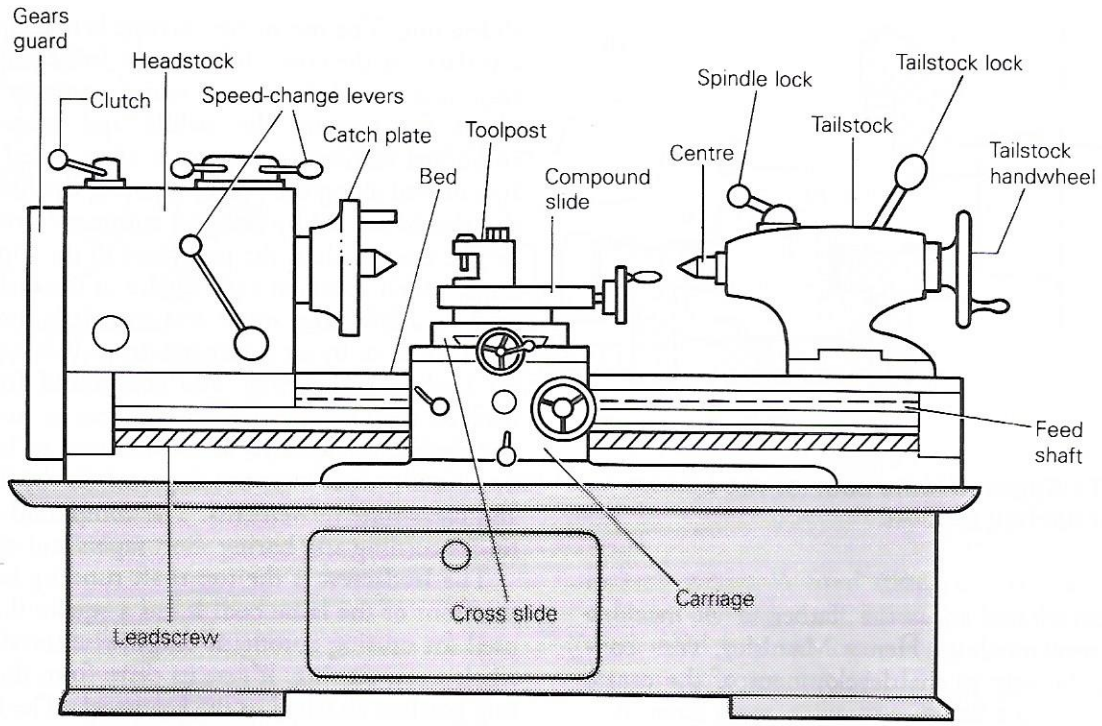

Figure 13.11 The centre lathe.

