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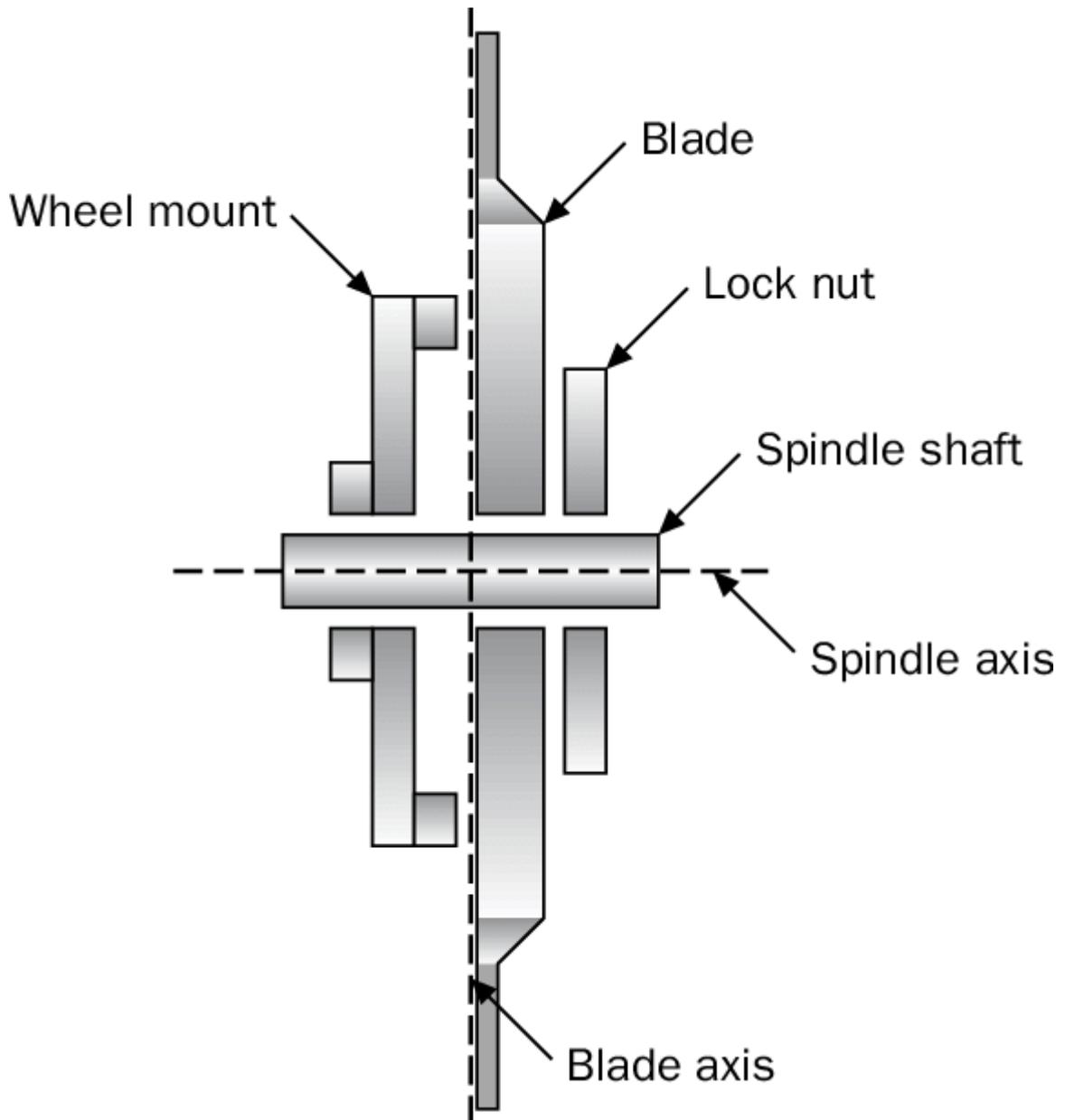
Department: Mechanical Engineering

Subject: ME-405 (Manufacturing Technology)

Unit: V, Topic: Sawing

## Sawing

Sawing is a process wherein a narrow slit is cut into the work piece by a tool consisting of a series of narrowly spaced teeth, called a **saw blade**. Sawing is used to separate work parts into two or more pieces, or to cut off an unwanted section of a part. Sawing machine, device for cutting up bars of material or for cutting out shapes in plates of raw material. The cutting tools of sawing machines may be thin metallic disks with teeth on their edges, thin metal blades or flexible bands with teeth on one edge, or thin grinding wheels.



