Lecture # 5.6

Keys

Keys

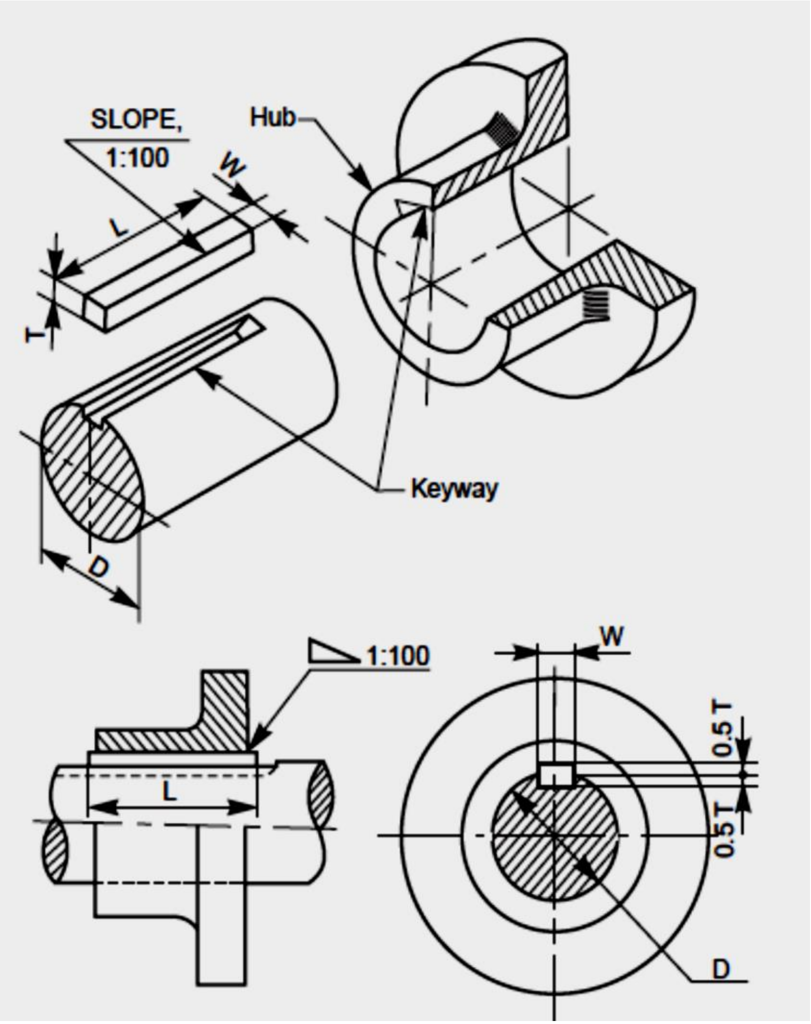
Keys, cotters and pin joints are some examples of removable (temporary) fasteners.

Assembly and removal of these joints are easy as they are simple in shape.

The standard proportions of these joints are given in the figures.

Keys are machine elements used to prevent relative rotational movement between a shaft and the parts mounted on it, such as pulleys, gears, wheels, couplings, etc.

Figure 1.1 shows the parts of a keyed joint and its assembly.



Keys

For making the joint, grooves or keyways are cut on the surface of the shaft and in the hub of the part to be mounted.

After positioning the part on the shaft such that, both the keyways are properly aligned, the key is driven from the end, resulting in a firm joint.

For mounting a part at any intermediate location on the shaft, first the key is firmly placed in the keyway of the shaft and then the part to be mounted is slid from one end of the shaft, till it is fully engaged with the key.

Keys

Keys are classified into three types, viz., saddle keys, sunk keys and round keys.

Saddle Keys:

