

# PULLEY

## 1. Introduction

Power transmission between shafts is achieved either through gear or belt drives. In the latter case, pulleys are mounted on shafts, over which a belt runs, transmitting the power. Generally, pulleys are made of cast iron or wrought iron; but at times, from steel plates also, by welded construction. Depending upon the application, a pulley may be of a single piece or split type. The latter one is used, where a pulley has to be mounted at an intermediate location on a shaft.

Pulleys are mounted on shafts, by using sunk keys.

## 2. Belt Driven Pulleys

Flat and V-belts are used for power transmission between shafts. A flat belt operates on a pulley with a smooth surface; whereas pulleys with wedge shaped groove(s) is (are) used with V-belt(s).

### 2.1 Flat belt pulley

These pulleys are of different sizes and shapes, the designs of which are based on the functional requirements. A flat belt drive uses a flat belt of rectangular cross-section; the width of which is appreciably larger than the thickness. The belt operates on the surface of a pulley. The following are the main types of pulleys used with flat belts:

#### 2.1.1 Armed pulley

The main parts of a pulley are the hub or boss, rim and arms or spokes. Figure 1 shows an armed pulley with the proportions marked. It may be noted that the arms of a pulley are either straight or curved; the cross section being elliptical in shape. Rims of cast iron pulleys are often provided with slight convexity, known as crowning. This prevents the axial slipping of the belt during operation.

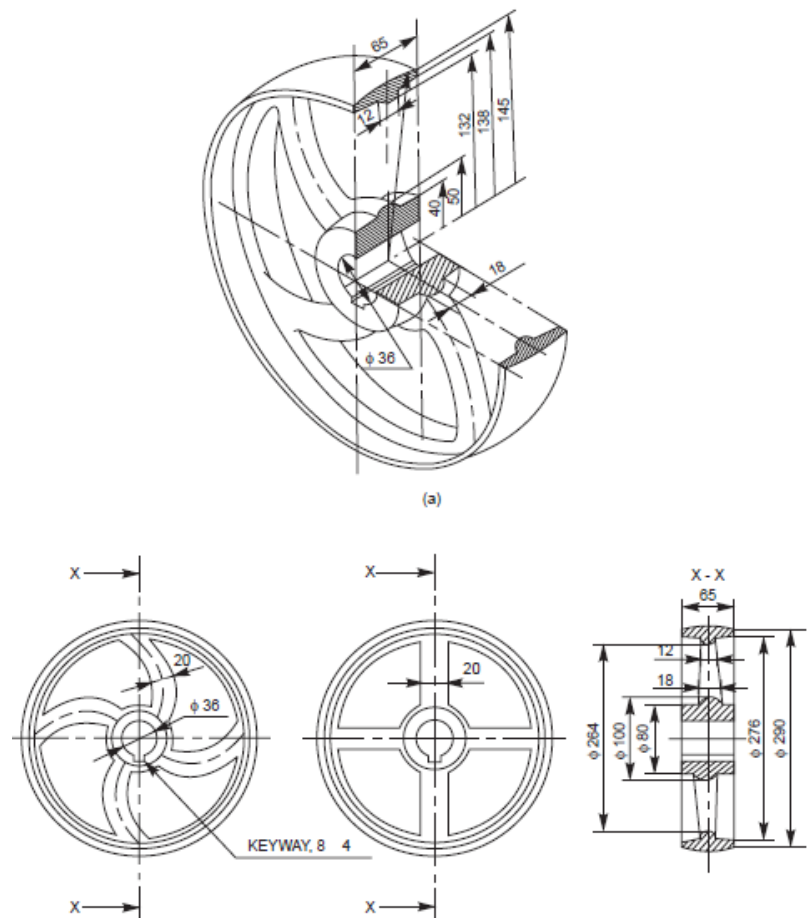


Fig. 1 Pulley with arms

### 2.1.2 Pulley with web

When the diameter of a pulley is relatively small, the hub and rim of the pulley are connected with a web, which is in the form of a disc. Figure .2 shows a pulley with a web. To make the pulley light in weigh t, holes may be provided in the web.