## **Power Hacksaws:**

Hacksaws were originally and principally made for cutting metal, but can also cut various other materials, such as plastic and wood; for example, plumbers and electricians often cut plastic pipe and plastic conduit with them.

The Power Hacksaws are used to cut large sizes (sections) of metals such as steel. The heavy 'arm' moves backwards and forwards, cutting on the backwards stroke. The metal to be cut is held in a machine vice which is an integral part of the base. Therefore **power hacksaws** have been developed to carry out the difficult and time consuming work

## **POWER HACKSAW MACHINES:**

**DESCRIPTION:** All power hacksaw machines are basically similar in design. Figure shows a typical power hacksaw and identifies its main parts, which are discussed below.

**BASE:** The base of the saw usually contains a coolant reservoir and a pump for conveying the coolant to the work. The reservoir contains baffles which cause the chips to settle to the bottom of the tank. A table which supports the vice and the metal being sawed is located on top of the base and is usually referred to as part of the base.

**VICE:** The vice is adjustable so that various sizes and shapes of metal may be held. On some machines the vice may be swivelled so that stock may be sawed at an angle. The size of a power hacksaw is determined by the largest piece of metal that can be held in the vice and sawed.

**FRAME:** The frame of the saw supports and carries the hack saw blade. The machine is designed so that the saw blade contacts the work only on the cutting stroke. This action prevents unnecessary wear on the saw blade. The cutting stroke is on the draw or back stroke. Some machines feed by gravity, the saw frame having weights that can be shifted to give greater or less pressure on the blade. Other machines are power fed with the feed being adjustable. On these machines, the feed is usually stopped or reduced automatically when a hard spot is encountered in the material, thus allowing the blade to cut through the hard spot without breaking.

**SPEED-CHANGE MECHANISM:** The shift lever allows the number of strokes per minute to be changed so that a variety of metals may be sawed at the proper speeds. Some saws have a diagram showing the number of strokes per minute when the shift lever is in different positions; others are merely marked "F," "M," and "S"(fast, medium, and slow).

**ADJUSTABLE FEED CLUTCH:** The adjustable feed clutch is a ratchet-and-pawl mechanism that is coupled to the feed screw. The feed clutch may be set to a desired amount of feed in thousandths of an inch. Because of the ratchet-and-pawl action, the feed takes place at the beginning of the cutting stroke. The clutch acts as a safety device and permits slippage if too much feed pressure is put on the saw blade. It may also slip because of a dull blade or if too large a cut is attempted. This slippage helps prevent excessive blade breakage.