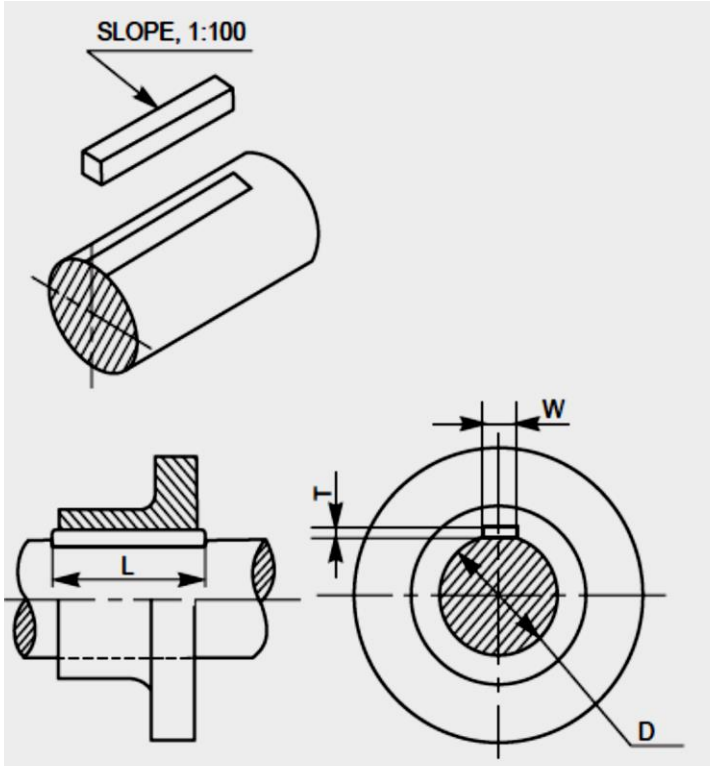
These are taper keys, with uniform width but tapering in thickness on the upper side.

The magnitude of the taper provided is 1:100. These are made in two forms: hollow and flat.

A hollow saddle key has a concave shaped bottom to suit the curved surface of the shaft, on which it is used.

A keyway is made in the hub of the mounting, with a tapered bottom surface.

When a hollow saddle key is fitted in position, the relative rotation between the shaft and the mounting is prevented due to the friction between the shaft and key (Fig. 1.2).



Keys

Flat Saddle Key:

It is similar to the hollow saddle key, except that the bottom surface of it is flat.

Apart from the tapered keyway in the hub of the mounting, a flat surface provided on the shaft is used to fit this key in position (Fig. 1.3).

The two types of saddle keys discussed above are suitable for light duty only.

However, the flat one is slightly superior compared to the hollow type.

Saddle keys are liable to slip around the shaft when used under heavy loads.

Keys

Sunk Keys:

These are the standard forms of keys used in practice, and may be either square or rectangular in cross-section.

The end may be squared or rounded.

Generally, half the thickness of the key fits into the shaft keyway and the remaining half in the hub keyway.

These keys are used for heavy duty, as the fit between the key and the shaft is positive.

Sunk keys may be classified as:

(i) taper keys,

(ii) parallel or feather keys and

(iii) woodruff keys.

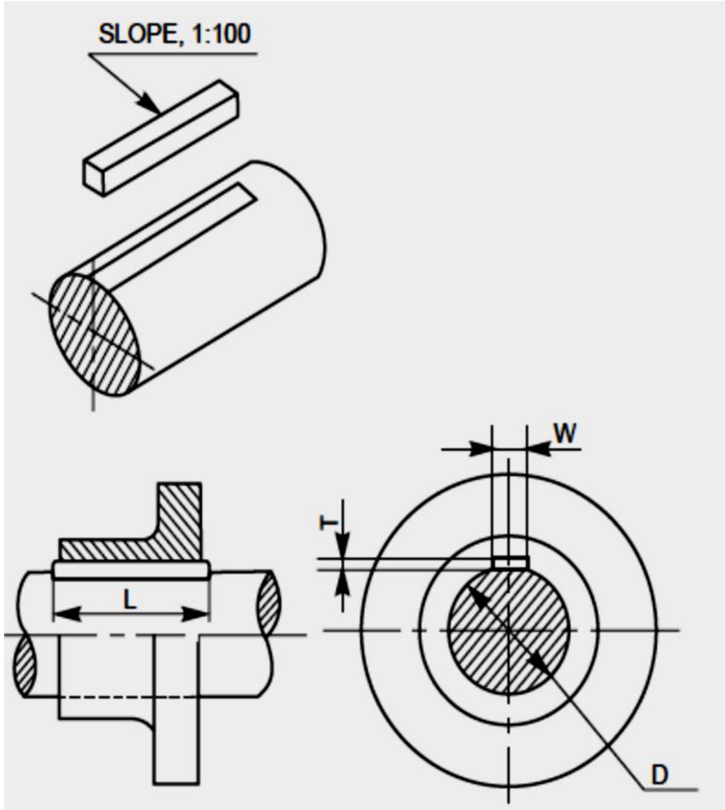
Keys

Taper Sunk Keys:

These keys are square or rectangular in cross-section, uniform in width but tapered in thickness.

The bottom surface of the key is straight and the top surface is tapered, the magnitude of the taper being 1:100.

Hence, the keyway in the shaft is parallel to the axis and the hub keyway is tapered (Fig. 1.1).



