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TM 28-325

WAR DEPARTMENT TECHNICAL MANUAL

SOLDIER HANDICRAFTS

WAR DEPARTMENT • JUNE 1945

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WAR DEPARTMENT TECHNICAL MANUAL

TM 28-325

SOLDIER HANDICRAFTS

WAR DEPARTMENT • JUNE 1945

United States Government Printing Office
Washington : 1945

WAR DEPARTMENT
Washington 25, D. C., 15 June 1945

TM 28-325, Soldier Handicrafts, is published for the information and guidance of all concerned.

[AG 300.7 (5 Jun 45)]

By order of the Secretary of War:

G. C. MARSHALL
Chief of Staff

Official:

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Major General
The Adjutant General

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Refer to FM 21-6 for explanation of distribution formula.

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CHAPTER I

INTRODUCTION

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1. How to Use This Manual

a. This manual on handicrafts is intended as a guide to the efficient organization, administration, and practice of the various phases of arts and crafts as an integral part of the Special Services program.

b. It has been prepared and edited to insure the maximum use and benefit to all types of military personnel, from skilled arts and crafts supervisors and professional artisans to novices who are experimenting for the first time with various forms outlined in this book.

c. The manual sets forth basic principles of methods and procedure whereby the Special Service officer can organize and set up a full scale workable program with complete studio and workshop facilities for large installations. It is equally applicable for the operation of a program with limited facilities, and to the needs of individuals and groups in isolated areas. It outlines as well the elementary principles whereby a handicraft program can be conducted in limited space aboard transports, and in convalescent areas and rest camps.

d. It has also been planned as a practical handbook of instruction for the individual serving in small isolated areas where the usual means of recreation and entertainment are unavailable. With few materials and little equipment this manual will serve as a "how to do it" guide to technical procedures.

e. This manual will make possible a large field of improvisation for the resourceful person who can, by using salvage and native sources, create many things out of available material.

f. Whether for groups working together in fully equipped studio workshops, or for the individual working alone, the methods of instruction are described so that each art and craft activity is started at the most elementary level and developed through more advanced techniques with suggestions for the proper materials and tools to be used and appropriate illustrations and diagrams.

g. It is basically a "get started" book so that one can learn the first principles of making things by progressive stages and then develop skill and dexterity sufficient to create an increasing variety of worthwhile items. For the more advanced and experienced artist and craftsman there is appended a descriptive bibliography on arts and crafts for more elaborate and ambitious projects.

h. In order to obtain the greatest possible results from this manual, it is urged that the preliminary chapters be read and understood before going on to a particular art or craft.

CHAPTER 2

HANDICRAFTS IN THE ARMY

2. General

The fact that over 50 percent of our Army is made up of men who have used their hands in their civilian occupations and apply their manual skills to military needs is an indication of the value of arts and crafts as a recreational activity. Mechanics, metal workers, riveters, carpenters, painters, masons, leather workers, and others as well as artists can be given a pleasant and useful change from their routine military activities by the application of a handicraft program. Almost every individual who has some facility with his hands desires to make something for himself, whether it is a leather wallet, a pair of book ends, or a piece of clay sculpture. The accomplishment of any article is a great satisfaction to the maker. The degree of skill and experience in creating is secondary. Because of its great variety and the simplicity with which a handicraft program can be started, it can be applied to all types of men in all types of military installations.

3. Reception Centers

The first days of army life are difficult and the new soldier will be very busy with processing and orienting himself to his new conditions. Although his free time will be extremely limited, a few hours with one of the arts or crafts will provide relaxation and diversion.

4. Static Camps and Bases

A studio workshop outlined in chapter 4 is ideal for permanent installations. However, if this is not available, sketching, modeling, leatherwork, knotting and braiding, celluloid etching, and whittling can be practiced in small, temporary quarters.

5. Isolated or Small Units

Handicrafts are particularly applicable to small units and isolated areas. For this purpose a series of kits have been planned which are available on oversea requisitions from the appropriate port of embarkation. If the kits are not available a program can be carried on with improvised and salvage materials.

6. Field Exercises and Periods of Action

A limited use of handicrafts can be developed for troops engaged in active military activities. Something that a soldier can easily carry with him such as a sketch pad and pencil, a stick of wood and a knife, or a small piece of pyro-cord with which he can braid a lanyard will be extremely helpful in providing temporary relief from strain.

7. Staging Areas

A studio workshop or any kind of facility where arts and crafts materials can be kept will serve a useful purpose for the men waiting shipment. Materials can be supplied to men in the barracks so that they can occupy their time by making some article.

8. Transports

Arts and crafts materials are supplied to ports of embarkation for use on board ships. Here, limited space programs can be initiated by the chaplain and Special Services personnel aboard.

9. Rest Areas and Redistribution Stations

In this type of military installation, handicrafts can be very beneficial. This atmosphere is well suited to hobbies and here the men can experiment with a number of the various arts and crafts. Qualified instructors and supervisors can do much to make the soldier's stay here restful and pleasant.

10. Coordinating Arts and Crafts with Other Activities

Arts and crafts are primarily a recreational activity. However, a program can be devised so that they can be applied to many other uses in the Army. Signs, posters and all types of visual aids for Information and Education, safety, transportation, mess and other departments, can be produced for the benefit of the whole installation. In conjunction with other Special Services activities the arts and crafts unit can be used to make scenery for soldier shows, improvised musical instruments, cartoons for camp newspapers, decorations for unit parties and manifold other worth-while projects. Most of these can be accomplished in a studio workshop or any other facility available.

11. Building Improvements and Decoration

A handicraft group can be of great service to an installation in the painting and decoration of buildings of general assembly. In service clubs, day rooms, cafeterias, libraries, mess halls, chapels, theaters, guest houses, and other military buildings the painting and designing of an interior can provide a more pleasant atmosphere for the soldiers who use these facilities constantly. Such projects can be accomplished in off-duty times, and different groups of men can be called in to render additional assistance. For example, painters can do all of the flat work and carpenters some of the necessary small alterations. The artists can work in groups and decorate several buildings at the same time. Individuals who have particular talents as easel painters should be encouraged to make pictures to be hung in the various buildings. Some of these pictures dealing with the particular activities of an installation could be suitably installed in the Post Headquarters. Other subjects might be suitable for day rooms and guest houses. This program benefits the individual artist, who is encouraged to practice his art, as well as the entire installation.

CHAPTER 3

ORGANIZATION OF A HANDICRAFT PROGRAM

---

12. General

The following suggestions apply to the organization of a program for all types of troops in permanent installations. Personnel and facilities are estimated on the basis of serving one regiment or its equivalent. The program may of course be expanded or reduced to provide for larger or smaller units and may be adapted in many ways to local conditions. One of the practical advantages of a handicraft program is its extreme flexibility; the information below is offered as a guide to the general type of organization which has already proved workable.

13. Personnel

a. The personnel of a handicraft program should possess both manual and executive ability. They should have ample time to spend on the program, preferably as part of the permanent staff of the Special Services officer. Selection may be made from the Officers' Classification Card (WD AGO Form 66-1 or 66-2) or the Soldiers' Qualification Card (WD AGO Form 20). The following occupations will provide personnel with adequate technical knowledge.

Occupation	*Army Specification Serial No.*
Animation Artist, Motion Picture	130
Architectural Engineer	313
Artist	296
Blacksmith	024
Bookbinder	416
Cabinet Maker	038
Cameraman, Motion Picture	043
Cartographer	387
Carpenter, Construction	050
Copper or Tinsmith	061
Draftsman	070
Draftsman, Mechanical	071
Electrician	078
Electroplater	125
Glass Blower	358
Jeweler	361
Lathe Operator (engine)	101
Leatherworker	104
Lithograph Engraver	109
Locksmith	362
Machinist	114
Master Mechanic	342
Metal Worker, Sheet	201
Model Maker	136
Operator, Air Brush	143
Painter, General	144
Painter, Sign	145
Pattern Maker, Wood	148
Photographer, aerial	001
Photolithographer	107
Photographer, still	152
Photographic darkroom man	154
Photographer, news	402
Photographer, portrait	155
Photo Technician, aerial	003
Photographer, retouching artist	157
Printer	168
Radio Engineer (technician)	178
Radio Repairman	174
Saddle Harness maker	192
Shoe Repairman	204
Student, Art	396
Student, draftsman	392
Student, electrical engineering	223
Student, geology	393
Student, manual arts	396
Student, mechanics	397
Stone Mason	214
Teacher	327
Tracer	337
Tool Maker	241
Weaver	023
Welder, spot	334
Woodworking machine operator	113
Upholsterer	248

b. If enough instructors cannot be found among enlisted personnel, it is often possible to obtain volunteer or paid civilian assistants. Workshops established in service clubs have occasionally been supervised by the hostess. A minimum staff at regimental level should include the following:

1 supervisor (officer or noncommissioned officer).
1 handicraft director (E/M or E/W).
1 supply sergeant (E/M or E/W).

c. If the size of the staff can be increased, it is advisable first to appoint two directors, one in arts and one in crafts, then add individual instructors for each of the activities which the workshop is equipped to handle.

14. Funds

Expenses may be paid from the following sources:

WEM (welfare, enlisted men) funds which are appropriated.
Nonappropriated funds in accordance with AR 210-50.
Unsolicited donations from civilians or civilian organizations.
FDGA funds at the disposal of heater commanders for local purchases.

15. Facilities

A day room, a mess hall, a room in a service club or almost any other kind of building with a roof and sufficient light can be used for the handicraft program. Chapter 4 gives detailed recommendations for organizing the space available.

16. Equipment and Supplies

a. Oversea kits containing tools and materials for a variety of individual arts and crafts may be requisitioned for oversea use only. (See W.D. Memorandum 35-44, 6 May 1944.) They are designed to serve two to five men and cover such fields as leathercraft, metalcraft, knotting and braiding, artist sketch, block printing, and many others.

b. The Army Exchange Service catalogue lists price agreements on a wide assortment of arts and crafts supplies available through post exchanges in the continental United States, overseas, in hospitals, and ship's service stores. Local purchases of materials may also be made.

c. Salvage of all kinds and surplus property from the Engineer, Quartermaster and Signal Corps can be used extensively. (See ch. 5.)

17. Operation

a. The workshop and studio should be open every day and evening, including Sundays and holidays, for as long as possible. Army standards of cleanliness should be maintained by policing at regular intervals.

b. The duties of the handicraft personnel should be divided approximately as follows with the Special Services officer as supervisor. The following functions would be under his jurisdiction:

Supervisor

Provides adequate studio and workshop facilities.
Receives work requests from other departments and approves their execution before assigning them to the handicraft director.
Organizes and presides over a handicraft council composed of all interested personnel to discuss current problems.
Obtains necessary funds.
Requisitions materials and equipment.
Organizes publicity, arts and crafts exhibitions and contests.
Obtains services of visiting lecturers and demonstrators.

Handicraft director

Maintains and supervises the studio and workshop.
Acts as instructor in all activities (unless special instructors are available).
Assigns to individuals work requests from other departments approved by the supervisor.
Arranges exhibitions and contests under direction of the supervisor.
Procures for use in the workshop books, plans and other instructional material.

Supply sergeant

Prepares requisitions of supplies.
Keeps inventory of stock and issues supplies to the studio and workshop groups.
Procures salvage materials from the salvage depot.
Is responsible for policing the studio and workshop and for maintenance of equipment.
Packs and unpacks travelling exhibits.
Delivers work completed for other departments.

18. Publicity, Contents and Exhibitions

a. While the natural interest of the participants will sustain a handicraft program, it is advisable at the beginning and at periods thereafter to give it adequate publicity. Full use should be made of the camp newspaper, Special Services bulletins, P.A. systems, lantern-slide announcements in theaters, and posters distributed as widely as possible.

b. Exhibitions of work done by the handicraft group will also stimulate general interest. They should be installed in a service club or other building on the post, and prizes should be awarded if possible.

c. Demonstrations by visiting authorities on such subjects as cartooning, painting a portrait, etc., are always extremely popular. If they are given in the service club or post theater they will attract the attention of many to the handicraft program.

CHAPTER 4

PLANS FOR A STUDIO WORKSHOP

19. General

A studio workship designed to serve one regiment or its equivalent should have a minimum floor space of aproximately 2000 square feet. This may be laid out in a variety of ways. The following plans illustrate an ideal arrangement which can be much simplified and freely adapted to local facilities.

20. Location

A separate building on the post makes the best workshop. An unused warehouse, mess hall, or barracks is excellent. Vacant space in service clubs or other buildings will also serve, while civilian facilities such as nearby schools may occasionally prove practical.

21. Partitioning

a. If space is extremely limited, it is best to keep partitioning to a minimum. One corner of the workshop should be screened off for storage of tools and supplies. If photography is to be included, a dark room with running water must also be divided from the main work area.

b. A slightly larger shop should be partitioned into two rooms of about equal size. One is used for the arts and crafts which are quiet and require concentration, such as painting, knotting and braiding, clay modeling, etc. Woodwork, metalwork and similar noise making activities are grouped in the other room.

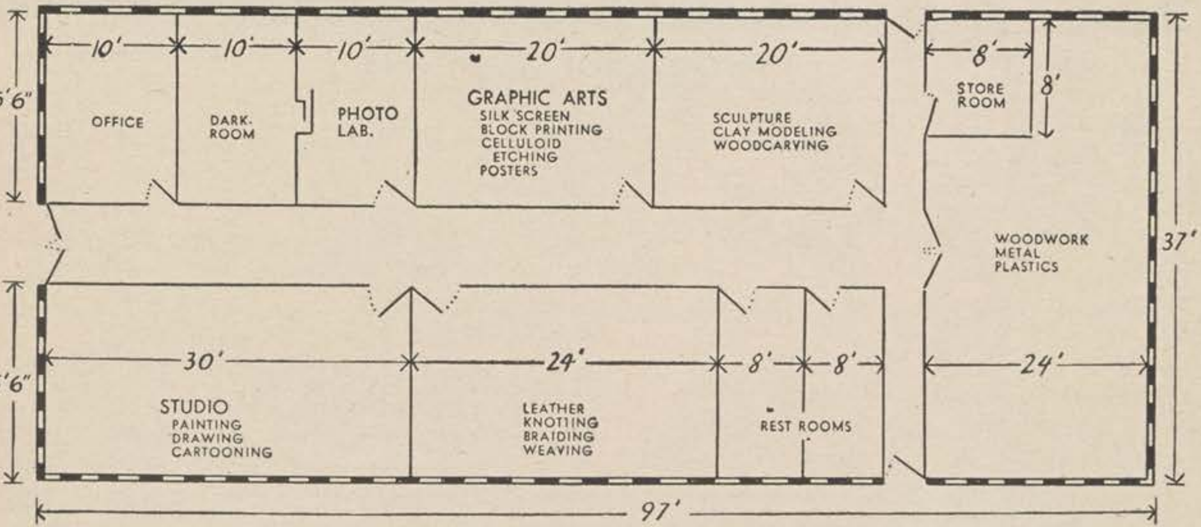
c. An ideal studio workshop can be further divided into a number of rooms for related arts and crafts (fig. 1).

The activities in each room are similar and use many of the same tools and equipment.

d. Chairs and stools, long work tables, some storage bins or shelves, and a few easels and drawing boards are the minimum equipment needed at the beginning.

e. If power tools are to be used in woodworking, they should be placed to permit the easy handling of large work (fig. 2).

It is advisable to have first aid equipment on hand and to require that the machines always be used with the guards in place.

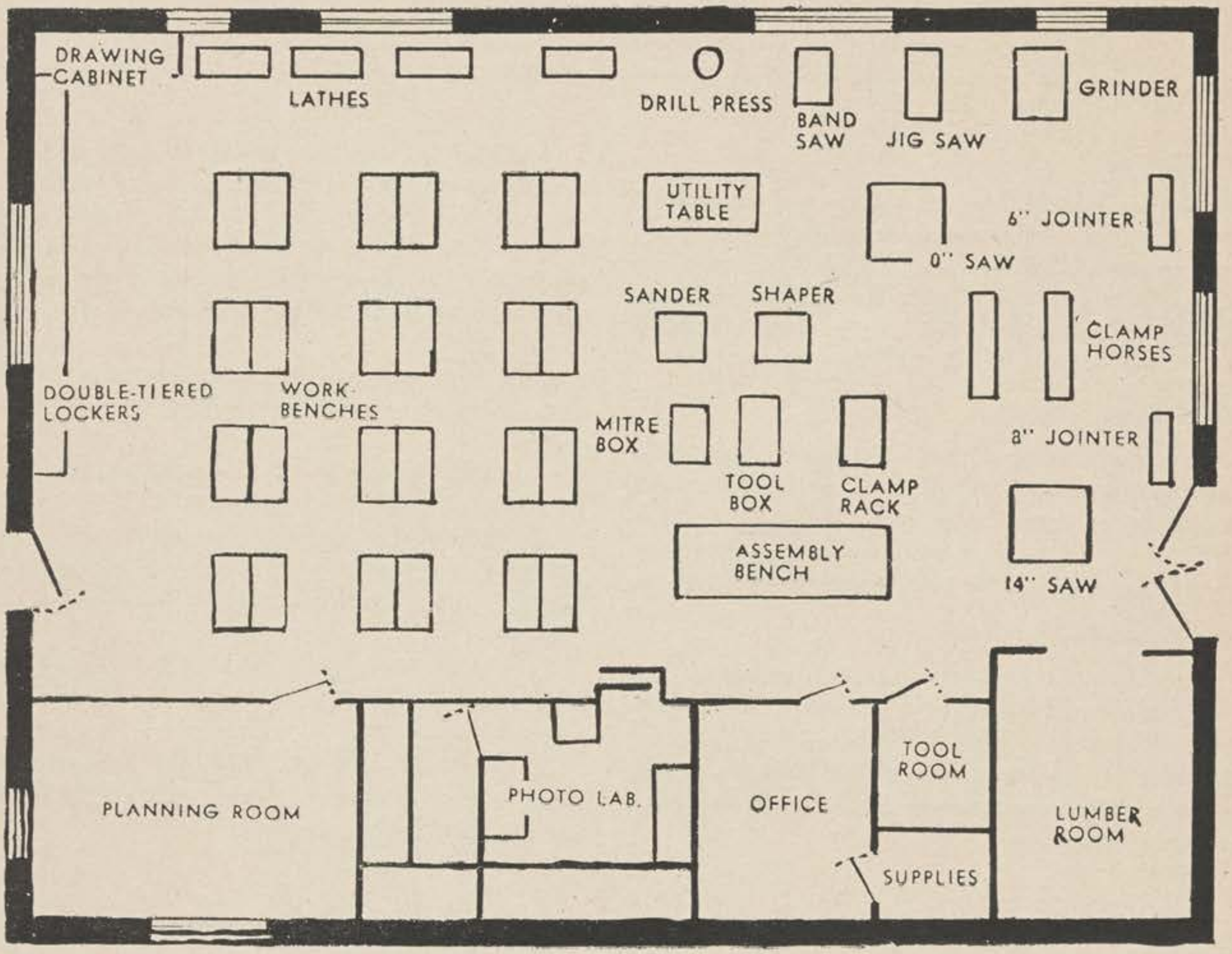

10'
10'
10'
20'
20'
8'
8'
15'6"
OFFICE
DARK-ROOM
PHOTO LAB.
GRAPHIC ARTS
SILK SCREEN
BLOCK PRINTING
CELLULOID
ETCHING
POSTERS
SCULPTURE
CLAY MODELING
WOODCARVING
STORE ROOM
WOODWORK
METAL
PLASTICS
37'
15'6"
30'
24'
8'
8'
24'
STUDIO
PAINTING
DRAWING
CARTOONING
LEATHER
KNOTTING
BRAIDING
WEAVING
REST ROOMS
97'

GENERAL FLOOR PLAN

Figure 1.

22. Light and Ventilation

In planning the division of space, maximum light and ventilations should be provided for each room. If possible, place the painting and drawing on the north side of the building where it will not receive direct sunlight. Overhead lighting fixtures are sufficient for most activities if they are placed or hung directly over the work tables.