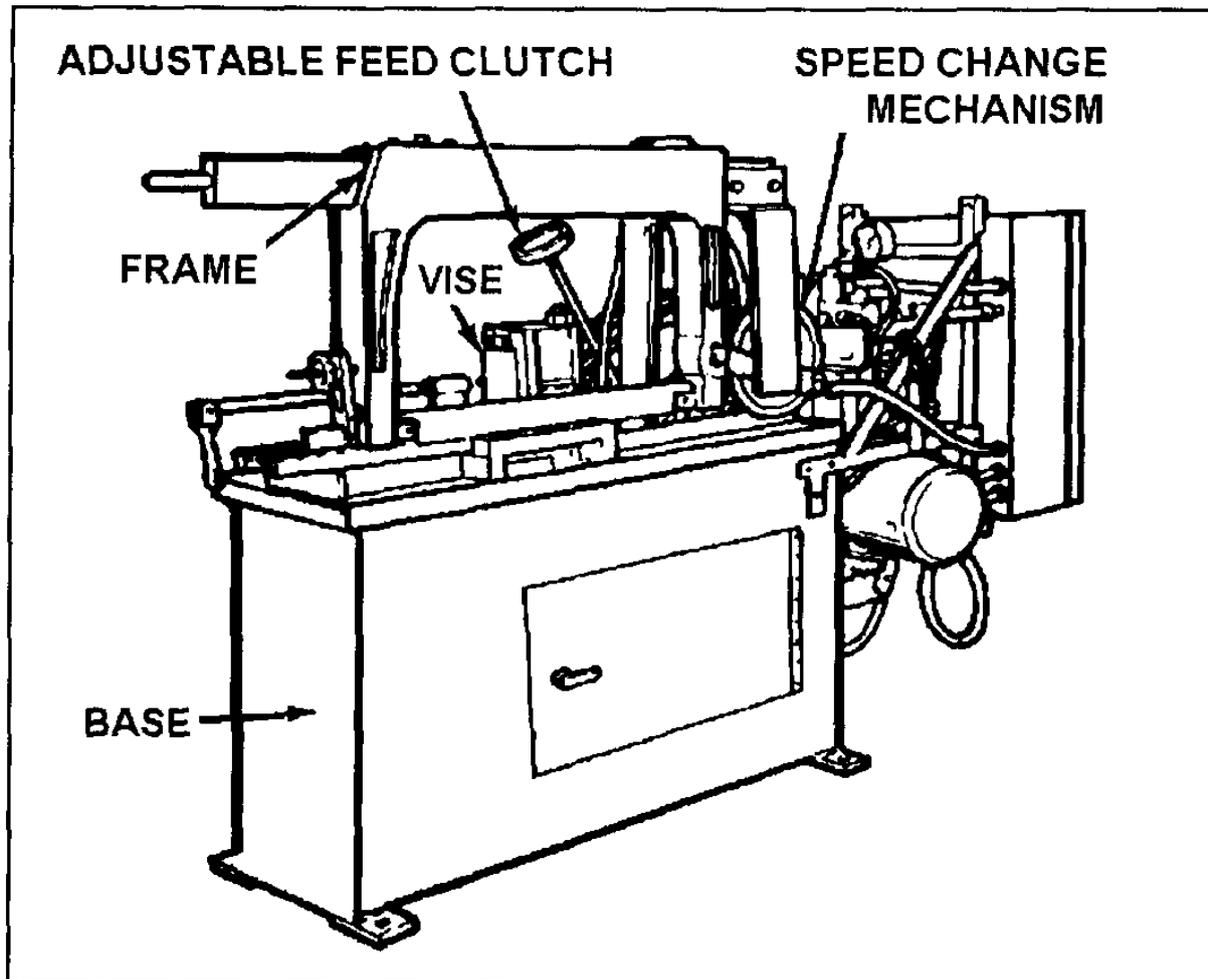


Figure 6-1. Power hacksaw.

### **BANDSAW MACHINES:**

Metal-cutting band saw machines fall into two basic categories: vertical machines and horizontal machines. Band saws use a continuous saw blade. Chip removal is rapid, because each tooth is a precision cutting tool and accuracy can be held to close tolerances eliminating or minimizing many secondary machining operations.

