

Principles and Practices of Light Construction



Ronald C. Smith, Ted L. Honkala, and Malcolm W. Sharp

SIXTH EDITION

6

Principles and Practices of Light Construction

Sixth Edition

Ronald C. Smith, Ted L. Honkala, Malcolm W. Sharp

This new edition updates one of the classics in the field. Materials and methods have been updated to include the latest standards and technology, including energy efficiency and the newest power tools. New illustrations have been added throughout the book to represent current trends in the workplace. The layout of the text corresponds closely to standard instructional requirements and the step-by-step approach enhances reference value.

New to this edition:

- Scaffold erection and safety
- All chapters updated
- 145 new illustrations
- Glossary of terms
- Improved review questions

Reviewer comments:

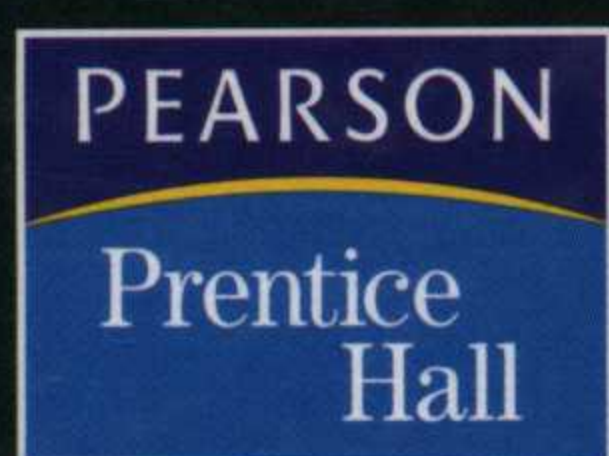
"The overall strength of this text is in its logical or sequential development related to the actual construction process. It is a good introductory book for beginning students."

—Eugene H. Wright, University of Nebraska—Lincoln

"This text is designed to provide learning options for both the teacher and for students. The authors understand the construction process and have shared their knowledge in a way that is meaningful, practical, and useful to build a house or small building."

—D. Perry Achor, Purdue University

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PRINCIPLES AND PRACTICES OF LIGHT CONSTRUCTION

Sixth Edition

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Ted L. Honkala

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MacNel Consulting Ltd.

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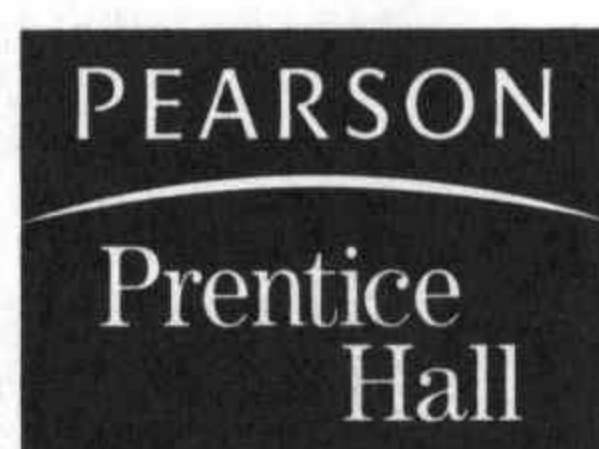
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PREFACE

As this is the sixth edition of *Principles and Practices of Light Construction*, we ascertain that it has been serving an important role in the light construction industry for many years. Since its publication in 1963 there have been numerous advances made, not only in building practices but also in materials, equipment processes, and design. Keeping abreast of these advances is a challenging task for all of us.

There has been a continual increase in the demand for new buildings, regardless of where you live. The pressures of increasing populations, urban expansion and renewal, the attractiveness of rural living, and a focus on different lifestyles all contribute to the demand.

We all learn from our experiences. From those experiences new ideas and methods evolve. The building industry is no exception. New materials, improved labor-saving techniques, better processes, and better trained personnel all make a difference in the way the construction industry has evolved. Prefabrication, molded products, plastics, vinyl components, composition materials, metals, and modifications in glass products all have required changes in the way we build. The increased demand for oil and gas along with higher prices has also led consumers to seek more energy-efficient buildings, and, with the introduction of sophisticated electronic systems in buildings, has necessitated changes.

The intent of this book is to provide a tool for people involved in the construction of “light” buildings to enable them to become better informed about current practices, methods, and materials. This book is written for those who are practitioners, or those intending to be practitioners, those who are involved in a peripheral way with buildings, and those who are novices interested in becoming knowledgeable about light construction, regardless of their reasons.

Acknowledgment must be given to Ronald Smith, a longtime colleague of mine who created the first edition. His knowledge and skills as a competent practitioner and instructor allowed him to put together a much-needed book on the subject. Likewise, Ted Honkala,

who co-authored with Ronald Smith, was also a colleague of mine. I have the greatest respect for his competence in the construction field and in his ability to put forth his experiences in a manner that allows others to reap untold benefits. Both of these people have set the groundwork for an exceptional book that made my job of editing and updating it much easier.

I also want to thank all those who have contributed their expertise, illustrations, and other materials that make the book as current as possible. Without their help and cooperation, this book would not have been possible. In addition, particular thanks are due to David L. Batie, East Carolina University; Eugene H. Wright, University of Nebraska–Lincoln; D. Perry Achor, Purdue University; and Robert Pyle, North Carolina A & T State University, for their assistance with the sixth edition text review.

Malcolm W. Sharp

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Chapter 1

TOOLS AND EQUIPMENT

OBJECTIVES

Here is what you will be able to do when you complete each component of this chapter:

1. Identify and determine uses of common hand and power tools used in the construction of buildings.
2. Describe how to care for tools.
3. Identify common construction equipment.

Regardless of trade or occupation, tools are an integral part of the job. Granted, they have evolved, but they remain essential. Hand tools are necessary for a multitude of tasks even though electrical or pneumatic tools have replaced many of the operations, resulting in increased efficiency. New hand and power tools continue to be developed as a result of new materials and processes.

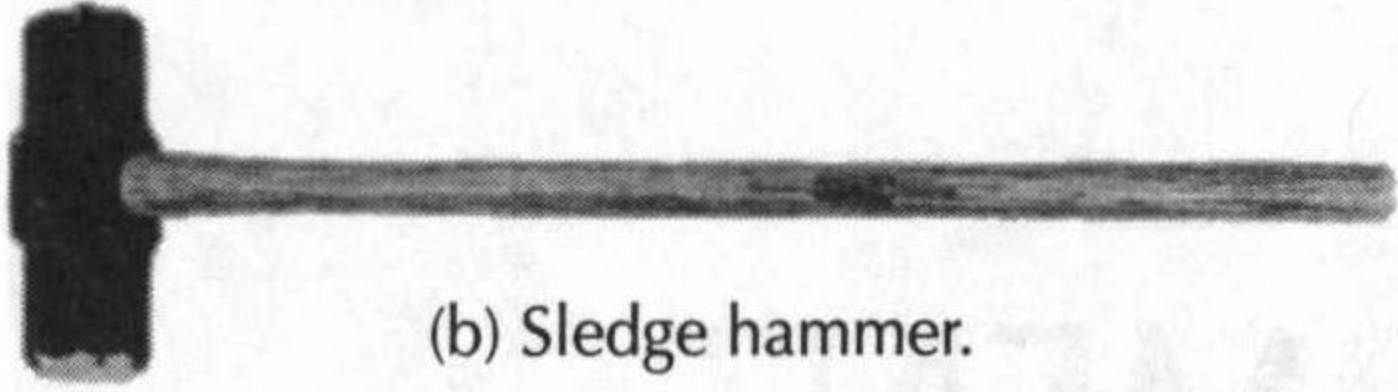
A successful practitioner must have a wide variety of hand and power tools, in order to perform many different operations required in the course of daily activities in the construction industry. Competence in their proper use is mandatory, and it is with this purpose this chapter deals with the identification and explanation for their intended use. Skill in performing operations will have to be achieved through experience and guidance from others. It is strongly recommended that this textbook be used in conjunction with a comprehensive hands-on component.