DRAWING CABINET
LATHES
DRILL PRESS
BAND SAW
JIG SAW
GRINDER
UTILITY TABLE
6" JOINTER
0" SAW
SANDER
SHAPER
CLAMP HORSES
DOUBLE-TIERED LOCKERS
WORK BENCHES
MITRE BOX
TOOL BOX
CLAMP RACK
8" JOINTER
ASSEMBLY BENCH
14" SAW
PLANNING ROOM
PHOTO LAB.
OFFICE
TOOL ROOM
SUPPLIES
LUMBER ROOM

WORK SHOP FLOOR PLAN

Figure 2.

CHAPTER 5

IMPROVISED TOOLS AND MATERIALS

23. General

The tools and materials for many crafts can be improvised from salvage and other widely accessible sources. The following suggestions outline a few of the most useful things that can be devised from scrap or surplus material. Other suggestions will be found in the chapters on individual crafts. The list can be much expanded, however, by the ingenuity of the individual.

24. Cutting Tools

a. A punch for use on leather or soft metal can be made from a large nail (fig. 3). Cut off the end and file to a wedge-shaped point. Do not remove the head.

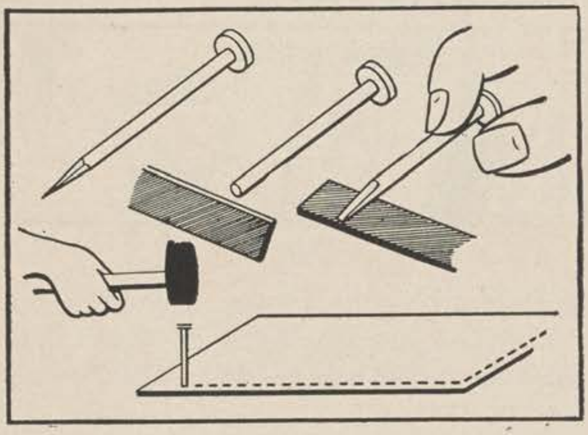


Figure 3.

b. An awl or scriber for use on leather, wood, or metal can also be filed from a nail (fig. 4). Use a carborundum stone to sharpen the point.

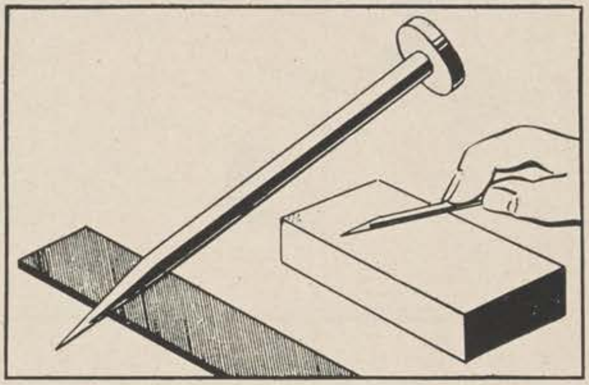


Figure 4.

An old ice pick serves as an excellent awl. A heavy needle with the eye end driven into a wooden handle makes a sharp awl useful for fine work.

c. Gouges for woodcarving and cutting linoleum may be fashioned in several ways (fig. 5). Pen points may be reversed with their tips inserted in the holders and the other ends honed until sharp. Or you may take a piece of ordinary tin, fold over the edges to strengthen them, and form into the shape desired. A cartridge shell, sawed in half lengthwise and inserted in a wooden handle, is good for heavier cutting. The edge should be sharpened and bent with pliers or hammered to the shape desired.

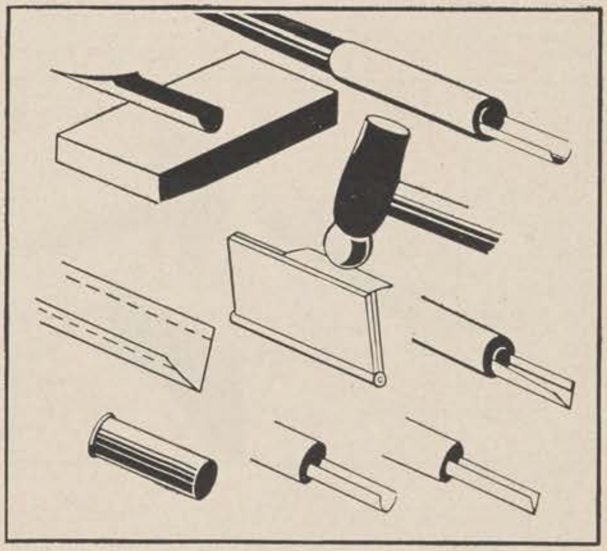


Figure 5.

d. Razor blades make extremely sharp knives and are easily replaced when broken (fig. 6). They should be held in a piece of leather to protect the fingers or inserted in an improvised holder of the type illustrated. This is made by inserting two small strips of metal in a wooden handle and drilling holes

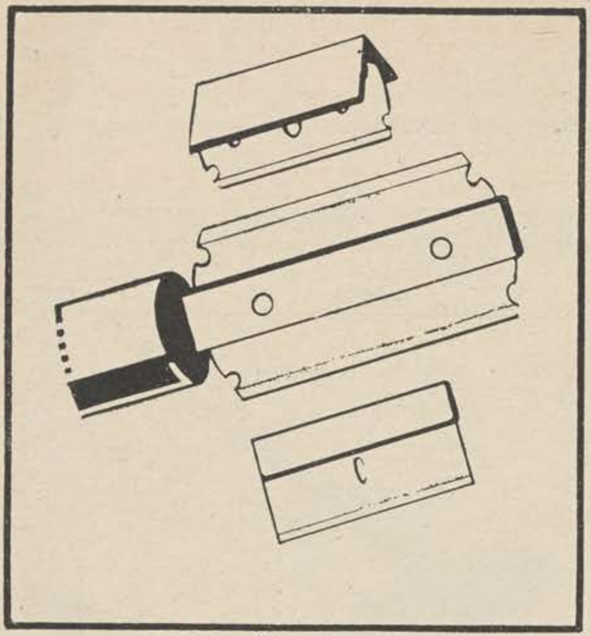


Figure 6.

to correspond with those in the blade. Small bolts and nuts hold the blade in place. Heavier knives can be filed from broken bayonets or broken springs from jeeps.

25. Shaping Tools

a. A useful vise for bending metal can be made from an ordinary door hinge (fig. 7).

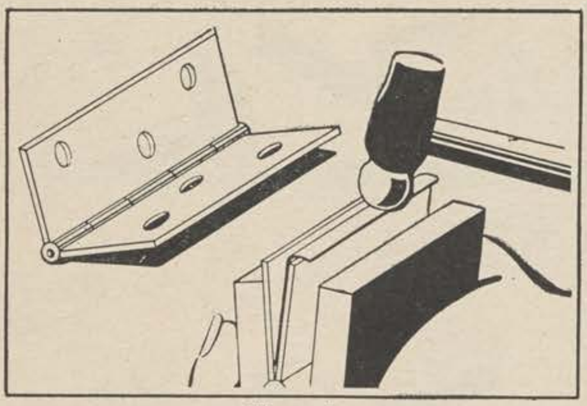


Figure 7.

b. A section of pipe strapped down with strips of metal or leather provides a mandrel for metal work (fig. 8).

c. To make embossing tools for leather, wood or metal, file the designs in the head of the heavy nail (fig. 9). The threaded end of a large bolt may also be filed in the same manner and makes a more substantial tool.

d. A beveler for leather work or metal repousse is also made from a nail (fig. 10). Drive the pointed end into a wooden handle, cut off the head and hammer, and file the end into the shape illustrated.

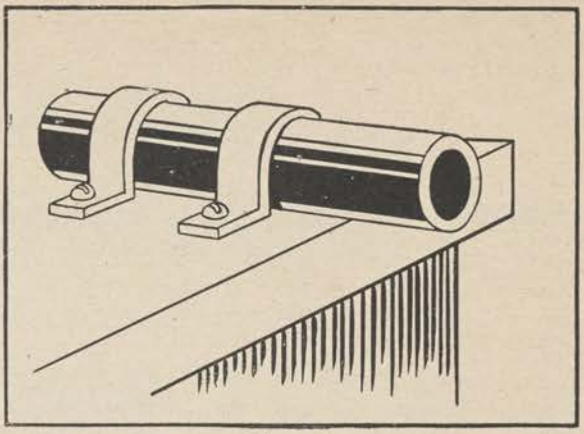


Figure 8.

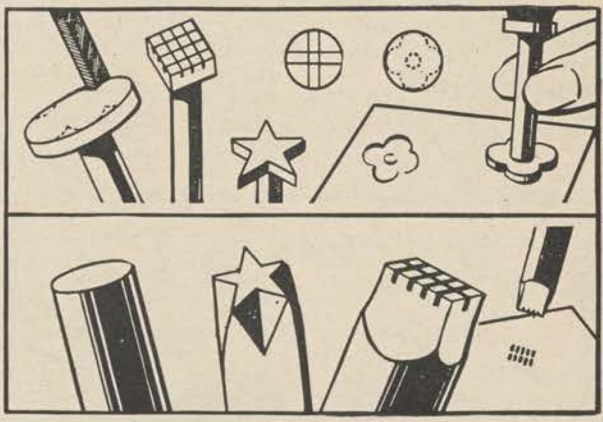


Figure 9.

26. Drafting Tools

a. A crate, sawed at the angle indicated by the dotted line, makes a useful work table or drawing desk (fig. 11).

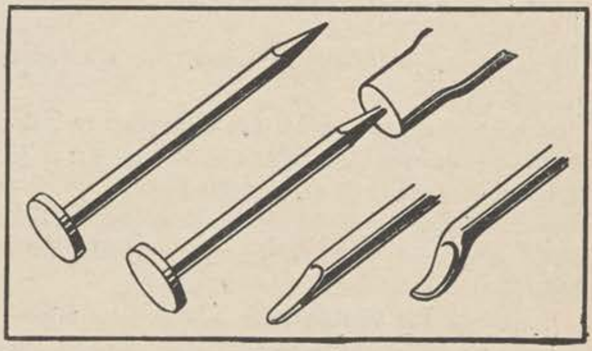


Figure 10.

b. Circles can often be drawn around a coin or an inverted glass. If an improvised compass is needed, it can be made from a strip of wood drilled to accommodate a nail as the pivot and a pencil (fig. 12).

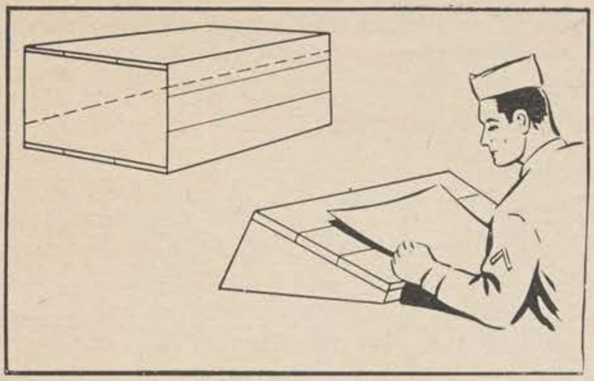


Figure 11.

Several holes for the latter may be drilled at various intervals.

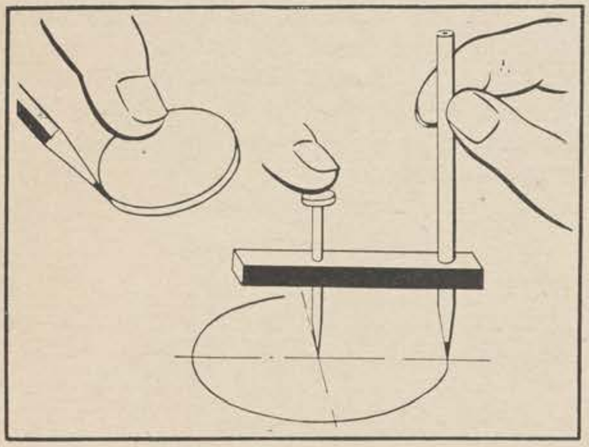


Figure 12.

c. A piece of sandpaper glued to the inside of a used match book is useful for putting a point on pencils (fig. 13). A pipe cleaner glued under the cover serves as a wiper.

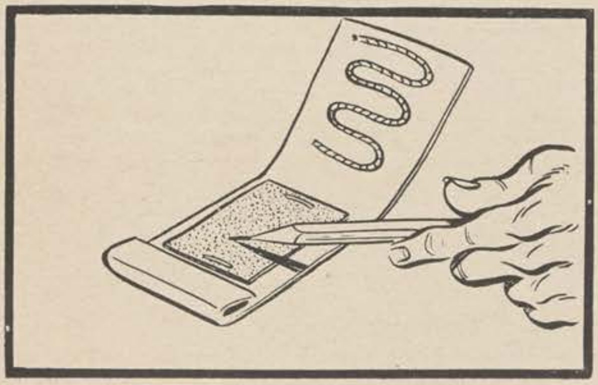


Figure 13.

27. Miscellaneous Tools

a. A small stove for heating and annealing metal or for use in bending plastic is made from a No. 10 tin can with one end removed (fig. 14). The bottom opening shown in the illustration provides the draft and permits fuel to be added. The smoke vent at the top should be cut on the opposite side of the can.

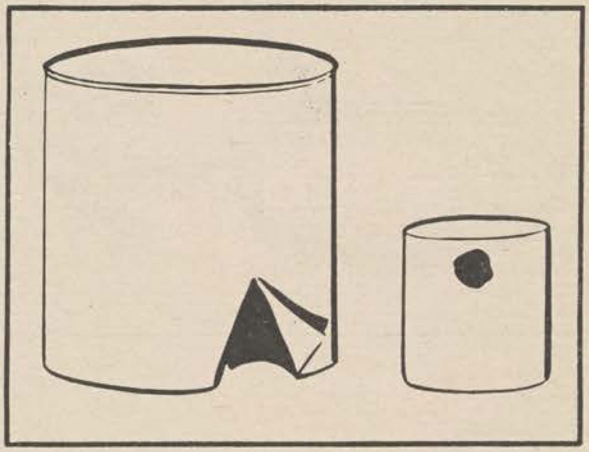


Figure 14.

b. Handles for any of the above tools can be made from sections of an old broomstick.

28. Materials

Craft materials are more varied than the tools, and many substitutes can be used. When leather is not available, for example, canvas or tentage can be worked in much the same way and with the same tools. Salvage will also supply many materials; a few of the commonest are listed below.

29. Wood

The wood from crates and large boxes, if sanded to a smooth finish, is entirely satisfactory for many projects. Wooden cigar boxes can be used where thin panels are required. Broken baseball bats are excellent for carving small figures in the round. In oversea areas many native woods of great beauty, such as teak and mahogany, are readily available.

30. Metal

In addition to tin cans, which are discussed in the chapter on metal work, empty cartridges and shell cases can be used for many articles. Salvaged aluminum can also be obtained at air fields.

31. Leather

Used basketballs and footballs or shoes worn beyond repair will provide enough leather for small articles. Thongs for braiding lanyards, leashes, or belts can be cut from small discs of leather by the method illustrated (fig. 15).

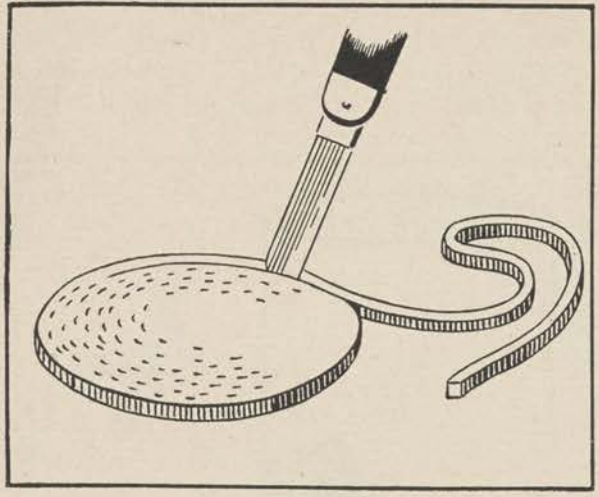


Figure 15.

32. Plastics

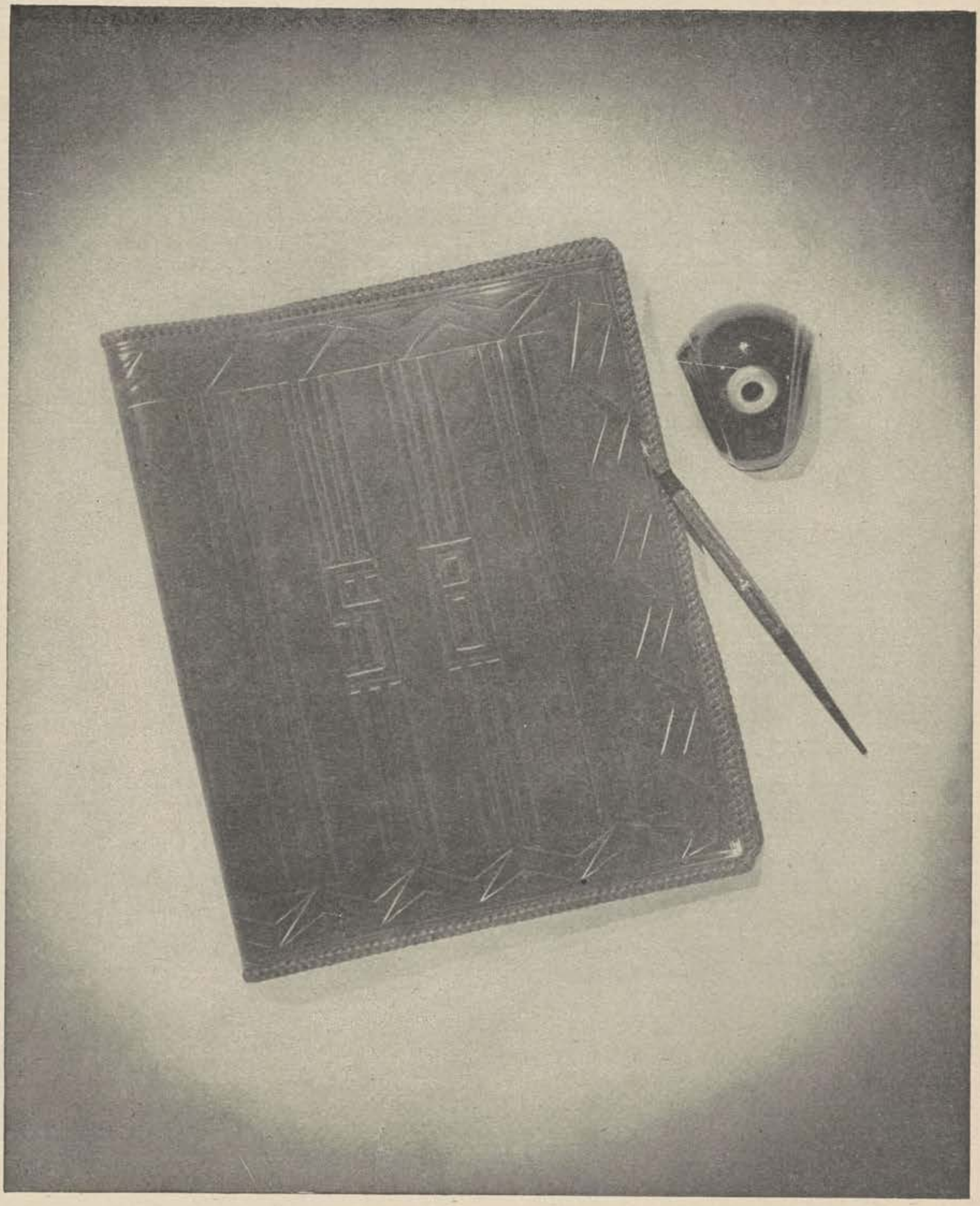
Air field salvage depots will yield many small pieces of plexiglas, a plastic which is particularly well adapted to craft work as it can be heated and bent. Other scrap plastics such as bakelite can also be utilized if bending is not required. Old tooth-brush handles are easily worked and can be made into a number of small articles.

33. Textiles

If artist's canvas is not available, oil paintings can be done on tentage, target cloth or parachute silk as well as on panels of wall board. Parachute cords are excellent for braiding or weaving. They have great tensile strength and may be dyed a variety of colors.

34. Miscellaneous Materials

Many localities provide native materials which are well suited to craft work. Bone and walrus or elephant ivory can be carved and filed. Shells, coils, and semiprecious stones can be used in jewelry. Native fibers and grasses will make braided sandals and similar objects. There are few locations in which the craftsmen cannot find materials at hand which will fit his needs.