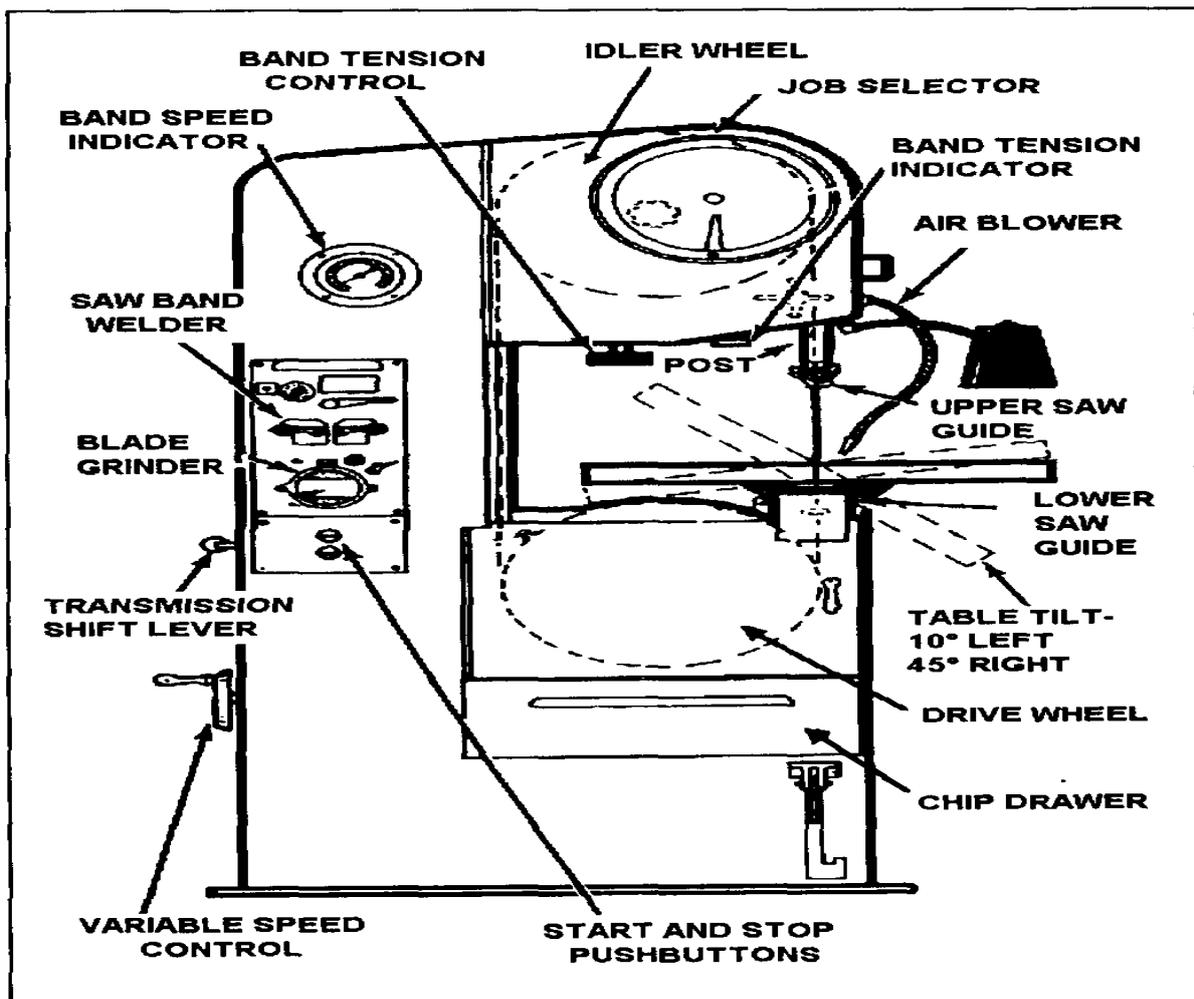
**VERTICAL BANDSAWING MACHINE:** The metal-cutting vertical band sawing machine, also called a contour machine, is made in a variety of sizes and models by several manufacturers. The size of a contour machine is determined by the throat depth, which is the distance from the saw band to the column. Figure shows a typical contour machine and identifies its main parts, which are discussed below.

1. The head is the large unit at the top of the contour machine that contains the saw band idler wheel, the drive motor switch, the tension adjustment hand wheel and mechanism, a flexible air line (directs a jet of air at the work to keep layout lines free from chips), and the adjustable post which supports the upper saw guide. The job selector dial is also located on the head.

2. The column contains the speed indicator dial, which is driven by a cable from the transmission and indicates the speed in feet per minute (FPM). The butt welder is also mounted on the column.