HAND TOOLS

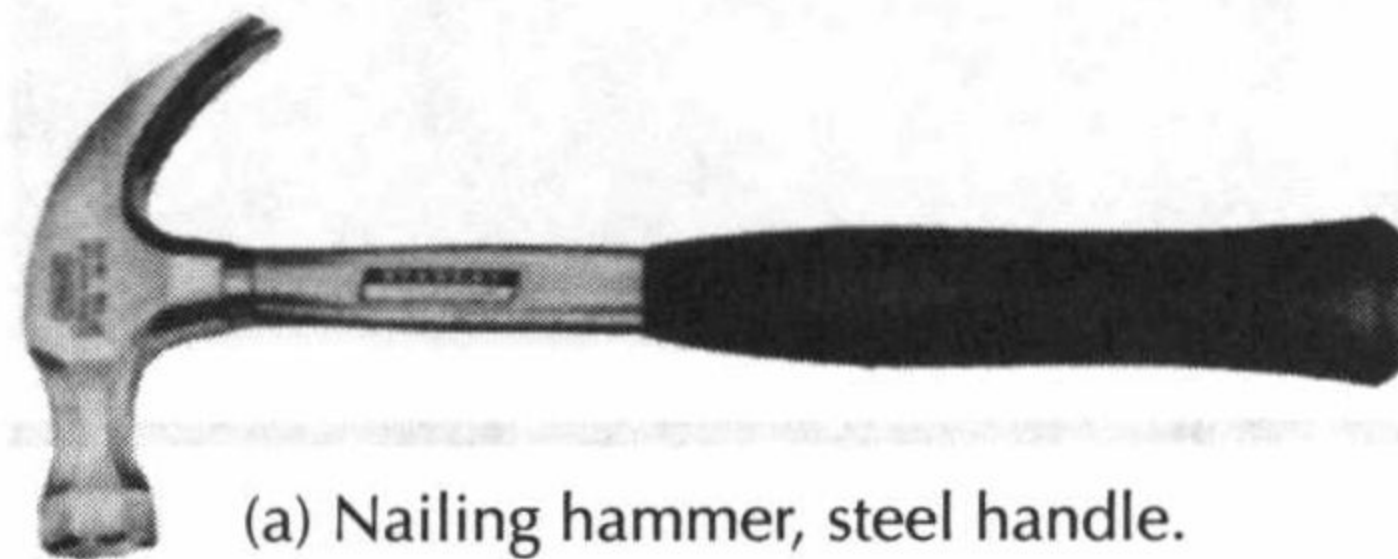
Hand tools may be divided into the following groups, based on the type of work done with them:



(a) Claw hammer.



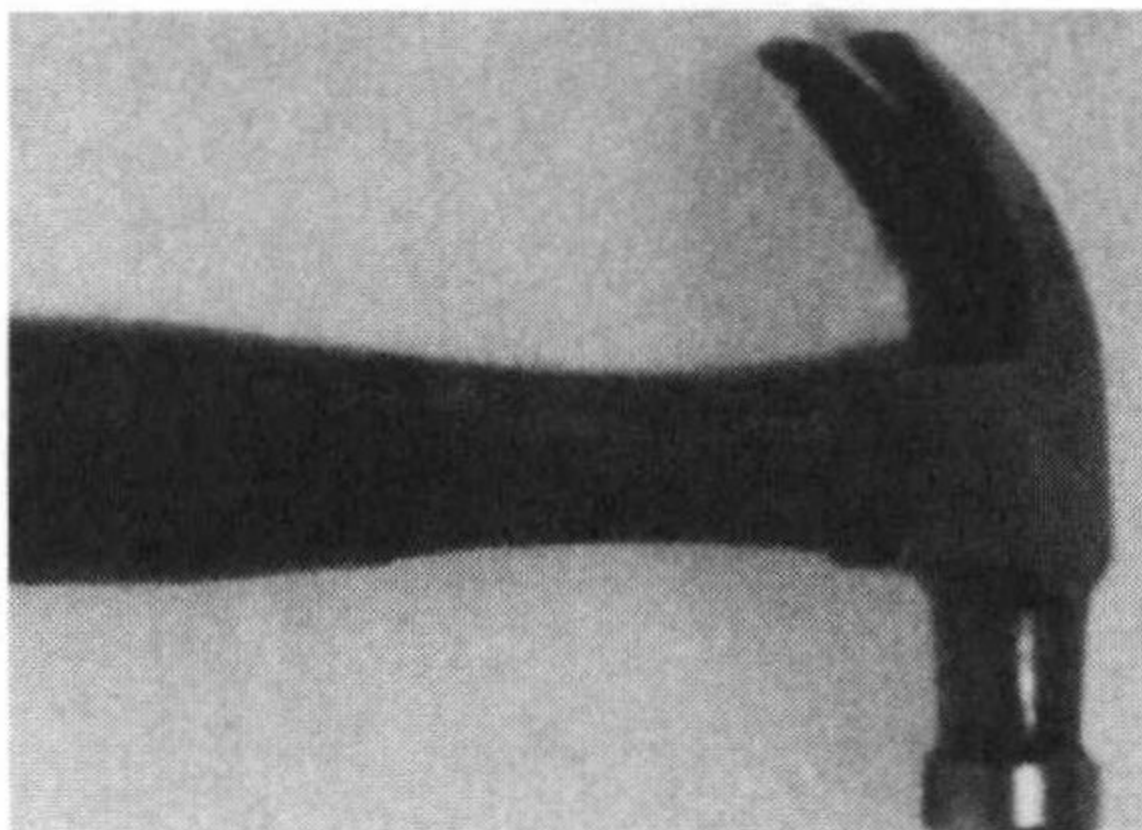
(b) Sledge hammer.

FIGURE 1-1 Hammers.

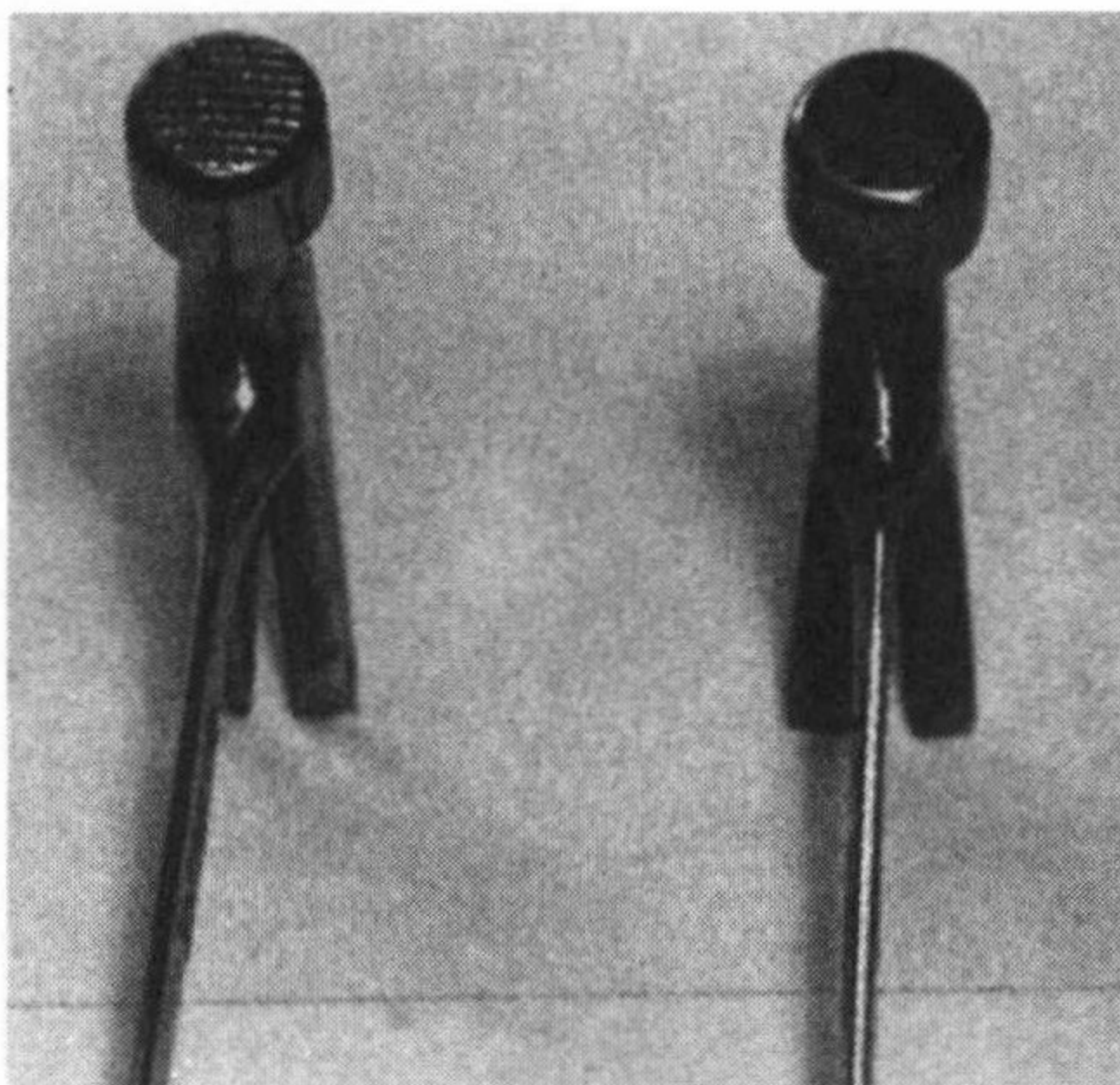
(a) Nailing hammer, steel handle.



