When pores cease to act as water conductors they frequently become plugged with sac-like growths called *tyloses*.

Softwoods are without pores, and therefore *the presence of pores is a clear indication that the timber is of the hardwood type*.

Fibres.—These are narrow thick-walled cells, shorter (1-mm.) but somewhat resembling the summer-wood tracheids of softwoods. The bulk of the wood consists of fibres, and their function is to provide strength to the tree. They cannot be separately distinguished by the naked eye (see M).

Parenchyma or Soft Tissue.—This consists of thin-walled, rectangular cells occurring as vertical strands surrounding the pores (see M), as bands linking up the pores and as fine lines separating the growth rings. They are visible on cross-section as light coloured bands or patches in contrast to the darker coloured masses of fibres. The function of the soft tissue is to store reserves of food.

Rays.—These also store food materials. Unlike the softwood rays described on p. 2, those in most hardwoods are several cells in width. These radiating strands sometimes appear as distinct broad bands, about 15 cells wide, separated by indistinct finer rays, about 3 cells wide (as in oak and beech, see J and K), or entirely as indistinct fine rays, about 3 cells wide, as in birch. The height (as in oak) may exceed 1-in., and the characteristic " silver grain " of quarter-sawn oak is due to the presence of these very broad and high rays.

Identification.—The identification of the more commonly used timbers does not present much difficulty to those experienced in the industry by observing such general characteristics as the colour, texture, smell, appearance of the growth rings, rays, etc. Most timbers, however, can only be identified with certainty by a close examination of the structure of a thin cross-section (cut by a sharp knife or chisel) through a *hand lens* which has a magnification of about ten times the natural size. When more reliable information is required, as is necessary to distinguish timbers which are closely allied, it is necessary to examine prepared slides of the specimens through a *microscope* which has a magnification of twenty-five to thirty diameters. For this purpose it is necessary to examine three sections from each specimen, *i.e.*, cross, radial and tangential, the radial and tangential sections being necessary for the examination of the rays. Briefly, a slide is prepared in the following manner: A slice of the wood, about $\frac{1}{2}$-in. square and $\frac{1}{1000}$-in. thick, is cut by a special knife called a *microtome*; the slice is stained by coloured alcohol and then pressed flat (mounted) on a piece of glass to which an adhesive (Canada balsam) has been applied.

The structure of a specimen should be methodically examined under the microscope. Thus, the group to which it belongs is first determined, absence of pores indicating a softwood; the size and distribution of the rays, type of pits and any resin ducts are diagnosed; if a hardwood (indicated by the presence of pores) the grouping of the larger pores (whether ring-porous or diffuse-porous) and the distribution of the smaller pores are noted, together with the character of the soft tissue, rays, etc. As the slide is being studied microscopically, a larger specimen of the wood is examined and the general features such as the colour, weight, characteristics of the growth rings, etc., are observed.

The appearance of cut surfaces of timber is influenced by its structure, and there are several terms used to express this appearance. These include (1) grain, (2) texture and (3) figure.

1. *Grain* applies to the general *direction* of the fibres and cellular units in relation to the longitudinal edges of a piece of wood or the vertical axis of a tree. There are several kinds of grain, *i.e.*, (a) *straight grain*, when the fibres are parallel; (b) *irregular grain*, when the fibres are inclined; (c) *wavy* or *curly grain*, when the fibres frequently change direction and produce alternating darker and lighter wave-like stripes on the surface (such timber when split has a corrugated surface); (d) *spiral grain*, when the fibres are arranged spirally; (e) *interlocking grain*, when the fibres in successive growth rings are inclined in opposite directions; and (f) *diagonal grain*, when straight-grained timber has been improperly converted so that the fibres are inclined to the longitudinal edges. Regarding :—

(*a*) Straight-grained timber is relatively strong and easy to work. It has only a plain figure (see p. 5).

(*b*) Irregular-grained timber is relatively weak, is difficult to work, but gives an attractive figure (see p. 5). The irregularity is often due to the presence of knots.

(*c*) Wavy or curly grained timber is highly decorative on account of the irregularly curved fibres.

(*d*) Spiral-grained timber is of reduced strength.

(*e*) Interlocking-grained timber may be subjected to excessive twisting when being seasoned, and is not easy to work. The strength is not seriously affected. The figure produced is described on p. 5.

(*f*) Diagonal-grained timber is reduced in strength owing to faulty conversion.

The term *end grain* refers to the arrangement of the exposed fibres on the cross-cut surface.

Flat-sawn or *plain-sawn* timber is that which has been converted (see pp. 5 and 6) so that the annual rings intersect the cut face over at *least half its width* at *less* than 45°. It is inaccurately described as " flat grain " or " slash grain." Timber can be converted quickly, cheaply and with the minimum waste by this method of conversion.

Quarter or *rift sawn* timber (see p. 57, Vol. I) is that which has been converted so that the annual rings intersect the cut face *in any part* at *more* than 45°. It shrinks less in width than flat-sawn timber and has less tendency to warp and split. The terms " quarter grain," " edge grain," " vertical grain " and " comb grain " are loosely applied to quarter-sawn timber.

When timber fails, due to its brittleness, it is often said to be " short in the grain." This is an inaccurate application of grain, as the condition is not affected by the direction of the fibres. Whilst it may be characteristic of certain timbers, it is also due to improper seasoning and fungoid decay, such as dry rot (see p. 14).

" Even grain " and " uneven grain " are other terms which are inaccurately used (as they are not influenced by the direction of the fibres) to describe timber whose growth rings are either uniform in width (" even ") or irregular in width ("uneven "). A more accurate expression is " growth rings of regular (or irregular) width."

2. *Texture* applies to the size and order or arrangement of the cells. Thus, a