

knives attached to a rotating shaft churn up the clay and force it downwards through the outlet at the base.

Crushing rolls are used for reducing clays of high plasticity. The rolls, driven at a speed which varies from 50 to 160 or more revolutions per minute, are in pairs, and are strong metal cylinders placed horizontally, side by side, with a space between; they are from 1½ to 3-ft. diameter and 2 to 3-ft. long. The clay is fed between the rollers from a hopper fixed above them. The surface of the rolls may be smooth or they may be either toothed, spiked, corrugated, etc., when they are called *kibblers*. The rolls may consist only of a single pair, or there may be two pairs with one pair above the other. The space between a single pair should not be less than ½-in.; if provided with a double pair of rolls, the upper pair are kibblers spaced up to 2-in. apart, and the lower pair of smooth rolls are closely spaced to a minimum of ⅓-in. The kibblers grip and crush the clay sufficiently for fine reduction by the lower rolls, from which it passes in thin sheets.

*Screening.*—Clay or shale after being ground is generally passed through a screen to ensure that only fine, well graded material is passed forward for moulding. The coarse material retained on the sieve is returned for further grinding.

*De-airing.*—As is implied, de-airing means extracting air, and is a process which has been recently introduced into this country and applied to certain clays and shales prior to the moulding operation. During the grinding and pugging processes air is introduced between the fine particles. This entrapped air reduces the plasticity of the clay, preventing the mass from becoming thoroughly homogeneous, and causing defects such as blisters, laminations and cracks (see p. 14). The removal of the air therefore increases the workability of the clay and prevents the development of these defects. A de-airing machine simply consists of a chamber to which a vacuum pump is connected. The fine particles of clay or shale are forced into the chamber and the air is extracted as the material proceeds to the moulding machine.

De-airing has been particularly successful in connection with the manufacture of wire-cut bricks (see below), where the complete plant may consist of a pug mill or an *auger machine* with a *shredding plate*, a de-airing chamber, and a second auger which conveys the clay from the chamber and forces it through the *die* to the wire-cutting machine. An auger machine is a horizontal pug mill with a powerful metal screw or worm instead of the shaft with blades. The extruded clay as it leaves the die is in the form of a continuous band having smooth surfaces and sharp, well defined arrises.

*Grog*, which is burnt waste bricks or burnt clay ground to a powder, is sometimes added to the raw clay in the mill to reduce shrinkage of the bricks during the drying and burning processes.

2. MOULDING.—The prepared clay or shale is machine-moulded by either the (a) wire-cut or (b) pressure processes, or it may be moulded by hand.

(a) *Wire-cut Process.*—The clay or shale, in the form of a continuous plastic band or column, is propelled from the pug mill or auger over oiled rollers to the *cutting table*. The exit, called the *die* or mouthpiece, is lubricated with water, steam or oil to reduce friction and ensure uniform movement of the column, and is approximately 9¼-in. by 4⅝-in.; this size is variable, depending upon the

shrinkage of the material, which may be ¾ to 1-in. per ft. and which occurs during the drying and burning processes.

The usual type of cutting table consists of a frame containing several wires at a distance apart equal to the thickness of the bricks plus the shrinkage allowance, and is shown in the sketch A, Fig. 1. These wires are kept taut by means of screws. As the end of the column reaches the stop, the frame automatically moves forward and the wires cut the column transversely into brick slabs; these are pushed forward, placed on barrows and wheeled to the drying floor. In other type of cutting table the frame is fixed and the column, which has been cut to length, is pushed forward past the wires. The frame in another type rotates and the wires divide the column by a downward cut. In one of the latest machines two columns are extruded, and two cutting tables can produce 5,500 wire-cuts daily. As the column leaves the die a small roller under it impresses the trade mark of the firm on the clay at brick thickness centres.

(b) *Pressure Process.*—The prepared clay is automatically fed into rectangular metal die-boxes or moulds which are the size of a brick plus shrinkage allowance. Two of many machines used for this purpose are shown diagrammatically at B and C, Fig. 1. The horizontal rotary table of machine B contains a number of moulds which are brought in turn under the plunger; the latter charges the moulds with clay and consolidates it under great pressure; as the table rotates the pressed brick slabs are automatically pushed upwards clear of the moulds and removed. In the press C the clay in the mould or die-box is consolidated as the plunger descends. Some bricks are passed through two presses, the second press producing a better shape and further consolidation. After consolidation the slab is removed either by an upward movement of the base or by the dropping of the sides, which in one type of mould are hinged at the bottom and collapse outwards.

At one works, referred to on p. 10, the clay, after being ground and screened, passes on to a moving steel belt which traverses a huge kiln and feeds the moulding machine which presses four bricks at a time and is capable of moulding 2,600 bricks per hour. This machine travels on rails and is brought opposite the empty chambers of the kiln in turn and into which the moulded bricks are passed direct.

Wire-cut bricks for facings are often *re-pressed* to consolidate them and render their arrises sharp and square. Both types of presses, B and C, are suitable for this purpose, that at B having moulds with collapsible sides which become vertical as each box comes under the plunger. Spraying oil over the bricks facilitates their removal.

*Hand-moulding Processes.*—Although bricks can be made more cheaply and much more quickly when machine-made, hand-moulding is far from being an obsolete process. On the contrary, the output of hand-moulded facings is increasing, as these are still considered to be best on account of their rich texture, beautiful colouring and durability. Purpose-made bricks which depart from standard sizes, and clay blocks of special shapes to meet specific requirements,