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ABSTRACT

This self-paced student training module on holding and fastening tools is one of a number of modules developed for Pre-apprenticeship Phase 1 Training. Purpose of the module is to enable students to identify, select, and demonstrate the proper selection, use, and care of pliers, wrenches, clamps, hammers, and screwdrivers. The module may contain some or all of the following: a cover sheet listing module title, goal, and performance indicator; study guide/checklist with directions for module completion; introduction; information sheets providing information and graphics covering the module topic(s); self-assessment; self-assessment answers; post assessment; and post-assessment answers. (YLB)

INDIVIDUALIZED LEARNING SYSTEMS

PRE-APPRENTICESHIP PHASE 1 TRAINING

HOLDING AND FASTENING TOOLS

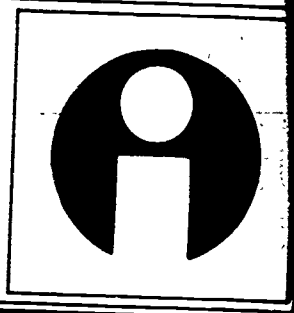
Goal:

Upon completing this module, the student will be able to identify, select, and demonstrate the proper selection, use and care of pliers, wrenches, clamps, hammers and screwdrivers.

Performance Indicators:

The student will demonstrate knowledge of the subject by successfully completing a Self Assessment exam and by either completing an Assignment page or by successfully completing a Post Assessment exam.

Study Guide



For successful completion of this module, complete the steps in the order listed below, checking each off as you complete it.

1. ____ Read the Goal and Performance Indicators on the cover of this module to determine what you will be expected to gain. Read the Intorduction to discover this module's importance to you and your trade.

2. ____ Study the Information section of the module to acquire the knowledge necessary to answer the exam questions which follow.

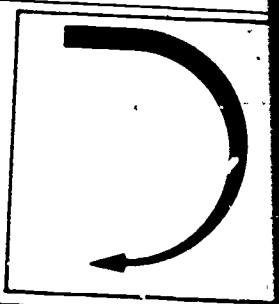
3. ____ Complete the Self Assessment exam, referring to the Information section or asking your instructor where help is needed. It is recommended you score well on this exam before proceeding.

4. ____ Complete the Post Assessment exam, and turn your answer sheets in to your instructor for grading,

   or

   complete the Assignment page as instructed. It is recommended that you score at least 90% on the Post Assessment or satisfy your instructor by demonstrating thorough and complete knowledge of the subject before going on to the next module.

Introduction



A wide variety of tools for holding and fastening are common to all of the skilled trades. Basic tools of these types, such as screwdrivers, pliers, wrenches, vises, and hammers, are so familiar that the apprentice may be tempted to believe that he or she can learn nothing new about them. However, the correct selection, use and maintenance of holding and fastening tools calls for some special knowledge and skills, and the apprentice should therefore study this module carefully to ensure complete understanding of the material covered. This is especially important for the safe use of the basic tools. Those devices used to fasten materials--nails, screws, bolts, studs, etc.--will be examined carefully in the next module.

Information

SCREWDRIVERS

Hand tools for driving and removing screws include square-shank, Phillips, and spiral ratchet screwdrivers as well as conventional screwdrivers. A hand brace fitted with a screwdriver bit is often used for the rapid driving and removing of screws in construction work.

CONVENTIONAL, OFFSET AND SQUARE-SHANK SCREWDRIVERS

Examples of screwdrivers of the various types used in the skilled trades are shown in Fig. E-17.

Conventional screwdrivers, which are made in many sizes and types, have flat-tipped blades and wood or plastic handles. The size of a screwdriver is determined by the length of its blade. The tips of conventional screwdrivers vary in width and in angle of bevel; in choosing a conventional screwdriver for a given job, the apprentice should be sure the tip fits deeply and snugly into the screw slot and that the tip is neither too wide nor too narrow for the screw head. Close-quarter screwdrivers and offset screwdrivers are useful for work where space is limited. The heavy-duty square-shank screwdriver is like the conventional type except that a wrench can be used on its shank for extra turning leverage.