(b) Framing hammer.

FIGURE 1-2 Hammer claws.

(a) Belled.



(b) Knurled and plain.

FIGURE 1-3 Hammer faces.

1. Assembling tools
2. Boring tools
3. Cutting tools
4. Holding tools
5. Layout and marking tools
6. Leveling and plumbing tools
7. Measuring tools
8. Sharpening tools
9. Smoothing tools
10. Wrecking tools.

On occasion there may be a tool that belongs in more than one of these groups.

Assembling Tools

Hammers. Hammers are classified according to the type of work done with them. Two of the most common classifications are sledgehammers [see Fig. 1-1(b)] and claw hammers [see Fig. 1-1(a)]. Claw hammers are used for driving nails while sledgehammers are used for driving stakes into the ground, or possibly for demolition work.

Claw hammers are made with either curved claws for nail pulling or straight claws for ripping and wrecking work [see Fig. 1-2(a) and 1-2(b)]. The ripping claw hammer is called a *framing hammer* and is typically used by those involved in framing work. The curved claw hammer is typically used for finishing or general work. The face of a nail hammer may be belled (convex surface), plane (flat surface), or knurled (checkered) (see Fig. 1-3). The weight of a hammer is usually 13 oz (370 g) for light finish work, 16–20 oz (455–570 g) for general work, and 22–28 oz (625–800 g) for framing work. Choose the hammer best suited for the job to be done.

Hammer handles may be made of wood, steel, graphite, or fiberglass. The wooden-handled hammer has more give or spring than the other types, but steel, graphite, and fiberglass handles are stronger and less likely to break. The grips on these handles are available in leather, plastic, or vinyl materials.

Claw hammers should never be used for purposes other than driving or pulling regular nails. When using a hammer to pull nails, use a block placed between the hammer and the surface next to the nail to increase the leverage (see Fig. 1-4), or if very hard to pull, use a wrecking bar (see Fig. 1-52).

When using a hammer, grip the handle near the end so the entire length of the handle provides leverage. Holding the handle near the head provides very little power behind the swing. Hold the handle firmly, use short strokes to start the nail, and then drive it home with longer strokes. When driving small nails with short strokes, use

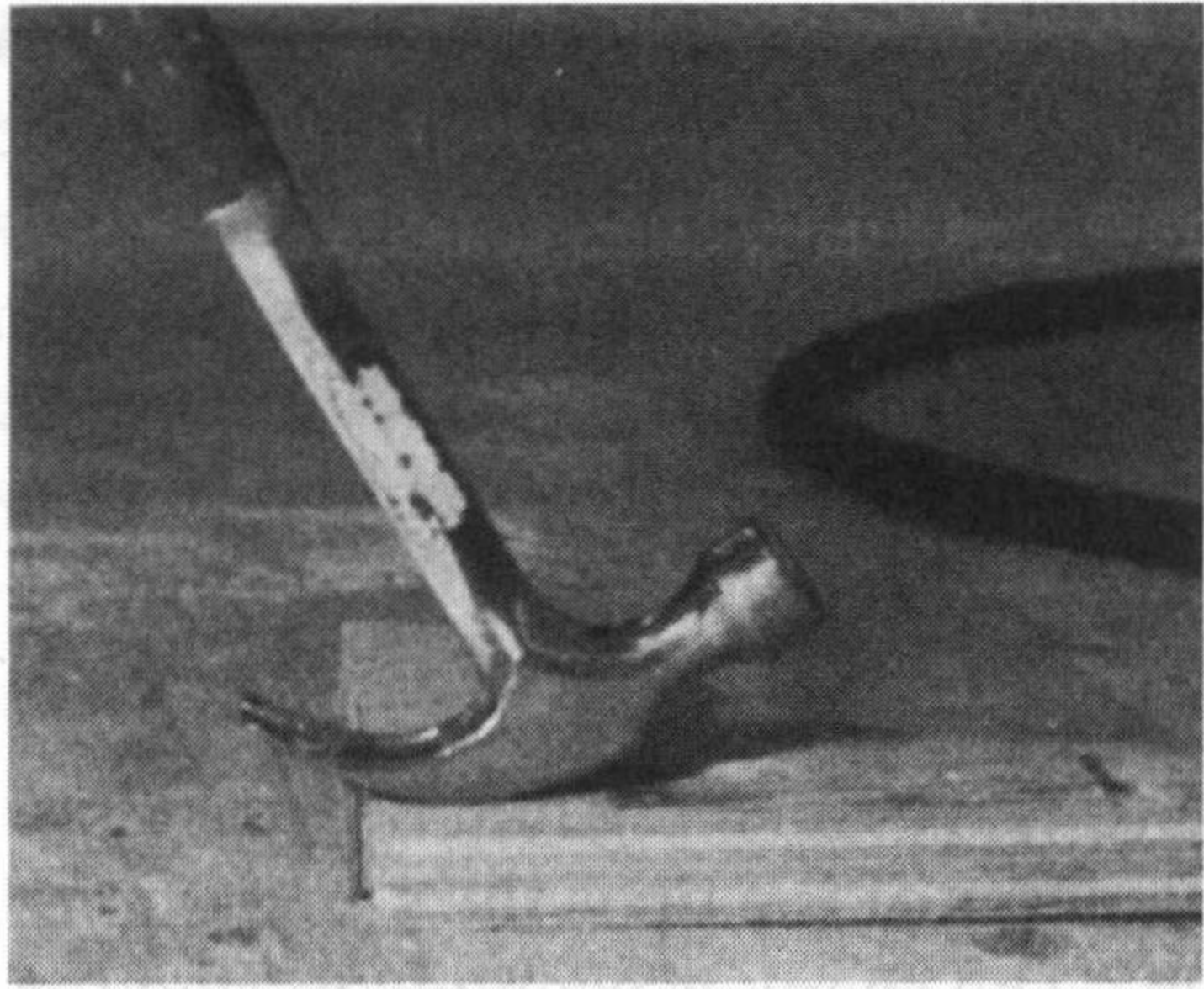


FIGURE 1-4 Block to assist pulling.

