

Modern Carpentry



Skilled carpenter laying out cut on finish stair tread. Note appropriate clothing worn which includes overalls, heavy work shirt with snug fitting cuffs, work shoes, hard hat, and safety glasses. The Occupational Safety and Health Administration (OSHA) specifies the wearing of approved hard hats on all construction sites. In addition to personal protective equipment, the law covers a wide range of standards to insure a safe and healthful environment in all branches of business and industry. (Stanley Tools)

GENERAL SAFETY RULES

Good carpenters recognize that safety is an important part of the job. They know that accidents are prevalent in building construction and that they often result in partial or total disability. Even minor cuts and bruises can be painful.

Safety is based on knowledge, skill, and an attitude of care and concern. Carpenters should know correct and proper procedures for performing the work. They should also be familiar with the potential hazards— how they can be minimized or eliminated.

Good attitudes toward safety are important. This includes belief in the importance of safety and willingness to give time and effort to a continuous study of the safest ways to perform work.

It means working carefully and following the rules.

CLOTHING

Wear clothing appropriate for the work and weather conditions. **Trousers or overalls should fit properly and have legs without cuffs.** Keep **shirts and jackets buttoned.** **Sleeves should also be buttoned or rolled up.** **Never wear loose or ragged clothing,** especially around moving machinery.

Shoes should be sturdy with thick soles that will protect feet from protruding nails. Tennis or lightweight canvas shoes are not satisfactory. **Never wear shoes with leather soles.** They will not provide satisfactory traction on smooth wood surfaces, roofs in particular.

Construction work will require a **hard hat (hat that will help prevent head injury from falling objects).** Headgear should provide the necessary protection, be comfortable, permit **good visibility, and shade your eyes.** All clothing should be maintained in a satisfactory state of repair and not be permitted to become badly soiled.

PERSONAL PROTECTIVE EQUIPMENT

Safety glasses should be worn whenever the work involves even the slightest hazard to your eyes. Standard specifications state that a safety lens must withstand the blow of a 1 /8 in. steel ball dropped from a height of 50 in.

Safety boots and shoes are required on heavy construction jobs. They consist of special reinforced toes that will **withstand**

a load of 2500 lbs.

Hard hats should be worn whenever you are exposed to any possibility of falling objects. Standard specifications require that such hats withstand a certain degree of denting. They must be able to resist breaking when struck with an 80 lb. ball dropped from a 5 ft. height.

Wear gloves of an appropriate type when handling rough materials. Use a respirator when working in dusty areas, while installing insulation, or where finishing materials are being sprayed.

HAND TOOLS

Always select the correct type and size of tool for your work. Be sure it is sharp and properly adjusted. Guard against using any tool if the handle is loose or in poor condition. **Dull tools** are hazardous to use because force must be applied to make them cut. Oil or dirt on a tool may cause it to slip and cause an injury.

When using tools, hold them correctly. Most edge tools should be held in both hands with the cutting action away from yourself. Be careful when using your hand or fingers as a guide to start a cut.

Handle and carry tools with care. Keep edged and pointed tools turned downward. Carry only a few tools at one time unless they are mounted in a special holder. **Do not carry sharp tools in pockets of your clothing. When not in use, tools should be kept in special boxes,** chests, or cabinets.

POWER TOOLS

Before operating any power tool or machine you must be thoroughly familiar with the way it works and the correct procedures to follow. In general, when you learn to use equipment the correct way, you also learn to use it the safe way.

There are a number of general safety rules that apply to power equipment. In addition, special safety rules must be observed in the operation of each individual tool or machine. Those that apply directly to the power tools commonly used for modern carpentry are listed in Unit 3. Study and follow them carefully.

GOOD HOUSEKEEPING

This refers to the neatness and good order of the construction site. Maintaining a clean site contributes to the efficiency of the worker and is an important factor in the prevention of accidents.

Place building materials and supplies in neat piles. Locate them to allow adequate aisles and

walkways. Rubbish and scrap should be placed in containers until disposal can be made. Do not permit blocks of wood, nails, bolts, empty cans, or pieces of wire to accumulate. They interfere with your work and constitute a tripping hazard.

Keep tools and equipment not being used in panels or chests. This will provide protection for the tools as well as the workers. In addition to improving efficiency and safety, good housekeeping helps maintain a better appearance at the construction project. This, in turn, will contribute to the morale of all workers.

DECKS AND FLOORS

To perform an operation safely, either with hand or power tools, the carpenter should stand on a firm, solid base. The surface should be smooth but not slippery. Do not attempt to work over rough piles of earth or on stacks of material that are unstable. Stay well away from floor openings, floor edges, and excavations as much as possible. Where this cannot be done, install adequate guardrails or barricades. In cold weather remove ice or cover it with sand or calcium chloride (salt).

EXCAVATIONS

Shoring and adequate bracing must be placed across the face of any excavation where the ground is cracked or caving is likely to occur. Inspect the excavation and shoring daily and especially after rains. Follow state and local regulations. Never climb into an open trench until proper reinforcement against cave-in has been installed or until the sides have been sloped to the "angle of repose" of the material being excavated.

Before beginning excavations determine whether there are underground utilities in the area. If so, locate and arrange protection for them during excavation operations.

Excavated soil and rock must be stored at least 2 ft. away from the edge of an excavation. Use ladders or steps to enter trenches which are more than 4 ft. deep.

SCAFFOLDS AND LADDERS

Scaffolds should have a minimum safety factor of four to one. This means that the scaffold will carry a load four times greater than the load it will probably be required to support. All scaffolding should be constructed under the direction of an experienced carpenter. Inspections should be made daily before use. Ladders should be checked at frequent and regular intervals. Their use should be limited to climbing from one level to another. Working while being supported on a ladder is hazardous and should be kept to a minimum. There are many safety rules that must be observed in the use of scaffolds and ladders. These are covered in Unit 24.

FALLING OBJECTS

When working on upper levels of a structure, you should be especially cautious in handling tools and materials so there is no chance of them falling on workers below. Do not place tools on the edge of scaffolds, stepladders, window sills, or on any other surface where they might be knocked off.

If long pieces of lumber must be placed temporarily on end and leaned against the side of the structure, be sure they will not fall sideways. When moving through a building under construction, be aware of overhead work, and, wherever possible, avoid passing directly underneath. Stay clear of materials being hoisted. Wear an approved hard hat whenever there is a possibility of falling objects.

LIFTING AND CARRYING

Injuries may be caused by improper lifting or carrying heavy objects. When lifting, stand close to the load, bend your knees, and grasp the object firmly. Then lift by straightening your legs and keeping your body as nearly vertical as possible. To lower the object, reverse the procedure.

When carrying a heavy load, do not turn or twist your body but make adjustments in position by shifting your feet. If the load is heavy or bulky, secure help from others. Never underestimate the weight to be moved or overestimate your own ability. Always secure assistance when carrying long pieces of lumber.

FIRE PROTECTION

Carpenters should have a good understanding of fire hazards. Know their causes and methods of control.

Class A fires result from burning wood and debris. Class B fires involve highly volatile materials such as gasoline, oil, paints, and oil soaked rags. Class C fires are caused by electrical wiring and equipment. Any of these fires can occur on a typical construction site.

Approved fire prevention practices should be followed throughout the construction project. Good housekeeping is an important aspect. Special precautions should be taken during the final stages of construction when heating and wiring are being installed and when highly flammable surface finishes are being applied. Always keep containers of volatile materials closed when not in use.

and dispose of oily rags and combustible materials promptly.

Fire extinguishers should be available on the construction site. Be sure to use the proper kind for each type of fire. Study and follow local regulations.

FIRST AID

A knowledge of first aid is important. You should understand approved procedures and be

able to exercise good judgment in applying them. Remember that an accident victim may receive additional injury from unskilled treatment by an unqualified person. Information of this nature can be secured from your local Red Cross.

As a preventative measure against infection, keep an approved first aid kit on the job site. Because of the nature of the material being handled and the dirty conditions of the work area, even superficial wounds should be treated promptly. Clean, sterilize, and bandage all cuts and nicks.



Safety tips for construction work. Left. When working with glass fibers, wear long sleeves, gloves, glasses, and a respirator. (Manville Building Materials Corp.) Center. Use extra care when handling large panels on windy days. Right. Ladders should extend above the roof edge at least 3 ft. See page 548. (Georgia-Pacific)



Portable power tools save time and energy in carpentry. They are used in nearly every stage of construction from rough framing to interior trim and cabinetwork. (Porter Cable Corp.)

Unit 3

POWER TOOLS

Modern power tools greatly reduce the time required to perform many of the operations in carpentry work. Heavy sawing, planing, and boring can be accomplished with far less human energy. Moreover, when proper tools are used in the correct way, high levels of accuracy can more easily be maintained.

There are two general types of power tools:

1. **Portable.**
2. **Stationary.**

Portable tools are light in weight, easily carried, and are held in the hands during operation. The tool is moved to the work. Portable tools are extensively used in nearly every stage of carpentry, especially rough framing.

Stationary tools (also called **machines**) **are mounted on benches or stands** which rest firmly on the floor. Work is brought to the machine.

Space permits only a brief description of the kinds of power tools most commonly associated with carpentry work. This should be supplemented with woodworking textbooks and reference books devoted to power tool operation. Manufacturer's bulletins and operator's manuals are also a good source of information.

POWER TOOL SAFETY

Safety must be practiced continually. Before operating any power tool, you must become thoroughly familiar with:

1. **The way it works.**
2. **The correct way to use it.**

You must be wide awake and alert. Never operate a power tool when tired or ill. Think through the operation before performing it. Know what you are going to do and what the tool will do. Make all adjustments before turning on the power. Be sure blades and cutters are sharp and are of the correct type for the work.

While operating a power tool, do not allow your-

self to be distracted. See Fig. 3-1 . Do not distract the attention of others while they are operating power tools. Keep all safety guards in position and wear safety glasses.

Feed the work carefully and only as fast as the tool will cut it easily. Overloading is hazardous to the operator and will likely damage the tool or work. When the operation is complete, turn off the power and wait until the moving parts have stopped before leaving the machine.

ELECTRICAL SAFETY

Always make sure that the source of electric power is the correct voltage and that the tool switch is in the "off" position before it is plugged into an electrical outlet.

Stationary power tools are factory equipped with magnetic starters. These are safety devices which will automatically turn the switch to the "off" position in case of power failure. This feature is important since personal injury or damage to the equipment could result if power is reestablished with the switch "on." Make sure these switches are in good working order.

The electrical cord and plug must be in good condition and must provide a ground for the tool. This means that extension cords should be the three-wire type. Make sure that the conducting wire is large enough to prevent excessive voltage drop.

Be careful in stringing electrical extension cords around the work site. Place them where they will not be damaged or interfere with other workers.

SHOCK PROTECTION

Electrical shock is one of the potential hazards of working with power tools. Always be sure that proper grounding is provided. Receptacles should be of the concealed contact type with a grounding terminal for continuous ground. Plugs and cords should be an approved type.



Fig. 3-1. When operating a power tool, give full attention to the work.

Portable power tools should be double insulated or otherwise grounded **to protect the worker from dangerous electrical shock.** Even though the circuit may be grounded, an operator of a portable power tool could be electrocuted should a bare conductor ground on a metal tool case. A ground fault circuit interrupter (GFCI) should be used on all construction job sites. These units can be installed in a circuit or can be plugged into an outlet which is grounded. These units "sense" when a short has occurred and will turn off power to the tool. See Fig. 3-2.