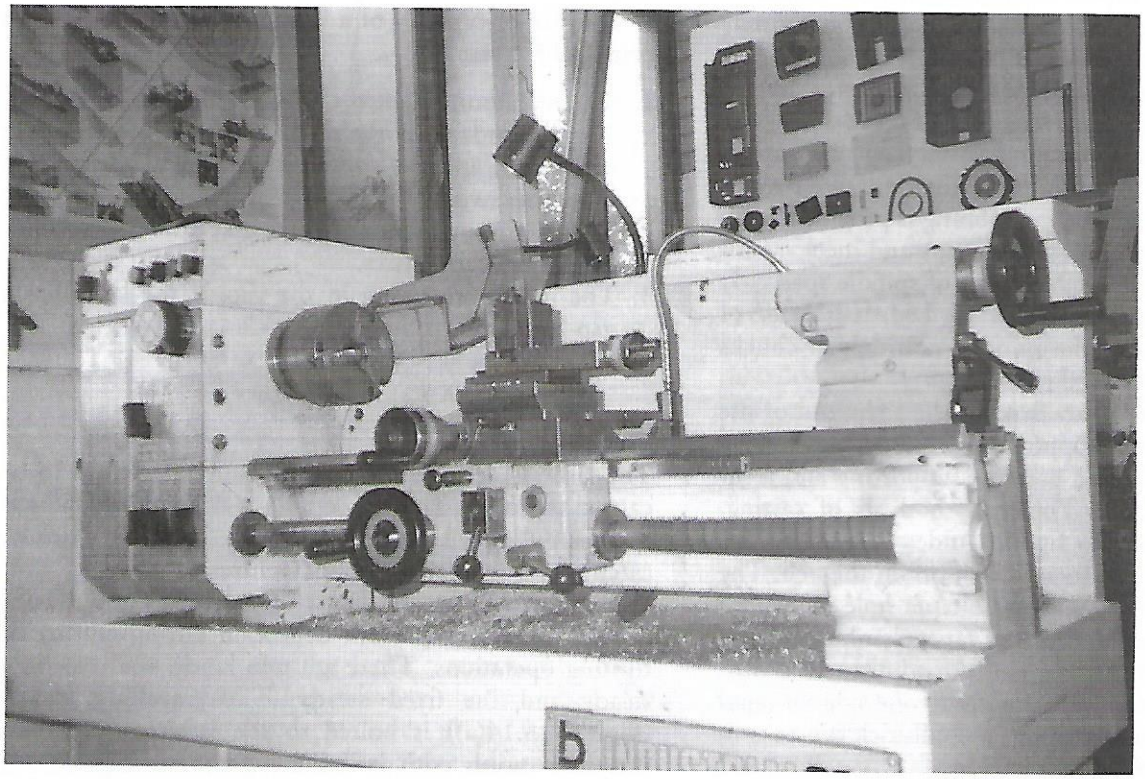

Figure 13.12 Typical centre lathe in the workshop.

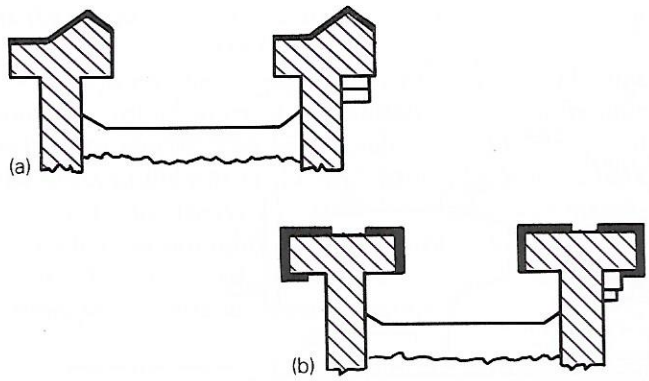

Figure 13.13 Types of lathe bed: (a) vee bed section; (b) flat bed section.

It is often referred to as the 'father of all machine tools'. We owe much to Henry Maudsley, who contributed significantly to the development of the centre lathe.

Main parts of the lathe

The **bed** is made of a heavy frame of high-grade cast iron. It forms the main structure on which the headstock is fixed. The top is machined to form guides or ways for the carriage and the tailstock. This guide may be flat, vee, or a combination of flat and vee (Figure 13.13). For both types, the tailstock slides on one pair of the surfaces while the carriage slides on the other pair. This arrangement prevents undue wear on any part of the bed. To ensure maximum rigidity and avoid twisting and other stresses, diagonal ribbing is provided.

The **headstock** contains all the gears and mechanisms necessary to obtain a suitable range of spindle speeds. It is always fixed to the left end of the bed. It is made of cast iron, and contains the spindle, onto which chucks and face-plates are screwed (fixed).

The **tailstock** is the part fixed to the right end of the bed, and is used for supporting work when turning between centres. It is also used for supporting and feeding drills, reamers, etc. The main body is of casting, machined on its base to fit the guides or ways of the bed, and can be moved to any position on the bed. The barrel of the tailstock has a morse taper hole to accommodate centres, taper sleeves and taper shank drills, and is moved by a wheel at its far end. An adjustment is provided for setting the tailstock centre to one side for taper turning. In its normal position, the tailstock centre is in line with that of the headstock.

The **carriage** is a flat-shaped casting, machined on its base to fit the guides or ways of the bed so that it can slide along. The top of the carriage is machined to form a surface for the cross-slide. To the front part of the carriage is attached the **apron**, which contains the mechanisms for moving the saddle and cross-slide. The combined carriage and apron is often called the **saddle**. It is moved along the bed by rotating the hand wheel. It can also be moved by using an automatic drive.

The **cross-slide** is the part fixed to the top of the carriage, which moves at right angles to the bed. It is operated by a left-hand screw and nut. It is moved by the hand wheel or by an automatic drive. It is normally used for feeding and facing. The **compound (top) slide** is fixed on top of the cross-slide, and can be turned (set) to any desired angle. This allows the tool to be moved in directions other than those permitted by the carriage and cross-slide movements. The compound slide is useful for turning and boring short tapers and chamfers.

The **leadscrew** is the top shaft running lengthwise at the front of the lathe bed. It has a square thread, and is used for causing automatic lengthwise travel of the tool when screw cutting. It gets its drive from the screw-cutting gearbox attached to the headstock. The **feed shaft** is the bottom shaft running lengthwise at the front of the lathe bed. When the automatic traverse lever is engaged and the feed shaft is rotating, the whole carriage slides or travels automatically along the bed. This method is often employed for general turning operations, particularly when a better finish is required.

The size or capacity of a lathe is determined by three principal factors:

1. The maximum diameter of work that can be turned. This depends upon the distance between the top face of the bed and the spindle centres. This distance is known as **swing**.
2. The maximum length of work that can be accommodated between centres.
3. The maximum swing in the gap, if the lathe has a gap-bed.