PHILLIPS SCREWDRIVERS AND SPIRAL RATCHET SCREWDRIVERS

The Phillips screwdriver is like a conventional screwdriver except that it has a cross-blade tip to fit the cross slots of Phillips screws. Four tip sizes cover the full range of Phillips screw gages.

The spiral ratchet screwdriver has a spring-return, double-spiral grooved shaft that turns and recesses into the handle when the handle is pushed. A reversible ratchet device in the ferrule determines the direction of rotation of the shaft.

The ratchet can be locked out to permit the tool to be used like a conventional screwdriver. In most makes, the chuck at the end of the shaft will accept tips of various types and sizes.

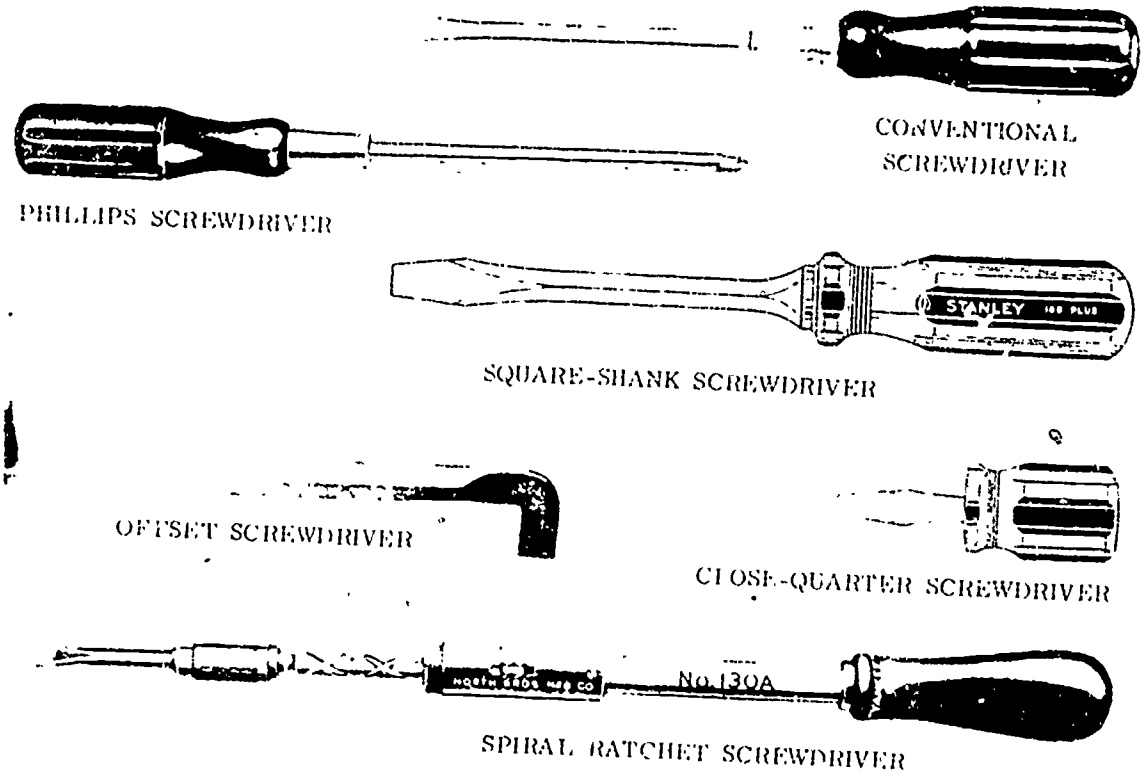


Fig. E-17. Screwdrivers

USE AND CARE OF SCREWDRIVERS

Like all tools, screwdrivers must be used correctly and maintained carefully if they are to be effective and safe. For example, a conventional screwdriver will be difficult and even dangerous to use if its tip has become worn or is damaged. If the screwdriver tip continually slips out of the screw slop, or if it scars the screw head, it should be reground or filed so that the flat sides of the tip are nearly parallel. In fact, it is desirable that the sides be ground slightly concave so that they will be almost perfectly parallel where the tip engages the screw slot. The end of the tip should have no rounded edges or corners and it must be square with the center line of the blade. (See Fig. E-18.)