PORTABLE CIRCULAR SAWS

This power tool is also called an electric hand saw or builders' saw. Its size is determined by the

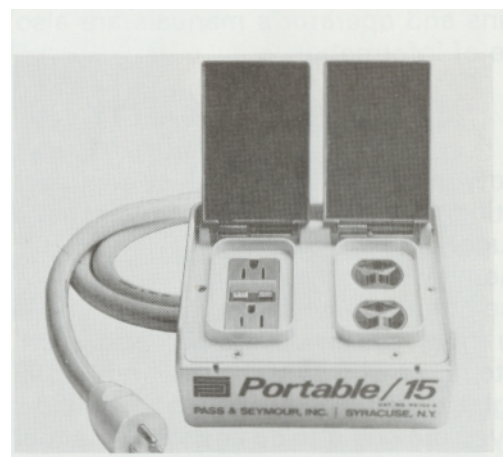


Fig. 3-2. Portable ground fault interrupter is used where permanent ground fault protection is not available. Power tools are simply plugged into the outlets. It will trip at around milliamperes turning off power to the grounded tool. (Pass & Seymour, Inc.)

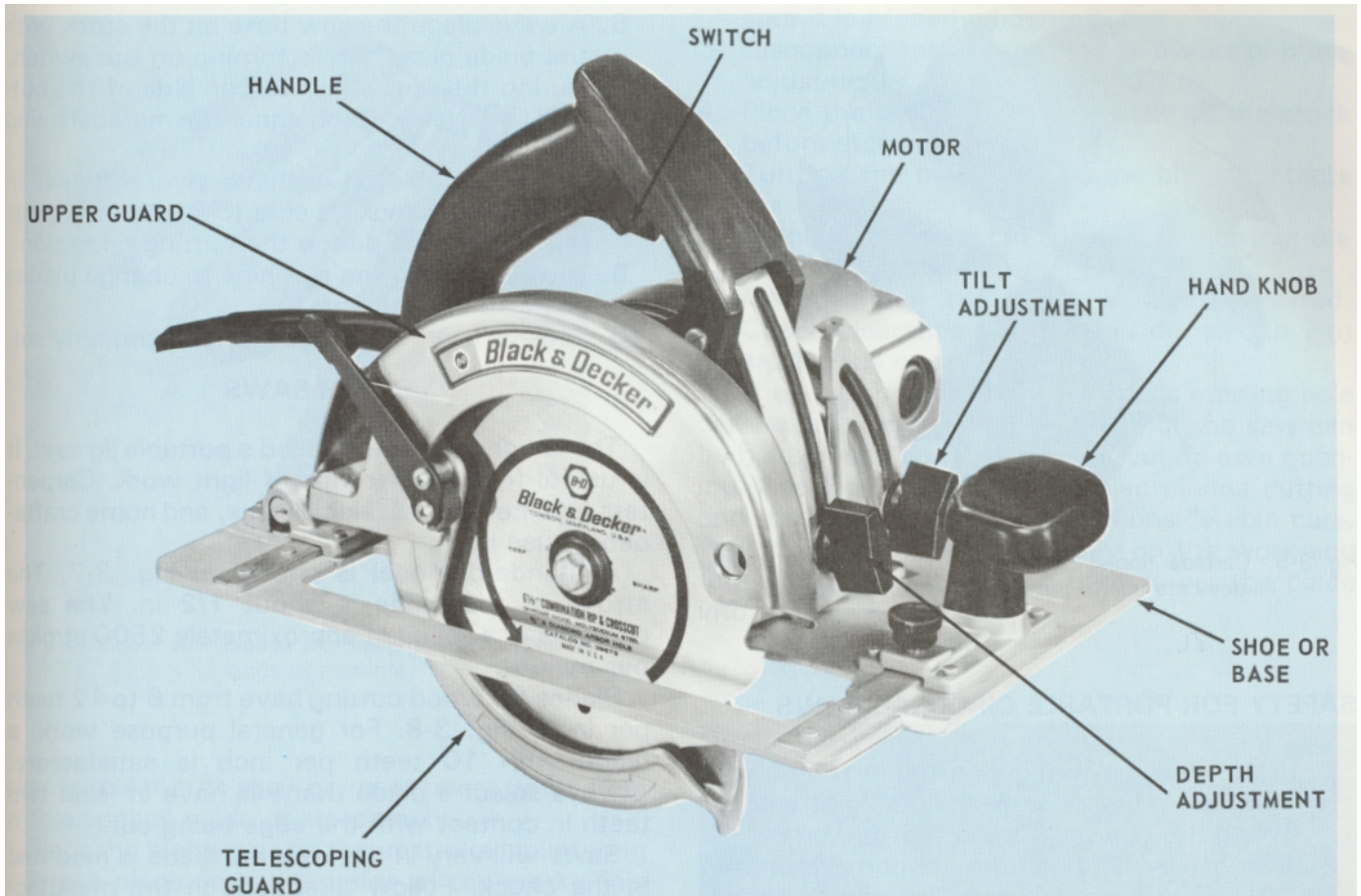


Fig. 3-3. Parts of a portable circular saw. During operation, telescoping guard is pushed back by the stock. Spring returns guard when the cut is completed.

diameter of the largest blade it will take. Most carpenters prefer a 7 or 8 in. saw. The depth of cut is adjusted by raising or lowering the position of the base or shoe. See Fig. 3-3. On many saws it

is possible to make bevel cuts by tilting the shoe. Portable saws are often guided along the layout line "free-hand." Therefore extra clearance in the saw kerf is required. To provide this clearance, teeth usually have a wide set. Fig. 3-4 shows standard types of blades. The rough-cut combination blade is popular because it is suitable for both ripping and crosscutting. Some carpenters prefer carbide tipped teeth, Fig. 3-5, because they usually stay sharp longer than teeth of a standard blade.

To use a portable saw, grasp the handle firmly in one hand with the forefinger ready to operate the trigger switch. The other hand should be placed on the stock, well away from the cutting line. Some saws require both hands on the machine.

Rest the base on the work and align the guide mark with the layout line. Turn on the switch, allow the motor to reach full speed, and then feed it smoothly into the stock as shown in Fig. 3-6. Release the switch as soon as the cut is finished. Hold the saw until the blade stops.

The portable saw may be used to make cuts in assembled work. For example, flooring and roofing boards are often nailed into place before ends are trimmed.

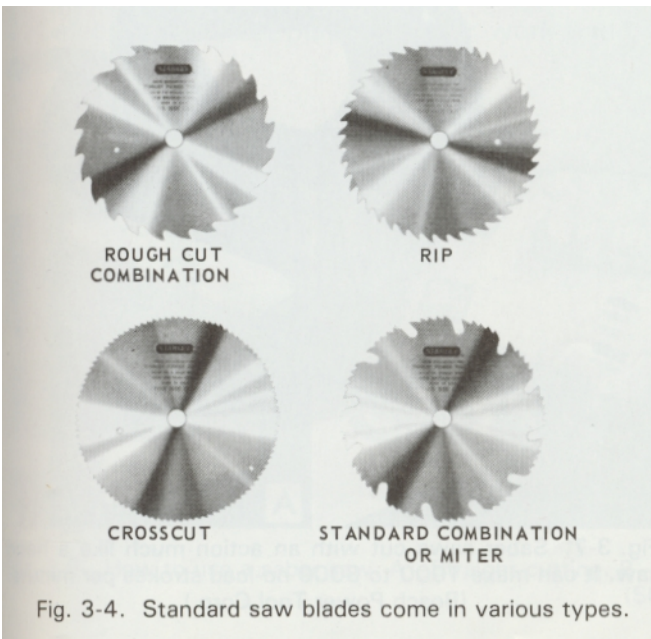


Fig. 3-4. Standard saw blades come in various types.

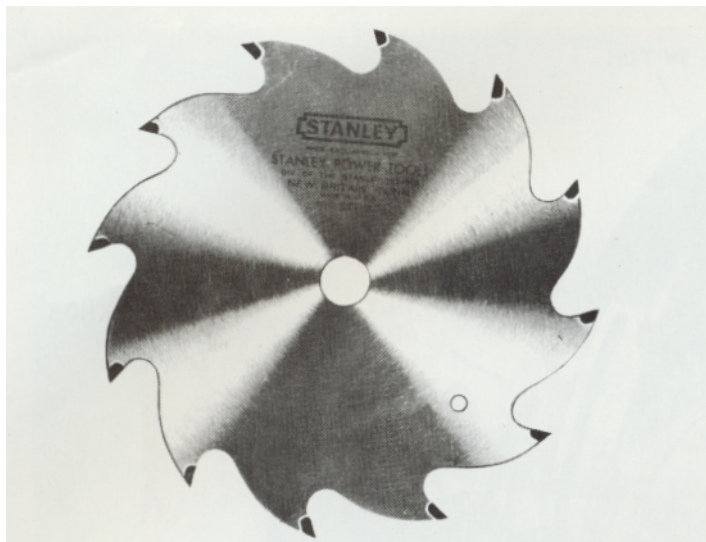


Fig. 3-5. Carbide tipped blade stays sharp longer. Handle blades carefully to prevent damage to points.

SAFETY FOR PORTABLE CIRCULAR SAWS

1. Stock must be well supported in such a way that the kerf will not close and bind the blade during the cut or at the end of the cut.
2. Thin materials should be supported near the cut. Small pieces should be clamped to a bench top or sawhorse.
3. Be careful not to cut into the sawhorse or other supporting device.
4. Adjust the depth of cut to the thickness of the stock, plus about 1/8 in.
5. Check the base and angle adjustment to be sure they are tight. Plug the cord into a grounded outlet and be sure it will not become tangled in the work.



Fig. 3-6. Using a portable circular saw to trim a 2 x 4 spacer block. Always make sure the workpiece is well supported before cutting begins.

6. Always place the saw base on the stock with the blade clear before turning on the switch.
7. During the cut, stand to one side of the cutting line. Never reach under the material being cut.
8. Some portable saws have two handles. In using such saws, be sure to keep both hands on the handles during the cutting operation.
9. Always unplug the machine to change blades or make adjustments.
10. Always use a sharp blade that is properly set.

SABER SAWS

The saber saw is also called a portable jig saw. It is useful for a wide range of light work. Carpenters, cabinetmakers, electricians, and home craftspeople use it.

A standard model is shown in Fig. 3-7. The stroke of the blade is about 1/2 in. The saw operates at a speed of approximately 2500 strokes per minute.

Blades for wood cutting have from 6 to 12 teeth per inch, Fig. 3-8. For **general purpose work, a blade with 10 teeth per inch is satisfactory.** Always select a blade that will have at least two teeth in contact with the edge being cut.

Saws will vary in the way the blade is mounted in the chuck. Follow directions in the manufacturer's manual. Also follow the lubrication schedule specified in this manual.

The saber saw can be used to make straight or bevel cuts as shown in Fig. 3-9. Curves are usually cut by guiding the saw along a layout line. How-



Fig. 3-7. Saber saws cut with an action much like a hand saw. It can make 1000 to 3000 no-load strokes per minute. (Bosch Power Tool Corp.)