Keys

A tapered sunk key may be removed by driving it out from the exposed small end.

If this end is not accessible, the bigger end of the key is provided with a head called gib.

Figure 1.4 shows the application of a key with a gib head. Following are the proportions for a gib head:

If D is the diameter of the shaft, then,

Width of key, W = 0.25 D + 2 mm

Thickness of key, T = 0.67 W (at the thicker end)

Standard taper = 1:100

Height of head, H = 1.75 T

Width of head, B = 1.5 T

Keys

Shaft diameter (mm)		*Width, W (mm)*	*Thickness, T (average value) (mm)*
Over	*Upto and including*		
6	8	2	2
8	10	3	3
10	12	4	4
12	17	5	5
17	22	6	6
22	30	8	7
30	38	10	8
38	44	12	8
44	50	14	9
50	58	16	10
58	65	18	11
65	75	20	12
75	85	22	14
85	95	25	14
95	110	28	16

Keys

A parallel or feather key is a sunk key, uniform in width and thickness as well.

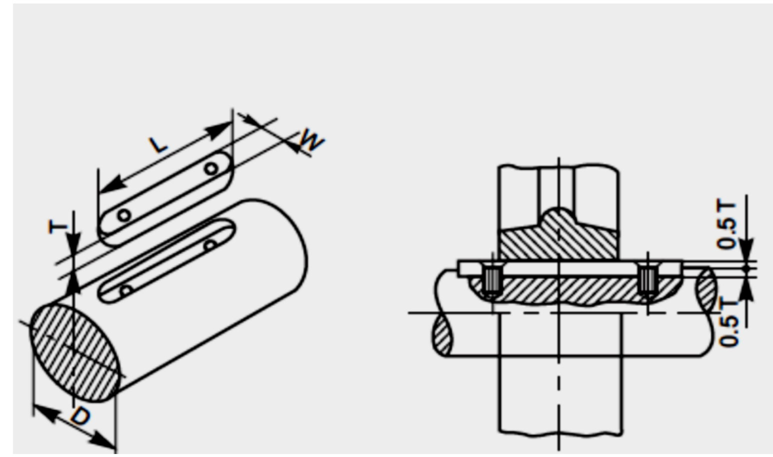
These keys are used when the parts (gears, clutches, etc.) mounted are required to slide along the shaft; permitting relative axial movement.

To achieve this, a clearance fit must exist between the key and the keyway in which it slides.

The feather key may be fitted into the keyway provided on the shaft by two or more screws (Fig. 1.5) or into the hub of the mounting (Fig. 1.6).

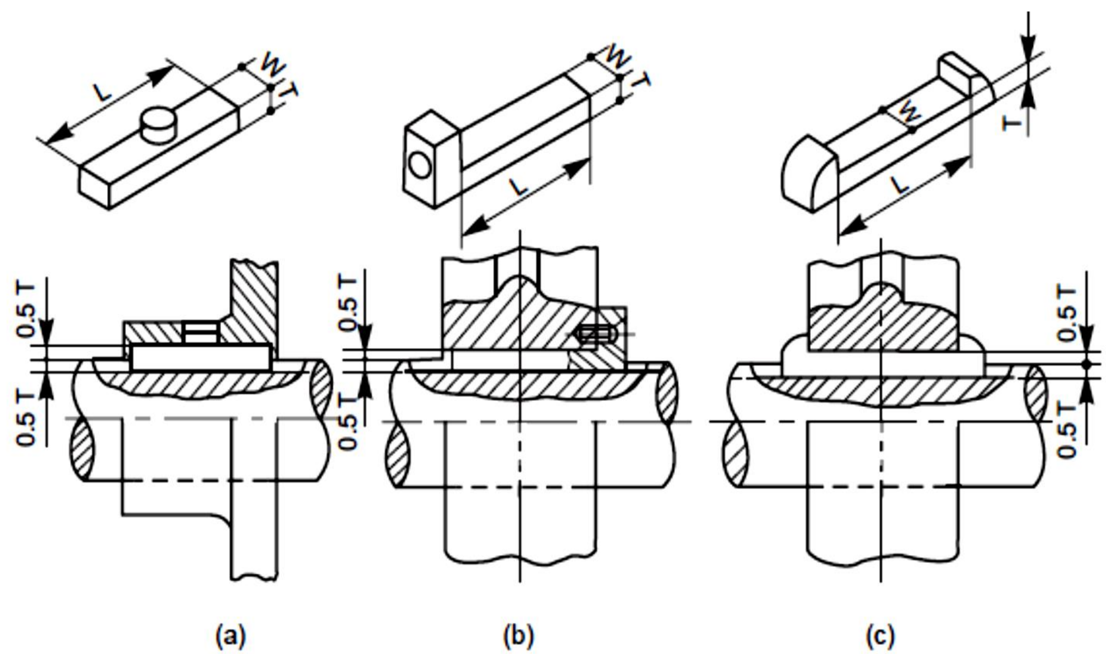
As seen from Fig. 6.6, these keys are of three types: (*i*) peg feather key, (*ii*) single headed feather key and (*iii*) double headed feather key.