3. The base contains the saw band drive wheel, the motor, and the transmission. The transmission has two speed ranges. The low range gives speeds from 50 FPM to 375 FPM. The high range gives speeds from 260 FPM to 1,500 FPM. A shift lever on the back of the base can be placed in the high, low, or neutral position. Low is recommended for all speeds under 275 FPM. The base also supports the table and contains the lower saw band guide, which is mounted immediately under the table slot. The power feed mechanism is located within the base, and the feed adjustment handle and foot pedal are located on the front of the base.

**VARIABLE SPEED UNIT:** The variable speed unit is located within the base of the machine. This unit consists of two V-type pulleys which are mounted on a common bearing tube. A belt on one pulley is driven by the transmission, while the belt on the other pulley drives the saw band drive wheel. The two outside cones of the pulleys are fixed, but the middle cone is shifted when the speed change wheel is turned. A shift in the middle cone causes the diameter of one pulley to increase and the diameter of the other pulley to decrease. This slowly changes the ratio between the two pulleys and permits a gradual increase or decrease in the speed of the machine.



**Vertical Band Sawing Machine**

**HORIZONTAL BANDSAW MACHINE:** The horizontal band sawing machine does the same job as the power hacksaw but does it more efficiently. The blade of the band saw is actually a continuous band which revolves around a drive wheel and idler wheel in the band support frame. Two band guides use rollers to twist the band so that the teeth are in the proper cutting position. The guides are adjustable and should be adjusted so that they are just slightly further apart than the width of the material to be cut. This will give maximum support to the saw band and help assure a straight cut.

The vice on the horizontal band saw is much like the one on the power hacksaw. However, the horizontal band saw has a much greater capacity for large stock than does the power hacksaw. The stationary jaw can be set at several angles. The movable jaw adjusts automatically to whatever position the stationary jaw is in when the vice hand wheel is tightened.

The horizontal band saw is operated hydraulically by controls on a control box, which is located on the front side of the machine. A motor and pump assembly supplies hydraulic fluid from a reservoir in the base to a cylinder, which raises and lowers the support arm and also controls the feed pressure and band tension. A speed and feed chart is sometimes provided on the machine, but when it is not, consult the operator's manual for the proper settings for sawing.

