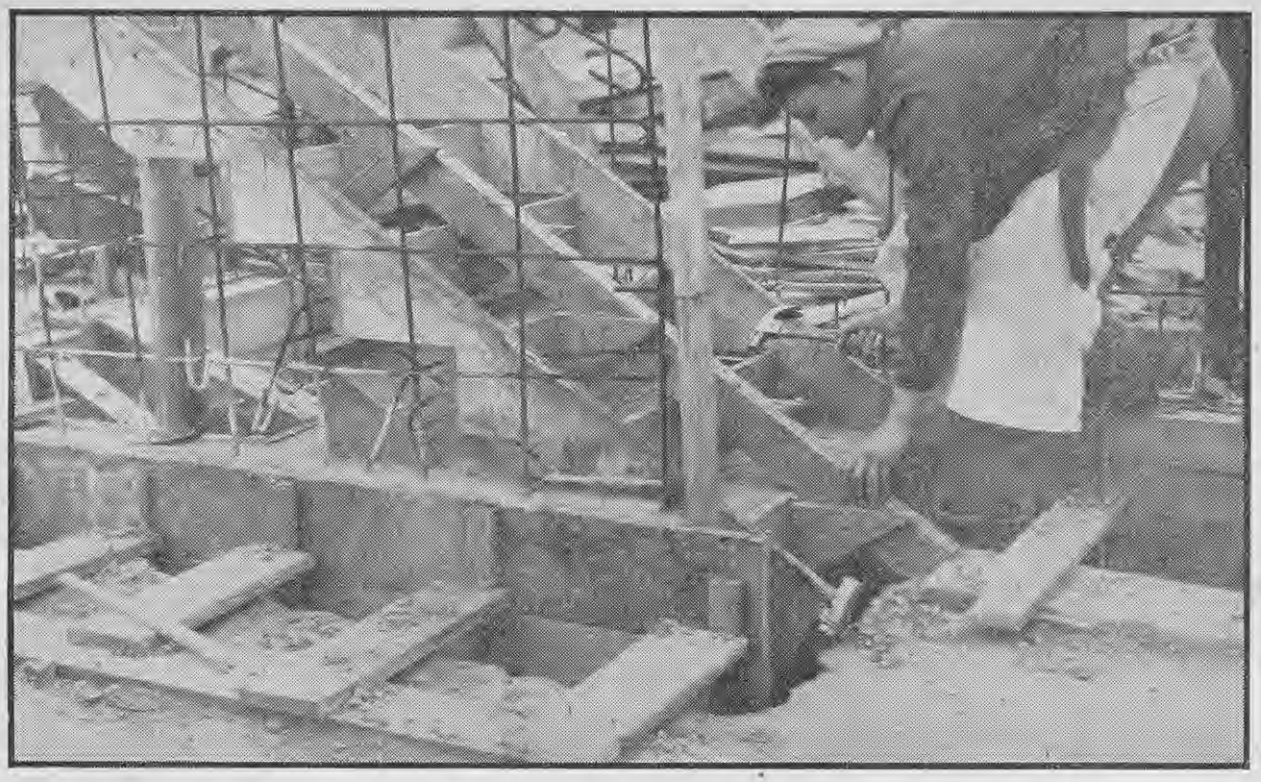

The Use of Reinforcing and Boxing in Preparing Concrete

IN the first article of this series, which was published in last month's issue of the "Journal," H. W. T. Eggers, Engineer, Department of Agriculture, Wellington, dealt with the properties and methods of working concrete. This article describes reinforcing and forms, and the third article, to be published in next month's issue, will describe concrete bricks, pipes, and posts.

THE greatest strength of concrete is compressive, and if any other stressing is to be given a concrete structure, this stressing must be provided for by the use of steel reinforcing. From this it will be realised that as reinforcing is used for a special purpose, to gain the maximum strength with the greatest economy, the sizing and position of reinforcing must be arranged in such a manner that the size is suited to the degree of stress and the position to the line of stress.

Reinforced concrete is therefore a combination of concrete and steel acting as a unit as a result of the adhesion between the two materials. Beams of plain concrete fail by tension under very low stresses, but if reinforced by the embedment of steel in their tensile portion, they may be stressed to the compressive working limit of concrete.

Reinforced-concrete structures are practically monolithic, more rigid than steel, and substantially fireproof. Reinforced concrete is used in parts of the structure in which tensile and compressive stresses exist, such as beams and slabs, and also in members subject to secondary bending stresses such as columns and struts. Reinforcing is also used to prevent cracks caused by changes of temperature and shrinkage, as in walls.

The use of reinforcing placed without regard to the work it is supposed to perform is a waste of material and labour, because unless the reinforcing is placed along the lines of stress, the structure is no stronger for its presence. If, on the other hand, the sizing and positioning of reinforcing are designed in correct relation to the stresses involved, the quantity of reinforced concrete required for any given loading will be considerably less than any unreinforced concrete used for the same loading.

Reinforcing Steel

Reinforcing steel is generally ordinary mild steel supplied in the shape of bars, plain round bars being most extensively used. A number of deformed bars (that is, bars with irregular surfaces) have been designed to produce mechanical bond and greater adhesion between steel and concrete. For all ordinary work plain bars may be used with safety, though deformed bars are of advantage in resisting temperature stresses. Fabric reinforcing, such as triangular mesh, expanded metal, welded wire, etc., is adapted in certain cases for slabs, walls, or partitions, or moulded articles such as watering troughs. Usually, however, bars are more economical.

All steel used for reinforcing should stand bending cold to an angle of 180 degrees around a diameter equal to that of the piece tested, without fracturing the skin at the bend.

It is of the utmost importance that all steel is clean and free from rust and that all scale is removed before fixing in the work.

In the work all cross rods must be sufficiently tied to the longitudinal rods so that the reinforcing forms a rigid mat which will not be displaced by the placing of the concrete. Soft-iron wire is the best material for binding rods together. Splices in rods should be lapped at least 40 diameters and securely bound, and all ends should be hooked, except on bars used solely for the purpose of taking temperature stresses.

Fabrics should be lapped for not less than 15in. in the direction of the longitudinal wires, and the side lap should not be less than 3in.

Bending and Fixing Reinforcement

As all steel must be accurately placed and supported in its correct position in the forms, it is very necessary that bending and cranking are done accurately. Bars must be cut to length and bent to fit their respective