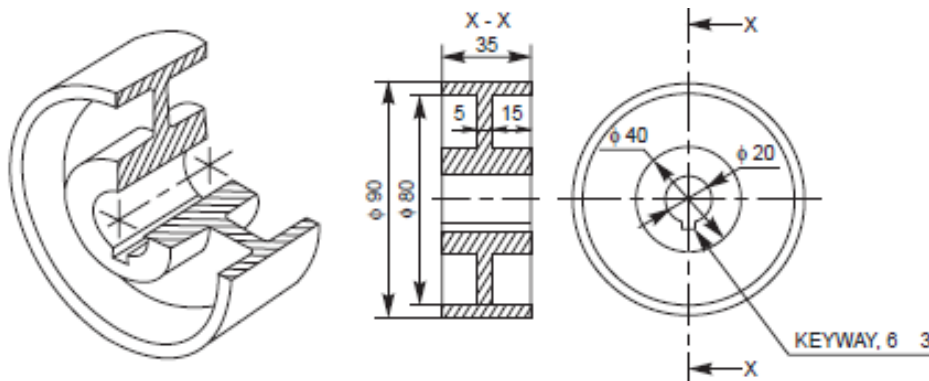


Fig. 2 Pulley with web

### 2.1.3 Cone Pulleys

Step cone pulleys are mounted on both the driver and driven shafts in opposite directions to provide different speed ratios between them for a constant speed of the driver shaft. The diameters of the steps in the two pulleys are such that the same belt can operate on any pair of steps. These pulleys are used in machine tools, such as lathe, drilling machine, etc. Figure 9.3 shows a step cone pulley with four steps.

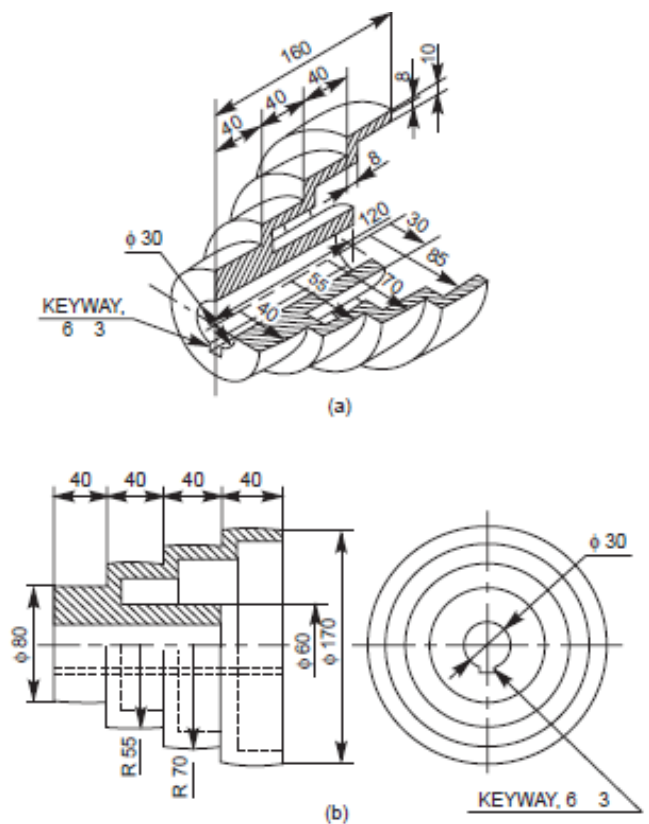


Fig. 3 Step cone pulley for flat belt drive

Flat belts are used when the center distance between the two shafts is more. However, V-belts are preferred when the shafts are located closer. The V-belt drive is relatively slip free. It is used for transmission ratios up to and above 15:1 without tension pulleys. The contact area between the belt and pulley can be increased and thus the power transmission can also be enhanced.

### 2.1.4 Fast and loose pulleys

When a number of machines are operated from a single power source, each machine is provided with a fast and loose pulley arrangement. With this arrangement, any machine may be started or stopped at will, while the lay shaft is running continuously.