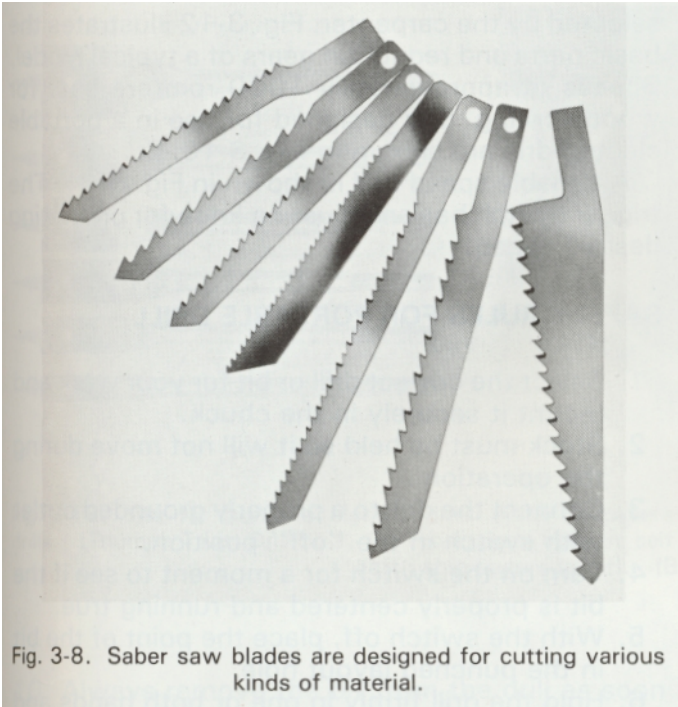


Fig. 3-8. Saber saw blades are designed for cutting various kinds of material.

3. Disconnect the saw to change blades or make adjustments.
4. Place the base of the saw firmly on the stock before starting the cut.
5. Turn on the motor before the blade contacts the work.
6. Do not attempt to cut curves so sharp that the blade will be twisted.
7. Make certain the work is well supported. Check clearance so that you do not cut into sawhorses or other supports.

When cutting internal openings, a starting hole can be drilled in the waste stock, or the saw can be held on end so the blade will cut its own opening. See Fig. 3-10. This is called plunge cutting and must be undertaken with considerable care. Rest the toe of the base firmly on the work and turn on the motor. Then slowly lower the blade into the stock.

ever, circular cuts may be made more accurately with a special guide or attachment.

Since the **blade cuts on the upstroke**, splintering will take place on the top side of the work. This must be considered when making finished cuts, especially in fine hardwood plywood. Always hold the base of the saw firmly against the surface of the material being cut.

SAFETY RULES FOR SABER SAWS

1. Make certain the saw is properly grounded through the electrical cord. The switch must be in the "off" position before connecting to power source.
2. Select the correct blade for your work and be

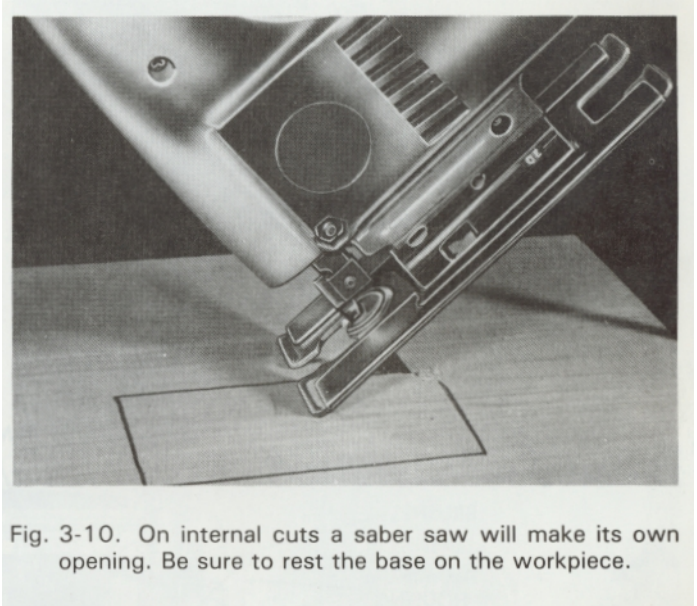


Fig. 3-10. On internal cuts a saber saw will make its own opening. Be sure to rest the base on the workpiece.

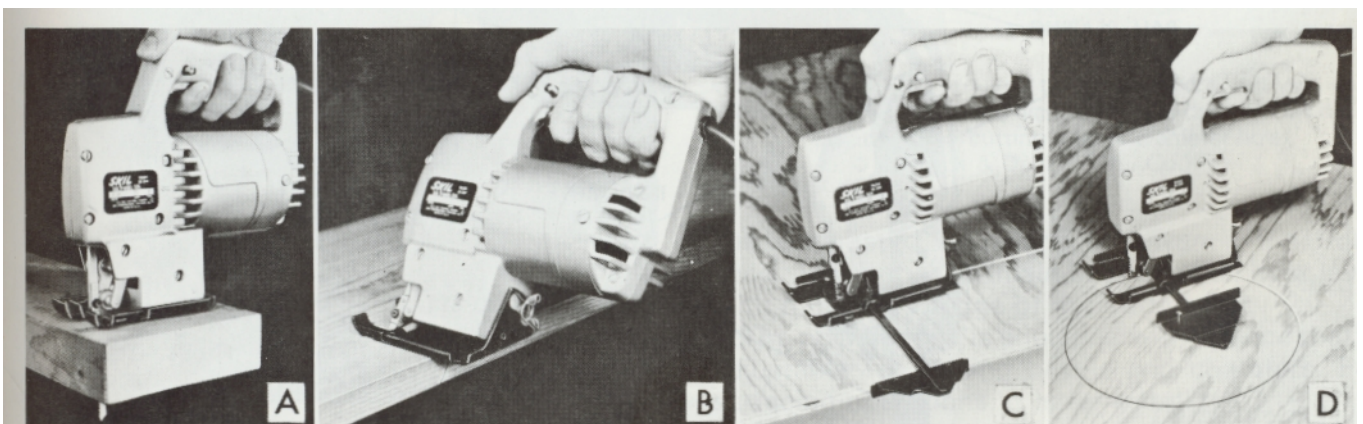


Fig. 3-9. How to use a saber saw. A—Straight cutting. B—Angle cutting. C—Using a fence. D—Using a circle cutting guide (Skil Corp.)

Another portable power tool is the reciprocating saw shown in Fig. 3-11. Operation is similar to the saber saw.

PORTABLE ELECTRIC DRILLS

Portable electric drills come in a wide range of types and sizes. The size is determined by the chuck capacity; 1/4 and 3/8 in. generally being

selected by the carpenter. Fig. 3-12 illustrates the basic parts and reduction gears of a typical model. Speeds of approximately 1000 rpm are best for woodworking. Bits designed for use in a portable electric drill are shown in Fig. 3-13.

A variable speed drill is shown in Fig. 3-14. The trigger switch has an adjusting knob for presetting desired speed.

SAFETY RULES FOR PORTABLE DRILL

1. Select the correct drill or bit for your work and mount it securely in the chuck.
2. Stock must be held so it will not move during the operation.
3. Connect the drill to a properly grounded outlet with switch in the "off" position.
4. Turn on the switch for a moment to see if the bit is properly centered and running true.
5. With the switch off, place the point of the bit in the punched layout hole.
6. Hold the drill firmly in one or both hands and at the correct drilling angle.
7. Turn on the switch and feed the drill into the work. The pressure required will vary with the size of the drill and the kind of wood being drilled. See Fig. 3-15.
8. During operation, keep the **drill** aligned with the direction of the hole.
9. When drilling deep holes, especially with a twist drill, withdraw the drill several times to clear the cuttings.



Fig. 3-11. Heavy-duty reciprocating saw operation is much like the saber saw. (Black & Decker Mfg. Co.)

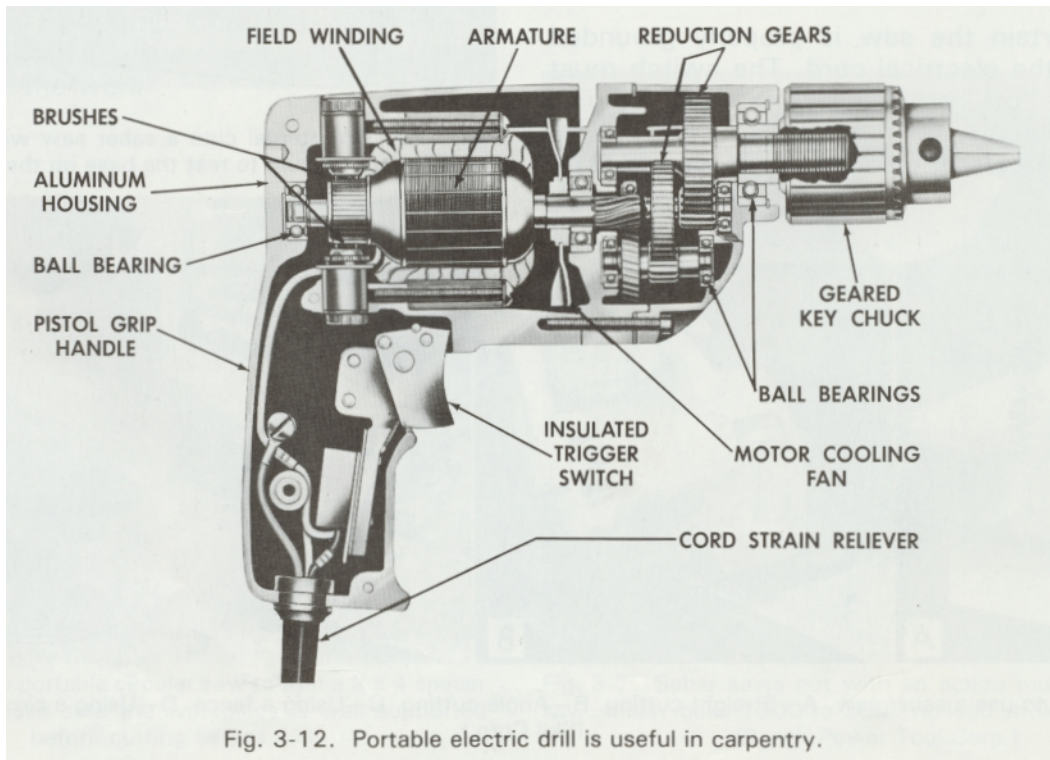


Fig. 3-12. Portable electric drill is useful in carpentry.

