chambers. The divisions may be temporary (see C, Fig. 3) or permanent (see B). The number of compartments varies; twelve is considered to be a minimum, fourteen and sixteen are common, whilst the largest kiln in this country (see p. 10) has 224 chambers. The length of a chamber is usually from 12 to 16-ft, the width varies from 9 to 16-ft., and the height to the crown rarely exceeds 9-ft. Best results are obtained if the total length of the chambers is not less than 200-ft. to permit of the efficient control of the various operations. Each chamber has an opening (known as a *wicket* or *door gap*) in the external wall for loading or "setting" and emptying or "drawing" the bricks; it has a flue, controlled by a damper, to convey the used gases to the main flue and thence to the chimney. In a more modern kiln, and especially those used for producing facing bricks, each chamber is connected to a hot-air flue (see p. 8). Small coal or slack is commonly used as fuel. This is fed through *feed-holes* situated in the top of the kiln, and these are preferably of fireclay blocks covered with movable metal airtight caps. The capacity of a chamber varies; the smallest will hold about 8,000 bricks, whilst a very large chamber will accommodate 40,000 or more bricks. It is customary for one chamber to be drawn and one to be filled daily. The rest of the kiln is divided into (1) drying, (2) pre-heating, (3) firing and (4) cooling zones (see U, Fig. 3).

(1) *Drying or Steaming or Water-smoking Zone.*—A brick, even after being treated in a dryer, has a comparatively large water content which often exceeds one-sixth of its dry weight. The process of eliminating this water is an important one, for, if not carried out gradually, the bricks will crack and their strength be considerably reduced by the formation of steam within the small voids or pores of the material. The bricks in the drying chambers of the kiln are gradually heated to a temperature of 120° C. (250° F.) by the admission of hot air from the pre-heating chambers. This hot air should be free from gases, such as sulphur dioxide, otherwise the bricks will be discoloured by a deposition on their exposed surfaces of a film called *scum* or *kiln-white* (see p. 14). The waste heat from the firing chambers should not be used for drying purposes in kilns in which facings are produced, as this contains gases which cause discoloration (see p. 8). Large volumes of steam are produced during the drying process, and for the production of good coloured bricks this steam must be rapidly removed through flues (see p. 14) to avoid condensation on the bricks. The length of the drying zone depends on the length of the chambers and the draught created by the chimney, but in a fourteen chamber kiln the zone usually comprises two chambers, and three will be required in a sixteen chamber kiln (see U, Fig. 3).

(2) *Pre-heating Zone.*—The bricks in this zone are gradually brought to a dark-red heat (600° C.), during which the chemically combined water is set free and removed, and then the burning is carefully controlled until the temperature is increased to approximately 950° C. During the latter stage the iron and other compounds are oxidized and the colour of the bricks is influenced; the burning must therefore not be hurried, otherwise the bricks will be discoloured and hearting (see p. 13) will result. The length of the pre-heating zone is usually equivalent to four chambers (see U, Fig. 3).

(3) *Firing Zone.*—The bricks are vitrified during the final heating which takes place in this zone in which the maximum temperature may reach 1,100° C.[1] The number of chambers in this full-firing zone is two and three in a fourteen and sixteen chamber kiln respectively (see U). Coal is added through the feed-holes every quarter of an hour, and fuelling of the kiln is confined to them, the chambers in the drying and pre-heating zones having been heated by waste heat from the cooling zone. The stoking is generally done by hand, although the employment of automatic feeders which discharge the required quantity of coal at regular intervals is increasing. The durability of the bricks depends upon the firing of the kiln at this stage; excessive temperature will cause the bricks to lose their shape, and under-burning will reduce their strength.

(4) *Cooling Zone.*—This usually consists of four chambers, as shown at U, although in the larger kilns the length of the zone is increased and the risk of damage, such as cracking, is correspondingly reduced. The temperature of the bricks in the unloading chamber, which adjoins the cooling zone, should be sufficiently low to enable them to be handled comfortably.

SETTING.—There are several different arrangements of setting the green bricks in a kiln, much depending upon the stiffness of the bricks and the type of kiln. One form is to stack them on edge in a series of *bolts* or rows, 9-in. thick, alternately as headers and stretchers and about ¾-in. apart. Another arrangement, suitable for a continuous kiln, is shown in the section at A, Fig. 3. This shows three courses of bricks (headers) on edge, "finger-space" (about ¾-in.) apart. A course of stretchers is placed upon these, followed by alternate double courses of headers and single courses of stretchers. Vertical flues, called *fire-columns*, are formed in the stack under the feed-holes. These extend from top to bottom, are about 5-in. square and serve as combustion spaces and for ashes.

The following is a description of some continuous kilns, including the Manchester, Zigzag, Hoffman and Habla kilns.

MANCHESTER KILN [2] (see A, B and C, Fig. 3).—That shown is a simple form of the Manchester kiln, and is suitable for the burning of common bricks.[3] It consists of two long compartments, separated by a longitudinal wall, and whilst it has no permanent division walls, it is divided into chambers by paper "partitions" (see p. 8), and it is therefore called a fourteen chamber kiln. Each chamber accommodates 8,000 bricks, and as one chamber of burnt bricks is emptied per day, the weekly output is approximately 50,000 bricks, which is considered to be the minimum for a continuous kiln. Whilst a smoke flue, controlled by a damper, can be provided for each chamber, the plan shows that one damper serves chambers 1 and 14, and similarly another damper is

[1] This varies; thus, for Fletton bricks the maximum temperature may not exceed 850° C.

[2] By courtesy of Messrs Dean, Hetherington & Co., Accrington. This is the smallest and simplest type of continuous kiln built by this firm.

[3] The Manchester kiln, incorporating a hot air flue, is used for the production of facing bricks.