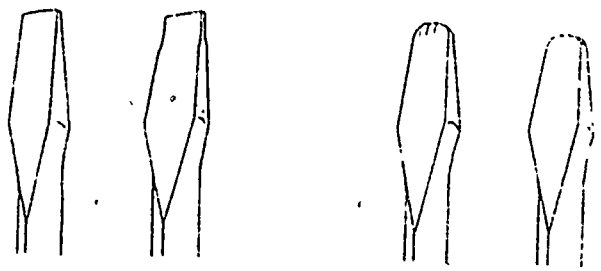


Fig. E-18. Correct and incorrect shapes for screwdriver tips

When using a screwdriver, the apprentice should observe the following rules:

- Use an awl, a drill, or a nail to make the starting holes for woodscrews. (Rubbing a little soap or wax on the threads of a woodscrew will make it easier to turn it.)
- When driving or removing screws in a small piece of work, hold the work in a vise or clamp, not by hand.
- To prevent the screwdriver from slipping, hold it so the tip is square with and centered on the screw head.
- Never use a screwdriver as a chisel, a pry bar, or a punch.
- Never use pliers to turn a square-shank screwdriver. If extra leverage is needed, use a close-fitting wrench.
- Repair or discard any screwdriver with a worn or damaged tip, a bent blade or a loose or cracked handle.
- When working on or around electrical equipment, use screwdrivers with insulated handles only.

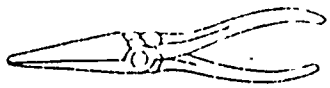
PLIERS

Pliers are intended for cutting or bending wire, cutting and removing cotter pins, and a variety of other cutting and gripping operations. They are not intended for use as wrenches for tightening or loosening bolts or nuts. If misused in this way, they are likely to slip and cause injury to the user and damage to the work. Pliers should not be used for gripping objects with hardened surfaces; this dulls their teeth.

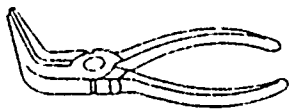
A complete listing of the many types of pliers used in modern industry is beyond the scope of this module, but a few of the more widely used gripping pliers are shown in Fig. E-19. The most commonly used type is the combination plier, which

has a slip joint that permits the jaw opening width to be increased as required for large objects. Combination pliers are made in lengths ranging from 5 to 10 in.

COMBINATION OR SLIP-JOINT PLIER



LONG-NOSE PLIER

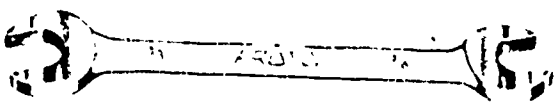


BENT-NOSE PLIER

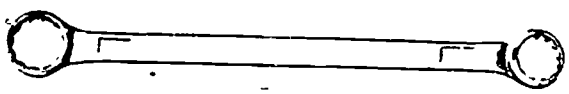
Fig. E-19. Pliers

WRENCHES

The kinds of wrenches in widest use in the skilled trades are those intended for tightening and loosening nuts, bolts and screws. Common wrenches in this category are the open-end box, socket, Allen and adjustable types. (See Fig. E-20.)