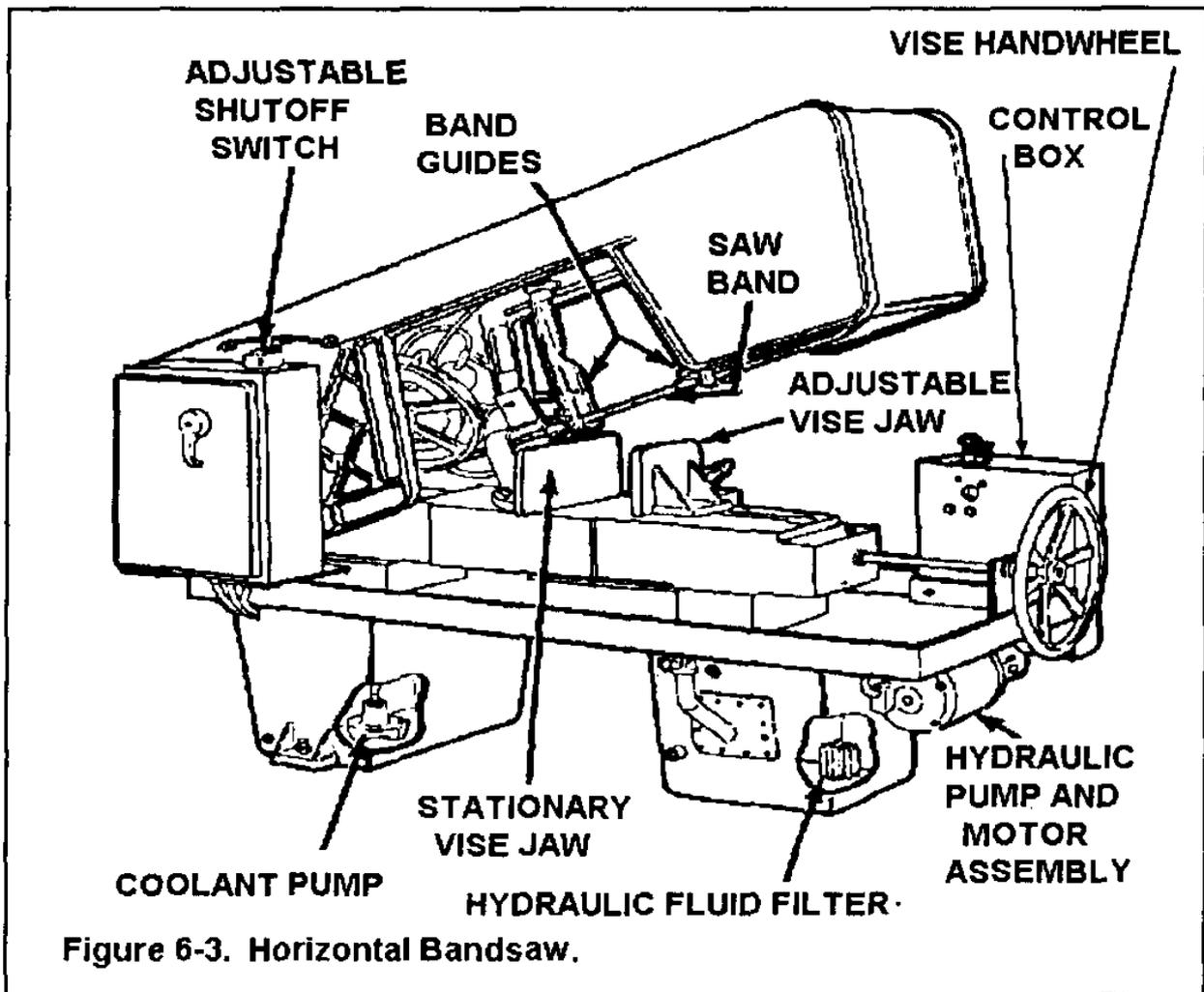


Figure 6-3. Horizontal Bandsaw.

## SAFETY PRECAUTIONS:

Sawing machines have some special safety precautions that must be observed. These are in addition to those safety precautions which are generally considered. Here are some safety precautions that must be followed:

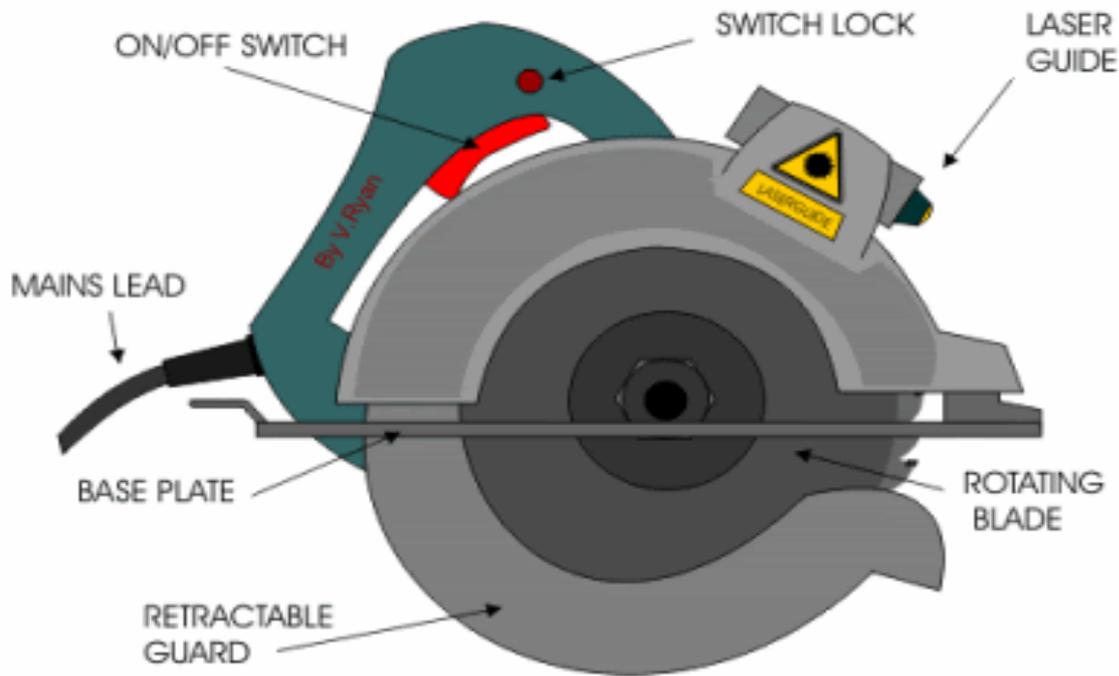
1. Keep hands away from the saw blade of hack sawing machine or Band sawing machine when in operation.
2. Ensure the power supply is disconnected prior to removal or installation of saw blades.
3. Use a miter guide of attachment, work holding jaw device, or a wooden block for pushing metal work pieces into the blade of band saw wherever possible. Keep fingers well clear of the blade at all times.
4. When removing and installing band saw blades, handle the blades carefully. A large springy blade can be dangerous if the operator does not exercise caution.