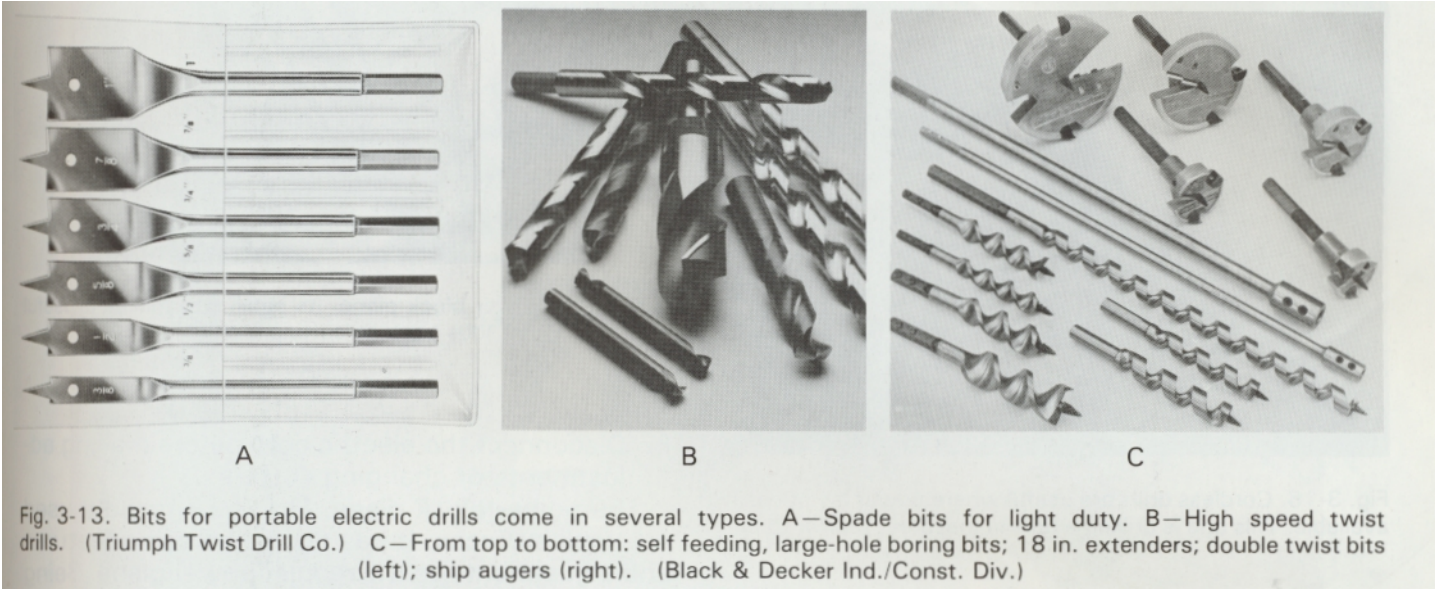


Fig. 3-13. Bits for portable electric drills come in several types. A—Spade bits for light duty. B—High speed twist drills. (Triumph Twist Drill Co.) C—From top to bottom: self feeding, large-hole boring bits; 18 in. extenders; double twist bits (left); ship augers (right). (Black & Decker Ind./Const. Div.)

10. Always remove the bit from the drill as soon as you have completed your work.

Cordless portable drills, Fig. 3-1 6, are handy for many jobs. Power is supplied by a small nickel-cadmium battery that can be recharged. Such drills are used for general maintenance work and on production jobs where there are no power lines.

POWER PLANES

The power plane produces finished wood surfaces with speed and accuracy, Fig. 3-1 7. The motor, which operates at a speed of about 20,000 rpm, drives a spiral cutter. The depth of



Fig. 3-14. Variable speed electric drill. Direction of rotation can also be reversed. No-load speed can be varied from 0 to 1500 rpm. (Bosch Power Tool Corp.)



Fig. 3-15. Pressure required to operate a drill will vary with drill size, type of wood, and diameter of the drill bit. This drill is operating a bit cutting a large diameter hole. (Black & Decker Mfg. Co.)

cut is adjusted by raising or lowering the front shoe. The rear shoe (main bed) must be kept level with the cutting edge of the cutterhead.

The power plane is equipped with a fence that is adjustable for planing bevels and chamfers. For surfacing operations, it is removed.

Hold and operate the power plane in about the same manner as a hand plane. The work should be rigidly supported in a position that will permit the



Fig. 3-16. Cordless drills are useful where power is not easily available. This one is drilling a hole in masonry. (Porter Cable)

operation to be easily performed. Start the cut with the front shoe resting firmly on the work and the cutterhead slightly behind the surface. Refer once more to Fig. 3-1 7. Be sure the electric cord is kept clear. Start the motor and move the plane forward with smooth, even pressure on the work. When finishing the cut, apply extra pressure on the rear shoe.

SAFETY RULES FOR POWER PLANES

1. Study the manufacturer's instructions for adjustment and operation.
2. Be sure the machine is properly grounded.
3. Hold the standard power plane in both hands before you pull the trigger switch. Continue to hold it in both hands until the motor stops after releasing the switch.
4. Always clamp the work securely in the best position to perform the operation.
5. Do not attempt to operate a power plane with one hand that was designed for two hands.



Fig. 3-17. Portable power plane is being used to plane a chamfer. Note arrow. (Bosch Power Tool Corp.)

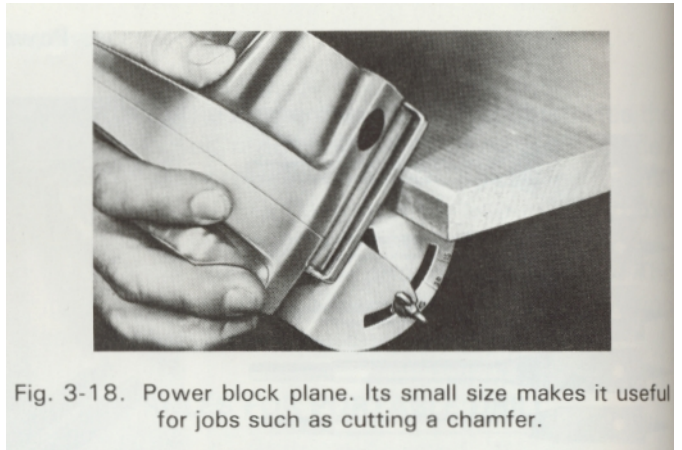


Fig. 3-18. Power block plane. Its small size makes it useful for jobs such as cutting a chamfer.

6. Disconnect the electric cord before making adjustments or changing cutters.

The power block plane, Fig. 3-1 8, can be used on small surfaces. It has about the same features and adjustments as the regular power plane. Being small, it is designed to be operated with one hand. When using this tool, the work should be securely held or clamped in place.

In planing small stock, kickbacks may occur. Be sure the hand not holding the plane is kept well out of the way.

PORTABLE ROUTERS

Routers are used to cut irregular shapes and to form various contours on edges, Fig. 3-1 9. When equipped with special guides, they can be used to

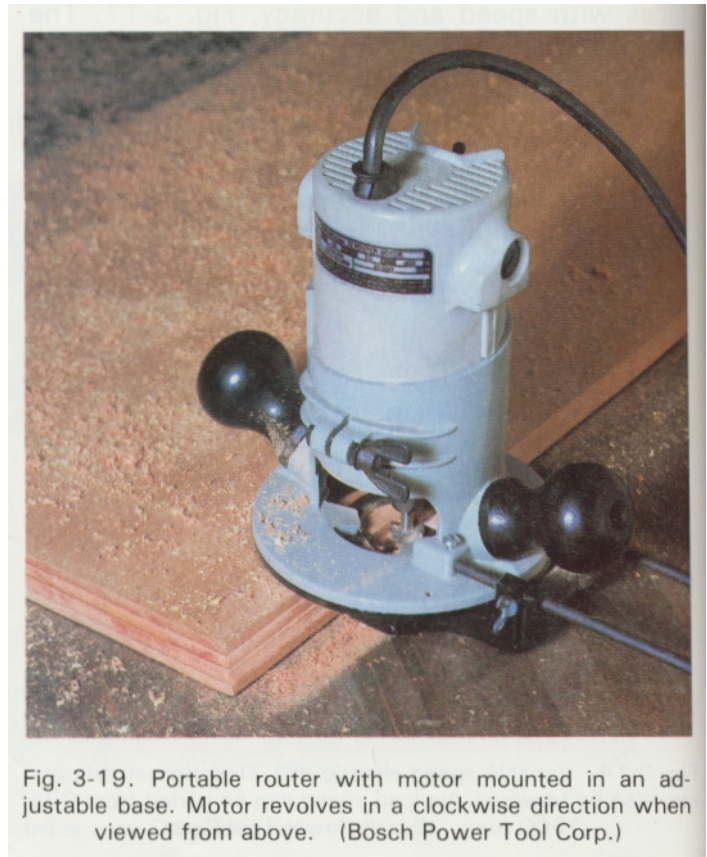


Fig. 3-19. Portable router with motor mounted in an adjustable base. Motor revolves in a clockwise direction when viewed from above. (Bosch Power Tool Corp.)



Portable power tools are used in every stage of construction. New and improved units are continually being developed. In the view above, an orbital sander is being used to smooth a cabinet door. Clockwise around the view is a plunge router, a cordless drill, and a plate joiner. The plate joiner cuts slots in the edges and ends of stock to be joined. Wooden biscuits (shown in the view) are inserted in the slots and the assembly is glued together in about the same way as dowel joints. (Porter-Cable Corp.)

cut dados, grooves, mortises, and dovetail joints. Important uses in carpentry include the cutting of gains for hinges when hanging passage doors and routing housed stringers for stair construction. See Units 16 and 17.

When mounting bits in the router, the base is usually removed as illustrated in Fig. 3-20.



Fig. 3-20. Straight router bit is being mounted in a collet type chuck.

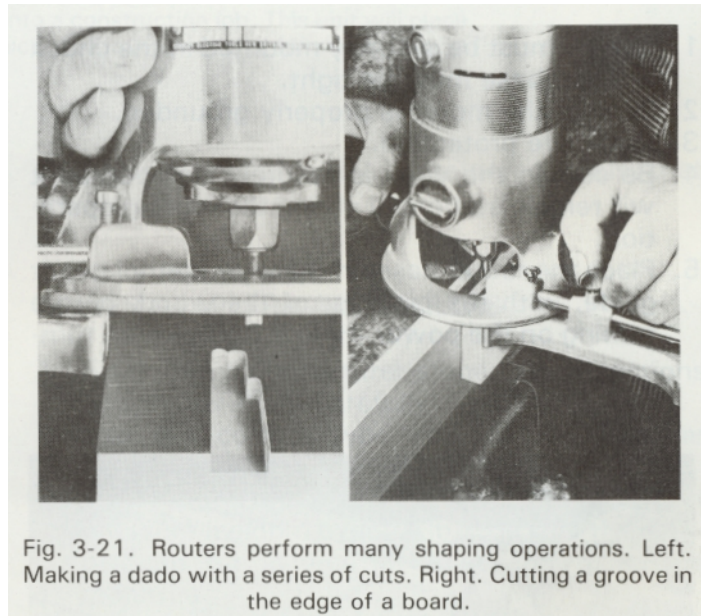


Fig. 3-21. Routers perform many shaping operations. Left. Making a dado with a series of cuts. Right. Cutting a groove in the edge of a board.

Straight bits are used when cutting dados and grooves. See Fig. 3-21.

Some bits for shaping and forming edges have a pilot tip that guides the router. The router motor revolves in a clockwise direction (when viewed from above) and should be fed from left to right when making a cut along an edge, as illustrated in Fig. 3-22. When cutting around the outside of oblong or circular pieces, always move in a

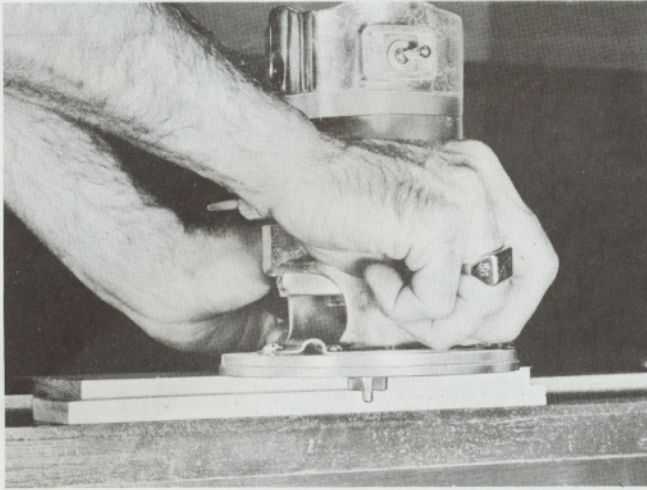


Fig. 3-22. Pilot tip on cutter controls the cut. Apply light pressure between tip and material. Too much pressure will cause burn marks.

counterclockwise direction.

