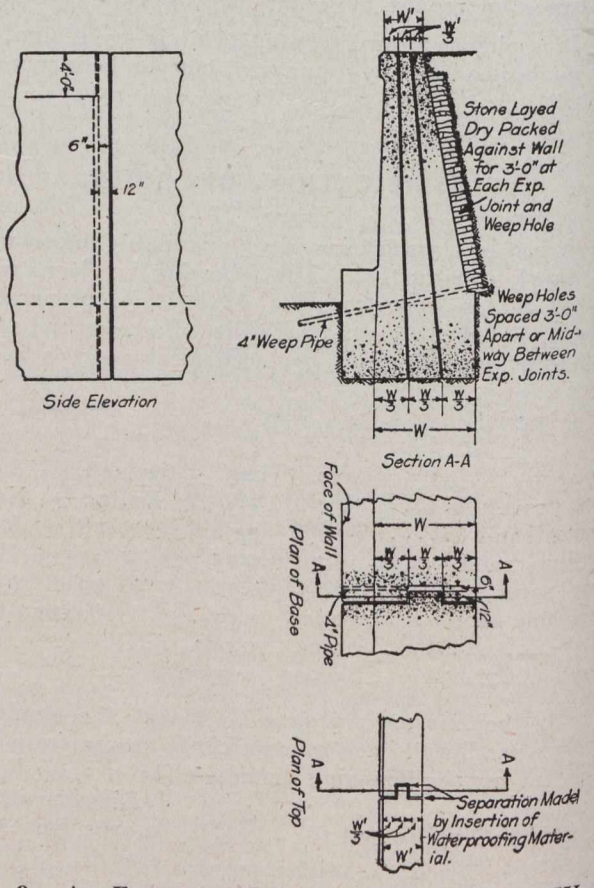

Fig. 3.—An Expansion Joint for Plain Concrete Walls.

structure the stresses from temperature alone are negligible because concrete and steel have practically the same coefficiency of expansion. They both expand or