LEATHERCRAFT

35. General

a. The natural beauty of leather and its adaptability to many articles of common use have made leathercraft one of the most popular and profitable pastimes. It is also one of the easiest in its simpler forms and has the advantage of requiring few specialized tools. These are discussed under the various operations below; they may be purchased, or many of them can be made from nails and other improvised materials (ch. 5).

b. Leather can be stained, painted, and decorated in many ways, several of which are described in the following chapter. It is important to keep in mind, however, that the attractiveness of the natural surface of most leathers is spoiled by too much decoration. In many cases, it is more satisfactory to leave the leather entirely plain and to depend on careful workmanship and polishing for the finished effect.

36. Leathers

It is important to know the various types of leather so that you can select the proper one for the article you make. The chemical or chrome-tanned leathers cannot be tooled. Vegetable or bark-tanned leathers are best suited for this purpose. Usually the back is the best part of the skin and should be used for fine work, the neck and sides for less finished articles. Small skins coming from young animals are always the most supple and of the highest quality.

37. Tooling Calf

This is suitable for nearly every type of leather work. It comes in various shades and thicknesses and is ideal for tooling and modeling. It has a fine natural tone which takes on a darker color when tooled.

38. Cowhide and Oxhide

These are very durable leathers especially adapted to articles that receive hard use. Cowhide comes in either a dull or glossy finish. Both can be tooled.

39. Steerhide

Steerhide is also a durable leather which will take tooling. It comes in several colors, black, brown, or russet, and is often used for purses, handbags, book covers and similar articles.

40. Sheepskin

Sheepskin is the most inexpensive of the different leathers and is good for beginners. It is loose in texture and can be easily stretched. Velvet sheepskin is an inexpensive suede obtainable in many colors. It cannot be tooled, but is suitable for pillow covers, book covers, moccasins and various small articles.

41. Goatskin

This is close-grained and very firm. Morocco leather is made from goatskin and is widely used for fine book bindings, ornamental boxes and ladies' vanity cases. The better grades are excellent for tooling.

42. Pigskin

Pigskin is another tight-grained leather which will stand up well under hard use. It is not satisfactory for tooling, but can be decorated by hot stamping.

43. Vellum or Parchment

This is produced from sheep or calfskin. It is stiff and thin with a paperlike surface and is used for book binding, diplomas and certain types of decorative work.

44. Deerhide, Elkskin, and Horsehide

These are not often used for small articles, but they are well suited for leather garments such as jackets or moccasins.

45. Crocodile, Snake, Lizard and Fishskin

All of these are used occasionally, but are chiefly limited to decorations or lacings on articles made of other leathers.

46. Skiver

Skiver is sheepskin split by machine into very thin sheets. It is extremely pliable and is excellent for linings. Novelties such as buttons and tassels can also be made from this leather.

47. Patterns for Cutting

a. Before touching the leather itself, a paper pattern or template of the article must be prepared. An easy method for the beginner is to take an old object of the same kind, rip it apart and place it on the paper as a guide in drawing the outlines. If you prefer to make your own pattern, draw it actual size, but be sure to make allowance for the leather which will be taken up by folds or by overlapping edges where two pieces must be joined. With thin leathers, the allowance for folds should be about 1/8 inch, for overlapping about 3/16 inch; with the heavier leathers it may have to be increased to as much as 1/4 inch for folds, 3/8 inch for overlapping.

b. When the pattern is drawn, cut it out with shears and transfer it to the leather in the following manner. Place the leather face, or finished side, up on a smooth surface. Lay the pattern on the leather and hold it securely with weights, especially at the corners. Then outline the pattern on the leather with any sharp pointed tool as an awl or the small end of the modeling tool described below. Some workers prefer to outline the pattern with pencil or ink on the wrong side of the leather.

48. Cutting and Skiving

a. Scissors can be used to cut light weight leathers, but they have a tendency to mar and stretch the edges of the heavier skins. It is better to cut the leather with a very sharp knife, guiding the blade on straight lines with a metal rule or square (fig. 16).

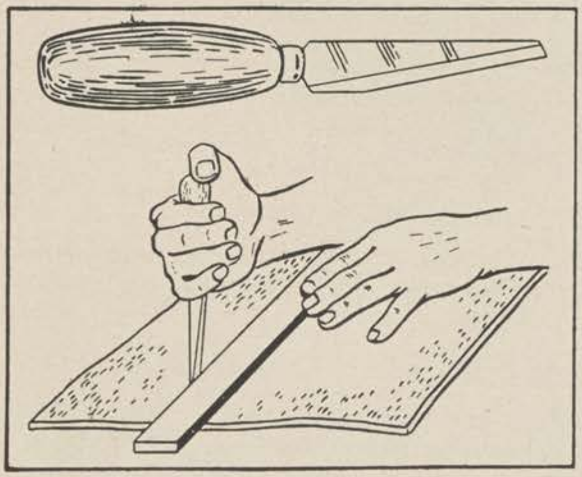


Figure 16.

The cutting should be done on a piece of heavy cardboard or linoleum.

b. Skiving is the process of shaving the edge of a piece of leather with a beveled cut (fig. 17). It is done with the same type of knife illustrated. The purpose of skiving is to thin two edges which are to be joined so that the seam will not be too bulky.

49. Patterns for Applying Designs.

a. Before decorating leather by any of the various methods described below, the design must first be worked out carefully on a paper pattern and transferred to the surface of the article. This is done after it has been cut out, but before it is stitched or laced together.

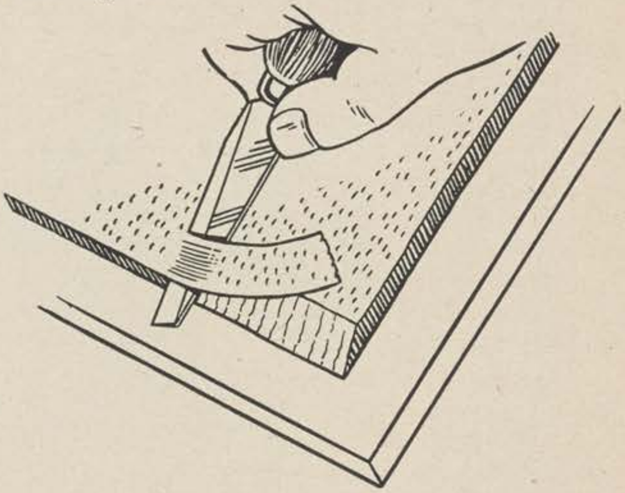


Figure 17.

b. To prepare the pattern, trace your design on a piece of strong tracing paper or cloth slightly larger than the article. The edges can then be folded around the leather and secured with clips, or they may be thumb tacked down just beyond the edges of the leather.

c. To transfer the design to the object, dampen the leather slightly on both sides with a sponge or rag. The moisture must penetrate thoroughly, but the leather should not be wet enough to give out water when pressed with a modeling tool. With the pattern in place, trace over all the lines on the paper with a tracer, awl or other smoothly pointed tool (fig. 18). Bear down firmly, but do not permit it to break through the paper. When all lines have been covered, lift off the pattern and you will find that the design is lightly indented in the surface of the leather. The lines can be strengthened by going over them with the same tool after the paper has been removed (fig. 19). When the leather dries, they will remain in the surface so it is important to handle the tool with care as mistakes cannot be corrected. No further work is required if your design is a simple combination of thin lines as in the illustration. The same procedure is used, however, in outlining large areas to be modeled or embossed.

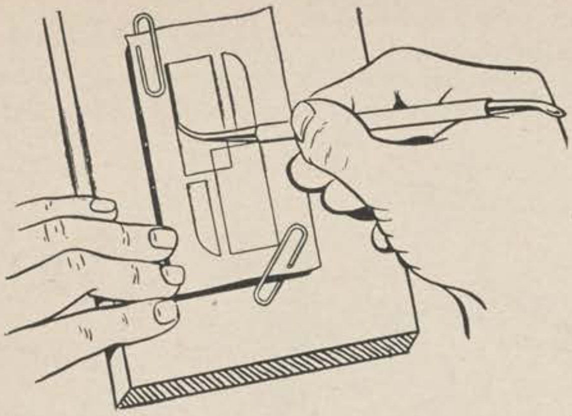


Figure 18.

50. Flat Tooling or Modeling

a. In this process, certain areas of the design are brought into relief by lowering the background around them. The principle is the same as in transferring the pattern. The leather is dampened and those portions which are pushed down remain lower than the untooled parts.

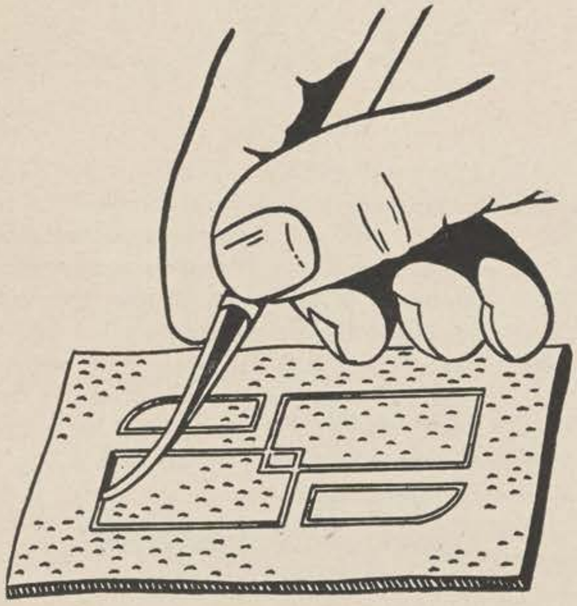
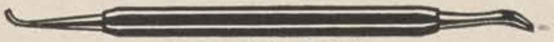


Figure 19.

b. Tooling should be done on a flat surface which will not absorb water from the leather. A slab of marble or a sheet of glass is excellent as it keeps the leather cool and provides a smooth surface. To lower the background evenly, use the broad end of the modeling tool illustrated. Dampen the leather until it is thoroughly moist, but not wet enough to give out water when pressed. Starting at the edge of the design, push the background down with short circular strokes of the modeling tool (fig. 20). Always work away from the edges of the design and be sure that the sharp edge of the tool does not come in contact with the leather. Even finger nail scratches will show and cannot be removed.



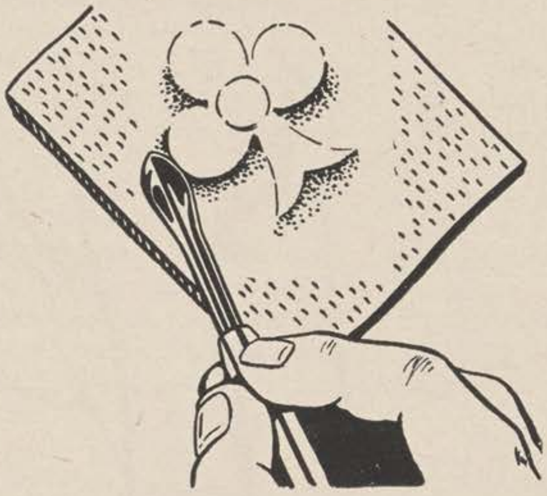


Figure 20.

c. If you wish to increase the contrast between the raised design and the background, the latter can be lowered by stippling. In this process, the damp leather is tapped with point of the tracer, or small end of the modeling tool (fig. 21). The result is a pebbled surface which emphasizes the relief of the smooth areas.

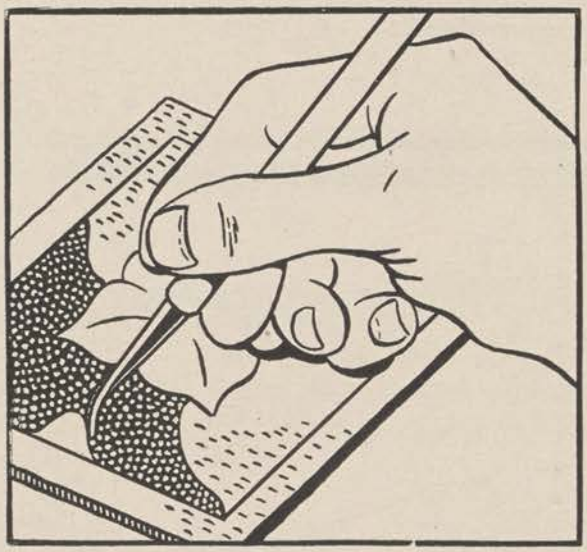


Figure 21.

51. Creasing and Beveling

One of the easiest ways of decorating an article is to run a single or double line around its edges. This is known as edge creasing and can be done on the damp leather with a rule and the pointed end of the modeler or with a special instrument known as an edge creaser (fig. 22). This is particularly useful in finishing belts. On thick leathers the edges are sometimes shaved with a beveler (fig. 23). This should be followed by the creaser to round the edges.

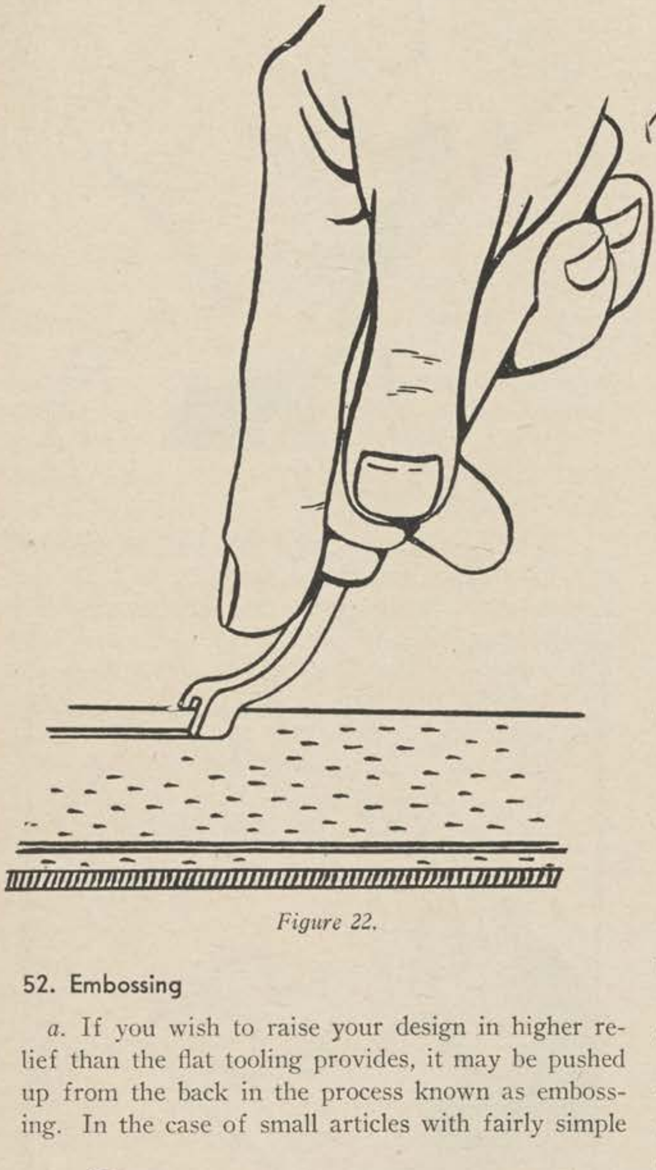


Figure 22.

52. Embossing

a. If you wish to raise your design in higher relief than the flat tooling provides, it may be pushed up from the back in the process known as embossing. In the case of small articles with fairly simple designs, this can be done by holding the dampened leather in the left hand and pressing up the part to be raised with the blunt end of the modeling tool (fig. 24). Keep glancing at the face of the article to make sure that the pattern is raised evenly. The leather stretches easily so pressure must be uniform.

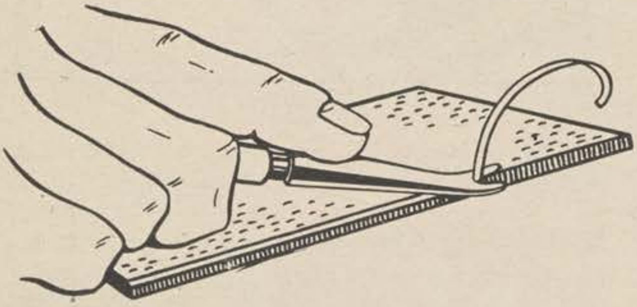


Figure 23.

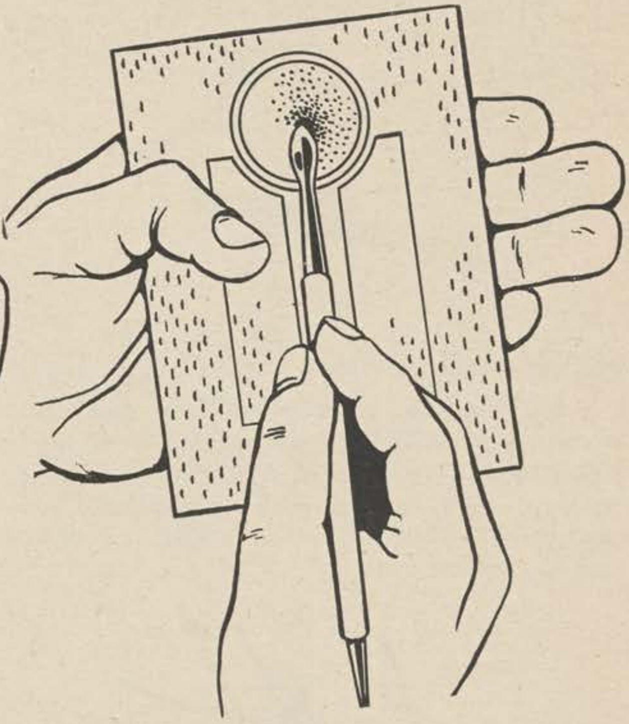


Figure 24.

b. If embossing is to be done on large articles which cannot easily be held in the hand, the leather may be placed face down on a pad of heavy felt or sponge rubber. The damp leather is then pressed down into the felt from the back as above. If this method is used, the pattern must be marked on the back of the leather as well as on the face to guide the modeling tool. To do this, cover a large piece of paper with chalk, shake off the surplus and lay the damp leather face up on the paper. Using the tracer, go over the lines which you have tooled on the surface with just enough pressure to make the chalk stick to the back of the leather in the same areas. When the leather is turned over and the excess chalk dusted off, the pattern will show clearly on the back.

c. When the embossing is finished by either of the above methods and the leather is thoroughly dry, it is generally advisable to stiffen or fill the raised areas so that they will not collapse as the article is used. One method is to coat the back of the embossed portion with a thin coat of fairly stiff flour paste. A second coat may be added after the first is thoroughly dry. A more widely used method is to fill the hollows caused by the embossing with strips of tissue paper coated with rubber cement. In this way layers of the filler are built up until they are level with the back of the leather. Lines can be filled with cotton cord or with small rolls of tissue paper.

53. Incising

a. Incising is used where very deep, narrow lines are desired. It requires a good deal of skill, and the beginner will do well to practice on scrap leather before using it in a project.

b. The pattern is transferred to the leather as above. While the surface is still damp, take a very sharp knife and cut along the lines of the design to a depth of about ¼ that of the leather (fig. 25).

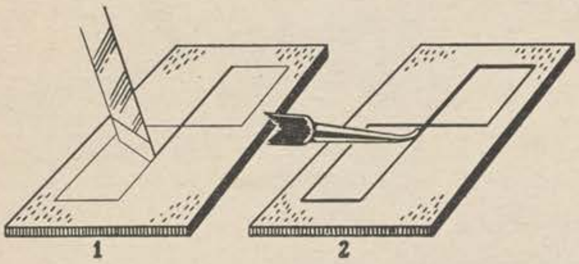


Figure 25.

If the cut is too deep, the white edges of the incision will show when the leather is bent and the whole article will be weakened. When the cutting is completed, go over the lines with the narrow end of the modeling tool pressing the incised edges down firmly. This step is also shown in the illustration.

54. Stamping and Blind Tooling

a. Various geometrical patterns can be indented in leather by the use of background stamps (fig. 26).

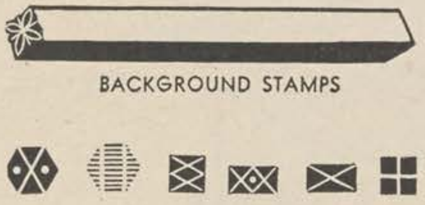


Figure 26.

