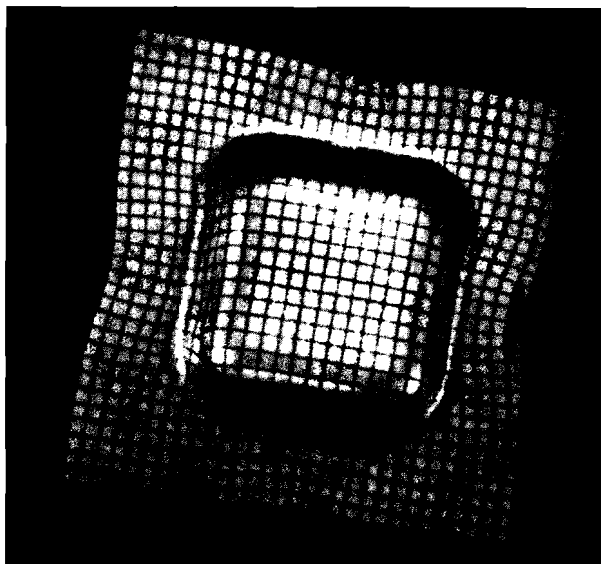
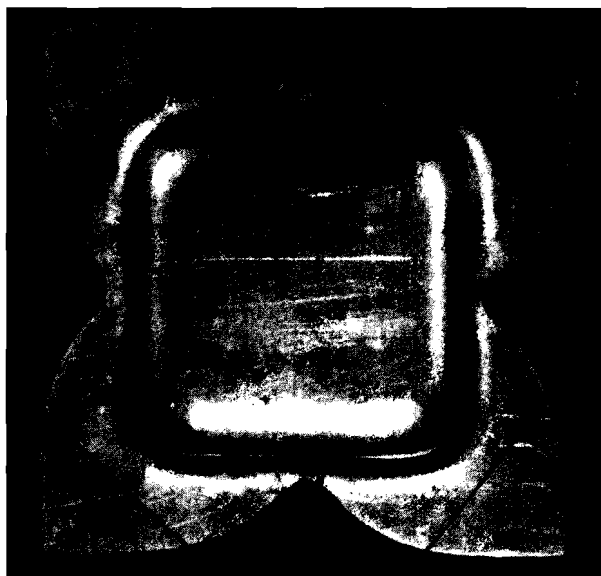


FIGURE 6.40

Tears occurring in box drawing

**FIGURE 6.41**

Optimized blank shape for drawing box-shaped cups



undistorted grid) so that it can be taken off the original blank. It has been found that the optimum shape is a circle with four cuts corresponding to the four corners. Also, the blank-holding force has been found to play a very important role. Better products are obtained by using a rubber-actuated blank holder that exerts low forces during the first third of the drawing stroke, followed by a marked increase in those forces during the rest of the drawing stroke to eliminate wrinkling and stretch out the product.

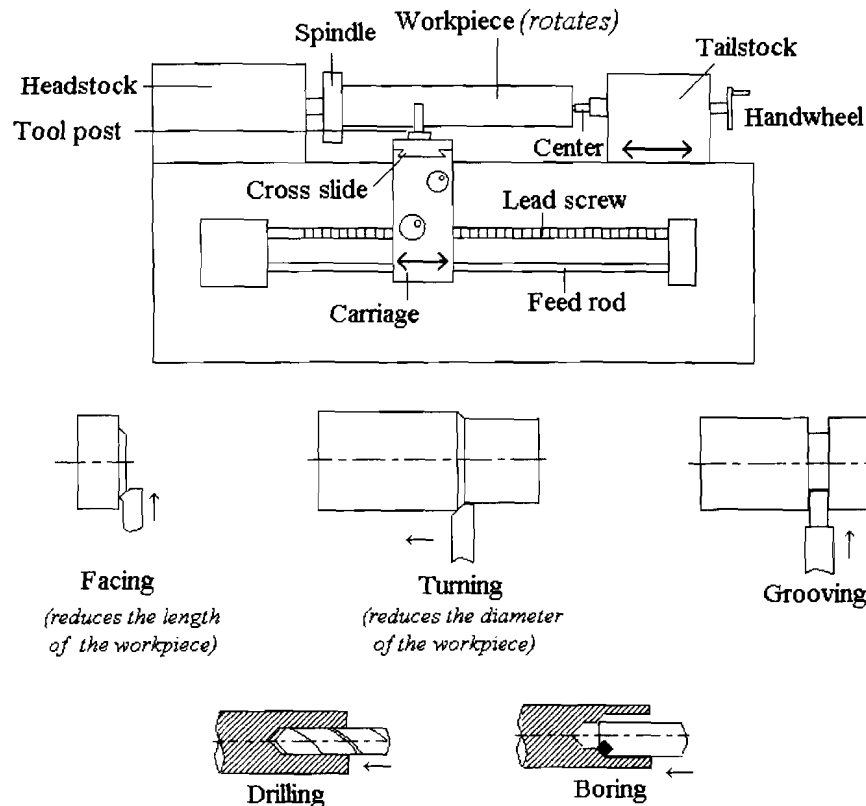


FIGURE 11.12 *Principal components and movements of a lathe and the basic operations that can be performed on it.*