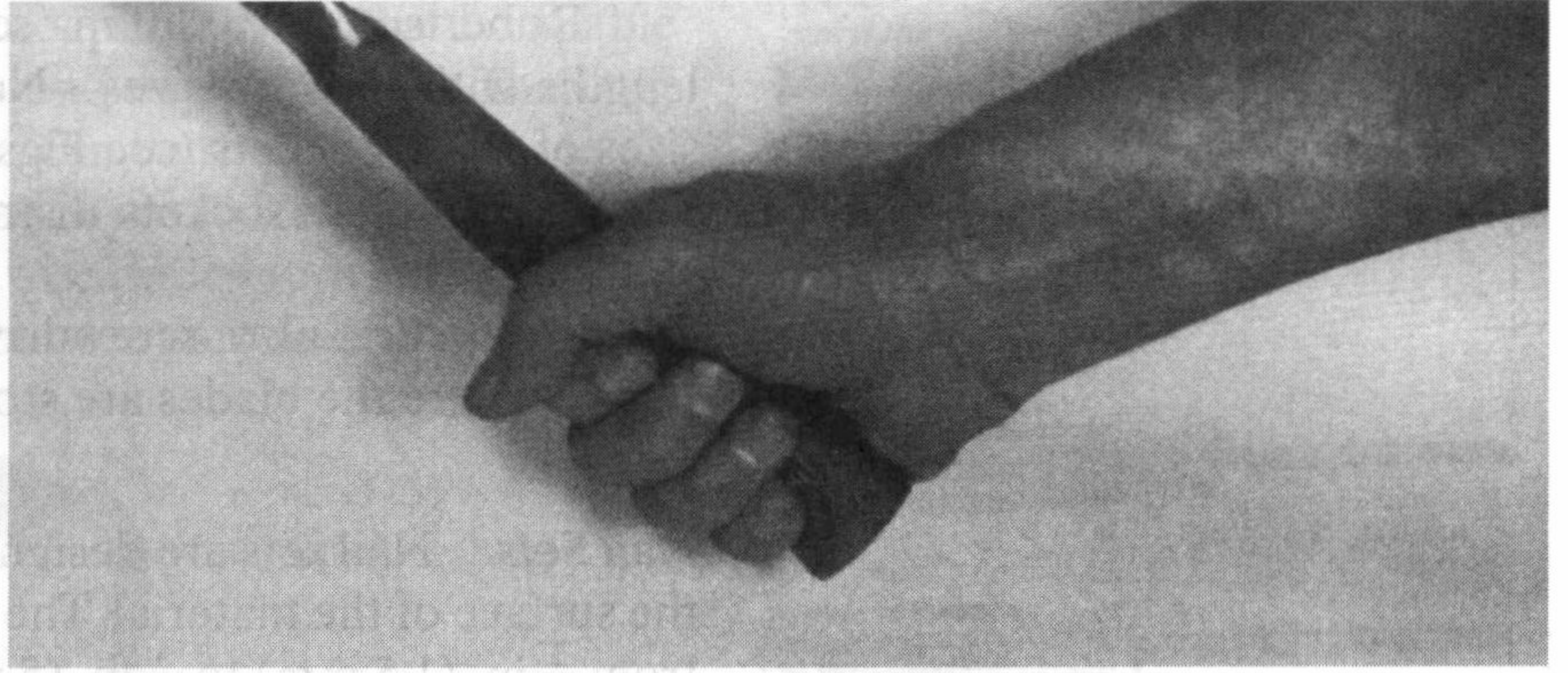


FIGURE 1-5 Hammer grip.

only your wrist and forearm in the swing. Long nails, such as those used in framing, need the force of your entire arm to drive them easily (see Fig. 1-5).

Screwdrivers. Screwdrivers are most common in three types: *flat blade*, for use with slotted screws; *Robertson*, for use with Robertson head screws, that have a square pocket in the head; and *Phillips*, for use with Phillips head screws, that have an indented cross in the head (see Fig. 1-6).

The blades of flat blade screwdrivers are made in a number of widths and thickness to accommodate the various sizes of screws (see Fig. 1-7). Some of these screwdrivers, called *stubbies*, have a very short blade and handle for use in hard-to-get-at places (see Fig. 1-8).

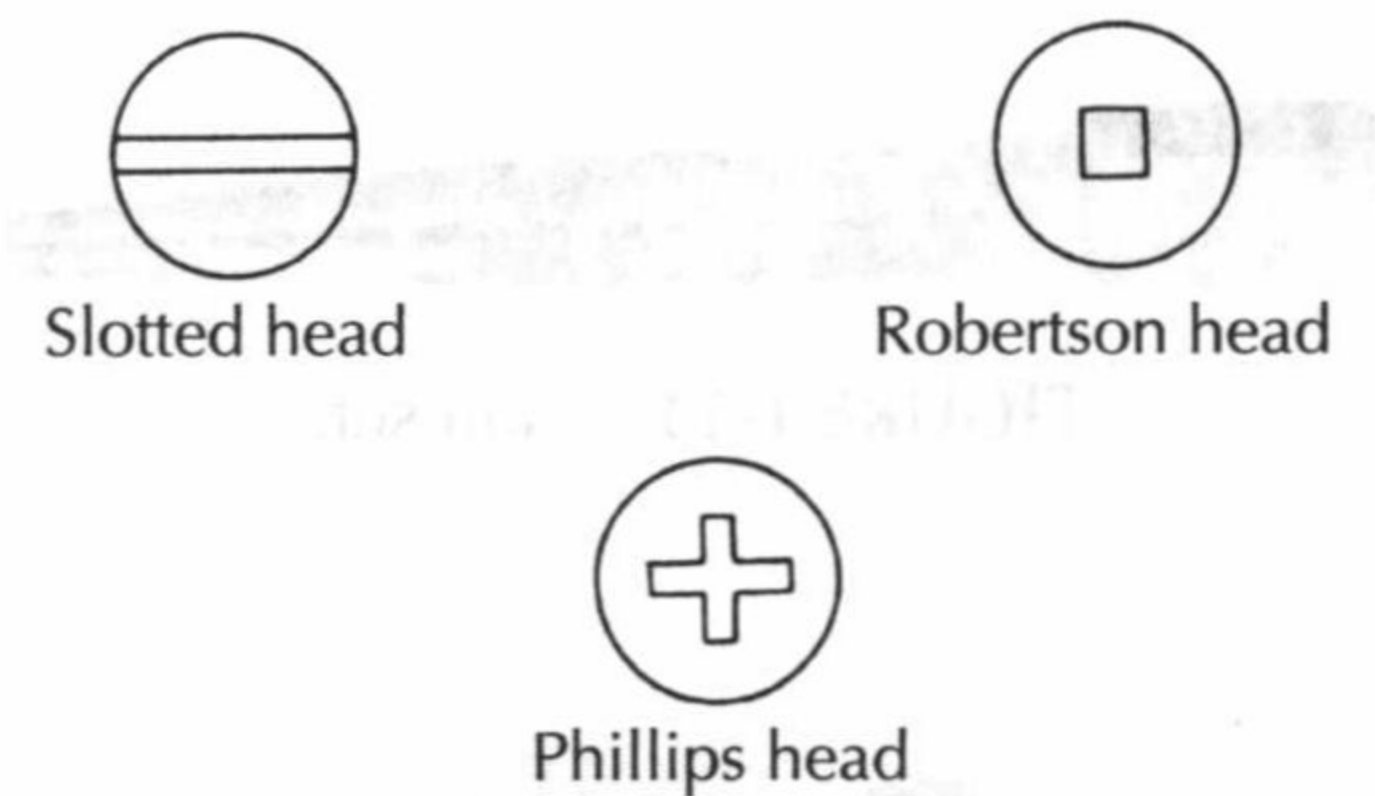


FIGURE 1-6 Screw head types.