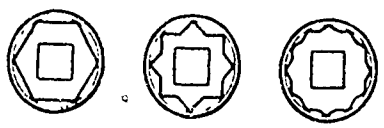


END WRENCH



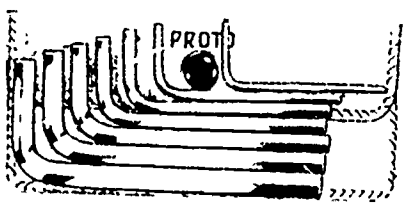
BOX WRENCH

SOCKET WRENCH

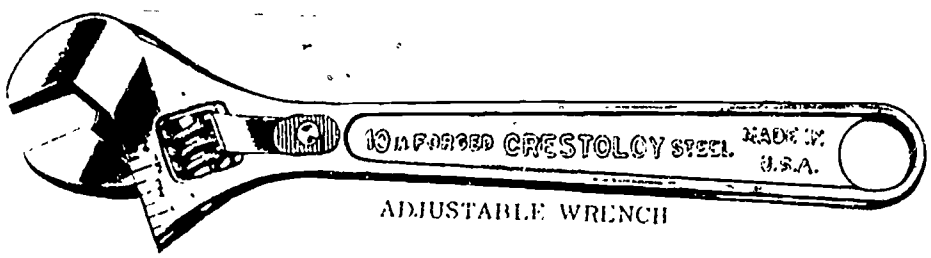


6-POINT 8-POINT 12-POINT

COMMON SOCKET OPENINGS



ALLEN WRENCH SET



ADJUSTABLE WRENCH

Fig. E-20. Wrenches

OPEN-END AND BOX WRENCHES

Open-end wrenches have parallel-sided openings at each end. A complete set will include wrenches of 10 or more sizes. A box wrench differs from an open-end wrench in that the opening completely surrounds the bolt head or nut. The openings of a good box wrench usually have 12 notches (points) to make it easier for the user to get a new "bite" on the nut in close-quarter tightening.

SOCKET WRENCHES

The opening of a socket wrench, like that of a box wrench, completely surrounds the nut. The opening may be a 6-, 8-, or 12-point type as shown in the illustration. A square opening in the opposite end of the socket accepts a conventional level handle, a ratcheting handle, or a crank-type handle for turning the socket. Socket wrenches are made in a wide range of sizes. Square drive openings of 1/4 in., 3/8 in., and 1/2 in. are common.

ALLEN WRENCHES

An Allen wrench is a light hexagonal steel bar designed to fit the recessed opening of an Allen screw head. The wrench has a right-angle bend near one end for leverage. Allen wrenches are made in a wide range of sizes.

ADJUSTABLE WRENCHES

An adjustable wrench is similar to an open-end wrench except that it has a single opening with an adjustable jaw. The thumbscrew mechanism for adjusting the jaw opening may incorporate a locking device to ensure that the selected opening will not change in size during use. Adjustable wrenches are made in lengths from 4 in. to 18 in. overall.

CORRECT USE OF WRENCHES

The apprentice should observe the following rules for the correct use of wrenches:

- Be sure the wrench fits the nut or bolt head. Use of a wrench with an opening of the wrong size will result in damage to both the work and the tool and hazard to the user.
- Always pull rather than push the handle of a wrench. If the wrench should slip, the chance of injury is lessened if the wrench is being pulled toward the user.
- When using an adjustable wrench, be sure the opening fits the nut accurately. Pull only against the stationary jaw, never against the adjustable jaw.

VISES AND CLAMPS

Workers in the skilled trades often find it necessary to fasten materials together temporarily or to hold them securely for drilling, sawing, gluing and other machining or assembly operations. Vises and clamps of various kinds are employed for these purposes.

BENCH VISES

Bench vises are made in a wide range of styles. A small vise that can be fastened to a bench or sawhorse when it is needed is a useful addition to the tool collection of a worker in the construction trades. (See Fig. E-21.) A bench vise of the type shown can be used for holding objects as large as a door or a sash.

A bench vise may incorporate a locking swivel base that allows the user to turn the vise on its vertical axis to the most convenient working angle. Some vises used in the machine trades can be swiveled on the horizontal as well as the vertical plane.