Keys



Peg Feather:

In this key, a projection known as peg is provided at the middle of the key. The peg fits into a hole in the hub of the sliding member (Fig. 1.6 *a*). Once placed in a position, the key and the mounting move axially as one unit.



Keys

Single Headed Feather Key: In this, the key is provided with a head at one end.

The head is screwed to the hub of the part mounted on the shaft (Fig. 1.6 *b*).

Gib Head Key:

In this, the key is provided with heads on both ends.

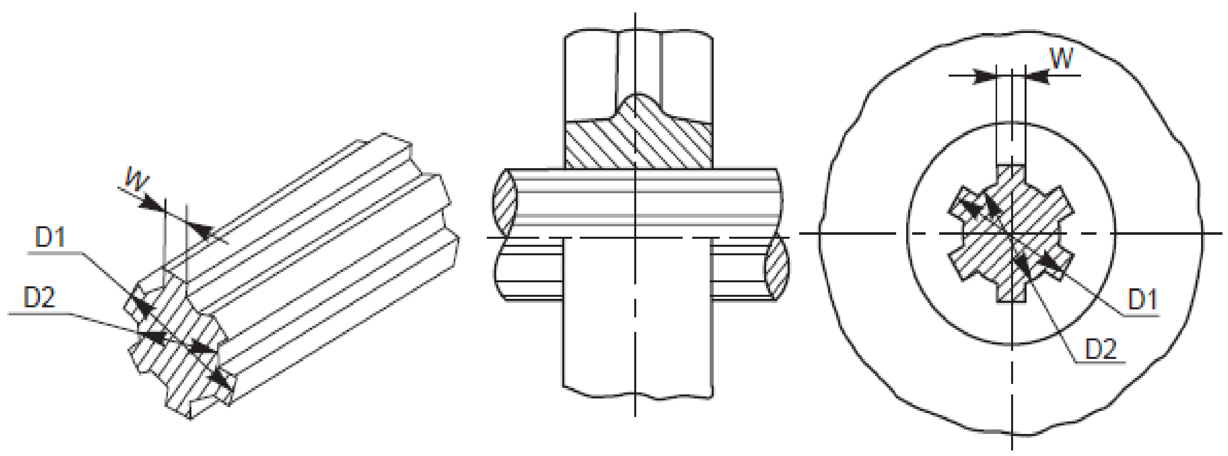
These heads prevent the axial movement of the key in the hub. Here too, once placed in position, the key and the mounting move as one unit (Fig. 1.6 *c*).

Keys

Splines are keys made integral with the shaft, by cutting equi-spaced grooves of uniform cross section.

The shaft with splines is called a splined shaft.

The splines on the shaft, fit into the corresponding recesses in the hub of the mounting, with a sliding fit, providing a positive drive and at the same time permitting the latter to move axially along the shaft (Fig. 1.7).

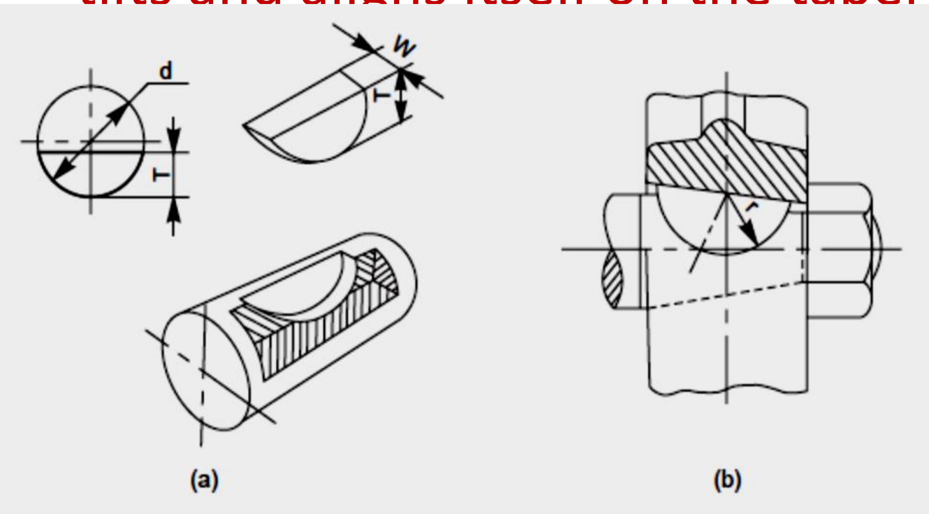


Keys

Woodruff Keys:

It is a sunk key, in the form of a segment of a circular disc of uniform thickness (Fig. 1.8 *a*).

