*steadies.* In some the work is steadied in a vee, or a right angle, in others adjustable pins or arms are brought into contact with it. As the pressure of the cut would cause an upward as well as back- ward yielding *of* the work, these two movements are invariably provided against, no matter in what ways the details of the steadies are worked out. Before a steady can be used, a light cut has to be taken in the locality where the steady has to take its bearing, to render the work true in that place. The travelling steady follows immediately behind the tool, coming in contact therefore with finished work continually.

*Mandrels.—*Some kinds of work are carried between centres indirectly, upon mandrels or arbors (fig. 36). This is the method

adopted when wheels, pulleys, bushes and similar articles arc bored first and turned afterwards, being chucked by the bore hole, which fits on a mandrel. The latter is then driven between point centres and the bore fits the mandrel sufficiently tightly to resist the stress of turning. The large number of bores possible involves stocking a considerable number of mandrels of different diameters. As it is not usual to turn a mandrel as often as a piece of work requires chucking, economy is studied by the use of *stepped* mandrels, which comprise several diameters, say from three to a dozen. A better device is the *ex panding* mandrel, of which there are several forms. The essential principle in all is the capacity for slight adjustments in diameter, amounting to from ¼ in. to ½ in., by the utilization of a long taper. A split, springy cylinder may be moved endwise over a tapered body, or separate single keys or blades may be similarly moved.

*Face-Work.—*That kind of work in which support is given at the headstock end only, the centre of the movable poppet not being required, is known as face-work. It includes pieces the length of which ranges from something less than the diameter to about three or four times the diameter, the essential condition being that the unsupported end shall be sufficiently steady to resist the stress of cutting. Work which has to be bored, even though long, cannot be steadied on the back centre, and if long is often supported on a *cone plate.* The typical appliance used for face-work is the common *face-plate* (fig. 37). It is a plain disk, screwed on the mandrel

nose, and having slot holes in which bolts are inserted for the pur­pose of cramping pieces of work to its face. There are numerous forms of these clamps, and common bolts also are used. The face­plate may also serve to receive an intermediary, the *angle-plate,* against which work may be bolted when its shape is such as to render bolting directly to the plate inconvenient.

*Jaw Chucks.—*When a face-plate has fitted to it permanent *dogs* or *jaws* it is termed a dog or *jaw chuck* (fig. 38). In the commonest form the jaws are moved radially and independently, each by its own screw, to grip work either externally or internally. In some cases the dogs are loosely fitted to the holes in a plain face- plate. In all these types the radial setting is tentative, that is,

the jaws being independent, there is no self-centring capacity, and thus much time is lost. A large group, therefore, are rendered self-centring by the turning of a ring which actuates a face scroll