Figure 4 shows the arrangement of a fast and loose pulley. In this, the fast pulley is mounted on the shaft with a keyed joint, whereas the loose pulley runs freely on the shaft. The diameter of the loose pulley is slightly less than that of the fast pulley so that when the belt is shifted on to the loose pulley, its tension is reduced. Power is transmitted only when the belt is on the fast pulley. Loose pulley takes care of the idling time of the machine and does not transmit any power.

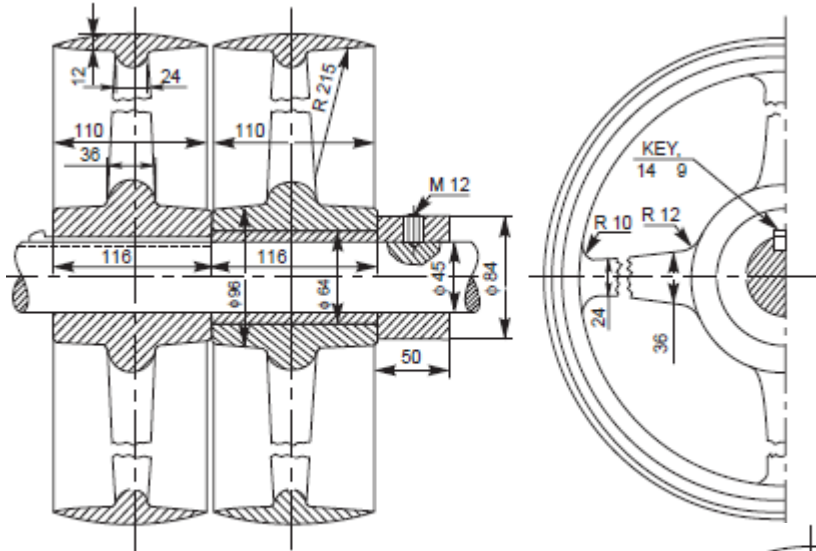


Fig. 4 Fast and loose pulleys

## 2.2 V-belt Pulleys

When a V-belt is used for power transmission, the pulley rim is modified by providing wedge shaped groove(s) so that the V-belt(s) can run in the groove(s).

Figure 5 (a) shows a V-belt pulley that operates with a single V-belt and Fig. 5 (b), pulley with three V-belts. In multiple V-belt drive; even if one belt fails, the remaining belts continue the drive until it is convenient to shut down the machine for repairs. This drive, on account of wedging effect of the belt in the groove, causes less pull on the shaft than flat belt of the same general characteristics.