These may be purchased or you can make your own by filing designs in tool steel or the heads of nails. (See ch. 5.) The leather is dampened and laid face up on the marble slab. The stamp is then placed on the leather and struck lightly with a mallet. Practice will show how heavy a blow is needed to leave a clear mark on the surface.

b. Blind tooling is a variation of this method. The pattern is first worked out on paper by inking the stamps on a stamp pad and pressing them on the paper pattern in the desired arrangement. The pattern is then placed over the damp leather, the stamps are carefully aligned over their marks on the paper and are pressed down by hand just enough to leave a faint impression on the leather. The pattern is then removed, and the final stamping is done with the mallet as above. The faint impressions made through the paper act as guides for the real stamping and are useful when a complicated design combining a number of different stamps is to be used.

c. Nontooling leathers can be stamped without moistening the leather by heating the metal stamps and pressing them by hand into the surface. To insure the correct temperature for this type of work, hold the stamp in a flame, then touch it briefly to a damp rag. As soon as it stops sizzling it is ready to use.

d. The embossing wheel, which can be purchased in a variety of patterns, is really a cylindrical stamp used chiefly for borders (fig. 27). The leather is dampened, and the tool is rolled along the edge with enough pressure to leave a clear imprint on the surface. It can also be guided by the metal rule if necessary.

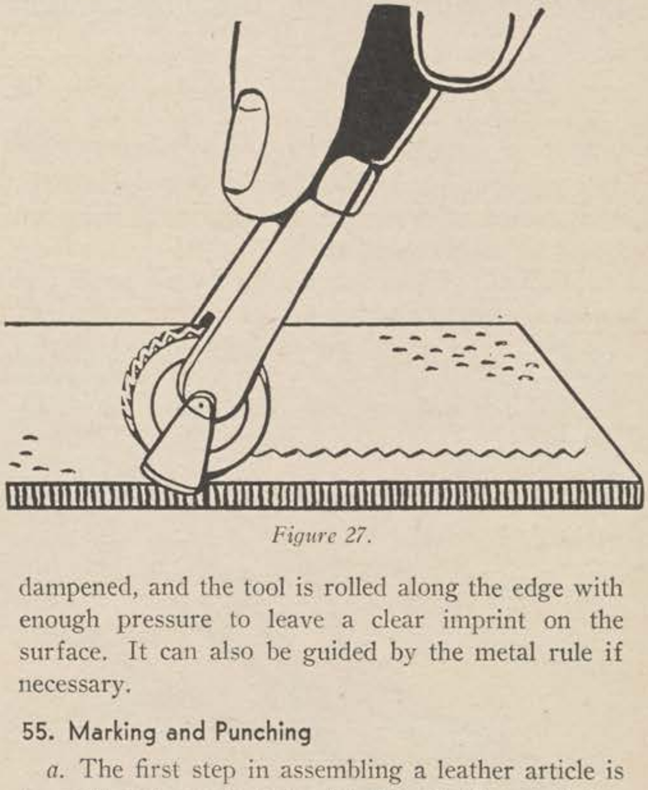


Figure 27.

55. Marking and Punching

a. The first step in assembling a leather article is to mark and punch holes for the stitching or lacing which will hold the various parts together. Even articles made of a single piece of leather are often laced along the edges to prevent wear and give a more finished appearance.

b. It is important that the holes for lacing be evenly spaced and that they run exactly parallel to the edge. The distance between holes should be about the same as the distance from the holes to the edge. This distance will vary from about ⅛ inch to ⅜ inch depending on the weight of the leather and the size of the lacing thong.

c. The easiest way of marking the leather for punching is to run a spacing wheel over the face of the leather, guiding it with a ruler on straight lines (fig. 28). If such a wheel is not available, lay a ruler along the edge to be laced and mark the leather at regular intervals with an awl or the small end of the modeling tool. Make sure that there will be a hole squarely in the middle of each corner even if it means adjusting the spacing of the holes between the corners somewhat.

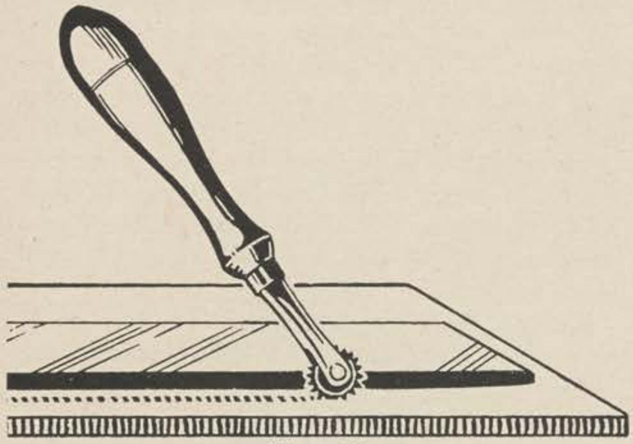


Figure 28.

d. When two pieces are to be joined, mark and punch the first one, then lay it carefully on top of the other. The second piece is then marked with an awl through the holes of the first piece so that when punched the openings will coincide perfectly (fig. 29).

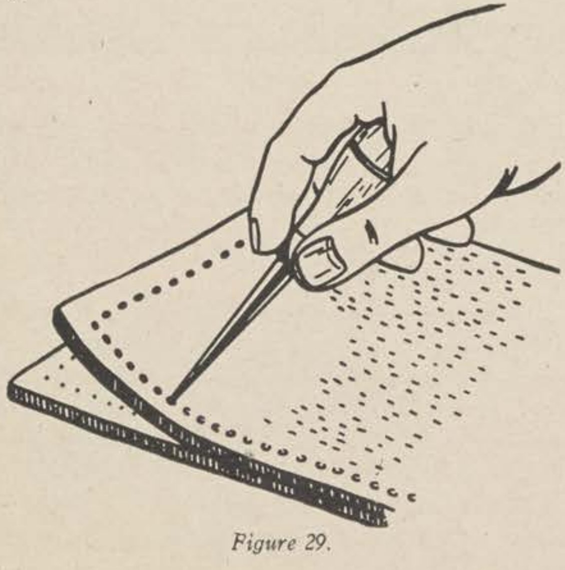


Figure 29.

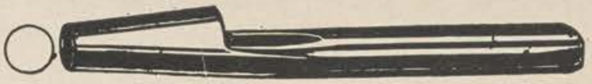

PUNCH

Figure 30.

e. Lacing is generally done through round holes which are made with a drive punch and a mallet or with a spring punch. The drive punch is centered over the mark and tapped with the mallet. Drive punches come in several sizes of which the No. 0 is most widely used for small articles (fig. 30). The spring punch of the type illustrated has a revolving head bearing punches of different sizes (fig. 31). It is quicker and more accurate than the drive punch.

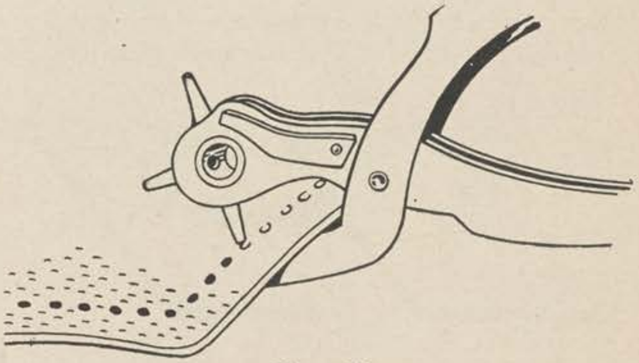


Figure 31.

f. For certain types of lacing, a slit is preferable to a round hole. These can be made with a three- or four-pronged chisel (fig. 32). A single-pronged chisel will also be needed for the corners.

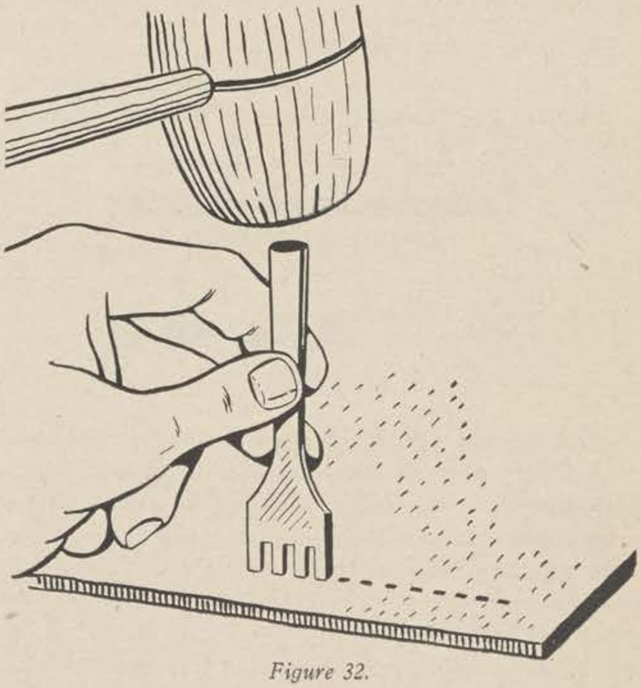


Figure 32.

56. Lacing and Stitching

a. Light weight leathers can be easily stitched by hand or on a sewing machine. If the machine is used, place a thin piece of paper beneath the leather to prevent the feed from marring the surface. Heavy leathers can be hand sewn, but small holes must be punched with an awl to accommodate the needle.

b. Lacing is done with narrow thongs of leather which can be either purchased or cut from a larger piece. (See ch. 5.) Various types of lacing are described below, but the following hints apply to all and will be of help in producing a neatly finished job.

c. If you have punched round holes, use a lace which is slightly larger than the openings, but which can be pulled through without tearing or stretching the leather. The working end of the lace should be trimmed to a point and may be stiffened by dipping it in glue or shellac. Always pass a lace through corner holes two or three times to cover the greater length of edge at these points.

d. Two laces can be spliced together by skiving the end of each at opposite angles and gluing them together with rubber cement (fig. 33). If you are working with slits rather than round holes, a lacing needle will be found necessary. The end of the thong should be skived thin and glued between the two wings of the needle (fig. 34).

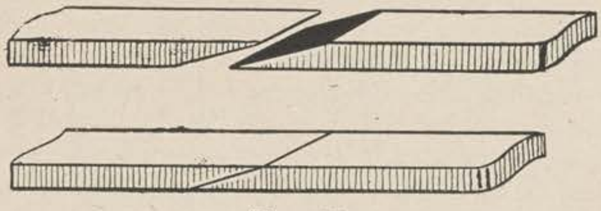


Figure 33.

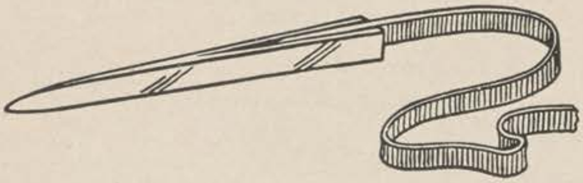


Figure 34.

e. When lacing has been finished, it may be tapped lightly with a wooden mallet or rolled beneath the head of the mallet to flatten any small irregularities.

57. Running Stitch (fig. 35)

This is the simplest type of lacing, but is generally used only for joining two pieces of leather where the joint is not an outer edge. The illustration shows how one end of the lace (A) is skived and glued down between the two pieces of leather at the beginning so that it will be hidden when the lacing is pulled tight. The working end of the thong (B) is tucked through the last hole in the same way and glued between the two pieces when the lacing is finished.

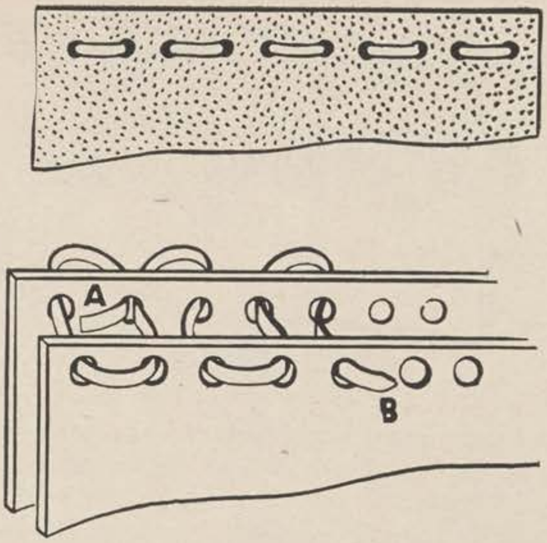


Figure 35.

58. Over and Over Stitch (fig. 36)

a. This is the simplest method of binding an edge. It is done by passing the lace through a hole, over the edge, through the next hole, and so on. It it is used on a single thickness of leather, the ends of the lace are tucked back through two or three stitches on the inside of the leather. If two pieces are being laced together, however, the ends can be concealed between them in the manner described below.

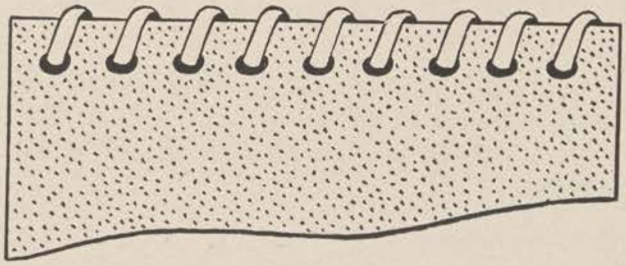


Figure 36.

b. The correct way to do this depends on whether the lacing is to go all the way around the article ending back at the starting point or whether it is to go only from one part of the edge to another. For partial lacing, the end (A) is skived and cemented between the two pieces of leather (fig. 37). The illustration shows how the lacing is done, starting

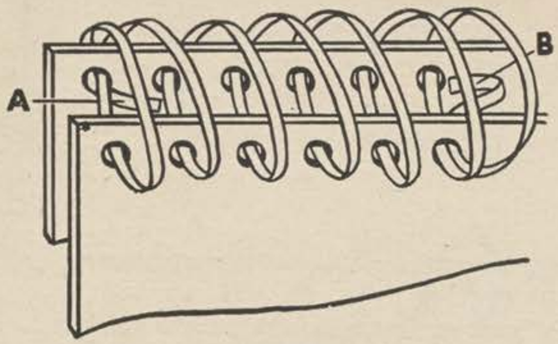


Figure 37.

and ending with a straight stitch which brings the lace twice through one hole at the beginning and twice through one hole at the end. The working end of the thong (B) is also skived and cemented between the two pieces of leather.

c. In continuous lacing, one end of the thong (A) is skived and cemented as above, but instead of beginning with a straight stitch the diagonal lacing is started at once (fig. 38). When it has been carried all the way around the article, there will be one empty hole left in the top piece of leather. The working end (B) is passed through this, skived and cemented.

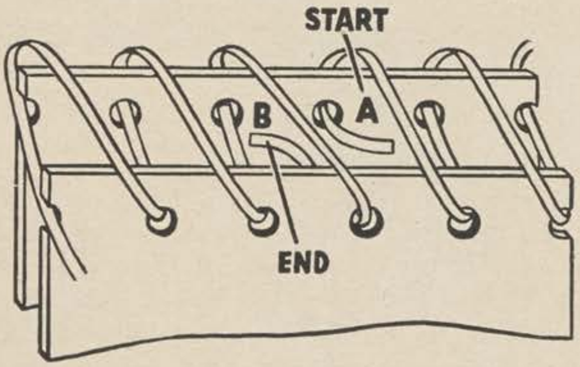


Figure 38.

59. Cross Stitch

a. This is simply a double over and over stitch (fig. 39). The thong is pulled through the first pair of holes to its middle point, and the lacing is done with both ends at the same time as in lacing a shoe (fig. 40).

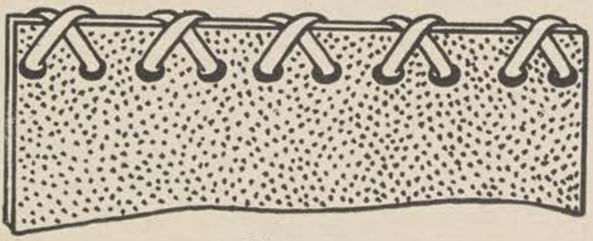


Figure 39.

b. If only part of an edge is to be covered, start with a straight stitch and continue lacing with both ends as in the over and over method. The illustration also shows how the lacing is ended by taking a straight stitch with each end of the thong and cementing them between the two pieces of leather.

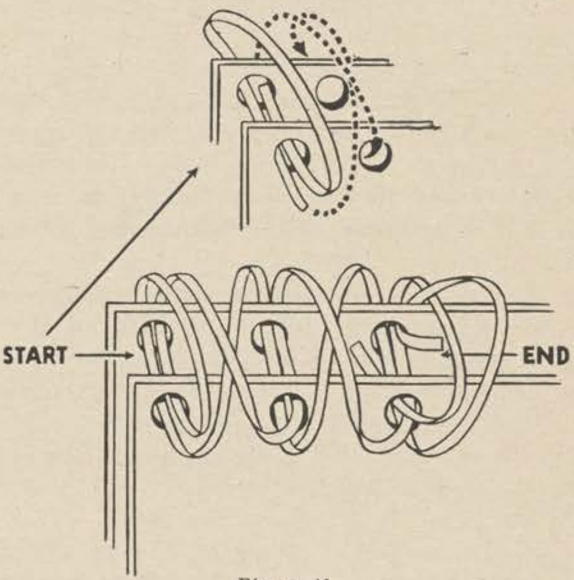


Figure 40.

c. If the stitching is continuous, it is started without the first straight stitch (fig. 41). The lace is passed through the first pair of holes and the diagonal lacing is continued with both ends around the whole article until it comes back to the starting point. The ends are then passed through the first pair of holes and cemented as above.

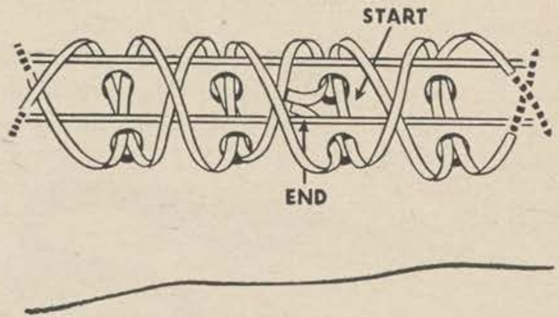


Figure 41.

60. Loop Stitch

This makes a heavier and more pronounced border than any of the above, but is somewhat more complicated to do well (fig. 42). The method of starting is the same, regardless of whether the lacing is to be continuous or not (fig. 43). The illustration

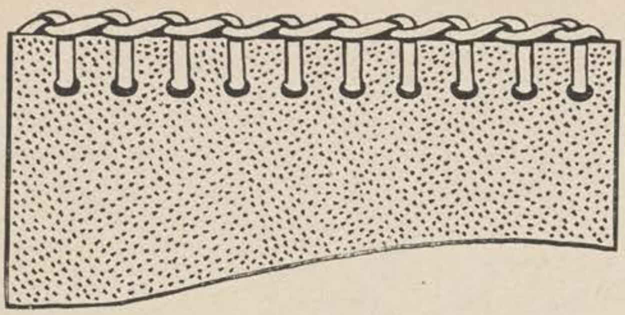


Figure 42.

also shows how the work is carried on. If the lacing does not go all around the article, the two loose ends are carried down between the pieces of leather and cemented. If it is continuous, a neat joint can be made as follows. Carry the lacing all the way around until it reaches the starting point.

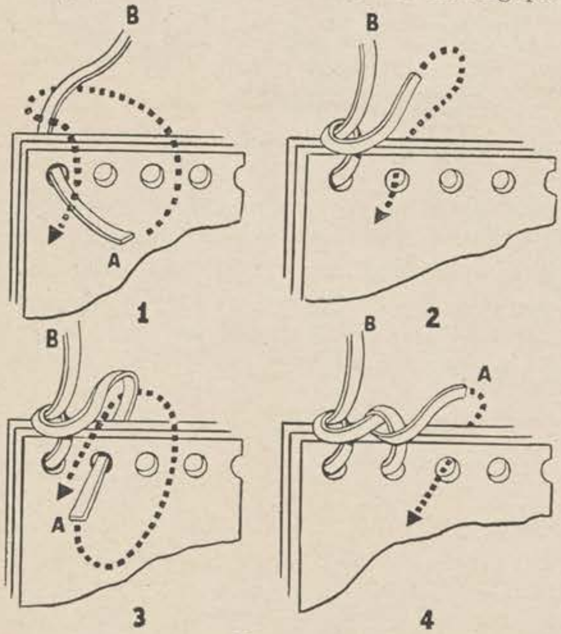


Figure 43.