Fixtures and templates are available that will guide the router through various decorative or blanking cuts. Fig. 3-23 shows a decorative cut being made on a cabinet door.

SAFETY RULES FOR PORTABLE ROUTERS

1. The bit must be securely mounted in the chuck and the base must be tight.
2. Be sure the motor is properly grounded.
3. Wear eye protection.
4. Be certain the work is securely clamped so it will remain stationary during the routing operation.
5. Place the router base on the work, template, or guide, with the bit clear of the wood, before turning on the power. Hold it firmly when turn-

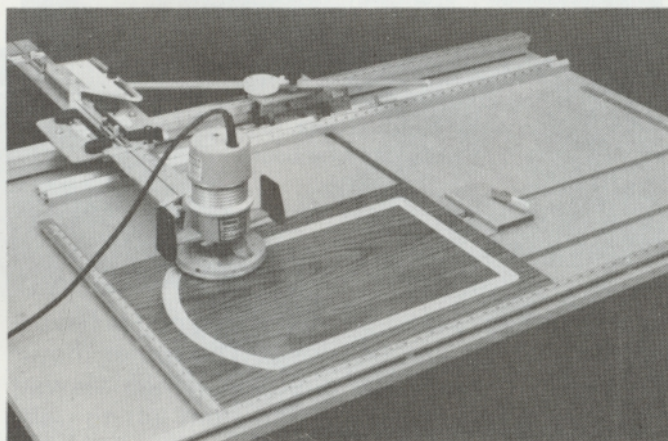


Fig. 3-23. Router can be mounted in a variable arc attachment to produce a decorative design.

ing on the motor. Starting torque could wrench the tool from your grasp.

6. Hold the router with both hands and feed it smoothly through the cut in the correct direction.
7. When the cut is complete, turn off the motor. Do not lift the machine from the work until the motor has stopped.
8. Always unplug the motor when mounting bits or making adjustments.

PORTABLE SANDERS

Portable sanders include three basic types:

1. Belt.
2. Disc.
3. Finish.

They vary widely in size and design. Manufacturer's instructions should be followed carefully in the mounting of abrasive belts, discs, and sheets. Also, follow the manufacturer's lubrication schedule.

The belt sander's size is determined by the width of the belt. Using the sander takes some skill. Support stock firmly. Switch must always be on "off" before plugging in the electric cord. Like all portable power tools, the sander should be properly grounded. Check the belt and make sure it is tracking properly.

Hold the sander over the work. Start the motor. Then, lower the sander carefully and evenly onto the surface. When using belt and finish sanders make sure to travel with the grain. Move it forward and backward over the surface in even strokes. At the end of each stroke, shift it sideways about one-half the width of the belt.

Continue over the entire surface, holding the sander level and sanding each area the same amount. Do not press down on the sander. Its weight is sufficient to provide the proper pressure for the cutting action. When work is complete, raise the machine from the surface and allow the motor to stop.

Finishing sanders, Fig. 3-24, are used for final sanding where only a small amount of material needs to be removed. They are also used for cutting down and rubbing finishing coats. There are two general types:

1. Orbital.
2. Oscillating.

STAPLERS AND NAILERS

A wide variety of power staplers and nailers is available. Most of them are air (pneumatic) powered. Those that are electrically operated should be properly grounded. Fig. 3-25 shows



Stationary planer is small enough to take onto a construction job. This unit will plane stock up to 13 in. wide and nearly 6 in. thick. (Delta International Machinery Corp.)

pneumatic and electrically powered tools that drive nails, staples, and screws.

SAFETY RULES FOR POWER STAPLERS AND HAILERS

1. Study the manufacturer's operating directions and follow them carefully.
2. Use the correct type and size of fastener recommended by the manufacturer.
3. For air-powered nailers, always use the correct pressure (seldom over 90 lb.). Be sure the compressed air is free of dust and excessive moisture.
4. Always keep the nose of the stapler or nailer pointed toward the work. Never aim it toward yourself or other workers.
5. Check all safety features and be sure they are working. Make a test by driving the staples or nails into a block of wood.
6. During use on the job, hold the nose firmly against the surface being stapled or nailed.
7. Always disconnect the power tool from the air or electrical power supply when it is not being used.

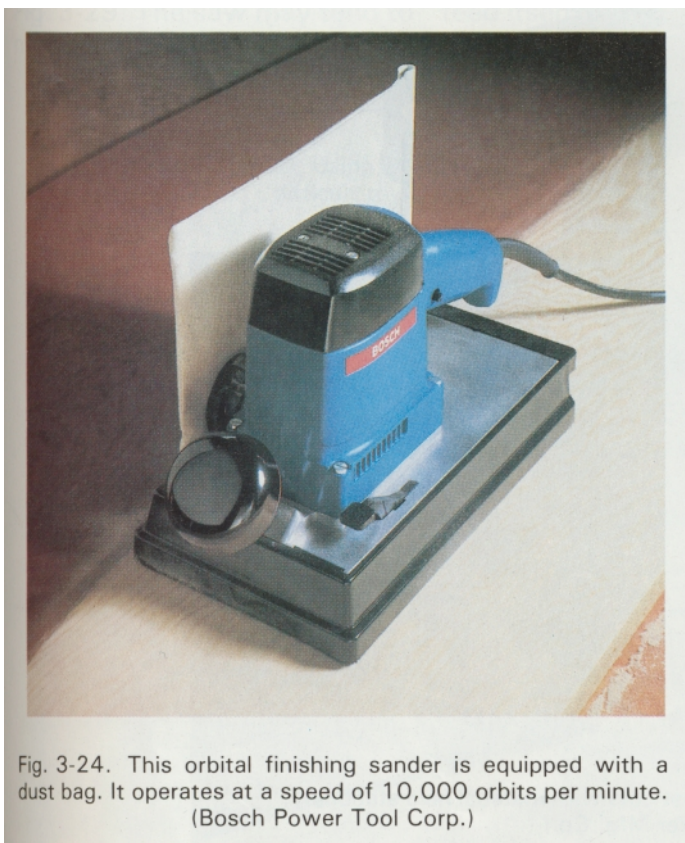


Fig. 3-24. This orbital finishing sander is equipped with a dust bag. It operates at a speed of 10,000 orbits per minute. (Bosch Power Tool Corp.)

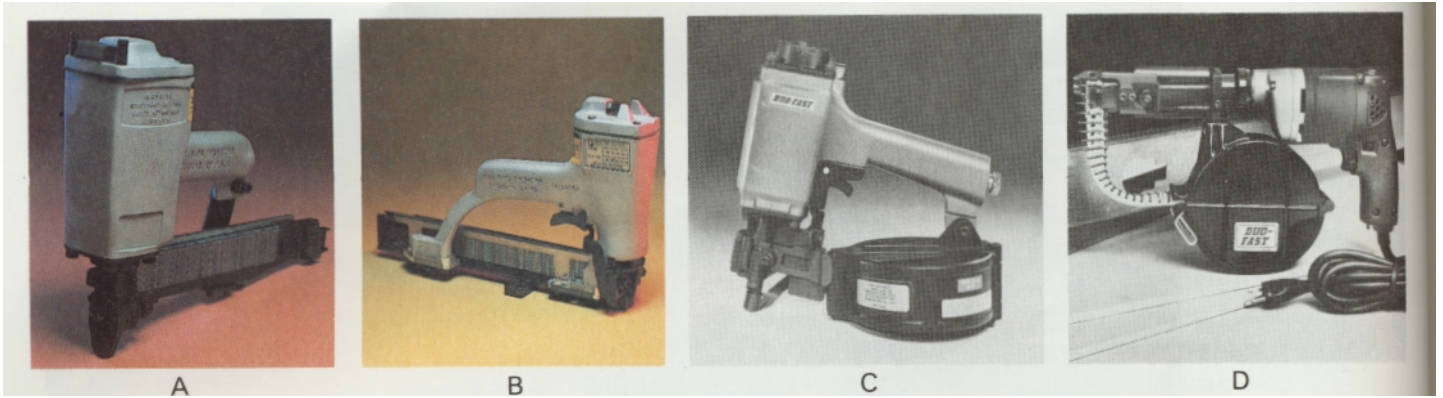


Fig. 3-25. Pneumatic and electrically powered fastening tools. A—Pneumatic stapler drives staples from 5/8 to 2 in. long. B— Roofing stapler installs staples up to 1 1/4 in. long. (Paslode Co.) C-- Coil nailer can drive 25 different nails from 1 to 2 in. long. D— Automatic screw fastener is designed for driving screws into drywall to wood or metal studs. (Duo-Fast Corp.)

RADIAL ARM SAWS

Motor and blade of the radial arm saw are carried by an overhead arm. The stock is supported on a stationary table. The arm is attached to a vertical column at the back of the table. The depth of

cut is controlled by raising or lowering the overhead arm. Fig. 3-26 shows the parts of a typical radial arm saw.