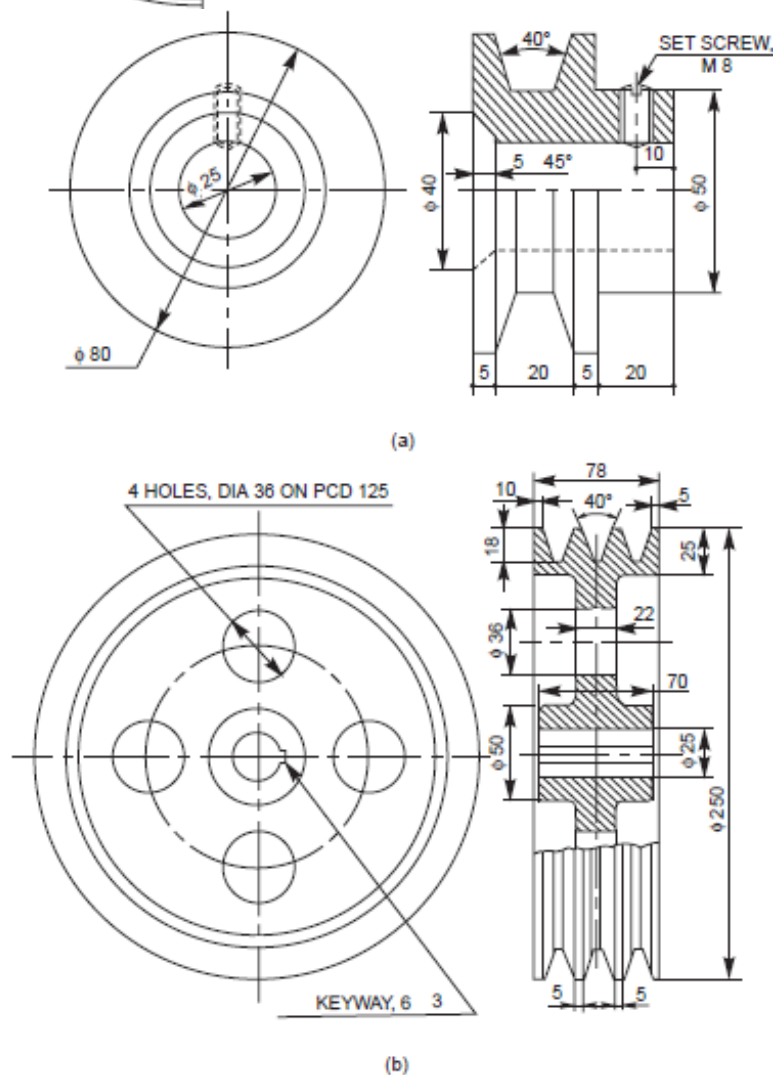
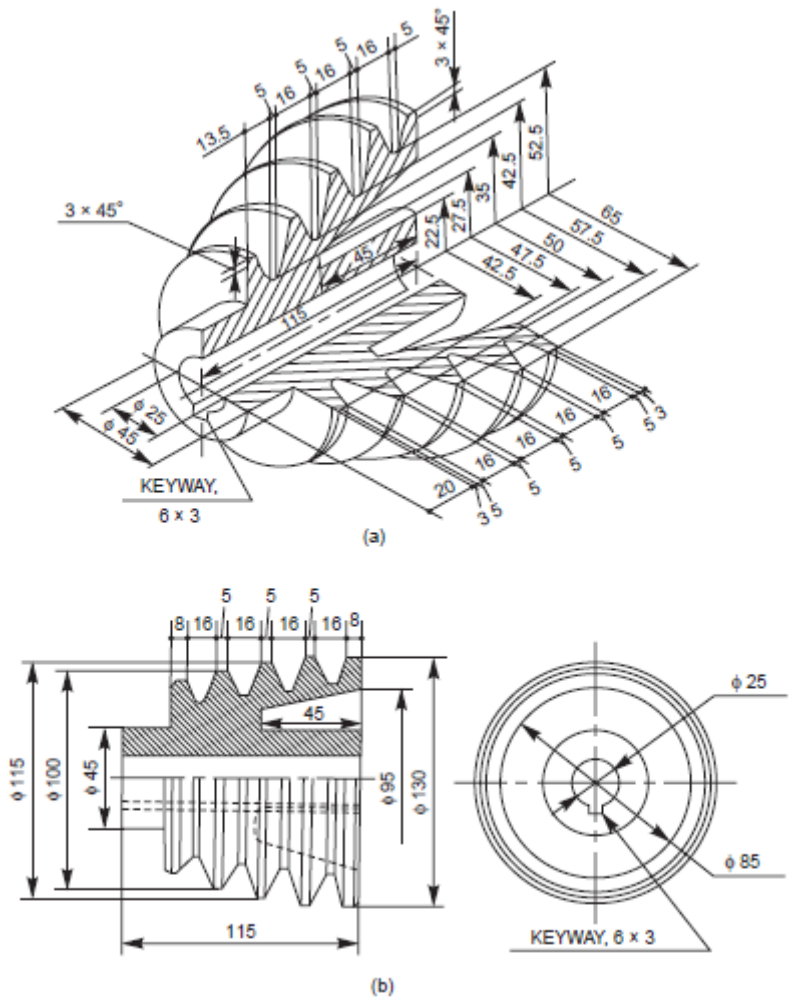


Fig. 5 V-belt pulleys

### 2.2.1 Step Cone Pulley ( for V-belt)

The principle and the purpose for which a step cone pulley for V-belt drive is used are the same as those associated with the step cone pulley for flat belt. Figure 9.6 shows a cone pulley for V-belt with four steps.