Then turn the work around so that the back piece of leather is facing you (fig. 44). First pull the end (A) out of its loop. Second, pass the other end (B) down through the same loop. Third, pull the end (A) back through the hole (X) so that it hangs down between the two pieces of leather. The end (B) is then passed through the same hole and both ends are cemented in place between the sheets of leather.

61. Cleaning and Polishing

Many leather workers recommend cleaning and polishing the various parts of an article before they are assembled, as this protects the surface from finger marks during the lacing. In any case, a final cleaning and polishing is advisable after the object is completed and at intervals thereafter. This will keep the leather permanently clean and pliable. Leather that is very dirty can be cleaned with a 10 percent solution of oxalic acid applied to the dampened surface. In most cases, however, saddle soap will both clean and polish the leather sufficiently. An ordinary sheepskin shoe polisher will give the leather a soft shine. If a higher degree of polish is desired, use a neutral colored paste wax. Rub on a very thin coat and polish briskly but lightly. A good liquid polish may be used when the wax is dry if desired.

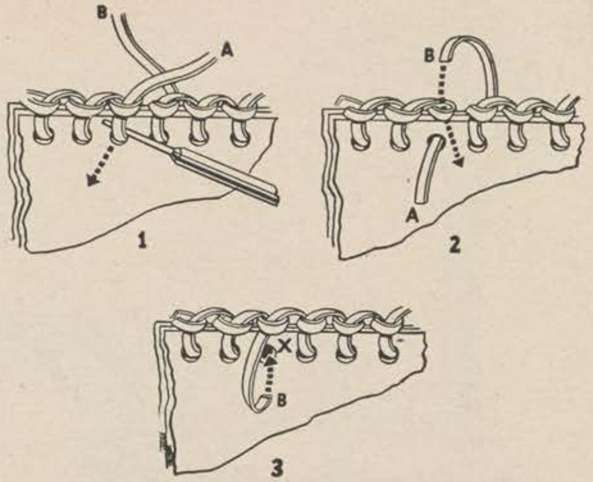


Figure 44.

62. Attaching Fasteners

a. Metal plates, such as the kind used in key containers, can be fastened to leather by means of a split eyelet which is pushed through a hole in the leather, then through a corresponding hole in the metal plate and secured by bending out the edges of the eyelet with an eyelet setter (fig. 45).

b. To attach snap fasteners to leather, it is advisable to use one of the sets sold for this purpose. Each half of the fastener is in two parts. The bottom half consists of a post and a spring (fig. 46). The same illustration shows how these are assembled. The post is set on the end of the anvil with the small projection. A hole is punched in the leather just large enough to fit over the post. The spring is placed over the end of the post. The small end of the special hammer which comes with the set is then placed over the spring and is given a sharp blow with an ordinary mallet. This secures the bottom part of the snap.

c. The top half of the snap consists of an eyelet and a cap (fig. 47). The leather is punched and the eyelet is worked through the hole with the help of

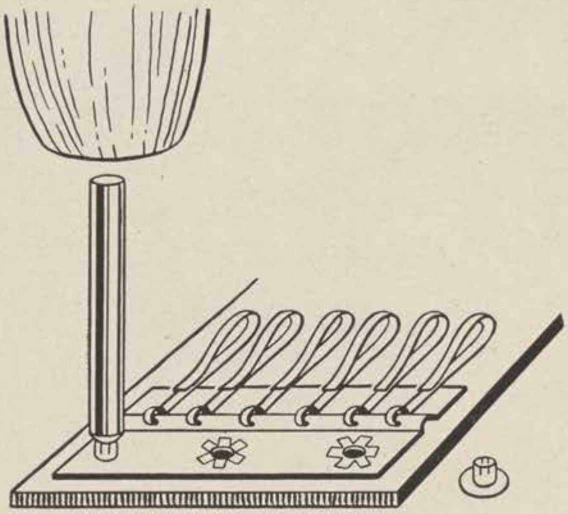


Figure 45.

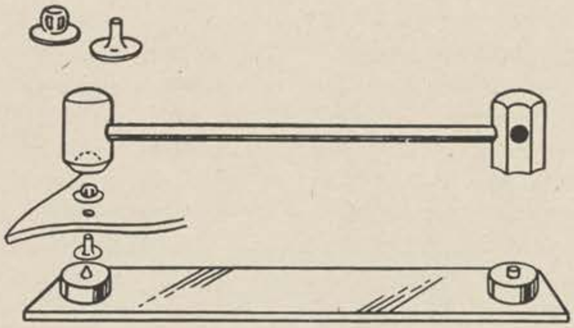


Figure 46.

a pointed bodkin, as shown in the same illustration. This also shows the manner in which the eyelet is placed on the other end of the anvil with the cap over its top. The large end of the special hammer is then placed on the cap and is struck sharply with a mallet, making this part of the fastener secure.

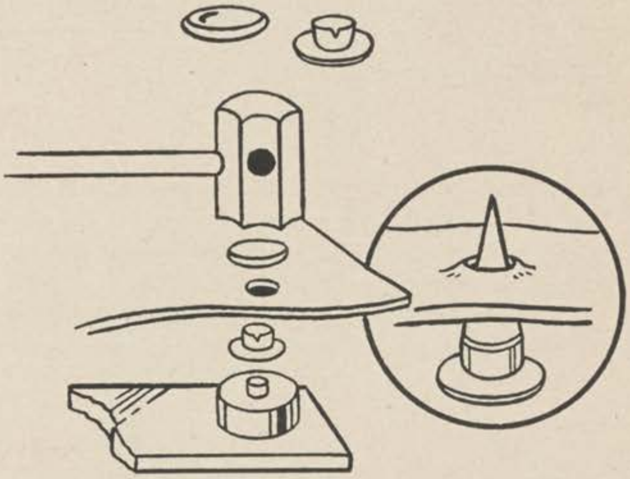
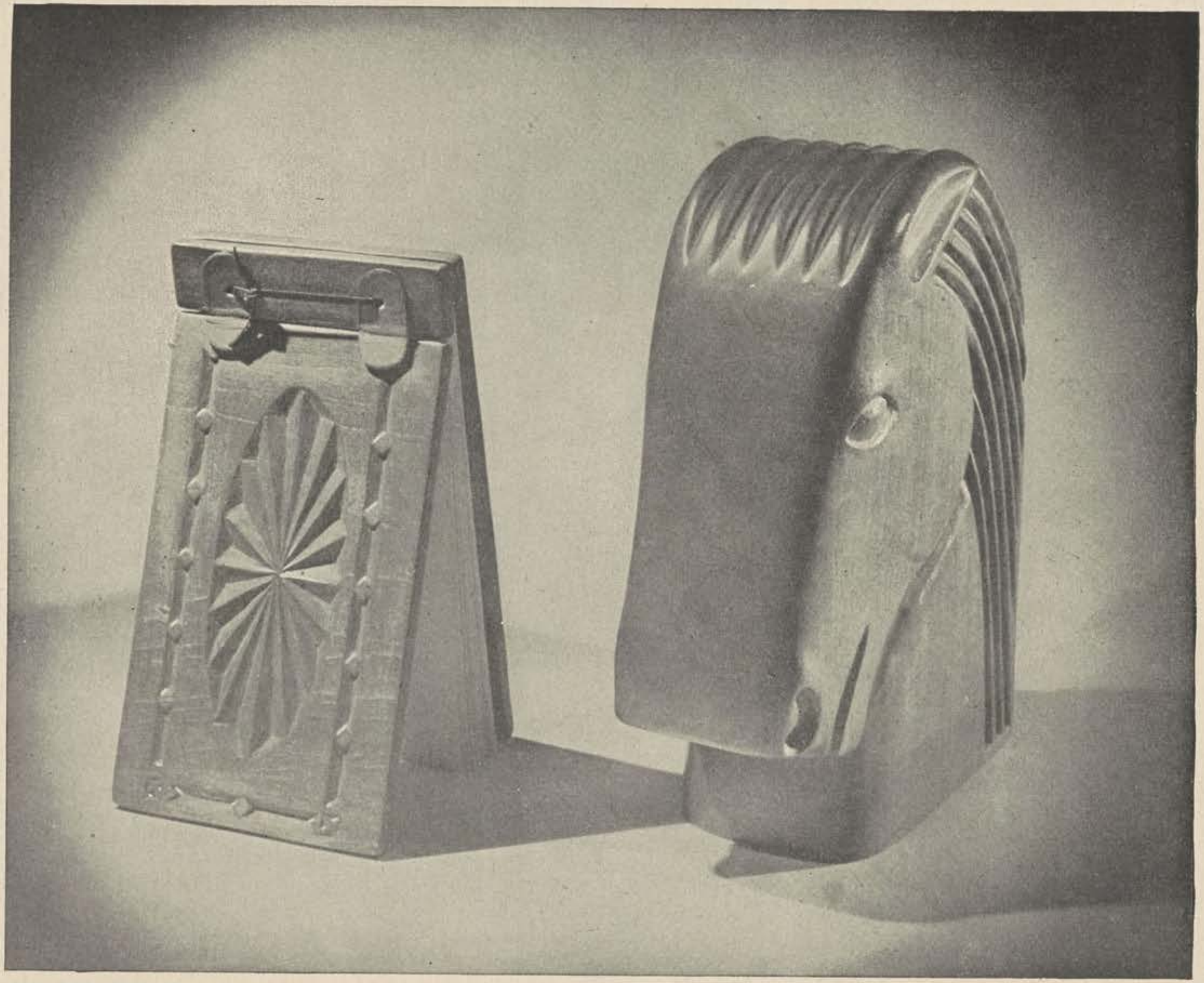


Figure 47.

Care must be taken with snap fasteners to place the two halves exactly opposite each other so that they will come together correctly when the flap of the pocket book or key case is closed. For this reason, snap fasteners are not usually set until the article is completely assembled.



CHAPTER 7

WOODCARVING AND WHITTLING

63. General

Whittling is an old Yankee pastime that requires nothing but a pocket knife and a piece of wood. The casual whittler who has produced only shavings or monograms on tree trunks has little conception of the variety of objects that can be carved with this simple tool. As skill increases, you may decide to take up more elaborate forms of wood-carving, using a variety of chisels and gouges to supplement the knife. But no matter how far you carry the technique, you will find carving one of the most enjoyable and satisfactory of the crafts.

64. Woods

Almost any well seasoned wood can be carved or whittled, but certain varieties are easier to handle because of their even texture and resistance to splitting. Bass and poplar are both soft, rather spongy woods which are extremely easy to cut and hence good for the beginner in the United States. White pine, particularly the variety known as California sugar pine, is the most widely available wood suitable for carving. It is soft, has little grain and works well. Other domestic varieties which are recommended for either their texture or their color are aromatic red cedar, black walnut, willow, maple, and oak. Fruit woods such as apple, cherry, or pear are also satisfactory. Mahogany, ebony, teak, and lignum vitae are the imported woods most widely used. Mahogany carves easily, but the other three, while beautiful in color, are extremely hard.

65. How to Carve

a. All whittling is done with a few standard knife cuts. The commonest is the full hand grip (fig. 48). It removes waste wood quickly, but is hard to control. Extending the thumb along the back of the blade gives less power, but better guidance (fig. 49). The knife may also be drawn toward you with a full hand grip or with the thumb braced on the work (fig. 50). For deep, straight cuts, reverse the full hand grip (fig. 51). In outlining or making stop cuts, the blade is guided by the forefinger (fig. 52).

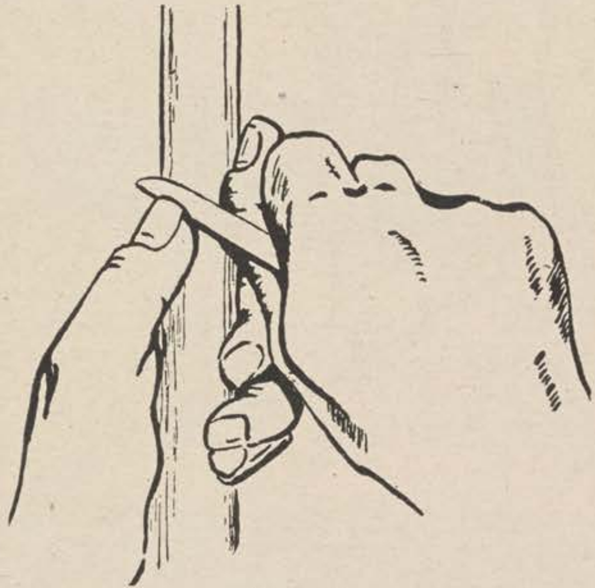


Figure 48.

b. The stop cut is the most important technical trick in carving. It is a deep, vertical incision either with or across the grain and following the outline of an area of wood that is to be removed. As you whittle toward a stop cut, the wood splits away sharply along the line of the cut giving a clean edge precisely where you want it. Without the stop cut, there is danger that the wood will splinter beyond the point intended.

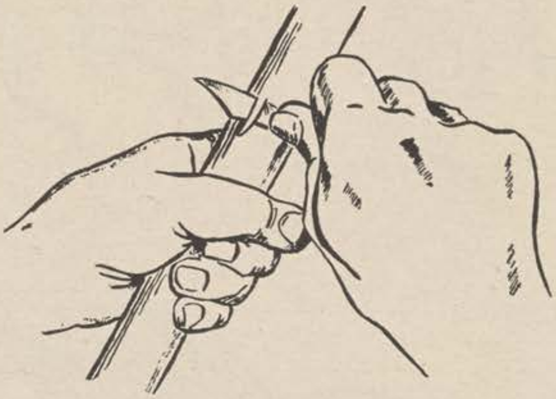


Figure 49.

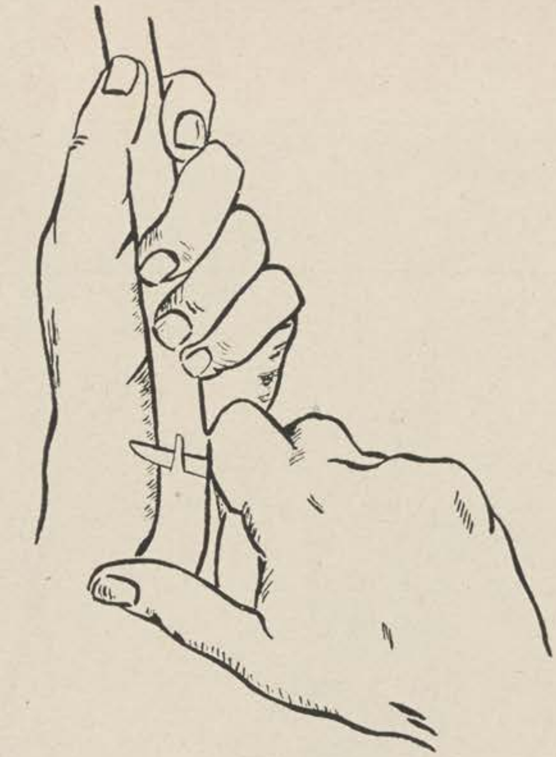


Figure 50.

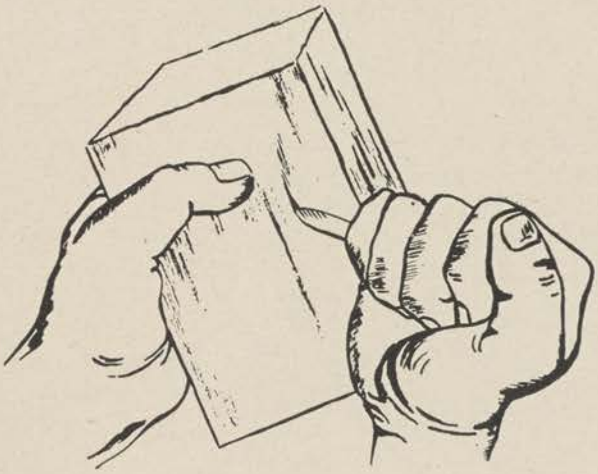


Figure 51.

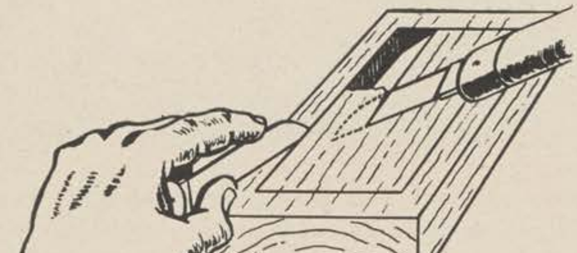


Figure 52.

c. While quite complicated carving can be done with the knife alone, you will find that by using a chisel and one or more of the wood carving tools illustrated your work will be easier and faster (fig. 53). The shape of the blade suggests the special purpose for which each is designed. In carving with these tools, the blade is generally guided by the left hand, while the right hand pushes it through the wood (fig. 54). The tool may also be held in the left hand and the handle tapped with a wooden mallet.

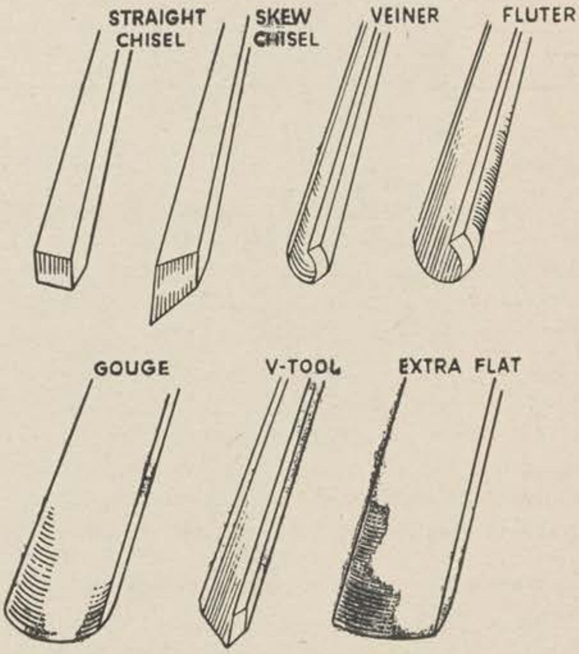


Figure 53.

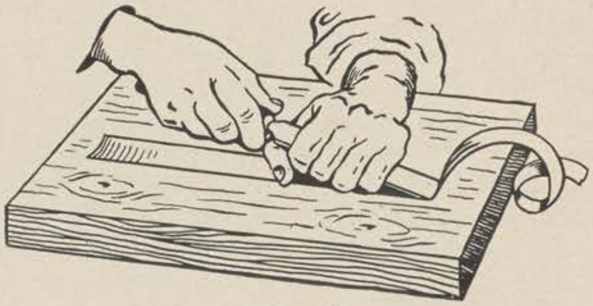


Figure 54.

66. Bark Whittling

Canes, paper knives, spoons, and similar objects can be easily whittled from saplings or branches and decorated by bark whittling. This consists of cutting away portions of the bark, exposing the wood beneath in a geometrical design (fig. 55).

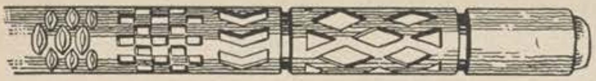


Figure 55.

Any tree with a smooth bark can be used. It is best to let the branch dry for a few days before starting to whittle. Wood that has grown in unusual shapes can often be used to create animals or grotesque heads. The features, such as eyes, mouth, wings, etc., are outlined by bark whittling (fig. 56).

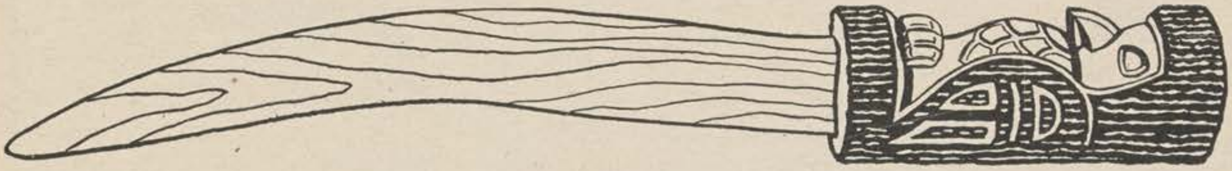


Figure 56.