Lathes

Lathes are used primarily for the production of cylindrical or conical exterior and interior surfaces, via turning, facing, boring, and drilling (see Figure 11.12). Lathes are also used for the production of screw threads. In a lathe, the workpiece is rotated while the cutting tool is moved (“fed”) into the workpiece in a direction parallel and/or perpendicular to the axis of rotation of the workpiece.

Vertical and Horizontal Boring Machines

These machines are used in place of lathes for the machining of large workpieces. They can be used to perform turning, facing, and boring. Boring machines are also used to form grooves and for increasing the diameters of existing holes.

Vertical and Horizontal Milling Machines

These machines (Figure 11.13) are used to form slots, pockets, recesses, holes, and other features. In this case the cutting tool is rotated and the workpiece is fed.

Planing and Shaping Machines

These machines are used primarily for reducing the thickness of blocks and plates and for “squaring up” blocks and plates. Shapers are also used to machine notches and keyways and to form flat surfaced on parts formed by other processes such as casting and forging. In the shaping machine shown in Figure 11.14 the

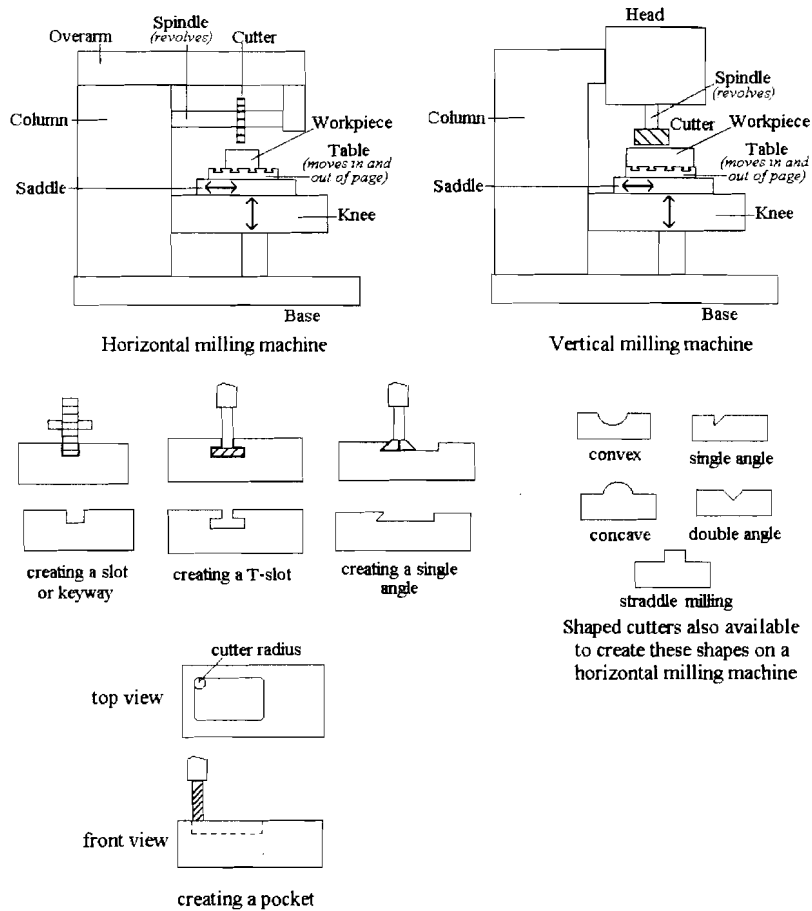


FIGURE 11.13 Principal components and movements of horizontal and vertical milling machines and the basic operations that can be performed on them.

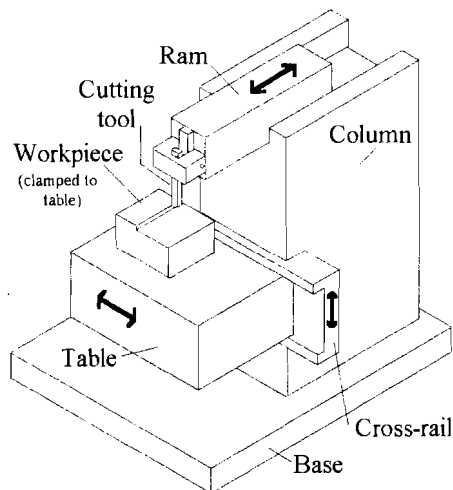


FIGURE 11.14 Horizontal shaper, used primarily to reduce the thickness of blocks and plates.