Lathe accessories

The lathe is designed to permit many operations to be carried out on it. To help certain operations, the lathe is often supplied with additional fixtures, such as a steady, catch plate, dog, face plate and centres.

A **steady** is a fixture that is used on the lathe to support long bars, to prevent deflection during cutting or turning operations. There are two kinds: the travelling steady and the fixed steady. The **travelling steady** (Figure 13.14(a)) is bolted to the lathe carriage and therefore travels with it, following the cutting tool. It has two pressure pads (fingers) made from bronze, which are positioned just behind the cutting tool. The

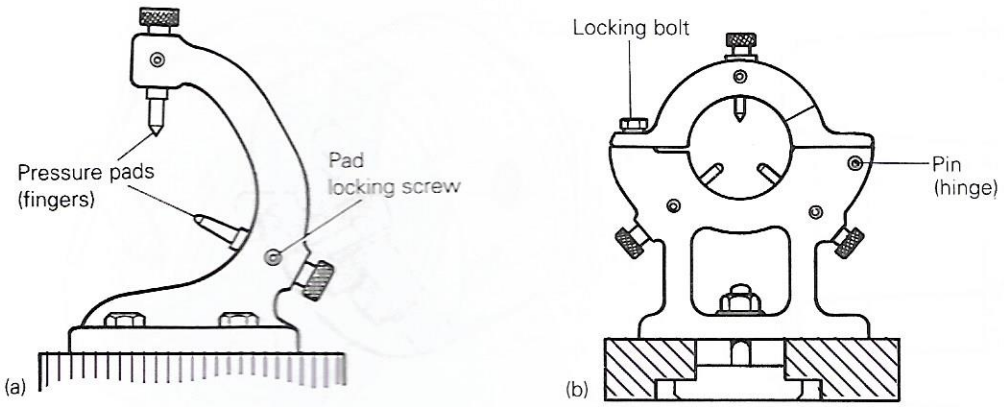

Figure 13.14 Lathe steadies: (a) travelling steady; (b) fixed steady.

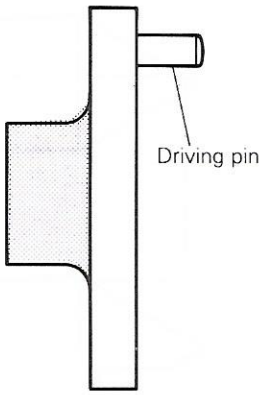

Figure 13.15 Catch plate.

Figure 13.16 Dog or carrier.

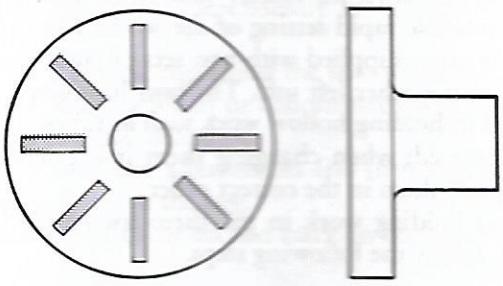

Figure 13.17 Face plate.

pads are held in position by locking screws. The **fixed steady** (Figure 13.14(b)) is bolted to the lathe bed and therefore remains fixed at one place (stationary) throughout the operation. It has three adjustable pressure pads, which enclose the work when adjusted to keep in contact. The pads are secured in position by locking screws. A fixed steady can be used to support the end of long work held in a chuck, or to support work held between centres provided the cutting tool movement is not obstructed.

A **catch plate**, sometimes called a driving plate, is an accessory used as a device when turning between centres (Figure 13.15). It is a circular plate with a threaded hole at the centre for screwing onto the lathe spindle nose. A driving pin is fixed near the extreme end of the face. As the catch plate rotates with the spindle, the driving pin runs against the lathe dog, which is bolted to the work and drives it together with the work.

The **lathe dog** (carrier) is a forged piece of metal with a hole across the larger portion through which the end of the work is fitted (Figure 13.16). At the larger end is a threaded hole, which accommodates the locking screw for holding the work down. The small end runs against the driving pin of the catch plate. Some dogs have a **hook** end that fits into a slot at the edge of the catch plate.

A **face plate** (Figure 13.17) is an accessory used for holding irregular work. It is circular in shape, with a threaded hole at the centre. It is identical to the catch plate except that it has a number of slots on the face. The slots are used to receive bolts used for securing the work placed on the face plate. It is screwed on the spindle nose of the lathe and therefore rotates with it.

A **lathe centre** is used as a support at the end of a work (Figure 13.18). It is usually made from carbon tool steel, and should be hardened and slightly tempered. It has a morse taper shank, which fits into the tapered hole in the tailstock sleeve and the tapered hole in the headstock spindle nose. The other end, on which the work fits, is conical and pointed to an angle of 60°. For heavy work, the angle may be 75° or 90°.