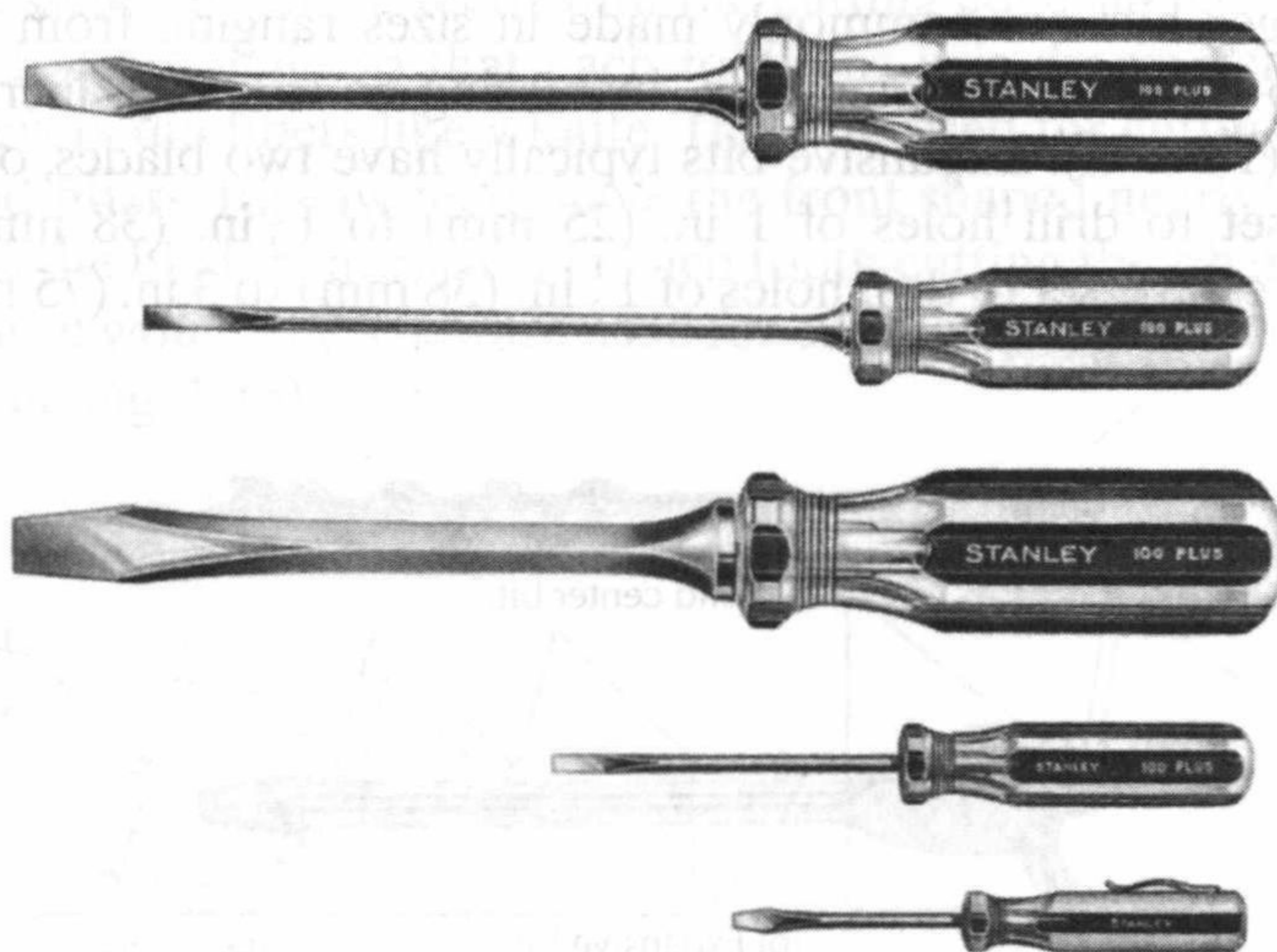
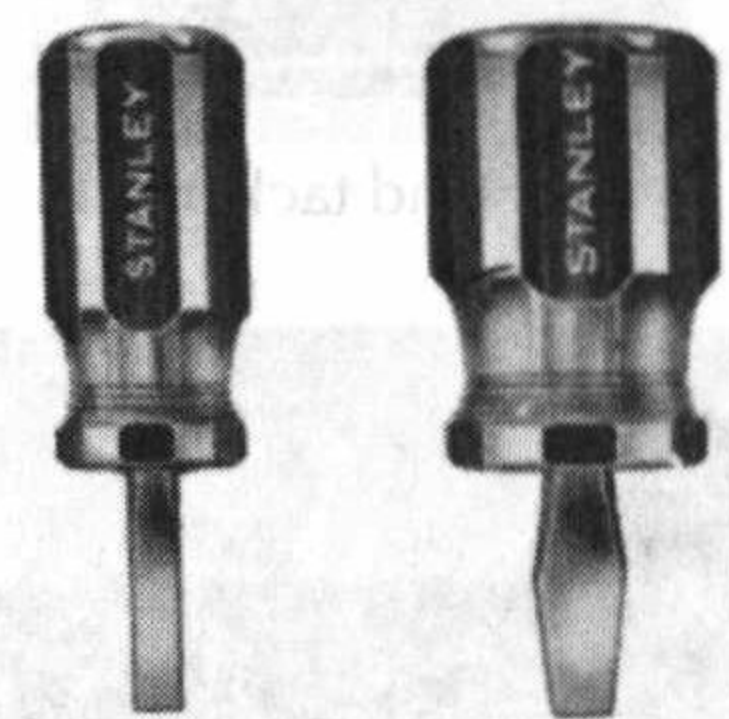
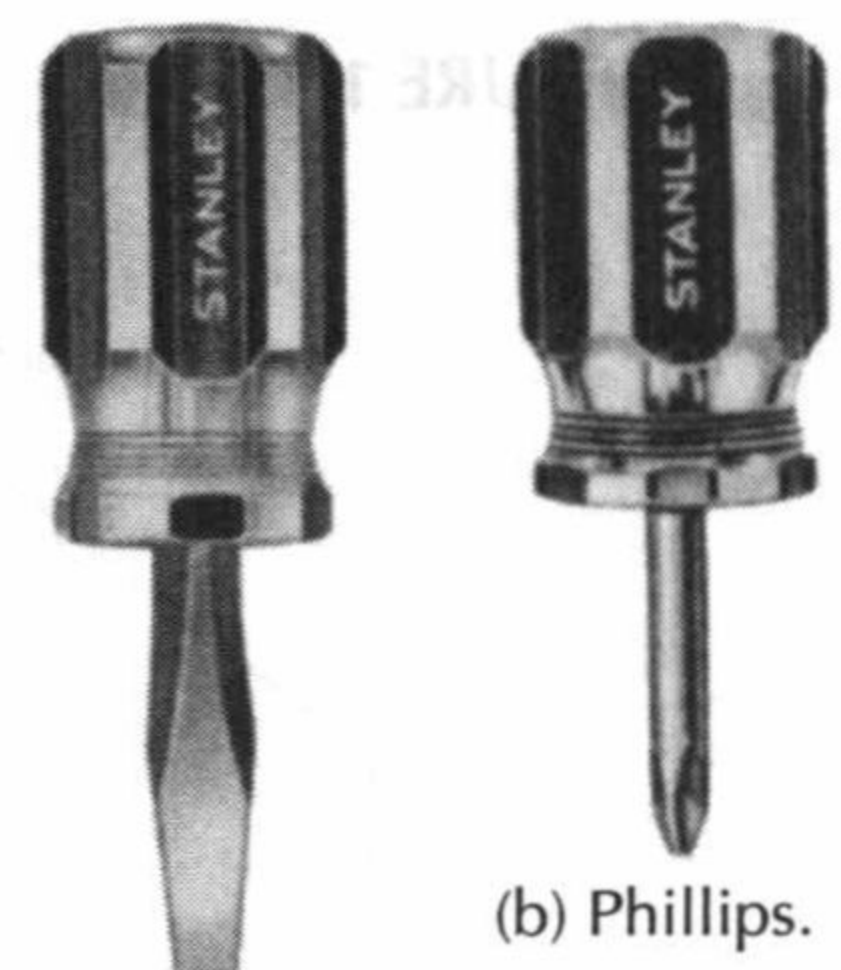


FIGURE 1-7 Plain-handled screwdrivers.



(a) Flat blade.



(b) Phillips.

FIGURE 1-8 "Stubby" screwdrivers.