The motor is mounted in a yoke and may be

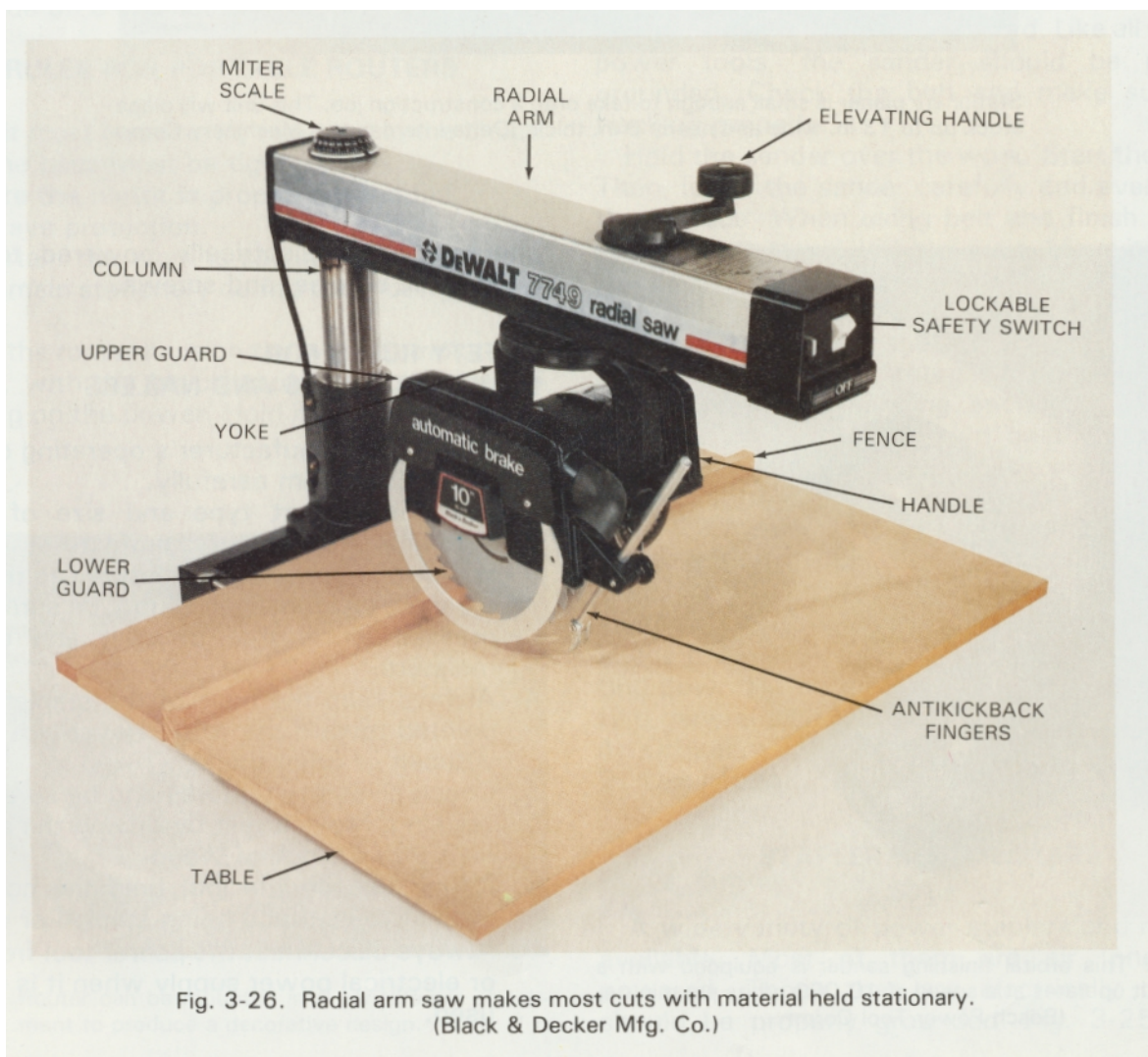


Fig. 3-26. Radial arm saw makes most cuts with material held stationary. (Black & Decker Mfg. Co.)

tilted for angle cuts. The yoke is suspended from the arm on a pivot which permits the motor to be rotated in a horizontal plane. Adjustments make it possible to perform many sawing operations.

When crosscutting, mitering, beveling, and dadoing, the work is held firmly on the table and the saw is pulled through the cut, Fig. 3-27. For ripping and grooving, the blade is turned parallel to the table and locked into position. Stock is then fed into the blade in somewhat the same manner as a table saw, Fig. 3-28.

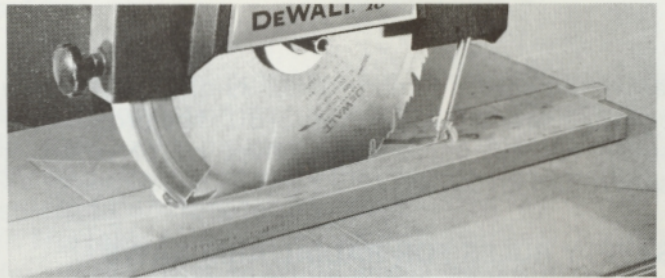


Fig. 3-28. Ripping operation. Fence, not visible, is set in the table to guide the work.

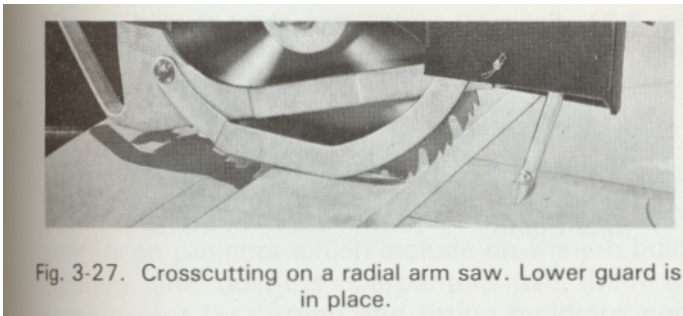


Fig. 3-27. Crosscutting on a radial arm saw. Lower guard is in place.

For regular crosscuts and miters, first be sure the saw is against the column. Then place your work on the table and align the cut. Hold the stock firmly against the table fence with your hand at least 6 in. away from the path of the saw blade.

Turn on the motor. Grasp the saw handle pulling the saw firmly and slowly through the cut. See Fig. 3-29. The saw may tend to "feed itself." You must control the rate of feed. When the cut is

completed, return the saw to the rear of the table and shut off the motor.

The radial arm saw is especially useful in cutting compound miters. It is also a good tool for cutting

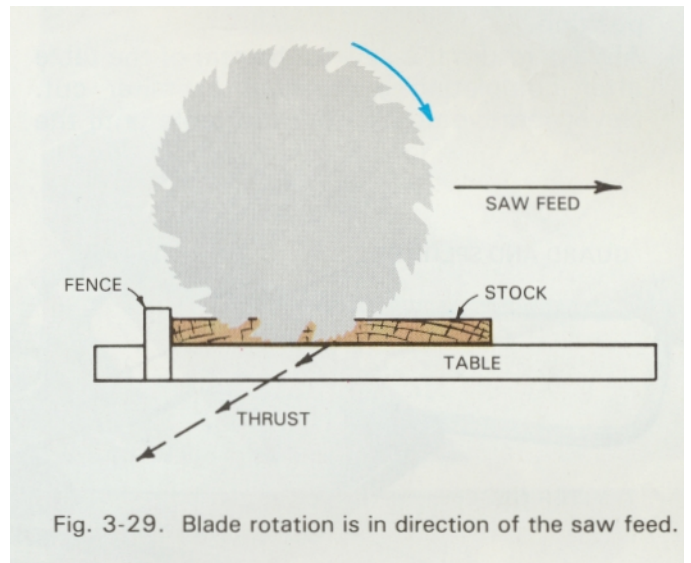


Fig. 3-29. Blade rotation is in direction of the saw feed.

Fig. 3-30. Using a radial arm saw to cut dimension lumber. Material of this size would be difficult to slide through a table saw. (Delta International Machinery Corp.)



larger dimension lumber which is difficult to slide across a saw table. See Fig. 3-30. The proper saw setup for cutting a large sheet of plywood is shown in Fig. 3-31.

SAFETY RULES FOR RADIAL ARM SAWS

1. Stock must be held firmly on the table and against the fence for all crosscutting operations. The ends of long boards must be supported level with the table.
2. Before turning on the motor, be sure clamps and locking devices are tight. Check depth of cut and table slope. It must be slightly lower at back than front to prevent blade from "running" forward.
3. Keep the guard and anti-kickback device in position.
4. Always return the saw to the rear of the table after completing a crosscut or miter cut. Never remove stock from the table until the saw has been returned.

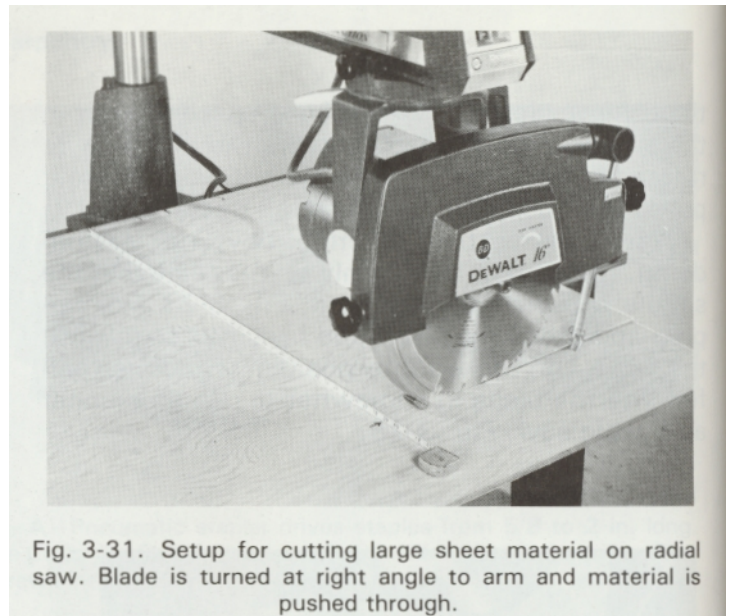


Fig. 3-31. Setup for cutting large sheet material on radial saw. Blade is turned at right angle to arm and material is pushed through.