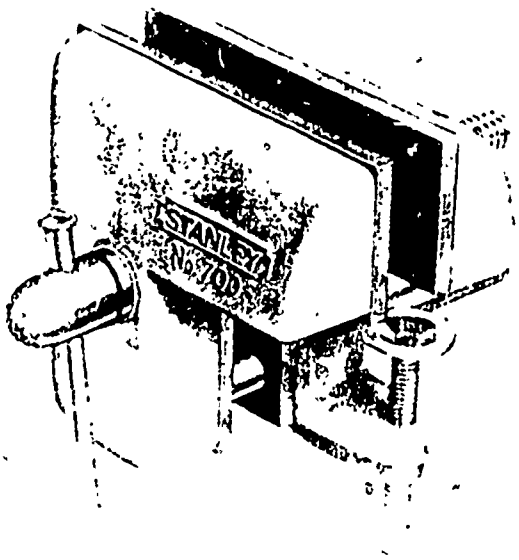


Fig. E-21. A bench vise

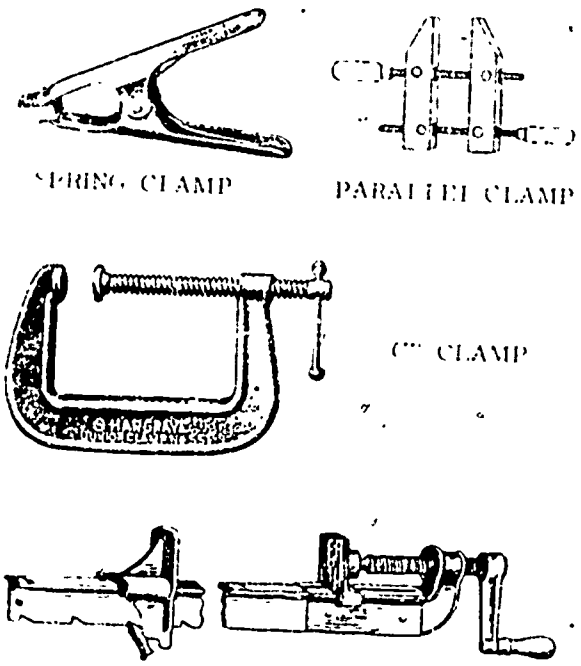


Fig. E-22. Clamps

CLAMPS

A variety of clamps are used in the skilled trades for holding pieces of work together during assembly or fabrication operations. Types commonly used include spring clamps, parallel clamps, C-clamps and bar clamps. (See Fig. E-22.)

NAILING TOOLS

The driving, setting and pulling of nails in construction work calls for hammers in a variety of types and sizes and nailsets, pinchbars, prybars and ripping bars.

HAMMERS

The hammer most commonly used for driving nails is the claw hammer. (See Fig. E-23.) The claw is intended for pulling nails and ripping; it may be straight or curved. The straight-claw hammer is the better type for ripping; the curved-claw hammer is more efficient for pulling nails. The hammer head may be bell-faced (slightly convex) to make it easier to drive nails flush without leaving a hammer mark. Flat-faced hammers are in some cases cross-checkered at the face to reduce the tendency of the hammer head to glance off the work.

The drywall hammer shown in Fig. E-23 is the hammer commonly used by lathers and drywall workers. Its rounded face dimples the wallboard slightly on the final nailing stroke, making a smooth depression that can easily be filled. The wedge-shaped blade can be used for prying wallboard into place and it also has a nail-pulling edge.