67. Whittling Tricks

a. An exercise which will test your skill as a whittler is the chain carved from a single piece of wood (fig. 57). The same principle is used in producing a variety of other truck effects such as the ball-in-a-cage, the interlaced hearts, etc. (fig. 58). While these objects have little practical value, they are excellent practice and there is a certain fascination in watching them take form.

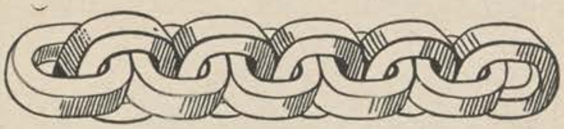


Figure 57.

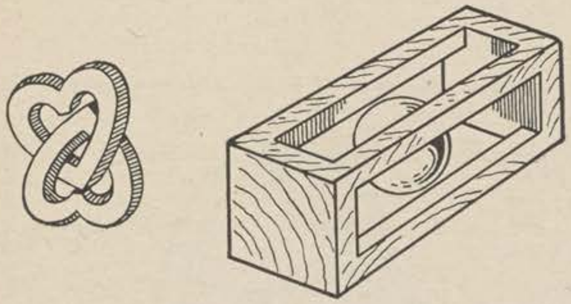


Figure 58.

b. The chain is whittled from a piece of white pine or bass wood about 1½ inches square and 11 inches long. Divide each side into three equal parts by drawing parallel lines and cross hatch the outer sections (fig. 59). Cut away the cross-hatched areas until you have a long stick of wood in the shape of a cross. Measuring from one end, mark off the divisions for the links 2 inches apart on the vertical bars of the cross; do the same on the horizontal bars, but start 1 inch from the end so that the marks will be staggered between those of the first set (fig. 60). Draw in the curves of the links between these two sets of marks and whittle their outside contours (fig. 61).

c. Now shade with a pencil the inner part of each link to be cut out. This is the most difficult operation and requires great care. Use stop cuts wherever possible so that you will not split out part of the rings. Use a very sharp knife and bear down on it lightly. When all rings are freed, the chain is finished although you may wish to whittle the links thinner.

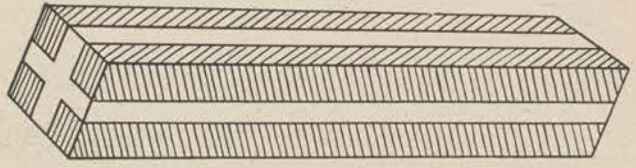


Figure 59.

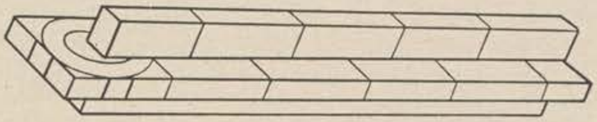


Figure 60.

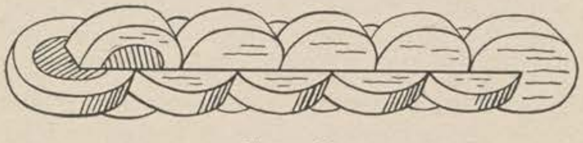


Figure 61.

68. Chip Carving

Chip carving is the simplest method of decorating a flat wooden surface. It can be applied to boxes, chests, trays, bookends, etc. It is advisable to start with one of the softer woods such as pine, gumwood, or poplar. A great variety of geometrical designs can be produced by this method. The basic form in chip carving is the triangle with either straight or curved sides. These may be cut out with an ordinary knife, but a skew knife or skew chisel will be found helpful (fig. 62). The same illustration shows the method of removing the chips. First, straight or slightly slanting cuts about ⅛ inch deep are made along two sides of the triangle. The skew chisel is then inserted on the third side and pushed down at an oblique angle, removing the chip cleanly with a single cut. On longer triangles, several cuts may be necessary. A few of the many designs which can be created by chip carving are shown in the illustration (fig. 63). On the long, curved triangles, it is easiest to make the preliminary stop cuts along the short base of the triangle and one of its sides. The chip is then removed by cutting along the other long side.

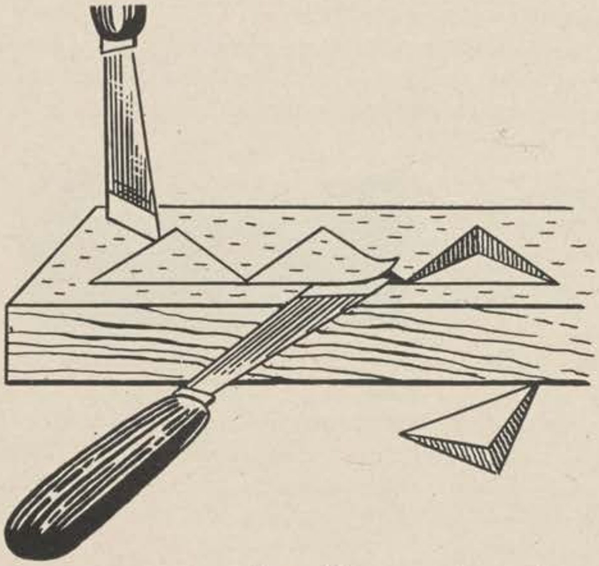


Figure 62.

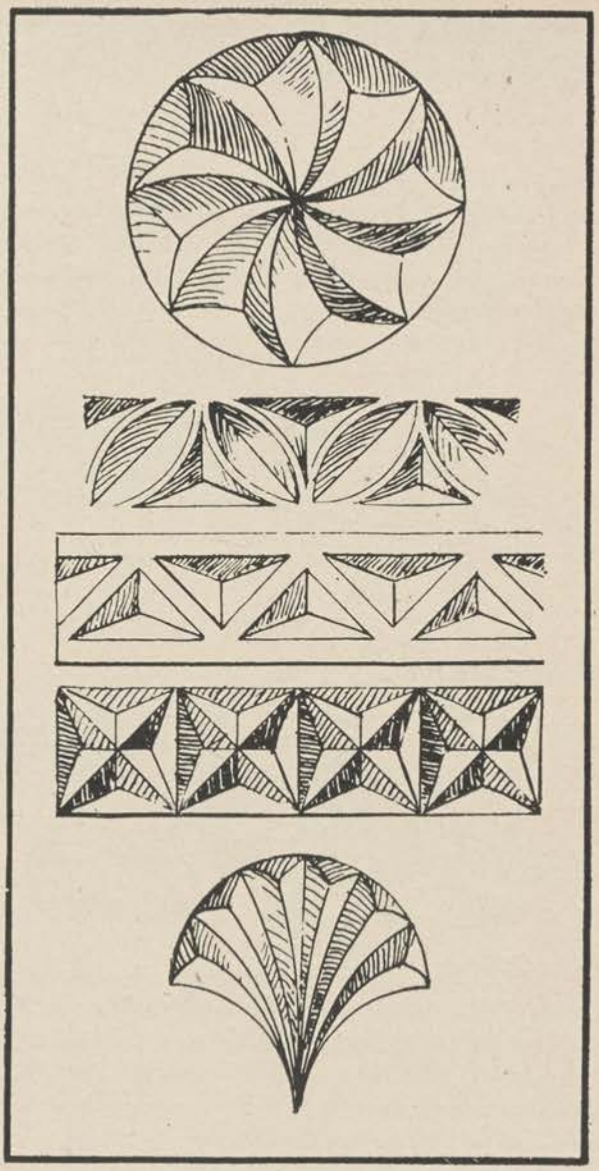


Figure 63.

69. Incising

a. Like chip carving, incising is a process of decorating wood by cutting a design below the surface. It is done, however, with one or more of the woodcarving tools, usually gouges, **V**-tools, or veiners. Letters, monograms and freely curving patterns are more easily achieved by this method (fig. 64).

b. The tool is held in the manner described above with the left hand guiding its point and the right supplying the power. A little experience will show you the best way of manipulating it, but the following suggestions may help. When two grooves intersect at right angles, cut the one that runs across the grain first, then the one with the grain. Otherwise the edges will have a tendency to split where the grooves come together.

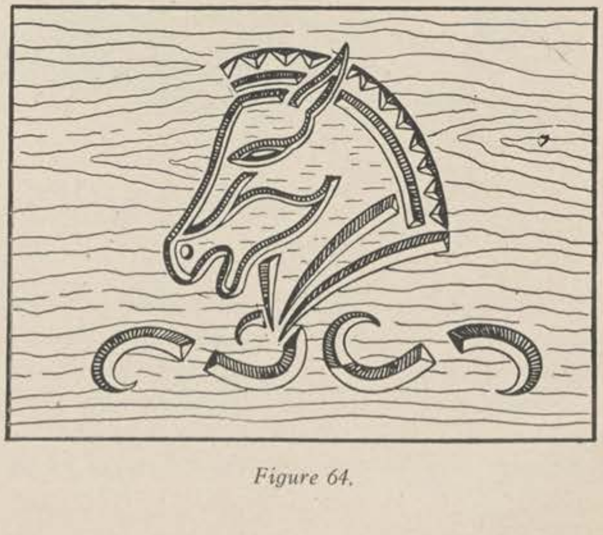


Figure 64.

c. Cuts which are curved or which run diagonally across the grain are often rough on one side and smooth on the other. This is due to the fact that the two blades of the V-tool or veiner meet the grain at a different angle, and that one side tends to cut more sharply than the other. To avoid this, incise your line lightly in one direction then reverse the tool and go back over the same line in the other direction.

d. Incised designs are particularly well adapted to borders and frames or to flat surfaces, such as chair backs and table tops, where a raised carving would be undesirable.

70. Carving in Relief

a. The most elaborate form of decoration is relief carving. It can also be used to produce wall plaques of birds, horses or other figures. It requires skill and a number of carving tools, but the beautiful effects which can be achieved are worth the effort.

b. The easiest form of relief carving is flat surface relief, which is simply the reverse of incising. Instead of cutting the lines of the design into the wood, they are left standing and the background is lowered by gouging it out (fig. 65).

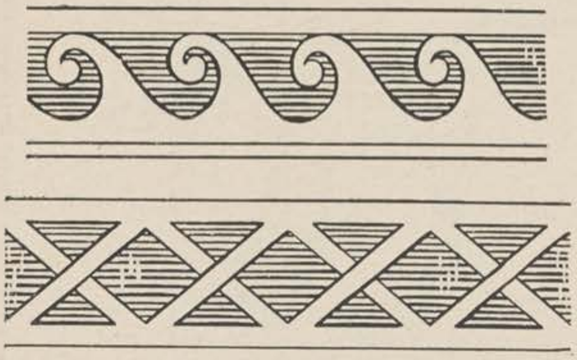


Figure 65.

c. With a design drawn carefully on the wood, proceed as follows (fig. 66): First, outline the long, more or less unbroken contours by shallow grooves made with a veiner or V-tool. Second, the edges of the short and sharp curves are cut by driving a chisel or gouge straight down into the wood with a mallet. This acts as a stop cut for the final operation, which is shaving away the background with gouges and extra flats.

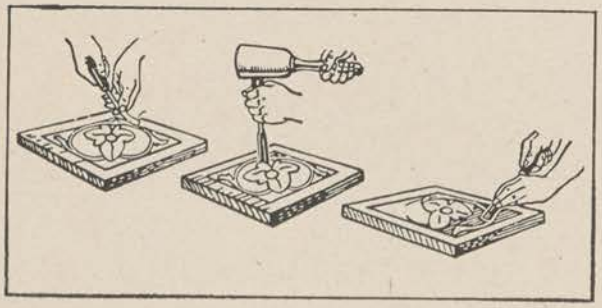


Figure 66.

d. A more advanced type of carving is full relief, illustrated here in a wall plaque (fig. 67). The preliminary steps are exactly the same as in the flat-surface relief above. When the background has been removed, the figure or design is modeled by rounding contours and paring away the portions that require lowering with appropriate carving tools. While this does not sound difficult, it requires skill and great care in cutting as a slip of the tool at this stage can spoil all the preliminary work.

71. Figures in the Round

a. Carving human or animal figures in the round, that is, as three dimensional pieces, is not as difficult as it seems if you start with a fairly simple form such as the elephant illustrated (fig. 68). It is possible to whittle such a figure with a knife alone, but a chisel and a few carving tools will make the job easier.

b. The three principle steps are shown in the same illustration. First, select a block of soft wood such as pine or bass with the grain running in the direction indicated. It is possible to carve it with the grain running in the opposite direction, but there is more danger of splitting. Mark all surfaces of the block in squares of uniform size and outline the form of the elephant. The profile view should be drawn on both sides of the block and the other views on the two ends, the top and bottom. The squares will help you to get these views in perfect alignment.

c. The second step is to rough out the general form. If you have a coping saw, you can save time by using it to remove the largest areas. The sawing should be done along the outline of the profile view. The taper of the tail and head, the division between front and rear legs, etc., can then be roughly carved with the knife or chisel.

d. In the final stage, the sharp edges are rounded and the finished shape of the elephant is achieved by careful cutting. In this process, turn the work frequently and do not work too long on one part. This will help avoid the lop-sided appearance which is common in beginners' work. When the shape satisfies you, add the small details such as the eyes, toe nails, etc. The elephant may be left rough with the tool marks showing or may be smoothed with the knife and then with sandpaper to a highly polished

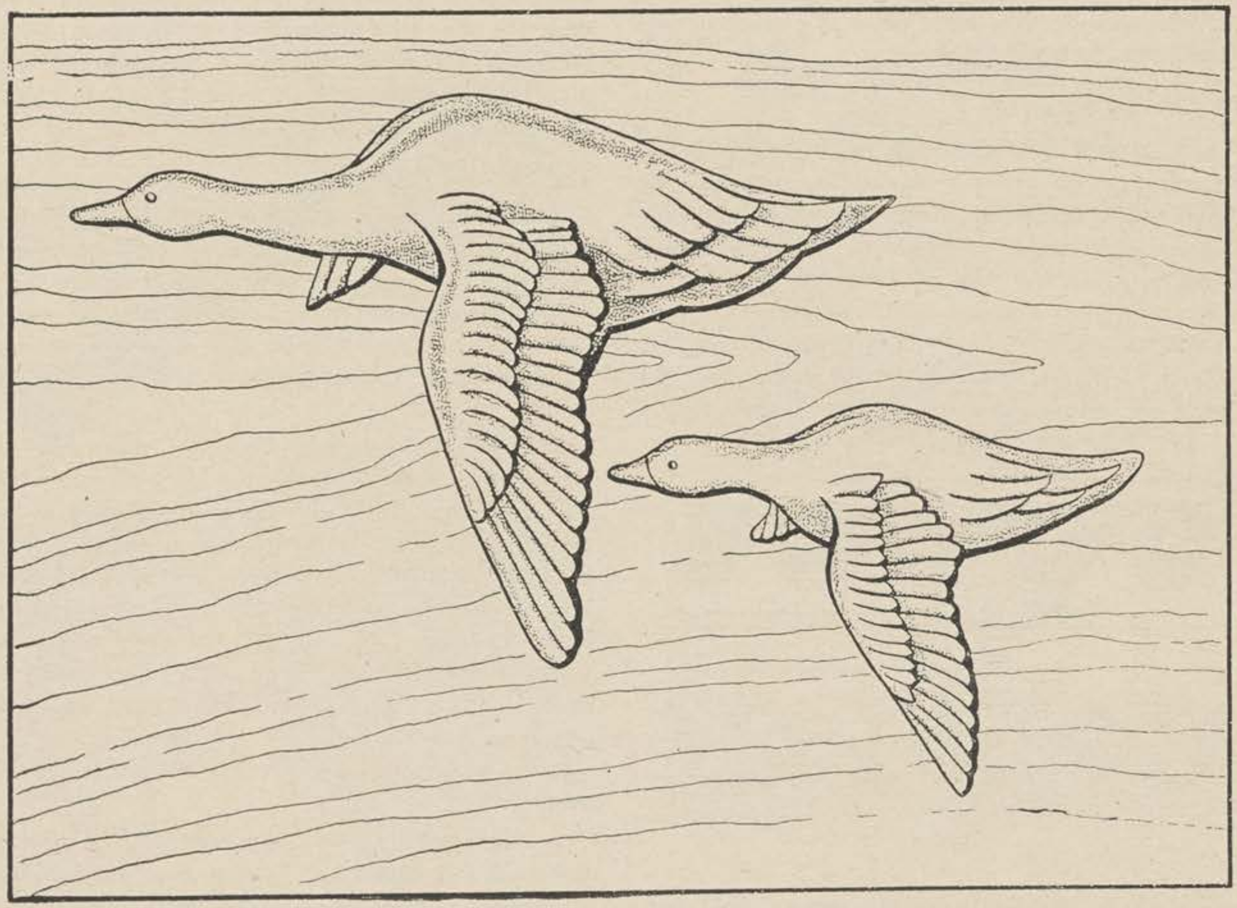


Figure 67. Wall plaque illustrating full relief carving.

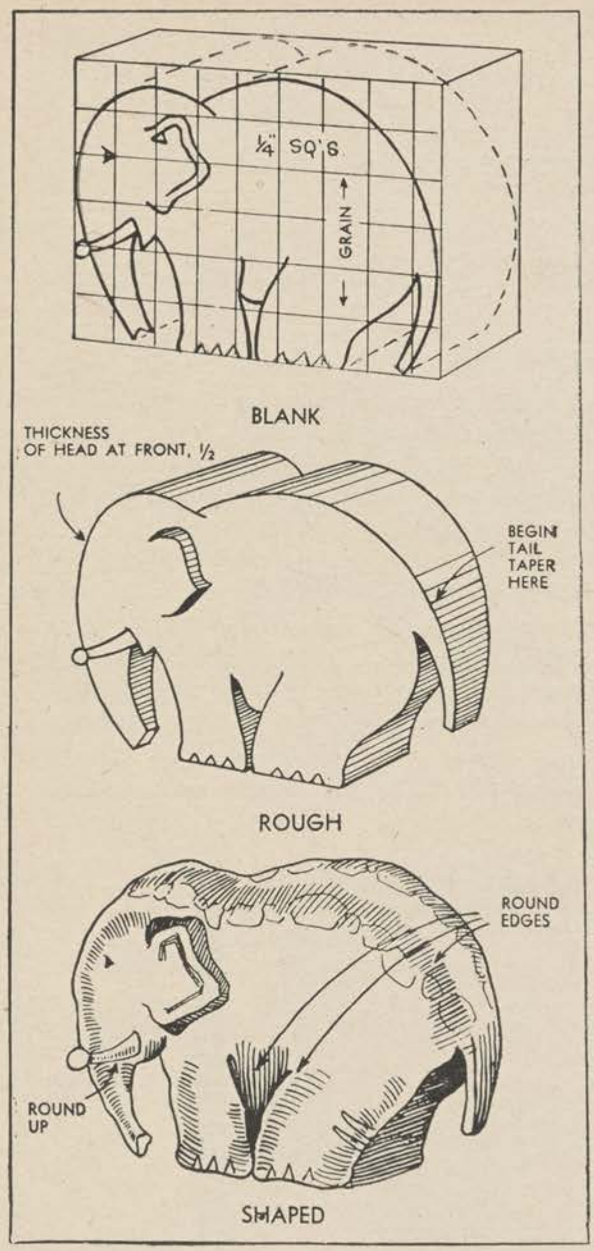


Figure 68

finish. The same method of carving can, of course, be applied to any other type of figure.

72. Finishing

a. For sanding, garnet paper is better than flint or sandpaper. Work on large areas should be done with the paper wrapped around a hardwood block. For fine details, roll it into a small cylinder and use it with extreme care. Always sand with the grain wherever possible. The best grades for finishing are 4/0, 6/0 and 8/0.

b. Varnish, shellac and lacquer can be used on wood, but are not advisable as they change its color to a considerable extent. A good grade of paste floor wax, on the other hand, will provide a soft finish without too much shine and will not discolor the wood. Simoniz may also be used, particularly on walnut, mahogany, or poplar.

c. Wax or Simoniz are applied with a soft rag and polished as soon as they are dry. Three coats are generally sufficient. If you wish to bring out the grain and darken the wood slightly, several coats of linseed oil may be rubbed on at 24-hour intervals before waxing.

d. Discolored surface spots on wood can be removed by applying a little laundry bleaching solution and allowing it to dry. Rinse with clear water, then with a wash containing some white vinegar or acetic acid. Sand as soon as the surface is dry.

e. Wood can be colored by either staining or painting. The best stains are water stains; cloth dyes diluted in water do very well for this purpose. Unless wood is to be placed out of doors, water colors are the most satisfactory paints to use. They should be applied thinly in two coats and the piece waxed as above.