A centre that is fitted in the spindle nose and rotates with the spindle is called a **live centre**. The one fitted in

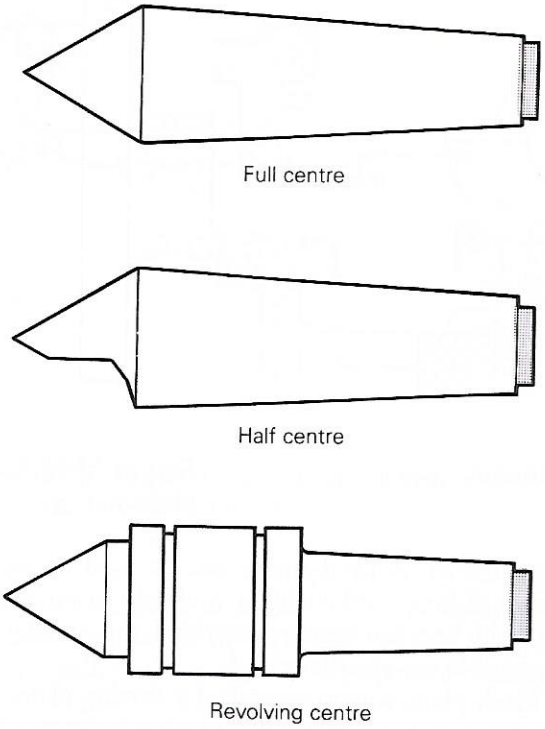

Figure 13.18 Lathe centres.

the tailstock, however, remains stationary while the work rotates on its point, and is called a **dead centre**. The type of centre that has a full point angle is known as a **full centre**. This type obstructs facing up to the end of the work. It also hampers turning to a small diameter, as the cutting tool touches the point when feeding close to the right hand end of the work place. A **half centre** is a centre that is cut away almost to its point. It is often used in the tailstock for facing up to or for turning close to the end of the work.

A **revolving centre** has a bearing incorporated between the point and the shank. This arrangement allows the point to rotate independently of the shank. It is often used in the tailstock. The main advantage of this type is that the point does not wear off easily: it rotates together with the work, eliminating friction generation between the centre of the work and the point.

Method of holding work on the centre lathe

We have said that the lathe is the most versatile of all the machine tools. This implies that you can use it to perform a wide variety of operations. It therefore needs various methods for holding the workpieces, as they may be of different shapes and sizes. The main methods of holding work on the lathe are: the three-jaw chuck; the four-jaw chuck; holding the work between centres; using a face-plate; using collets; and using a mandrel.

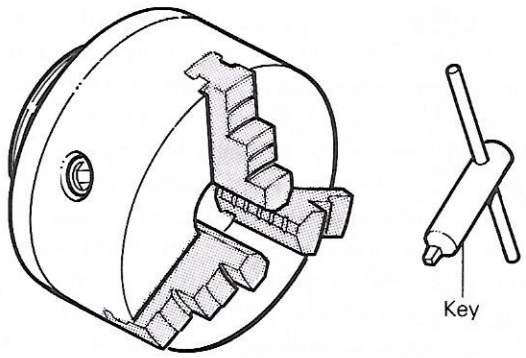

Figure 13.19 Three-jaw chuck.

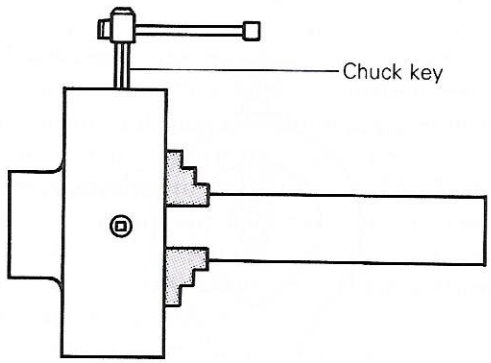

Figure 13.20 Work in three-jaw chuck.

Using the three-jaw chuck

The three-jaw chuck (Figure 13.19), sometimes called the **universal** or **self-centring chuck**, is a geared-scroll type of chuck. With this type, the jaws move in or out when the key is turned in any of the three sockets. This connects the jaws, no matter what their position, and makes possible rapid setting of the work. The three-jaw chuck is often supplied with two sets of jaws, one hardened and the other left soft. The jaws have steps, which are used in holding hollow work such as tubes. The jaws are numbered; when changing them it is essential that you replace them in the correct order.

When holding work in the three-jaw chuck (Figure 13.20), follow the following steps.

1. Insert the key in one of the sockets and turn it anticlockwise to open the jaws enough to receive the work.
2. Insert the work in the open jaws.
3. Grip the work tightly by turning the key clockwise.
4. Ensure firm gripping and remove the key from the socket immediately. This is important; otherwise the key may fly off and injure the operator when the machine is switched on.