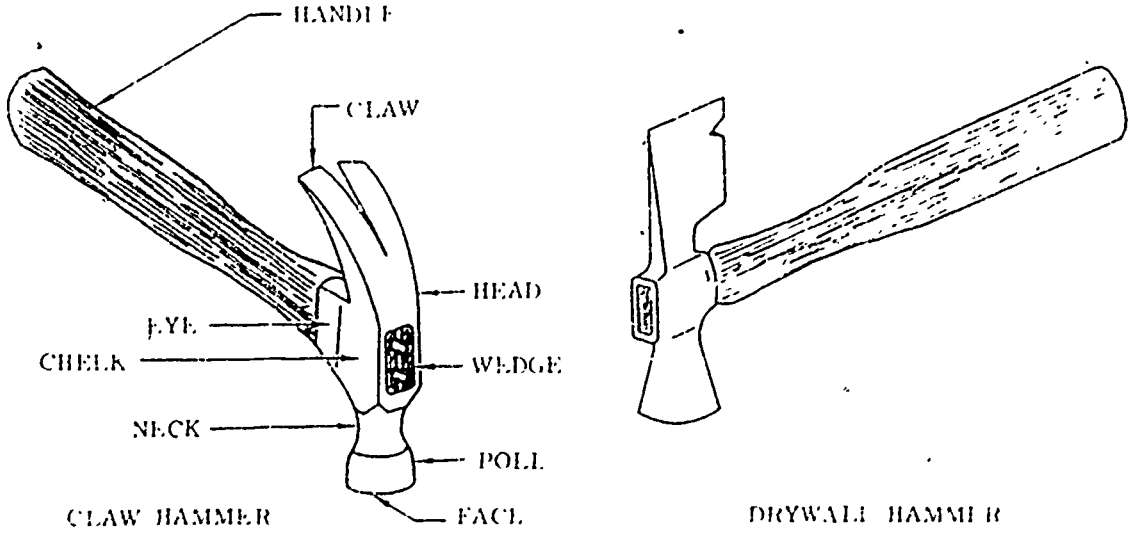


Fig. E-23. Hammers

Good hammer heads are made of drop-forged steel and are tempered and heat treated. Nailing hammers are sized by the weight of their heads, ranging from 7 oz. to 20 oz. The 16-oz. nailing hammer is a popular size. Hammer handles are generally made of wood, but they may be made of steel covered with leather or plastics.

Wood handles require tightening and replacing from time to time. The eye or hole in the hammer head is slightly tapered so that the hole size increases toward the wedge end. In tightening or replacing a wood handle, the fitted handle end is driven fully into the eye, and the metal wedge is then driven firmly into a saw kerf in the end of the handle. The wedge forces the wood tightly against the tapered sides of the eye to hold the handle secure.

CORRECT USE OF HAMMERS

The apprentice should observe the following rules for the correct and safe use of hammers:

- Grip the hammer handle near the end. A hammer held too near the head cannot be swung with full force or best control.
- Strike the object squarely with the full force of the hammer.
- Avoid damaging the wood with the hammer edges. This is particularly important in finish work.
- Keep the hammer face clean to prevent it from glancing off the nail head.
- Do not use the hammer handle for prying or pounding.
- Never use a hammer that has a loose head.
- If burrs should develop on the head or claw of a hammer, file or grind them off.
- Never strike two hammers together, and never pound a hammer on a hardened steel surface.

NAIL SETS

In finish work, it is usual to set nail heads slightly below the surface. The device used for this purpose is called a nail set, a punch-like steel tool having a cup-shaped point that fits over the head of the nail. Nail sets are made in several sizes; for a given job, the one used should have a point of about the same size as the head of the nail.

Before the nail set is used, the nail should be driven almost flush with the surface of the wood. Then, with its point held squarely on the nail head, the nail should be tapped just hard enough to sink the nail about 1/16 in. below the surface. (See Fig. E-24.) Putty or some other suitable filler can be used to conceal the recessed nail head.

PINCH BARS

In cases where a claw hammer does not provide enough leverage for removing a large nail, the worker can use a pinch bar or, even heavier work, a prybar or a ripping bar. (See Fig. E-25.) Bars of this type are also useful for prying up boards or moldings.