CHAPTER 8

WOODWORKING

73. General

a. Almost everyone has some degree of familiarity with wood. It is one of the oldest and most easily worked materials. There is a good deal of difference, however, between the makeshift hammer and saw woodwork of the amateur and the fine cabinet work of the skilled craftsman. This skill cannot be achieved overnight, but with the right tools and a knowledge of the basic procedures outlined below, you can soon produce a wide variety of finished pieces.

b. While the present chapter covers only the fundamentals of woodworking, there are many books available which discuss the more advanced techniques. Some of these are listed in the bibliography; one of the best on both the use and care of tools and on larger building operations is TM 5-226, Carpentry.

74. Woods

a. Whenever possible, wood should be kiln dried. Unseasoned lumber will shrink, check (crack) and warp. Soft woods are the easiest to work and are recommended for beginners, but they do not have the durability or beauty of the hard woods.

b. The most widely available soft woods are white pine and basswood, both excellent for general work. Others are cedar, cypress, gum, poplar, redwood, and white spruce. Maple, oak, black walnut, and mahogany are the most popular hardwoods; others are ash, birch, chestnut, and yellow pine.

c. If kiln dried lumber is not available, wood from discarded boxes, crates, baskets, hampers or barrels can often be used to good advantage in small projects. It is generally clear and free from knots and can be given a handsome finish by planing and sanding. Compressed fiberboards and plywoods are also adaptable to certain types of work, while the recently developed wood and synthetic resin combinations such as impreg, compreg, urea wood, etc., offer new types of wood construction which are still being explored.

75. Hand Tools

Good tools are essential to good workmanship. It is better to start with a few of the best than with many poor tools. Those listed below with descriptions of their use are the basic ones, most of which will be needed at the beginning.

76. Measuring and Holding Tools

The most important aids to good cabinet work are the proper tools for measuring, marking, and holding the wood on which you will work. A 6-foot folding rule, a carpenter's pencil, a marking gauge and a square (either a try square or a steel square) are essential for the first two operations (fig. 69). A compass for laying out circles or curves and a bevel for angles are also convenient. The square is one of the most useful of all the tools. The end of every piece of lumber must be squared before work is started, and in all gluing or other assembling the square should be applied frequently to right angle joints to make sure that they are true. The marking gauge is used to rule long lines parallel to the edge of a board. The pin which makes the mark should project about $\frac{1}{16}$ inch below the beam. The head is set by means of a ruler, the thumb screw is tightened and the gauge, held in the manner illustrated, is pushed along the board away from the operator.

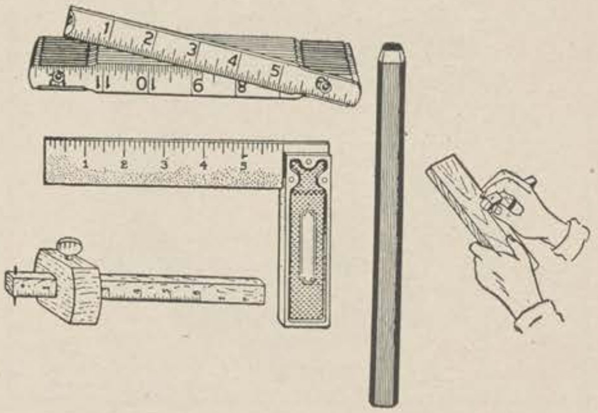


Figure 69.

77. Sawing

a. The saw is the most useful of the cutting tools. Every workshop should have at least one cross-cut and one rip saw, the former for cutting across the grain, the latter for cutting with it. Saws are graded by the number of points or teeth to the inch; the more points a saw has, the finer (and slower) its cut. A 10-point cross cut and a 5- or 7-point rip saw are recommended.

b. Always mark on the wood the line to be sawed. Try to cut along the outside edge of this line rather than on the line itself. This is the only way to insure accurate work. The lumber must be held firmly on saw horses, boxes, or a bench. The saw is held at about a 45° angle to the work and the first cut is made by drawing it towards you several times. As the sawing approaches its end, hold the piece that is being cut off so that it will not split away. The most difficult part of sawing for the beginner is learning to hold the blade vertical so that the edge of the cut is square. This is largely a matter of feeling and experience, though sighting along the blade as you work will help (fig. 70).

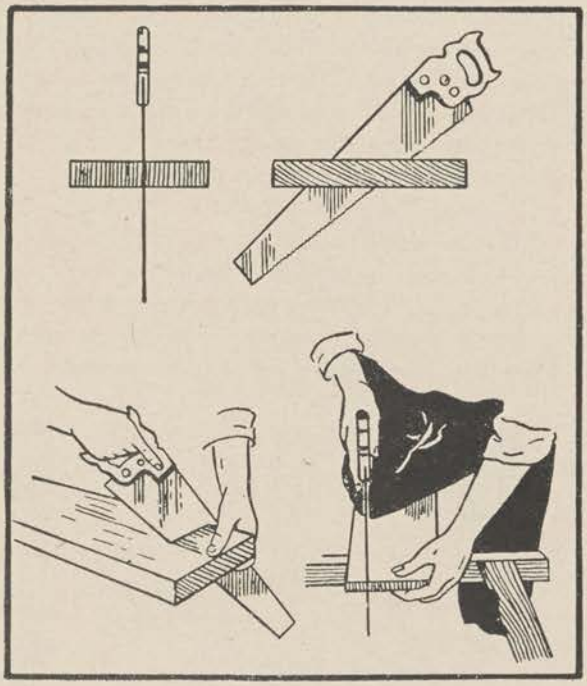


Figure 70.

c. Other types of saws which will be found useful are the coping saw for cutting curves in thin wood (fig. 71) and the compass saw for curves in thick wood (fig. 72). They are also used for either straight or curved inside cuts in which case a hole is first bored in the work to accommodate the blade. In cutting curves, the saw is held at a 90° angle to the wood.

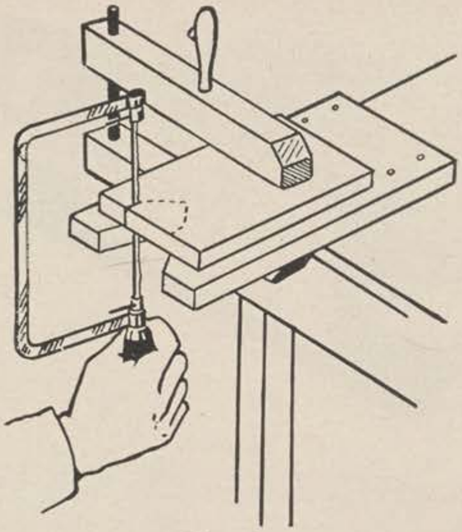


Figure 71.

d. A 14-point back saw is a valuable tool for fine work, especially when used with a mitre box (fig. 73). The latter can be of the improvised type shown, or it may be one of the more accurate metal ones sold commercially. It not only helps in cutting angles but also holds the saw vertical so that the edges of the cut are square.

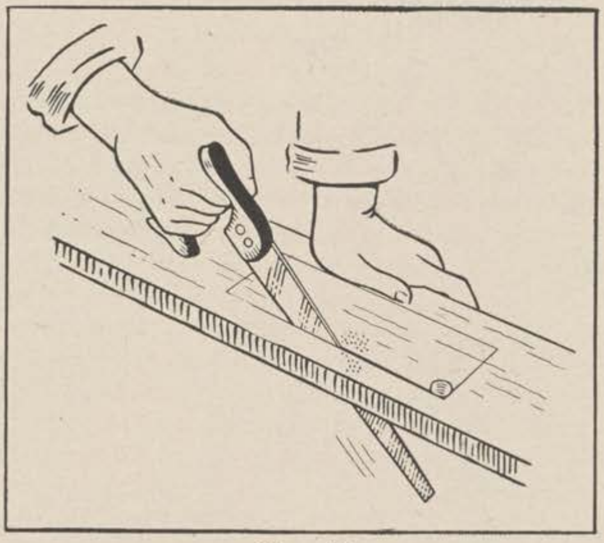


Figure 72.

78. Planing, Cutting and Filing

a. Two kinds of planes will be found useful for smoothing and truing up lumber. The jack place is designed to cut with the grain, the block plane across the grain. The jack plane is about 14 inches in length and is held in either of the two manners shown (fig. 74). The depth of cut is determined

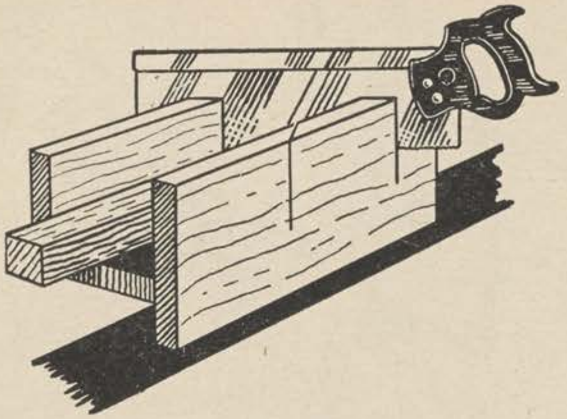


Figure 73.

by moving the adjusting nut. To insure an even shaving, sight along the bottom of the plane and move the lateral adjusting lever until the blade is parallel with the bottom. While the jack plane can, if necessary, be used to cut across grain on the end of a board, the block plane is easier to manipulate (fig. 75). It is held in one hand with the forefinger on the finger rest. Do not attempt to plane all the way across the end of a board or you will split the far edge. Instead, work from each edge towards the center.

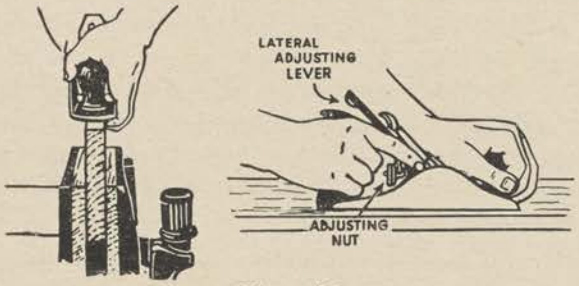


Figure 74.

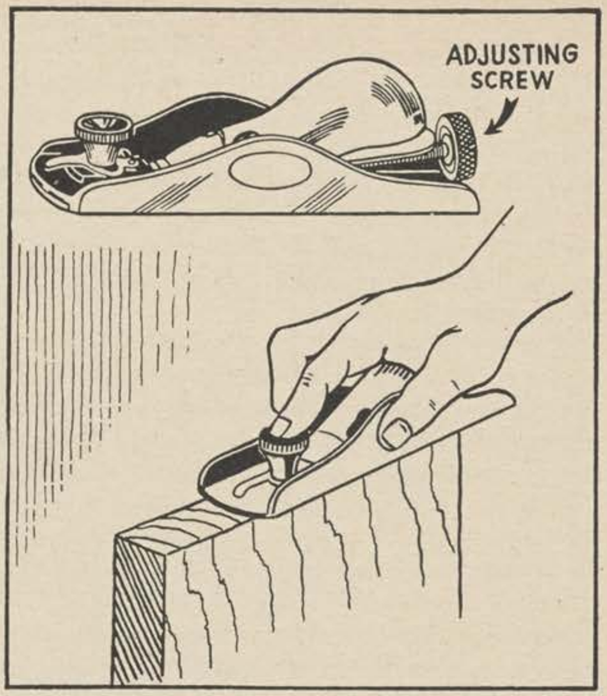


Figure 75.

b. The best chisel for general work is the kind known as a "firmer" with a beveled blade. It comes in many sizes, but a ¼-inch and a ¾-inch chisel will fill most needs. The chisel is extremely useful in small cutting and shaping operations and may be used in many different ways. Some of these are demonstrated in the illustration (fig. 76).

c. The main thing to remember in chiseling is that wood always tends to split in the direction of the grain. Cuts must always be planned so that if the wood splits it will take out only a portion that is to be removed anyway. It is also important to realize that when a beveled-edge chisel is hammered verti-

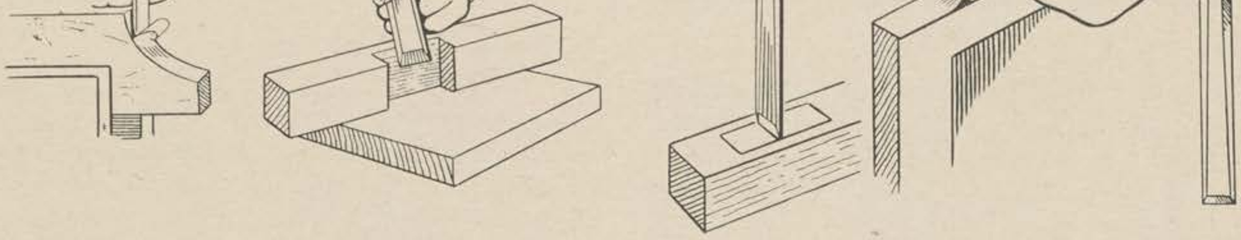


Figure 76.

cally into wood, it will leave a straight cut on the flat side of the blade, an angular cut on the beveled side. The latter should therefore always face the area to be removed. In horizontal chiseling or in working around a curve, a beveled edge, however, is generally used for cutting.

d. Filing wood gives a rather unpleasant surface and should be done sparingly, but wood files or rasps are occasionally indispensable for enlarging holes or smoothing out roughly chiseled curves. A slightly tapered half-round file of the type illustrated is best (fig. 77).

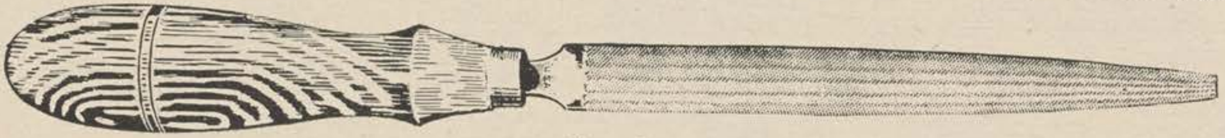


Figure 77.

79. Drilling

a. For rapid drilling of small holes, the hand drill with 6 or 8 bits of assorted sizes is recommended (fig. 78). The hole should be started with an awl to keep the bit from slipping. Pressure must be light and the crank turned at an even speed. Learn to hold the drill steady so that the hole will be straight. If the drill is permitted to wobble the hole will be enlarged and the bit may break.

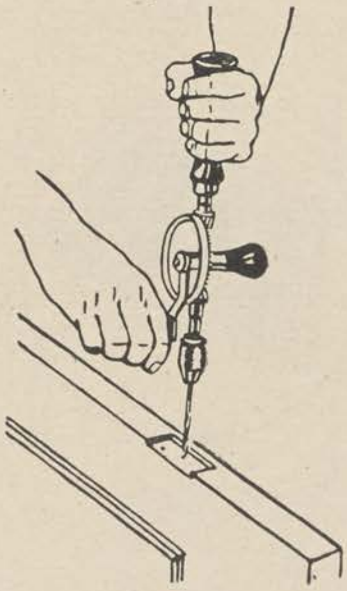


Figure 78.

b. More important than the hand drill, is the ratchet brace with assorted augur bits (fig. 79). It can be used for much larger holes than the hand drill and will also take a screw-driver bit and a countersink bit. In an emergency it can even handle the small smooth-shanked bits designed for the hand drill. For vertical drilling, the brace is held in the position illustrated. For horizontal drilling, the top of the brace can be held against the stomach. A try square may be placed next to the bit as a guide in keeping the drill vertical. When boring through a plank, the augur bit has a tendency to split the wood as it emerges on the bottom. To avoid this, stop drilling as soon as the point, or spur, of the bit comes through the bottom. Turn the board over and finish the hole by drilling from the reverse.

c. When holes are to be drilled to a certain depth, a convenient attachment is the bit gauge illustrated which stops the bit automatically when it has reached the depth for which the gauge is set (fig. 80). The same illustration shows an improvised gauge made from a block of wood or a dowel. The use of the screw-driver and countersink bits is described in that part of the manual describing nailing and screwing.

80. Nailing and Screwing

a. The commonest method of assembling wooden articles is by nailing. A 13-oz. claw hammer with a slightly curved face is recommended. The almost headless finishing nail is best for fine work. It can be countersunk, that is driven below the surface of the wood, with a nail set and the hole puttied or filled with plastic wood (fig. 81).

The corrugated fastener or wiggle nail is used to fasten mitred joints or in any edge to edge joining where appearance is not important or where the surface on which the nail is used will be hidden, as in the under side of a table top. The saw edged type is best for soft wood. In some corrugated fasteners the flutes are canted so that they pull the joints tight as they are hammered in (fig. 82).

b. Screws hold more securely than nails and should be used wherever there is a considerable strain on a joint. The flat-headed screw is the most generally useful although many other types are available. The screw driver's metal shank should run all the way through the handle and should be of a good grade of steel. When working with soft wood and short screws which need not penetrate deeply, as in screwing on a hinge or fastening, it is possible to start the screw by making a small hole with an awl (fig. 83). In most cases, however,

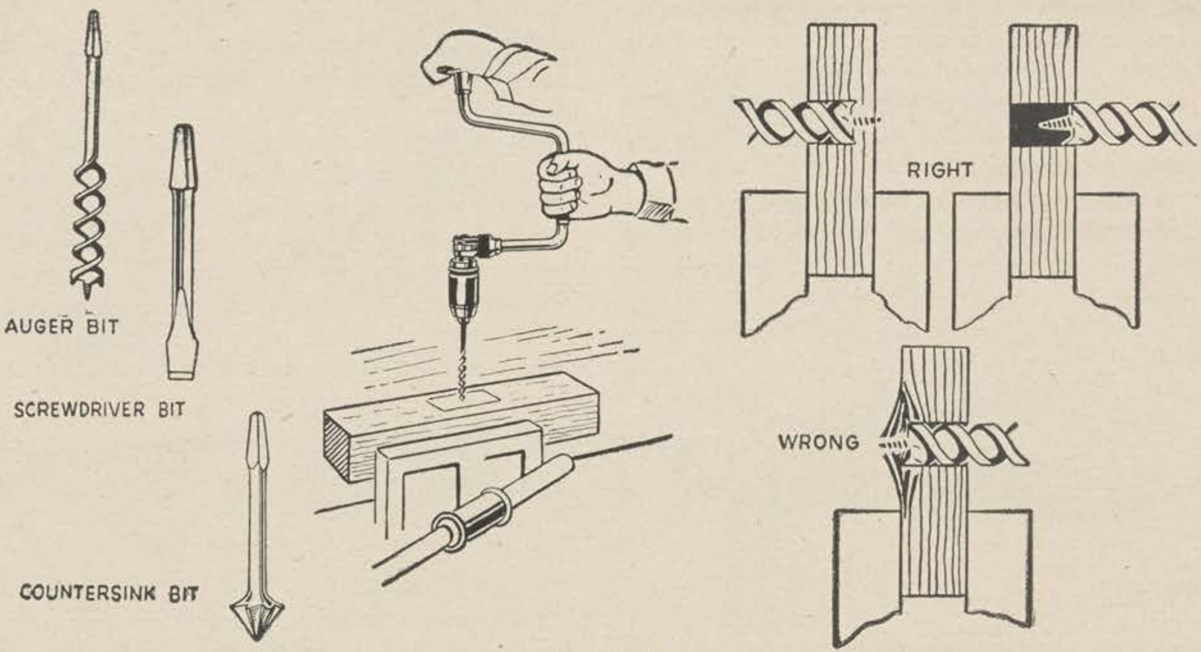

AUGER BIT
SCREWDRIVER BIT
COUNTERSINK BIT
RIGHT
WRONG

Figure 79.