As the bottom surface of the key is circular, the keyway in the shaft is in the form of a circular recess to the same curvature as the key. A keyway is made in the hub of the mounting, in the usual manner. Woodruff key is mainly used on tapered shafts of machine tools and automobiles. Once placed in position, the key tilts and aligns itself on the tapered shaft (Fig. 1.8 *b*).



The following are the proportions of woodruff keys:

If D is the diameter of the shaft,

Thickness of key, W = 0.25 D

Diameter of key, *d* = 3 W

Height of key, T = 1.35 W

Depth of the keyway in the hub, T1 = 0.5 W + 0.1 mm

Depth of keyway in shaft, T2 = 0.85 W

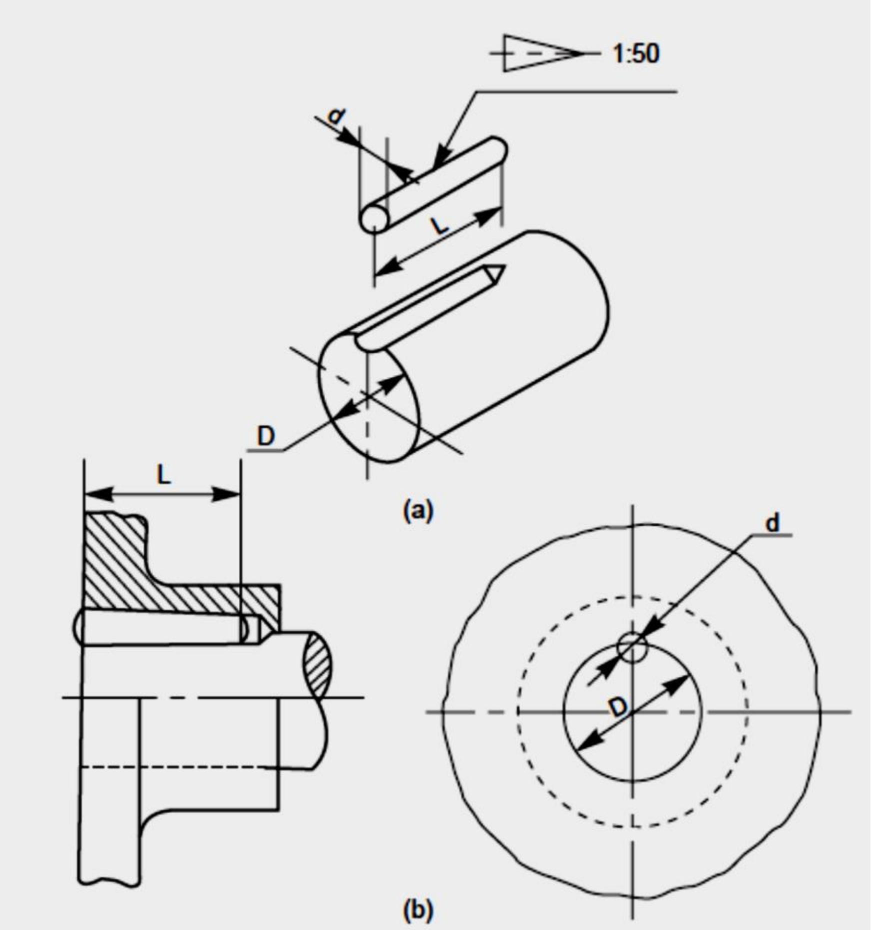
Keys

Round keys are of circular cross-section, usually tapered (1:50) along the length.

A round key fits in the hole drilled partly in the shaft and partly in the hub (Fig. 1.9).

The mean diameter of the pin may be taken as 0.25 D, where D is shaft diameter.

Round keys are generally used for light duty, where the loads are not considerable.



Keys

Problem:

Find the dimensions of suitable key for a steel shaft 90 mm diameter to transmit 120 H. P. at 300 rpm with mild fluctuations.

Keys