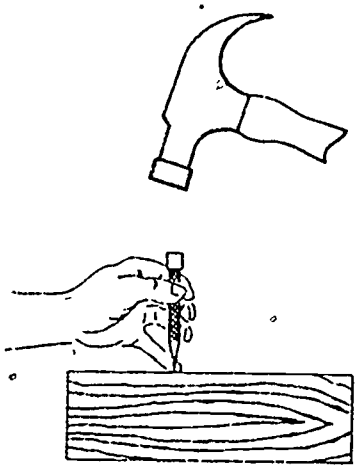


Fig. E-24. Using a nail set

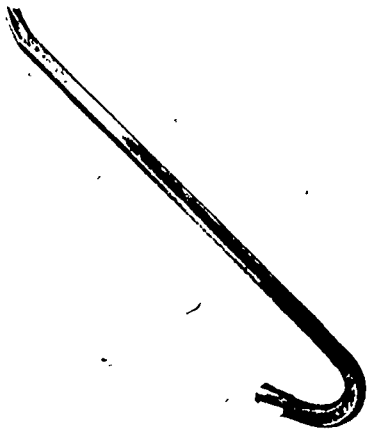
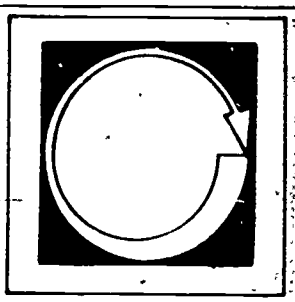


Fig. E-25. Ripping bar

Self Assessment



Read each statement and decide whether it is true or false. Write a T if the statement is true; write F if the statement is false.

1. ____ A square-shank screwdriver is designed to be used as a prybar or lever as well as a screwdriver.

2. ____ If a screwdriver continually slips from the screw slot, it is likely that the tip of the tool does not have the correct shape.

3. ____ The size of a screwdriver is determined by its overall length.

4. ____ A Phillips head screw has a single recessed slot.

5. ____ A screwdriver should never be used as a chisel, a prybar, or a punch.

6. ____ A strong pair of pliers may be used to tighten a bolt if a wrench is not available.

7. ____ Allen wrenches are specially shaped adjustable wrenches.

8. ____ When using an adjustable wrench, one should pull only against the stationary jaw.

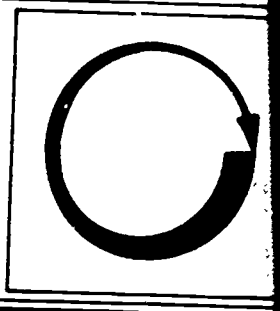
9. ____ Hammers are sized according to the weight of their heads.

10. ____ To get the best swing in hammering, the worker should grasp the hammer handle close to the head.

SELF ASSESSMENT ANSWER SHEET

1. F
2. T
3. F
4. F
5. T
6. F
7. F
8. T
9. T
10. F

Assignment



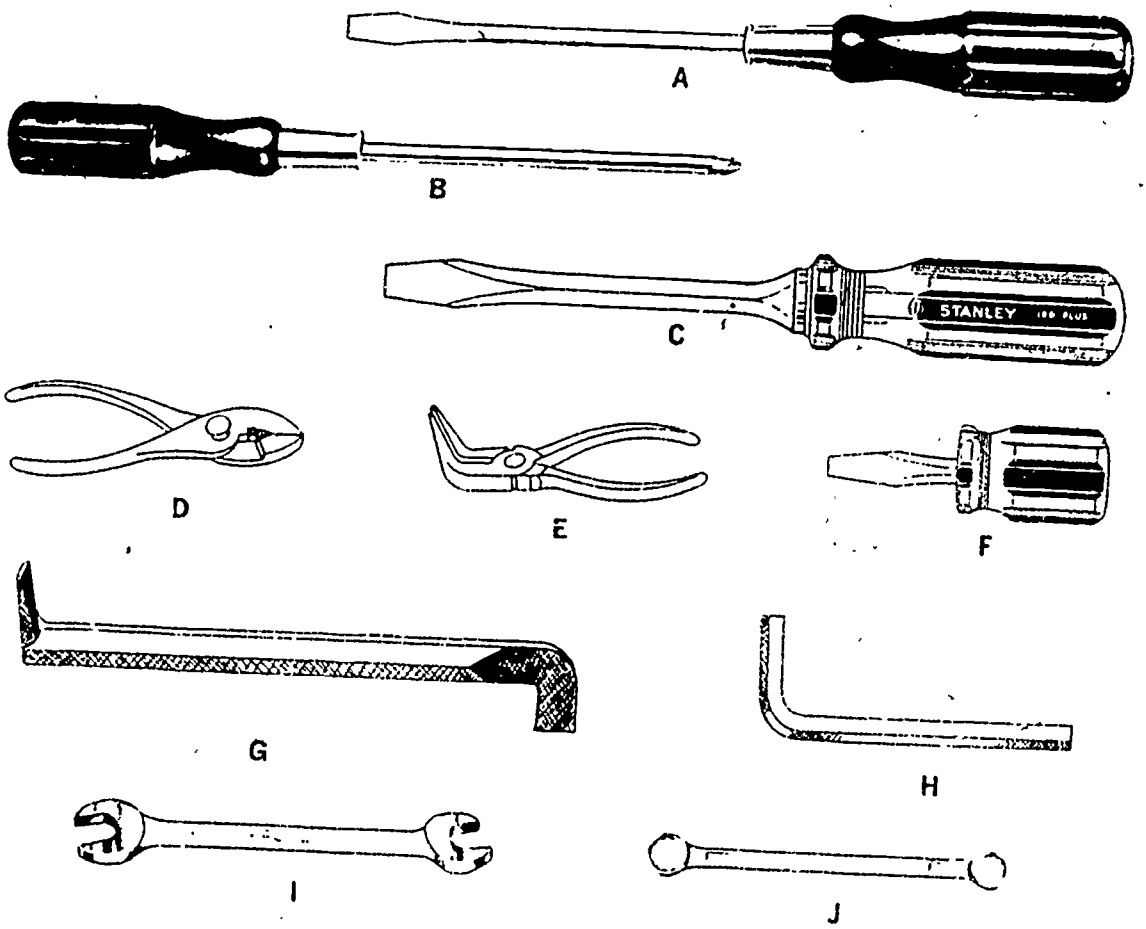
You are required to complete either the Assignment page or the Post Assessment exam before receiving credit for completing this module. The assignment consists of successfully completing the following. Please complete the Self Assessment before doing the assignment or taking the Post Assessment.