5. Maintain a 6 in. margin of safety. Keep your hands this distance away from the path of the saw blade.

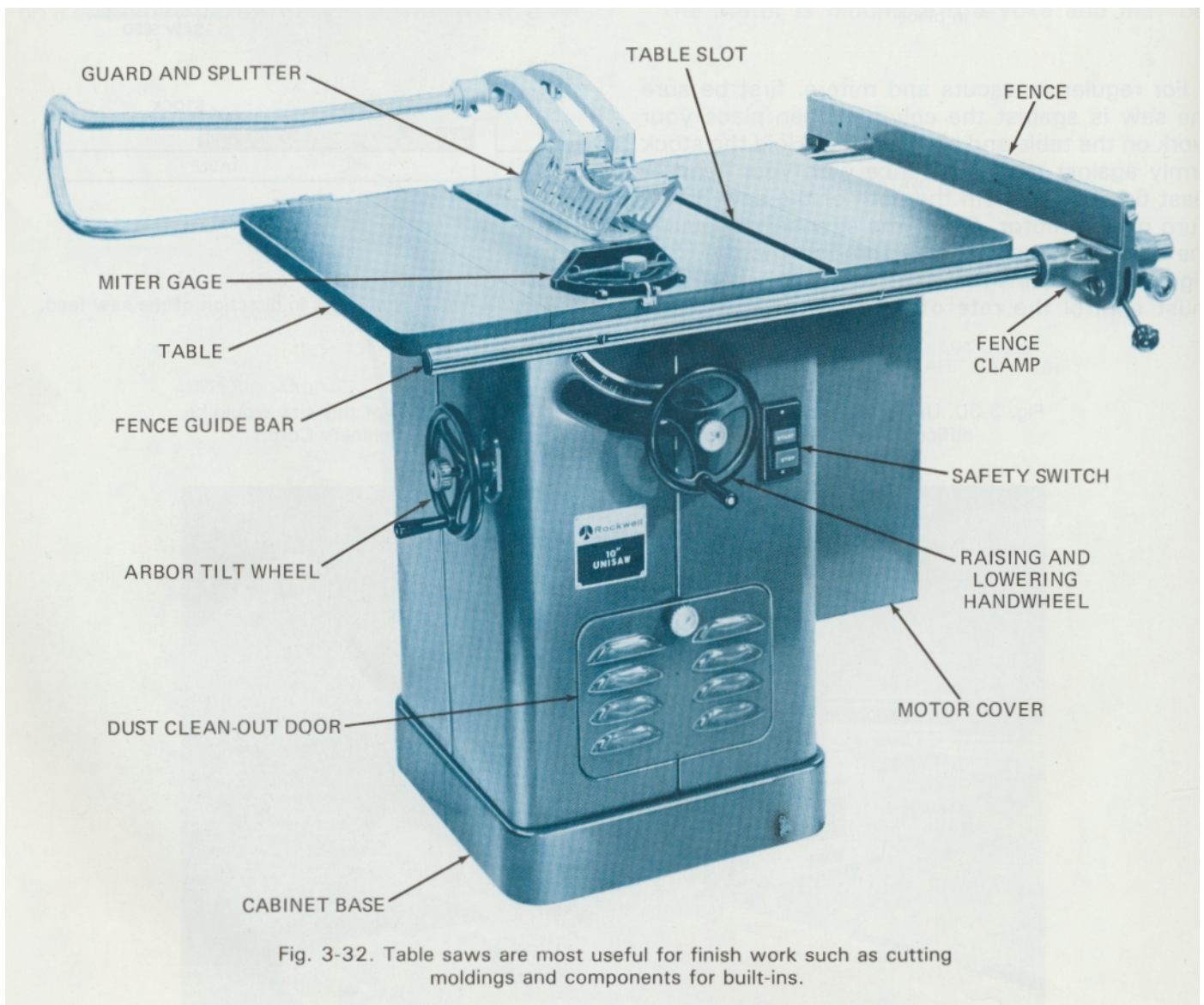


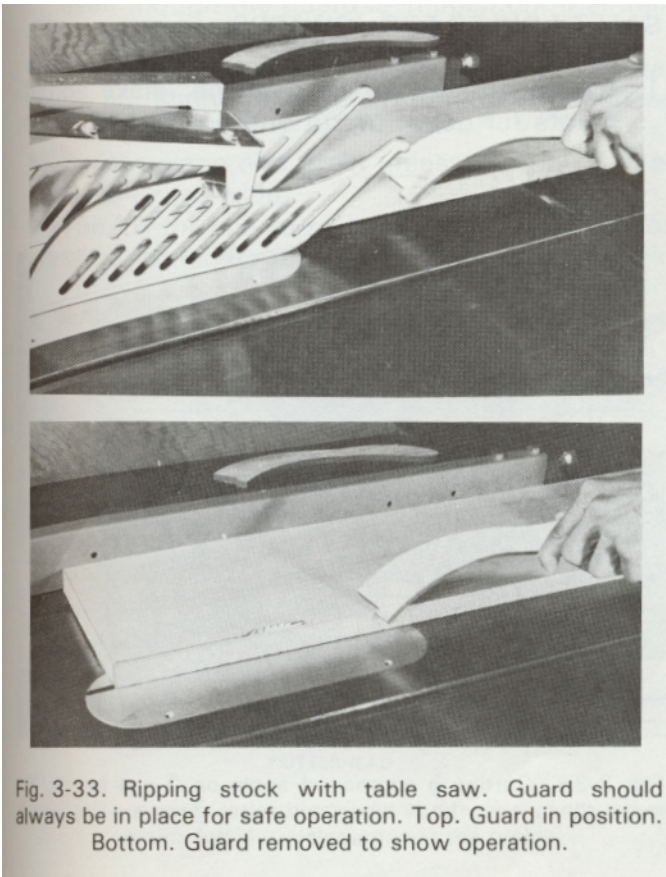
Fig. 3-32. Table saws are most useful for finish work such as cutting moldings and components for built-ins.

6. Shut off the motor and wait for the blade to stop before making any adjustments.
7. Do not leave the machine before the blade has stopped.
8. Keep the table clean and free of scrap pieces and excessive amounts of sawdust. Do not attempt to clean off the table while the saw is running.
9. In crosscutting, always pull blade toward you.
10. Stock to be ripped must be flat and have one straight edge to guide it along the fence.
11. When ripping, always feed stock into the blade so that the bottom teeth are turning toward you. This will be the side opposite the anti-kickback fingers.

TABLE SAWS AND JOINTERS

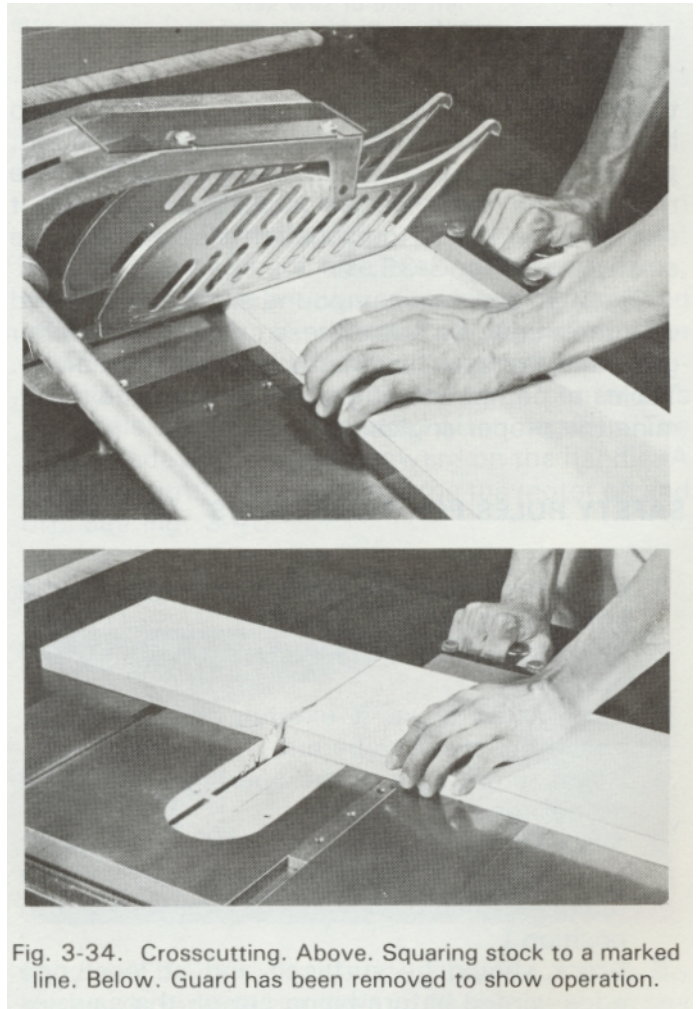
These power tools are basic machines used in cabinetmaking. They are frequently used by carpenters on projects which include on-the-job built cabinets and built-ins. Carpenters use them to some extent for cutting and fitting moldings and other inside trim work.

When used for carpentry, the smaller sizes (4 to 6 in. jointers and 8 to 10 in. table saws) are usually selected because they can be easily moved from one job to another.



Space in this book does not permit more than a brief introduction to this equipment. Woodworking textbooks provide a complete description of the wide variety of work they will do along with instruction on how to use them.

The table saw, also called a circular saw, is used for ripping stock to width and cutting it to length. It also will cut bevels, chamfers, and tapers. Properly set up, the table saw can be used to produce grooves, dados, rabbets, and other forms basic to a wide variety of joints. The size of the saw is determined by the largest blade it will take. Fig. 3-32 shows a typical model with the parts identified.



Stock to be ripped must have at least one flat face to rest on the table and one straight edge to run along the fence. Fig. 3-33 shows correct procedure for making a ripping cut. Be sure to follow the safety rules.

Fig. 3-34 shows a standard crosscutting operation. A line is squared across the stock to show where the cut is to be located. For accurate work make a check mark on the side of the line where

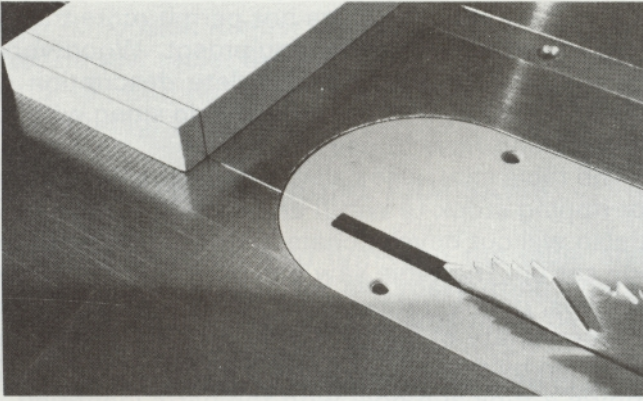


Fig. 3-35. Line scribed on saw table will help you align stock for more accurate cutting to a line. This line should align with left side of saw kerf.

the saw kerf will be located. The guard tends to hide the blade; it is helpful, when aligning the cut, to use a line scribed in the table surface. Since most of the work will be located to the left, it should extend back from the left side of the blade as shown in Fig. 3-35.

Fig. 3-36 shows a compound angle being sawed on a table saw. To make these cuts both the miter gage and the saw blade must be set at an angle. Tables of compound angles are available to determine the proper angles.

SAFETY RULES FOR TABLE SAWS

1. Be certain the blade is sharp and right for the job at hand.
2. Make sure the saw is equipped with a guard and use it.
3. Set the blade so it extends about 1/4 in. above the stock to be cut.
4. Stand to one side of the operating blade and do not reach across it.
5. Maintain a 4 in. margin of safety. (Do not let your hands come closer than 4 in. to the operating blade even though the guard is in position.)
6. Stock should be surfaced and at least one edge jointed before being cut on the saw.
7. Use the fence or miter gage to control the stock. Do not cut stock free hand.
8. Always use push sticks when ripping short, narrow pieces.
9. Stop the saw before making adjustments.
10. Do not let small scrap cuttings accumulate around the saw blade. Use a push stick to move them away.
11. Resawing setups and other special setups must be carefully made and checked before the power is turned on.

12. Remove the dado head or any special blades after use.
13. Other workers, helping to "tail-off" the saw, should not push or pull on the stock but only support it. The operator must control the feed and direction of the cut.
14. As work is completed, turn off the machine and remain until the blade has stopped. Clear the saw table and place waste in a scrap box.

Principal parts of a jointer are shown in Fig. 3-37. The cutter head holds three knives and revolves at a speed of about 4500 rpm. The size of the jointer is determined by the length of these knives.

The three main adjustable parts are:

1. The infeed table.
2. The outfeed table.
3. The fence.

The outfeed table must be the same height as the knife edges at their highest point of rotation. This is a critical adjustment. See Fig. 3-38. If the table is too high the stock will be gradually raised out of the cut and a slight taper will be formed. If it is too low, the tail end of the stock will drop as it leaves the infeed table and cause a "bite" in the surface or edge.

The fence guides the stock over the table and knives. When jointing an edge square with a face, it should be perpendicular to the table surface, Fig. 3-39. The fence is tilted when cutting chamfers or bevels.

SAFETY RULES FOR JOINTERS

1. Before turning on the machine, make adjustments for depth of cut and position of fence.

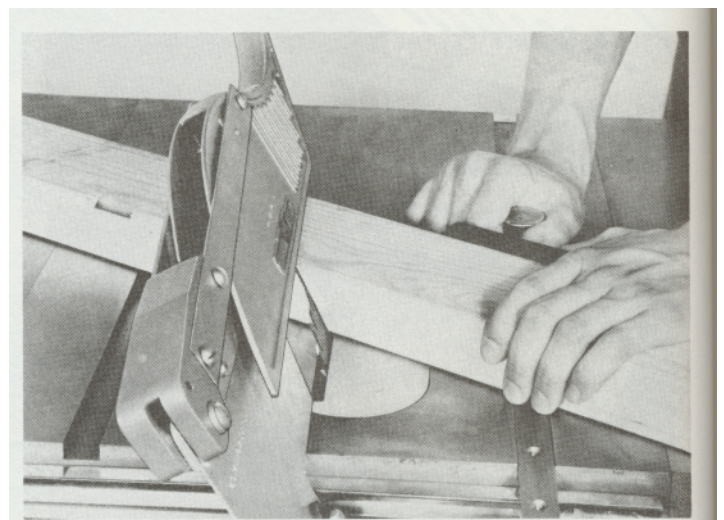


Fig. 3-36. Cutting a compound angle on 2 x 4 stock. To make these cuts, both blade and miter gage are set at an angle.