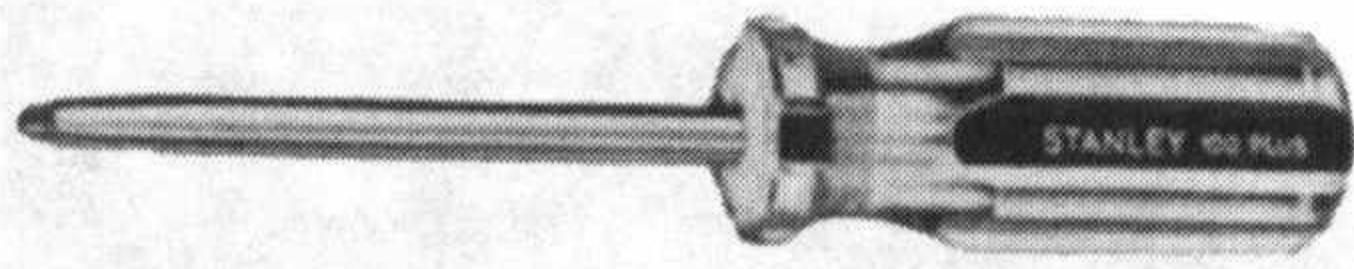


FIGURE 1-9 Robertson screwdriver.

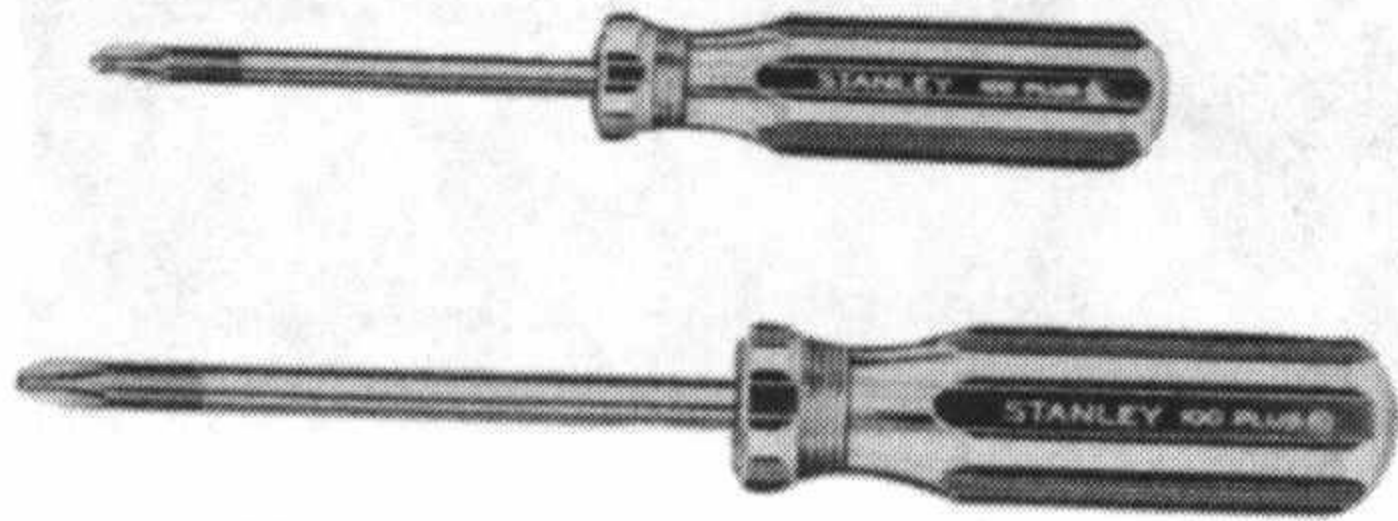
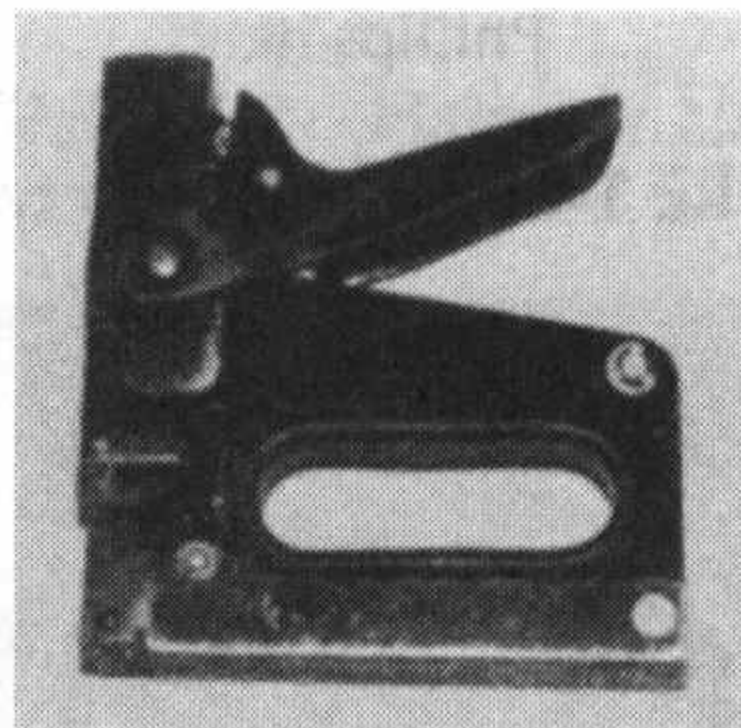


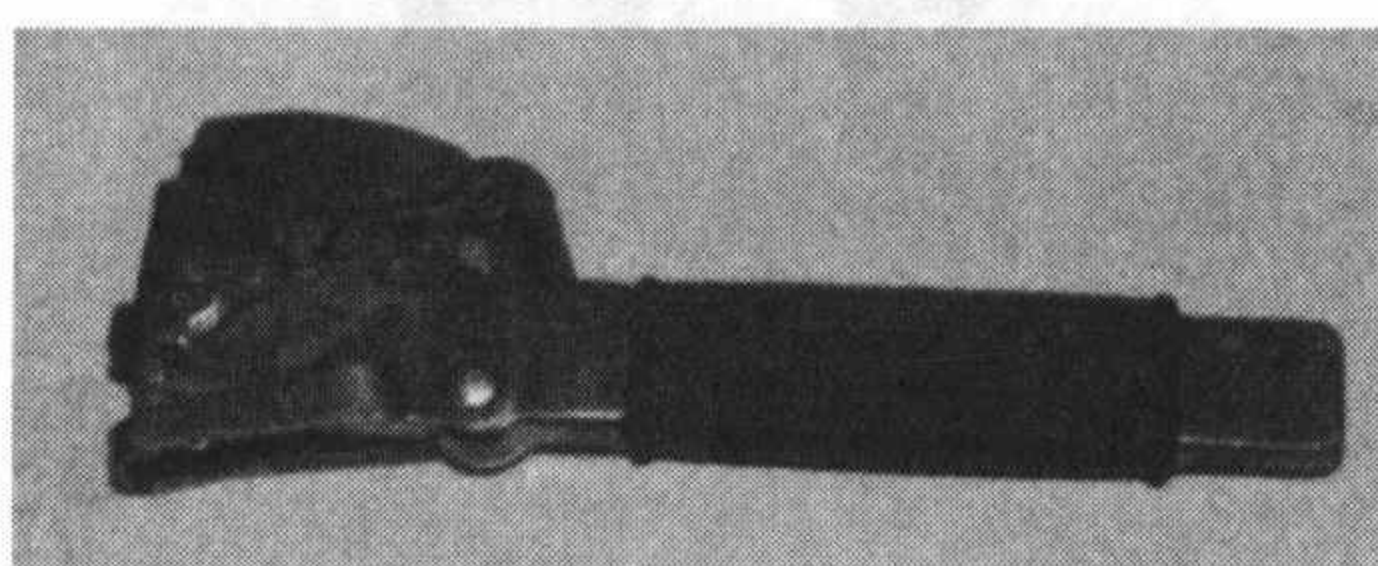
FIGURE 1-10 Phillips screwdrivers.



FIGURE 1-11 Nail set.



(a) Hand tacker.



(b) Hammer type stapler.