ASSIGNMENT

Describe, in your instructor's presence, the proper selection and use of every holding and fastening tool discussed in this module. Your instructor may name them and point them out, but you must describe what specific purposes they are used for and how to use them properly.

Post Assessment

A group of tools for holding and fastening is shown on this page. In each space in the numbered column below, write the letter of the illustrated tool that matches the tool named in the column.



1. ____ Phillips screwdriver
2. ____ Box wrench
3. ____ Square-shank screwdriver
4. ____ Allen wrench
5. ____ Offset screwdriver
6. ____ Slip-joint plier

Listed below each numbered item are four possible answers or completing phrases. Decide which of the four is correct, or most nearly correct; then write the corresponding letter in the blank space to the left of that item.

7. ____ Which one of the following wrenches is made to fit into a recessed, hexagonal hole in the bolt head?

a. open-end wrench
b. Allen wrench
c. adjustable wrench
d. box wrench

8. ____ Pliers are properly used to:

a. tighten bolts
b. bend cotter pins
c. turn square-shank screwdrivers
d. loosen nuts

9. ____ The size of a screwdriver is determined by the:

a. overall tool length
b. width of the tip
c. diameter of the handle
d. length of the blade

10. ____ Which one of the following screwdrivers is most useful in applications where working space is limited?

a. square shank
b. Phillips
c. offset
d. ratchet

11. ____ If a screwdriver continually slips from the screw slot, the most probable trouble is that the:

a. blade is bent
b. tip is incorrectly shaped
c. screw slot is inaccurately machined
d. blade is loose

12. ____ Which one of the following is a safety precaution relating to the use of wrenches?

a. Always pull rather than push the handle of a wrench.
b. Always use an adjustable wrench on square nuts.
c. Never use an end-wrench on stud bolts.
d. Never use an Allen wrench without a handle.

13. ____ Hammers are sized by the:

a. length of the handle
b. length of the head
c. weight of the head
d. width of the claw

14. ____ The most efficient hammer for pulling nails is the:

a. drywall hammer
b. straight-claw hammer
c. curved-claw hammer
d. ripping hammer

15. ____ The tool used to drive a nailhead below the surface of the wood without scarring the wood is called a:

a. driving tool
b. center set
c. center punch
d. nail set