**CIRCULAR SAW:** A circular saw is a power-saw using a toothed or abrasive disc or blade to cut different materials using a rotary motion spinning around an arbor. A hole saw and ring saw also use a rotary motion but are different from a circular saw. *Circular saws* may also be loosely used for the blade itself. Circular saws were invented in the late 18th century and were in common use in saw mills in the United States by the middle of the 19th century. A circular saw is a tool for cutting many materials such as wood, masonry, plastic, or metal and may be hand-held or mounted to a machine. In wood working the term "circular saw" refers specifically to the hand-held type and the table saw and chop saw are other common forms of circular saws. "Skilsaw" and "Skil saw" have become generic trade marks for conventional hand-held circular saws. Circular saw blades are specially designed for each particular material they are intended to cut and in cutting wood are specifically designed for making rip-cuts, cross-cuts, or a combination of both. Circular saws are commonly powered by electricity, but may be powered by a gasoline engine or a hydraulic motor which allows it to be fastened to heavy equipment, eliminating the need for a separate energy source.

**Hand-held circular saws for wood:** In woodworking the term circular saw is most commonly used to refer to a hand-held, electric circular saw designed for cutting wood, but may be used for cutting other materials with different blades. Circular saws can be either left or right-handed, depending on the side of the blade where the motor sits. A left-handed saw is typically easier to use if held in the right hand, and contrariwise for the right-handed saw, because the user does not need to lean across the saw to see the cutting line.

Blades for cutting wood are almost universally tungsten carbide tipped (TCT), but high-speed steel (HSS) blades are also available. The saw base can be adjusted for depth of cut and can tilt up to 45° and sometimes 50° in relation to the blade. Adjusting the depth of cut helps minimize kickback. Different diameter blades are matched to each saw and are available ranging from 14 centimetres (5.5 in) to 61 centimetres (24 in).

The saw can be designed for the blade to mount directly to the motor's driveshaft known colloquially as a sidewinder, or be driven indirectly by a perpendicularly mounted motor via worm gears, garnering considerably higher torque called a worm-drive saw.



### Hand-held circular saws

**Cold saw for metal:** Cold saw machines are circular saws that are used in many metal cutting operations. The saw blades used are quite large in diameter and operate at low rotational speeds, and linear feeds. There are three common types of blades used in circular saws; solid-tooth, segmental tooth, and the carbide inserted-tooth. The circular saw is typically fed into the work piece horizontally, and as the saw advances into the material, it severs the material by producing narrow slots. The material is usually held in place during the cutting operation by means of a vise. The chips produced by cutting are carried away from the material by both the teeth of the blade as well as the coolant or other cutting fluid used.



**Circular cold saw blade for metal**



**Circular cold sawing machine**