### 2.3 Rope Pulley

A rope drive is used for transmission of power over large distances. Ropes of cotton, manila or hemp, fitting into circumferential grooves on the pulleys are used for power transmission. The drive may use either a single or multiple ropes. A rope pulley is similar to V-belt pulley in construction, except for slight changes in the grooves as shown Fig. 7. This drive is preferred for transmission of power between shafts located at different elevations and at varying distances. Steel ropes are used for higher power transmission and in cases such as winch drives, rope ways, overhead cranes, etc.

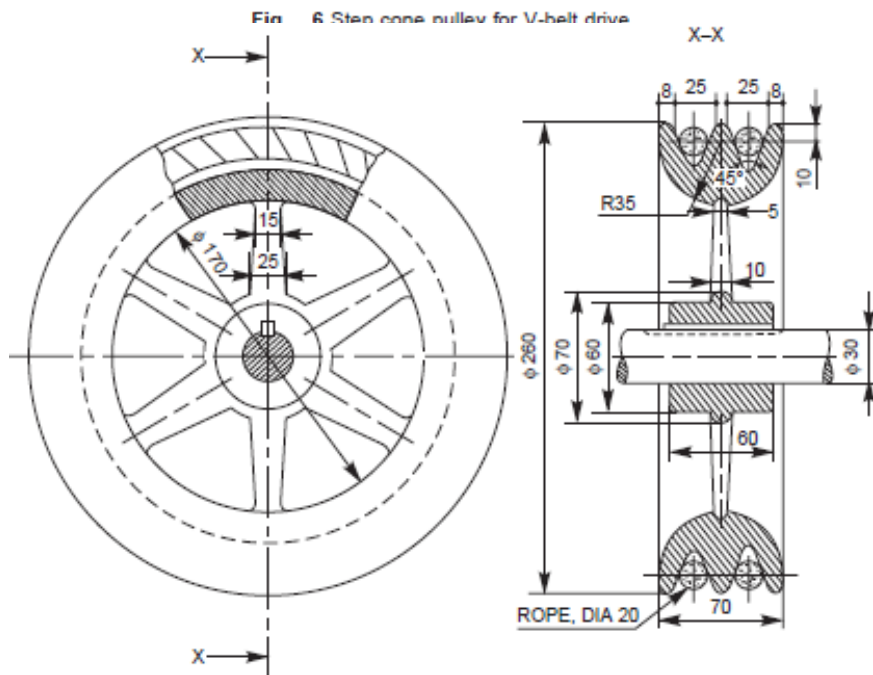


Fig. 7 Rope pulley

- 1 What is the use of a pulley?
- 2 How are pulleys mounted on shafts?
- 3 Name different types of pulleys?
- 4 What is “crowning” and where and why it is applied?
- 5 When is a flat belt pulley recommended?
- 6 What are the various types of flat belt pulleys?
- 7 What is the difference between an armed pulley and a pulley with a web?
- 8 What is meant by fast and loose pulleys? Explain its working principle.
- 9 What is the difference between a flat belt and a V-belt?
- 10 What are the various types of V-belt pulleys?
- 11 Where and why a step cone pulley is used?
- 12 Where do you recommend a rope drive?
- 13 Differentiate between a V-belt drive and a rope drive.
- 14 What are the materials used for the ropes?

**15** Sketch the following types of flat belt pulleys, providing necessary views; with proportionate dimensions marked

(a) armed pulley,

(b) pulley with a web.,

The pulleys are to be mounted on a shaft of diameter 50mm.

**16** Sketch the necessary view of a step cone pulley with four steps, operating with (a) flat belts and (b) V-belts.

Assume that the pulleys are to be mounted on shafts of diameter 50 mm.

**17** Sketch (a) sectional view from the front and (b) view from the side of a fast and loose pulleys.

Assume that the unit is to be mounted on a shaft of diameter 50 mm.

**18** Giving proportionate dimensions; sketch the necessary views of a V-belt pulley that operates with three V-belts.

**19** Sketch (a) sectional view from the front and (b) view from the side of a rope pulley. The pulley is to be mounted on a shaft of diameter 50 mm.

**H.W ) Solve question 3 in the exercises of pulleys  
peg. 123 in your book**

Q ) after assemble parts below draw

1- Front view

2- Side sectional view