FIGURE 1-12

Robertson and Phillips screwdrivers are made in a variety of lengths with four tip sizes—Nos. 0, 1, 2, and 3—to fit the standard sizes of screw sockets (see Figs. 1-9 and 1-10). These types of openings in the screw sockets distribute the force more equally than a slotted screw.

There are also screwdrivers available with interchangeable blades where the blades are stored in the handle.

Nail Sets. Nail sets are designed to drive finishing nail heads below the surface of the material. The diameter of the tip is the size, ranging from $\frac{1}{16}$ in. (1.5 mm) to $\frac{3}{16}$ in. (5 mm). The shank is usually knurled for better grip (see Fig. 1-11).

Staplers. Staplers perform a variety of operations, such as attaching building paper, vapor barrier, ceiling tile, and roofing materials (see Fig. 1-12). The hand tackers are spring-loaded for driving the staple, while the hammer type requires it to be swung like a hammer.

Boring Tools

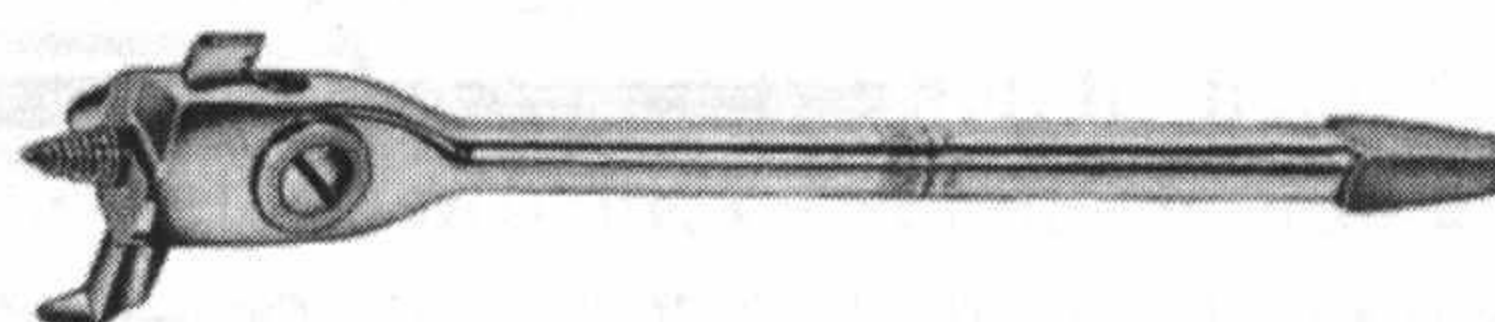
Today's trades rarely use hand boring tools, but there are occasions when they are used and you should be able to recognize them. Included in this group of tools are ones that cut holes in wood—*bits*—as well as tools that hold and turn them—*bit braces*.

Wood Bits. Wood bits are used with a bit brace and are made in several styles; two of the more common ones are illustrated in Fig. 1-13, a solid center auger bit and an expansive bit. Both have square ends for insertion into the chuck of a bit brace.

Auger bits are commonly made in sizes ranging from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in. (6–31 mm) in diameter, increasing in size by increments of $\frac{1}{16}$ in. (1.5 mm). Expansive bits typically have two blades, one that can be set to drill holes of 1 in. (25 mm) to $1\frac{1}{2}$ in. (38 mm), and one that can be set to drill holes of $1\frac{1}{2}$ in. (38 mm) to 3 in. (75 mm).



(a) Solid center bit.



(b) Expansive bit.

FIGURE 1-13 Wood bits.

Bit Brace. Figure 1-14 illustrates a standard bit brace that is capable of holding both square-end auger bits and expansive bits. The type shown is a *ratchet* brace. Ratchet braces can be set to drive in one direction (clockwise or anticlockwise rotation) or locked to turn in both directions. When set to rotate in a clockwise direction, as in a confined space, a full rotation of the handle is not necessary to drill a hole.

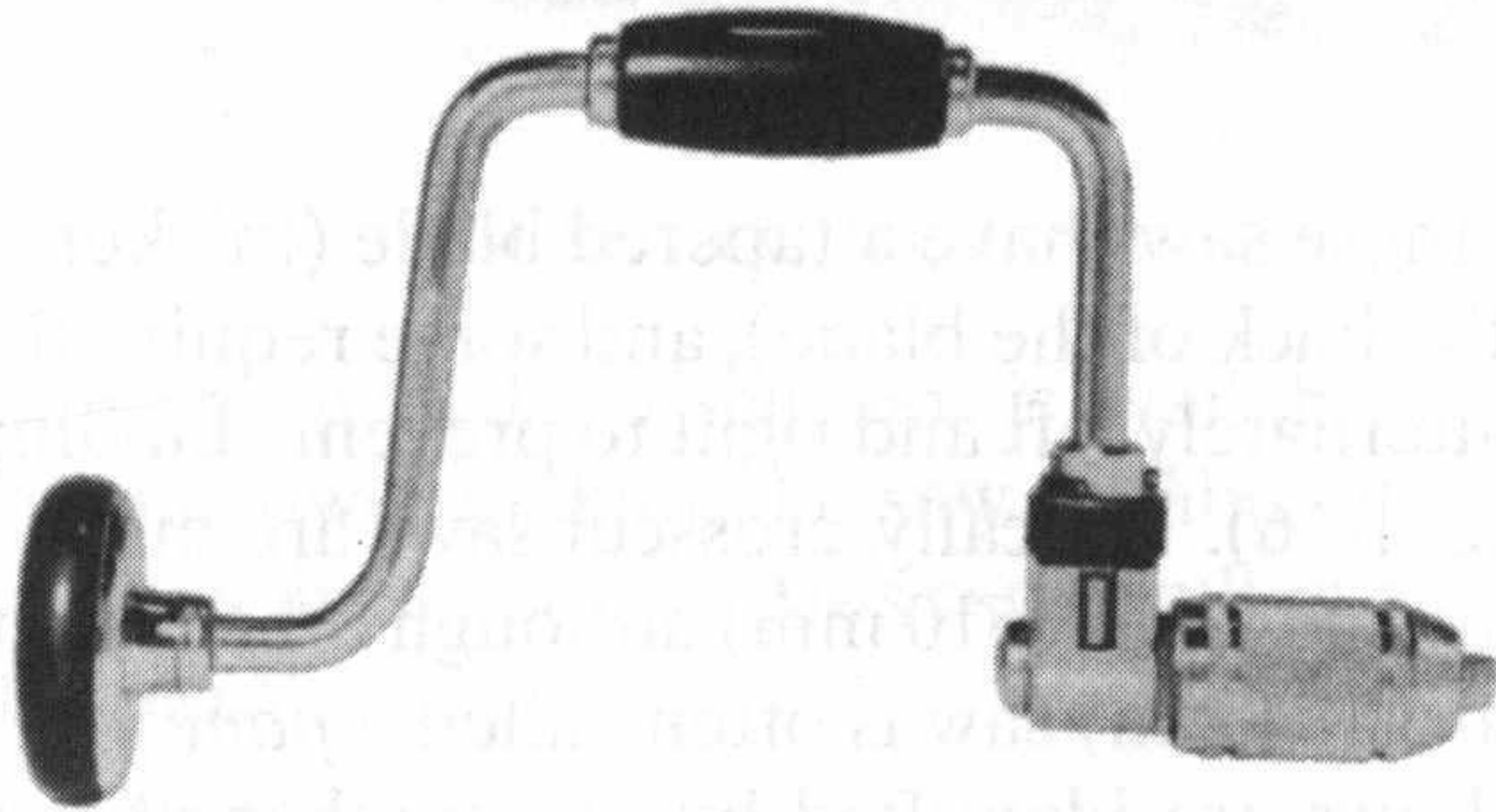


FIGURE 1-14 Hand brace with box ratchet.
(Courtesy Stanley Tools)

Cutting Tools

Cutting tools include *saws*, *chisels*, *axes*, *snips*, and *knives*. In each of these major categories there are a number of styles or varieties, each adapted for a specific purpose.