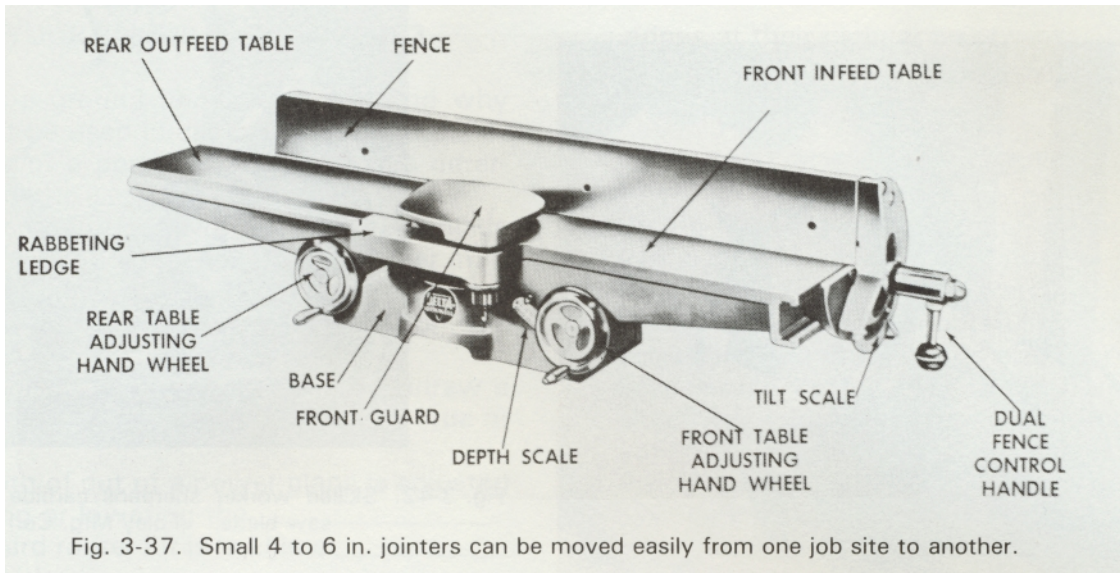


Fig. 3-37. Small 4 to 6 in. jointers can be moved easily from one job site to another.

Be sure the guard is in place and is operating properly.

2. The maximum cut for jointing on a small jointer is 1/8 in. for an edge and 1/16 in. for a flat surface.
3. Stock must be at least 12 in. long. Stock to be surfaced must be at least 3/8 in. thick unless a special feather board is used.
4. Feed the work so the knives will cut "with the grain." Use stock that is free from knots, splits, and checks.
5. Keep your hands away from the cutter head even though the guard is in position. Maintain at least a 4 in. margin of safety.
6. Use a push block when planing a flat surface. Do not apply pressure directly over the knives with your hand.
7. Do not plane end grain unless the board is at least 12 in. wide.
8. The jointer knives must be sharp. Dull knives will vibrate the stock and may cause a kick-back.
9. When work is complete, turn off the machine. Stand by until the cutter head has stopped.

SPECIAL SAWS

Special saws have been developed for certain uses in working with wood construction. If light weight and compact size are important factors, carpenter may use a power miter box or a frame and trim saw for accurate crosscuts and mitering. The motor and blade of the power miter saw are supported on a pivot. To operate it, the carpenter sets the angle from a scale marked off in degrees. The cut is made by pulling downward on the handle. A trigger control in the handle turns the motor on and off. See Fig. 3-40.



Fig. 3-39. Jointing an edge. "Step" the hands along the stock so they will not bear down on the stock while it passes over the cutter head.

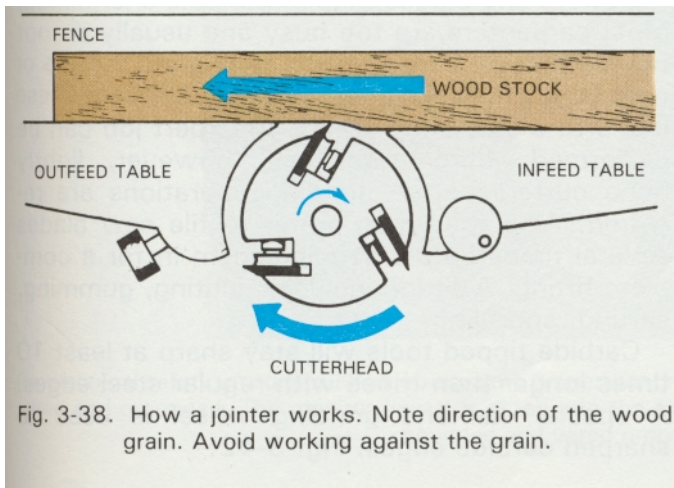


Fig. 3-38. How a jointer works. Note direction of the wood grain. Avoid working against the grain.

The frame and trim saw is supported on a pair of overhead shafts or guides. The support rotates left and right a little more than 45 deg. to make crosscuts and miter cuts. It is capable of all sawing operations except ripping. Its capacity is 16 in. width on crosscuts and 12 in. on miter cuts of 45 deg. An extension table allows one worker to cut long stock alone. See Fig. 3-41.



Fig. 3-40. Using a power (motorized) miter box to make an angle cut on a 2 x 4. Cuts can be made either to the right or left as with a regular miter box.

SAW SAFETY

1. Keep guards in place while operating.
2. Wear safety glasses or a face shield to protect eyes from sawdust and other debris.
3. Lock the saw securely at the angle of the cut.
4. Hold stock firmly against the fence.
5. Keep free hand clear of the cutting area.
6. Work only with a sharp saw blade.



Fig. 3-41. Sawbuck frame and trim saw being used to make a compound miter cut. It crosscuts, miters, bevels, and makes compound cuts on any stock up to 2 x 12. (Delta International Machinery Corp.)



Fig. 3-42. Skilled worker sharpens carbide tipped circular saw blade. (Foley Mfg. Co.)

POWER TOOL CARE AND MAINTENANCE

Care of power tools is especially important if they are to function properly while giving long service. Sharp blades and cutters ensure accurate work and make the tool much safer to operate. The good carpenters take pride in their tools' condition and appearance.

Most power tools are equipped with sealed bearings that seldom need attention. Follow the manufacturer's recommendations for lubrication schedules. Gear mechanisms for portable power tools usually require a special lubricant. All equipment will require a few drops of oil on controls and adjustment of bearings from time to time.

Clean and polish bare metal surfaces with 600 wet-or-dry abrasive paper when required. These surfaces can be kept smooth and clean by wiping them occasionally with light oil or furniture polish. Some carpenters apply a coat of paste wax to protect the surface and reduce friction.

Some power tools, especially those with a number of accessories, can be purchased with a case. While making transport easier, such cases keep the accessories organized and protected.

Cutters and blades require periodic sharpening. Most carpenters are too busy and usually do not have the equipment to accurately grind cutters or completely fit saw blades. They usually send these items to a saw shop where an expert job can be performed. Carpenters may, however, lightly hone cutters before grinding operations are required. Also they may prefer to file saw blades several times before sending them in for a complete fitting. A fitting includes jointing, gumming, setting, and filing.

Carbide tipped tools will stay sharp at least 10 times longer than those with regular steel edges. A special diamond grinding wheel is used to sharpen carbide edges, Fig. 3-42.

TEST YOUR KNOWLEDGE — UNIT 3

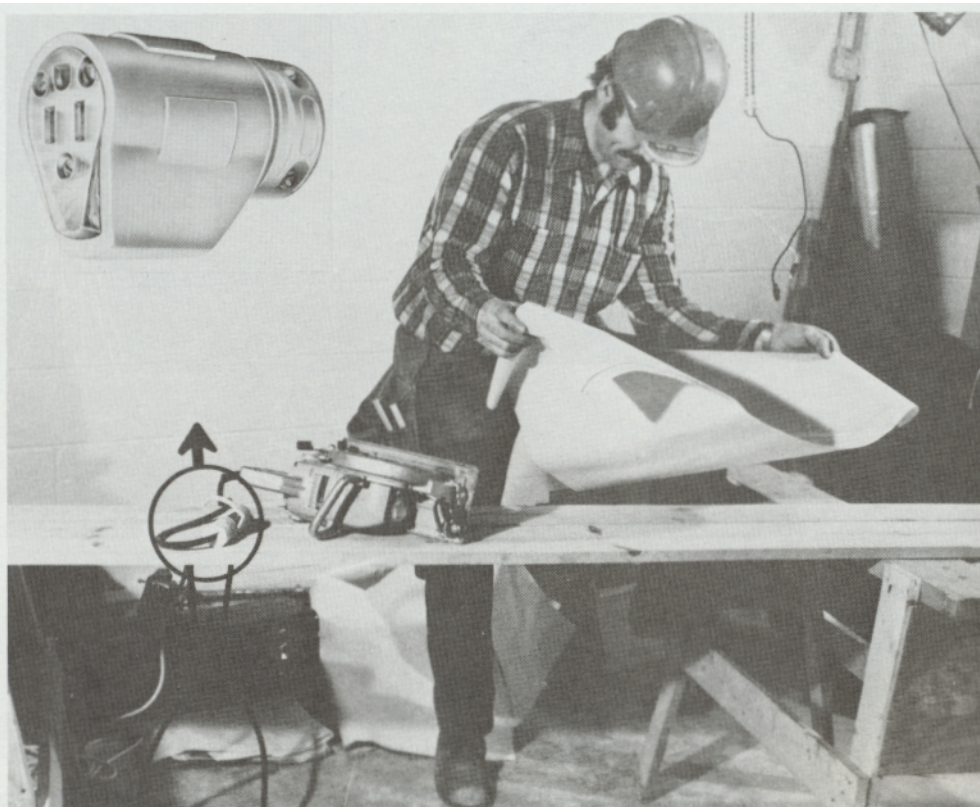
1. What is a ground fault interrupter and why should it be used in carpentry?
2. The size of a portable circular saw is determined by the _____
3. For general purpose work, a saber saw blade should have about _____ teeth per in.
4. When the base of the saber saw rests on a horizontal surface, the blade cuts on the _____ (up, down) stroke.
5. When drilling deep holes do not withdraw a twist drill until the hole is completed. True or False?
6. The depth of cut of a power plane is adjusted by raising or lowering the _____
7. A standard router bit is held in a _____ type chuck.
8. The size of a belt sander is determined by the _____
9. To adjust the depth of cut of a radial arm saw, the _____ is raised or lowered.
10. When crosscutting with the radial arm saw, the blade is _____ (pushed away, pulled toward) the operator.
11. For regular work, the _____ of the jointer should be perfectly aligned with the knife

edges at their highest point.

- 1 2. What cuts can be performed with a frame and trim saw?

OUTSIDE ASSIGNMENTS

1. Visit a builder's supply center and study the various portable circular saws on display. Also, secure descriptive literature concerning the various sizes. After careful consideration, select a brand, model, and size that you believe would be best for rough framing and sheathing work on residential structures. Give your reasons and report to your class. Include specifications and prices of your selection.
2. Visit with a carpenter in your locality and learn what procedures are followed in maintaining and sharpening tools. If he or she uses standard saw blades, learn how they are kept sharp. Secure a reaction to the use of hardened tooth and carbide tipped blades. If he or she has some tools sharpened at a saw shop, find approximate prices. If a tool maintenance center is located in your area, find out what services are available and what they cost. Prepare your notes carefully, then make a report to your class.



For electrical safety on construction job sites the ground continuity monitor is a constant check that an extension cord is properly wired and grounded. The monitor (inset) is wired into the extension cord. A light on the monitor will glow when the cord is grounded and wired properly. (Daniel Woodhead Co.)