same for all the slabs, which were all uniformly loaded to 224 lbs. per foot super. The remarks printed beneath each slab are of much interest as showing the behaviour of each material after being quenched with water when practically red-hot. The slabs were all 10 ft. by 2 ft. 7 in. clear span. Engineers will be interested to know that the furnace clinker mentioned was obtained from off the bars of an ordinary steam boiler, not from destructors.

Sand.

Sand is, in some parts of the country, more difficult to obtain than any other constituent of reinforced concrete. A certain amount is absolutely necessary, and nothing up to the present is known which really and entirely supplies its

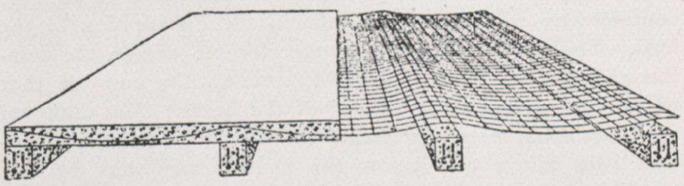

Fig. 2.—Reinforcement of Flat Surfaces; Wires or Rods held in place by Weaving.

place. Engineers having foundries will have a ready means of judging sand for reinforced concrete if they remember that, generally speaking, the better sand is for moulding, the worse it is for reinforced concrete. For instance, it must not "bind," that is, retain any shape when compressed, and it must be incapable of being smoothed with a trowel to a bright surface, or of "standing up" by itself when cut with a shovel; these being "rough-and-ready" methods of ascertaining that the sand has what is required, namely, large sharp grains. Dirt in the form of slime, mud, or vegetable refuse is distinctly bad.

If sand is scarce or costly, some economy may be effected by regarding the very small pieces of the stone or other aggregate, below ⅛-in. mesh, as sand, and mixing them with some real sand. The economy is not so apparent as appears at first because the small pieces must be screened out from the larger aggregate, and in most instances washed to remove the floury dust before being mixed with the real sand, ready for putting in the gauge boxes.

Reinforcement.

It is important that all reinforcement should be so designed as to possess a considerable amount of initial rigidity, so that it does not "sag" or "warp" or "twist" when placed in position in the mould boxes. Many illustrations regarding this could be quoted, but that of compression bars intended to be above the neutral axis in a beam, sagging down by their own weight till a portion of their length is below the said axis, where it is worse than useless, is not by any means as rare as it should be. The same remarks apply to lateral misplacement, particularly in the case of columns and struts, as well as to the pitching and spacing of reinforced bars or metal on flat surfaces such as floors, walls, etc. In these last-mentioned it is practically essential to have the bars or metal so designed that they cannot be knocked out of place, as it is almost impossible to keep a number of separate loose bars in proper pitch; it is advisable therefore that all reinforcements for this form of work be woven together, as shown in Fig. 2.

Punching or slitting solid plates into strips or bars is another efficient form of reinforcement for flat surfaces, particularly for those which are approximately square in plan, viz., where the strains are practically equal all over; but for flats where the length is considerably greater than the span, a wire meshing is cheaper, as the cross-span wires take the load, the longitudinal ones being only necessary to keep the others in pitch, and it is not advisable to pay for metal and strength in the longitudinal directions where it is not wanted.

Auxiliary Tension Members in Beams and Slabs.

An examination of all the accepted specifications, for the last ten years, dealing with reinforcements will show that it is almost universally acknowledged that these important accessories must be inclined to the main tension bars and not be at right angles thereto, and also that such bars must be so designed as to retain absolutely their positions where they are connected to the main tension bars and cannot be slipped or moved along the same when ramming the concrete or otherwise.

Reinforcements of Struts and Columns.

There are two very distinct methods of reinforcement in use for these—one being that in which the vertical bars are prevented from spreading by being spirally wound with rods of wire, and the other where the same end is obtained by means of rings or loops of wire tying the vertical bars together, such loops or rings being arranged at various distances apart to suit the design and strength desired. Both these methods have good and bad points, each one being the best under appropriate conditions.

The spiral winding has given most excellent results, and is considered by many to be the best for columns, etc., as it permits the use of lighter and fewer vertical rods, but it has the disadvantage of being somewhat difficult to make it a "good mechanical job," that is, so that the spirals shall all be the same diameter and parallel in bore, otherwise some will clasp the group of vertical bars too closely and others hardly touch them, which results in unequal stresses.

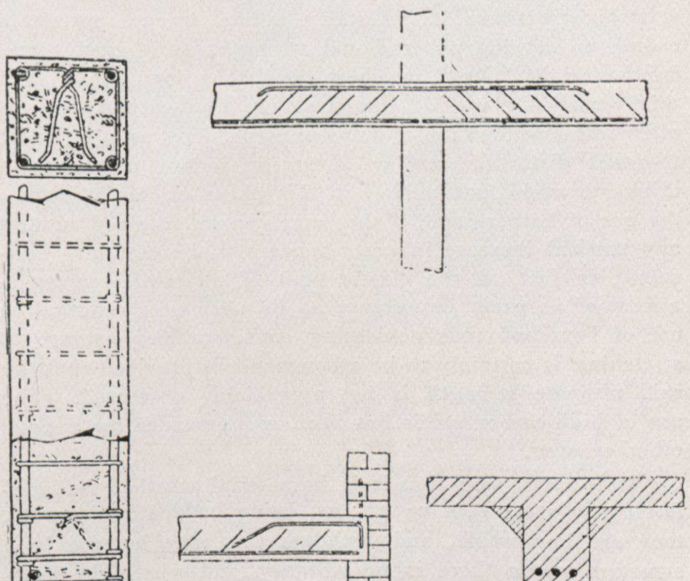

Fig. 3.—Arrangement of Column Reinforcement with vertical Rods and Loop-pieces.

Fig. 4.—Diagram showing Arrangement of Reinforcing bars and Shear Members to resist "Reverse Flexure" in Continuous Beam.

Fig. 5.—Diagram showing arrangement of Reinforcing Rods and Shear Members to resist "Reverse Flexure" in end of beam.

Fig. 6.—Diagram of Section of Beam and Floor showing increased area of Concrete in Compression.

This is, however, generally made much easier by using bands of flat rectangular section which bend readily, and by first winding the spirals on a cylinder and then slipping