Saws. Included in this category are *handsaws*, *backsaws*, *compass saws*, *coping saws*, *utility saws*, and *hacksaws*.

Handsaws. Two types of handsaws are made: one designed to cut across the fibers of wood—*crosscut saw*—and the other designed to cut along the fibers—a *ripsaw*. The main difference between them is the method of shaping and sharpening the teeth.

Crosscut saws have teeth with the cutting edge sloped forward and filed at an angle so that each tooth, as it is drawn across the wood, severs the fibers like a knife. They are used for cutting across the wood fibers. Ripsaw teeth have the front shaped nearly at right angles to the blade that results in each tooth cutting the fibers much like a chisel would cut. They are used for cutting parallel to the wood fibers (See Fig. 1-15).

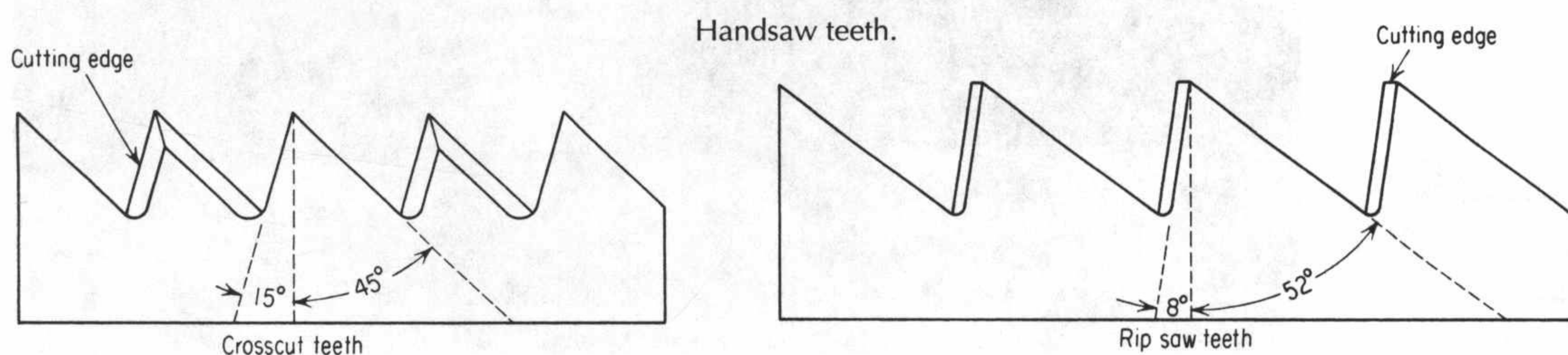


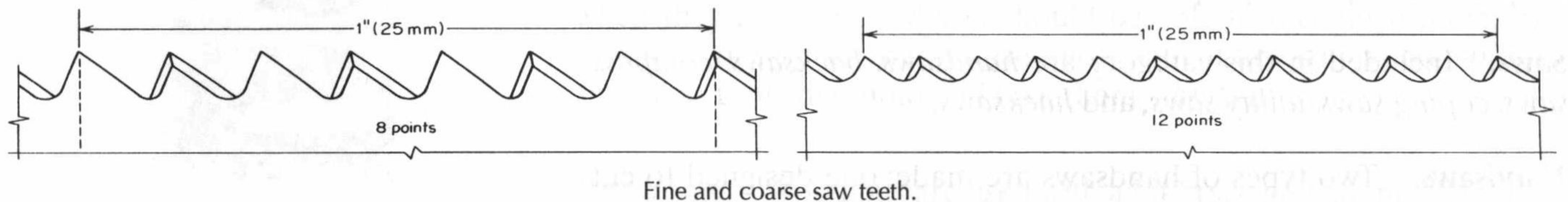
FIGURE 1-15 Handsaw teeth.



FIGURE 1-16 Full tapered saw blade.
(Courtesy of Kennametal Inc.)

Some of these saws have a tapered blade (thicker at the cutting edge than at the back of the blade), and some require the teeth to be slightly bent alternately left and right to prevent “binding” in the saw “kerf” (see Fig. 1-16). Typically, crosscut saws are made in lengths of 26 in. (660 mm) and 20 in. (510 mm) although other lengths are available. The 20-in. (510 mm) saw is often called a *panel* saw.

All handsaws are identified by the number of teeth or *points* per inch (25 mm) and will vary from $5\frac{1}{2}$ to 13, depending on the type. The closer the teeth are together the finer or smoother the cut will be (see Fig. 1-17). Some saws are available with the tips of the teeth hardened through a heat-treating process. These saws retain their sharpness much longer than the other types but are more difficult to re-sharpen (see Fig. 1-18).



Fine and coarse saw teeth.

FIGURE 1-17 Fine and coarse saw teeth.



FIGURE 1-18 Hardened tipped tooth saw.

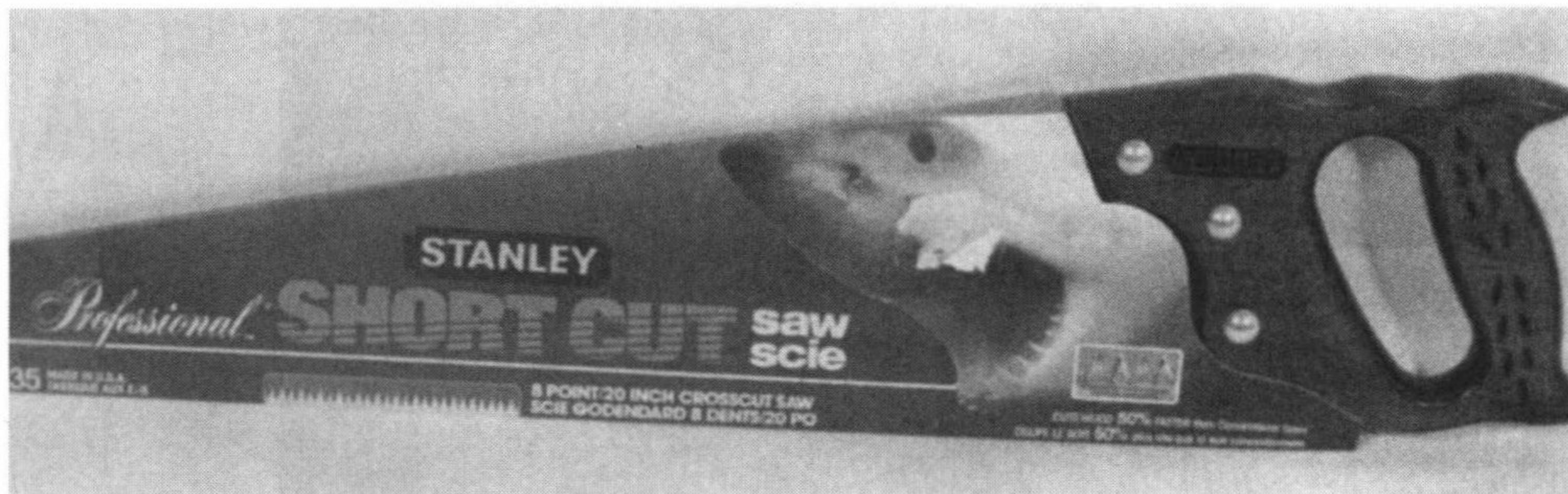


FIGURE 1-19 Short saw.

A specially sharpened crosscut saw is available where the teeth are longer and narrower making the saw capable of cutting on both the down as well as the up stroke. This can result in an increased cutting speed of up to 50% (see Fig. 1-19).

Backsaws. Backsaws are made with a stiff rib along the back of the blade and are intended for smoother cuts because of more teeth per inch (TPI). Several styles are available, including the *standard* backsaw, 12 in. to 14 in. (300–350 mm) with 12 to 15 TPI [see Fig. 1-20(a)]. Another type of backsaw is the *dovetail* saw that is 10 in. (250 mm) long with 16 TPI [see Fig. 1-20(b)]. Cabinetmakers prefer this type, as the cuts are smoother.



(a) Standard backsaws.



(b) Dovetail saw.

FIGURE 1-20 Specialty saws.