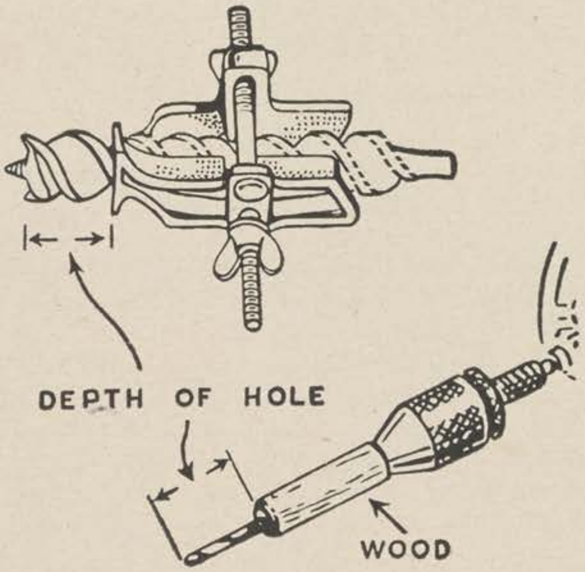

DEPTH OF HOLE
DEPTH OF HOLE
WOOD

Figure 80.

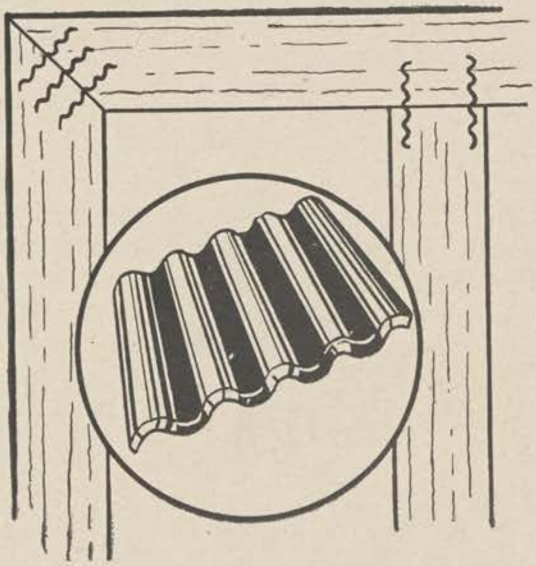


Figure 82.

Figure 81.

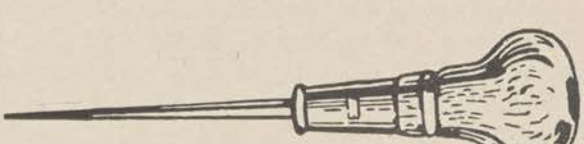


Figure 83.

it is necessary to drill holes for the screws; this is particularly important near the ends of boards where splitting will occur if the screws are turned directly into the wood.

c. The professional way of screwing two boards together is illustrated (fig. 84). First, holes are bored through the top piece with a drill of the same diameter as the shank, or unthreaded portion of the screw. Second, the hole is enlarged on the surface with a countersink so that the head of the screw will lie flush with or slightly below the surface when it is turned in. Third, a hole slightly smaller in diameter than the threaded part of the screw is bored in the bottom piece. The last step shows how the screw is turned in with the screw driver held vertically so that its tip fits squarely in the slot.

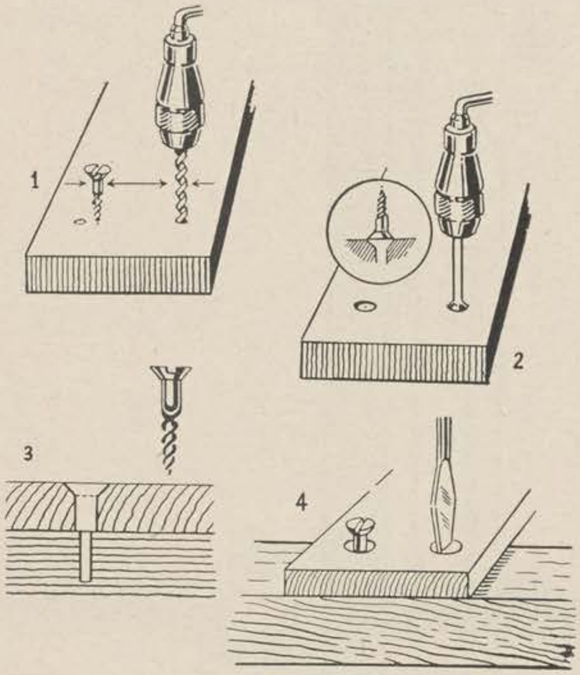


Figure 84.

81. Gluing

a. A glued joint, properly done, will be stronger than the surrounding wood and has the advantage of showing no fasteners. Hot glue has the greatest strength and is used by professional cabinet makers, but it must be handled with great speed and accuracy as it will not adhere after it has cooled. The cold glues are not quite as strong, but are easier for the beginner to use as they set slowly and allow time to adjust the work.

b. The best hot glues are made of hides and come in sheets or strips. They must be broken into a glue pot which may be one of the electric kind sold commercially, an ordinary double boiler or a can set in a pan of water. The glue is barely covered with cold water, allowed to stand overnight, then heated to a temperature of about 130° until dissolved. The surfaces to be joined must be absolutely dry and clean before the glue is brushed on.

c. There are several kinds of good cold glues such as casein, resin, and fish glues. These are all satisfactory and should be mixed according to the manufacturer's instructions. All glued joints must be held together firmly with clamps or other devices until the glue has set. Some of the most useful types which can be purchased are illustrated (fig. 85). It is also possible to hold work in place by various systems of wedges and stops (fig. 86). The stops are nailed to any flat surface, the glued work is set in place between them and the wedges driven in until the joint is tight. Certain types of work may be held together by ropes which are tightened by twisting them in the manner of a tourniquet.

82. Miscellaneous Tools

In addition to the above, the well equipped workshop should also contain pliers, a spoke shave, a cabinet scraper and an oil stone for sharpening tools. The spoke shave is like a miniature plane and is used in smoothing curved surfaces. The type with a straight bottom is recommended for general work (fig. 87). The cabinet scraper is also like a miniature plane, and is designed for use on flat surfaces where very fine shavings are to be raised (fig. 88). It is invaluable in scraping off paint or in smoothing a surface where further use of a plane might remove too much wood. Both the spoke shave and cabinet scraper are pushed away from the operator.

83. Power Tools

While it is not within the scope of this chapter to give instruction in the use of power tools, the following motor driven machines are recommended as basic ones for the large workshop. These are the bench circular saw, the jig saw, the drill press, the lathe and the grinder. A band saw, planer, machine sander, and dovetailing jig may be added at intervals. In most cases, the manufacturers provide manuals which serve as guides to the operation and maintenance of these machines.

84. Joinery

a. With a knowledge of tools and their use, you are now ready to learn the joints which are com-

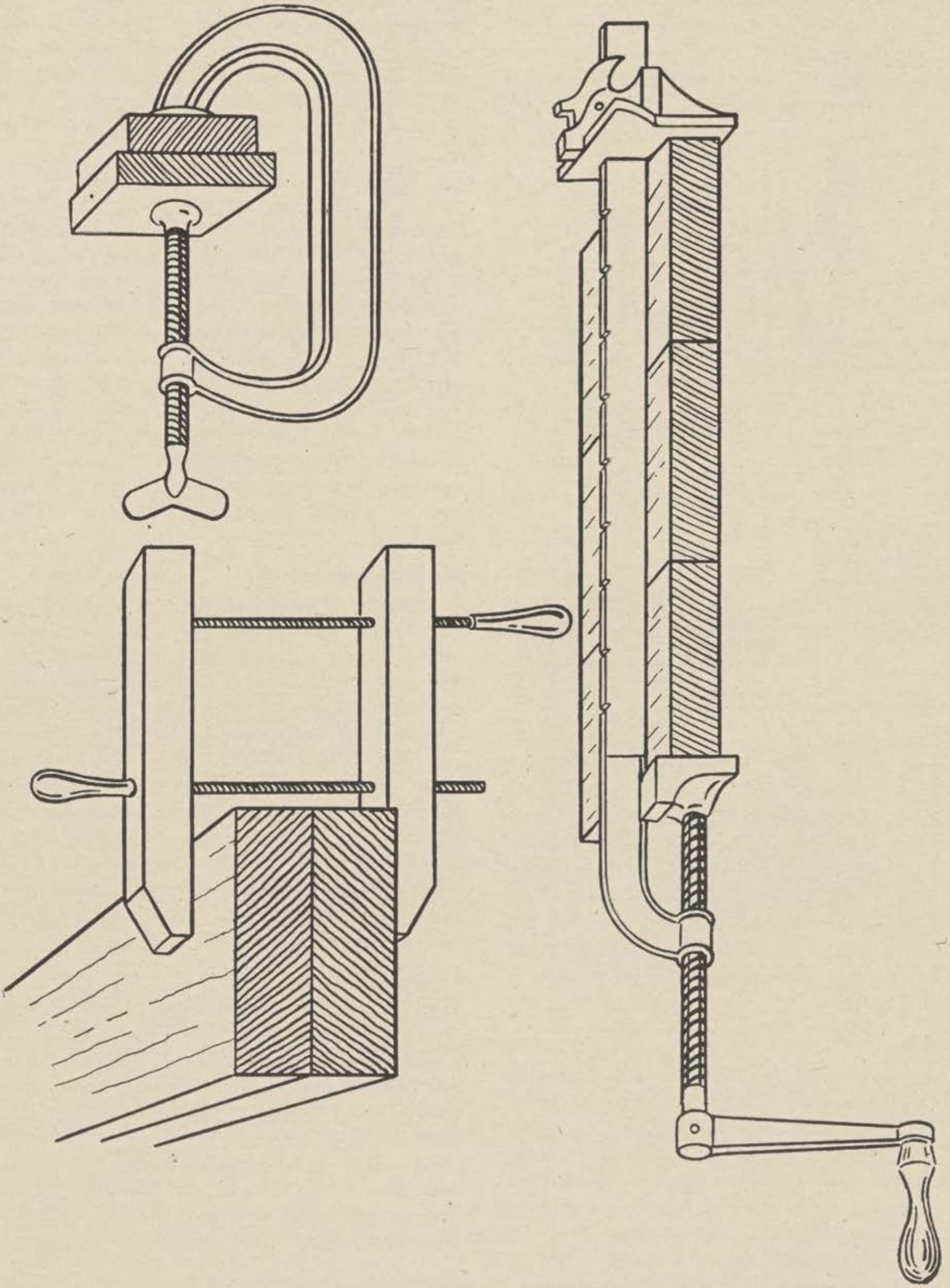


Figure 85. Clamps used to hold glued joints together.

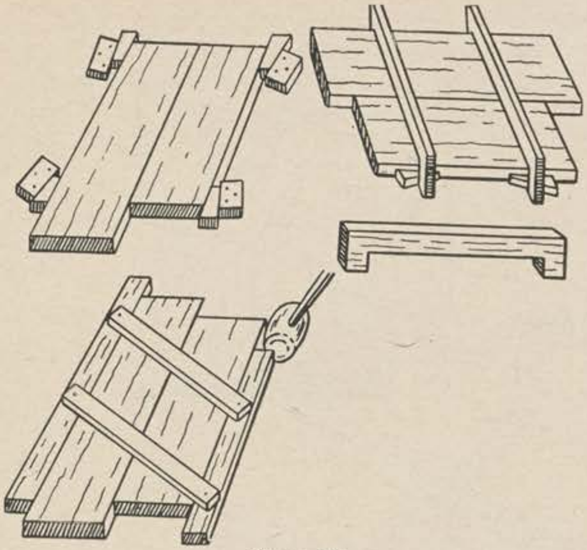


Figure 86.

monly employed in putting together all types of pieces (fig. 89). Each has its special uses, though many of them can be applied to a wide range of objects. In planning the construction of any article

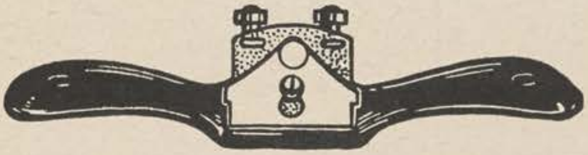


Figure 87.

it is necessary to determine in advance the type of joints you plan to use. It is also advisable to make at least a rough working drawing of the article with all dimensions indicated on it.

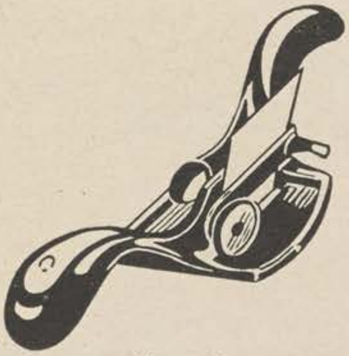


Figure 88.

b. The butt joint is one of the simplest and most common of all wood joints, particularly useful to beginners inasmuch as it does not require a high degree of skill. The securing element may be nails, screws, or combinations of either one with glue, dowel-and-glue, or corrugated fasteners.

c. The blocked joint is a modification of the butt joint; the blocking, either square or triangular, may be glued, nailed, or screwed to the members, depending on the specific requirements of the job. Its advantages are the ease and speed with which it can be made and the ease with which the piece can be disassembled if screws are used in the assembly.

d. The blind dowel is a variant of the butt joint; it has good holding power and is not very difficult to make but calls for somewhat more accuracy than the through-dowel since the holes must be drilled exactly opposite each other and perpendicularly. This joint can be used where it is desired not to have the dowel show on the surface.

e. The through-dowel, another variant of the butt joint, is one of the most useful because it is fairly easy, requires little time, and has good holding power. It is much easier and quicker (by hand) than is the mortise-and-tenon and can be used in types of work in which there is no objection to the end of the dowel showing. The through-dowel is made by clamping together the two pieces in correct position and drilling through one piece and into the other. The dowels are then inserted with sufficient glue and cut off with a back saw above the surface, leaving just enough material to sand down flush. The through-dowel is particularly advantageous in some kinds of large pieces if a portable electrical drill is available; the joint can then be made almost as rapidly as a nailed or screwed joint.

f. The dovetail is one of the most valuable of all joints because of its unusual strength. In addition to the holding power of glue this joint has an advantage over most others in that its form alone gives it great strength. Against it is the disadvantage that it requires very accurate workmanship if it is to be made by hand. There are, however, dovetail jigs which make it fairly easy when power equipment is available.

g. The mitre joint has many variants of which a few are shown here. It is commonly used where symmetry of appearance is desired, and to avoid the showing of the end grain of one of the members. This joint requires somewhat more skill, unless an accurately set mitre-box is available.

h. The lock-corner joint is extremely valuable for its great strength, which derives from the large amount of glue area its many open tongue-and-grooves provide. It calls for a fairly accurate skill if made by hand but is quite easy if the bench circular saw is available. This joint is especially useful for corners of boxes and similar places and offers effective decorative possibilities as well.

i. The half lap is useful in joining lengths of pieces together, having many other uses as well. As with other types of joints, the half lap is fre-

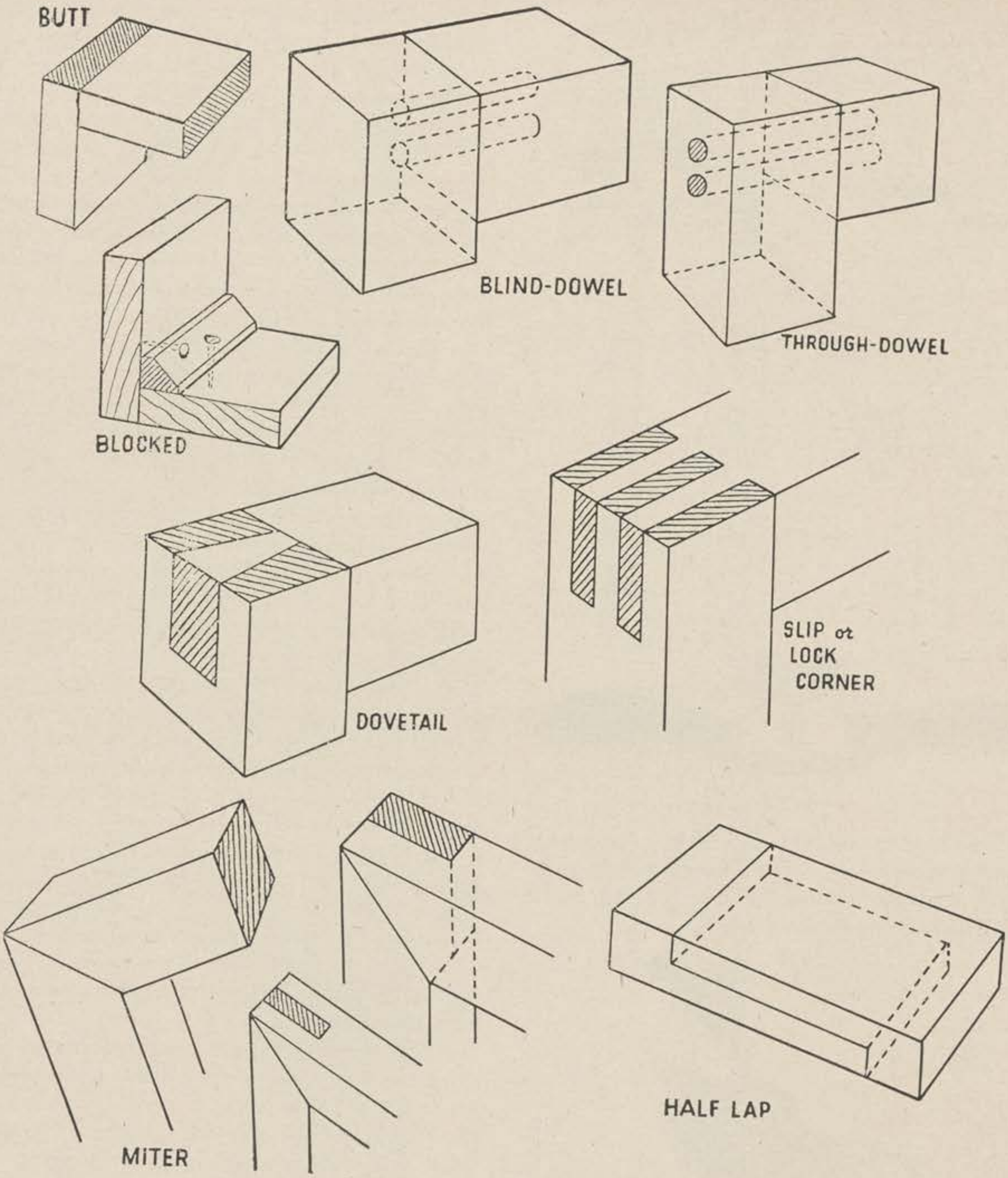


Figure 89.

quently reinforced with dowels, nails, or screws in addition to glue.

85. Finishing

a. The first step in finishing an article after it has been assembled is to sand it smooth. This not only removes small irregularities in the surface, but also cleans the wood for the final treatment. Sandpaper is surfaced with small particles of flint, garnet or quartz and comes in a number of textures. The flint and garnet papers are generally considered best. Three grades are sufficient for most work, No. 0 (fine), No. ½ (medium) and No. 1½ (medium coarse). Sanding should always be done with the grain and for flat surfaces the paper should be wrapped around a block (fig. 90). Always dust the surface of the wood carefully after sanding.

b. There are many types of finishes which protect the surface of the wood and enhance its beauty. The commonest are discussed briefly below and will fill the needs of the average worker. In some cases, as in painting and enameling, step-by-step instruction has been omitted as this information is given by the manufacturer on the container.

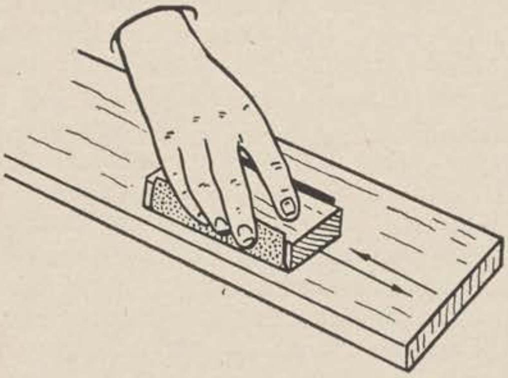


Figure 90.

c. Regardless of the finish used, the following suggestions may help. Always work in as clean a room as possible. Small particles of dust will adhere to a tacky surface and make it extremely difficult to get a smooth finish. Fill all holes with putty or plastic wood before applying finishing substances. Powdered pumice mixed with water (or linseed oil) to a creamy paste can be rubbed over almost any type of finish to dull it and remove too high a shine. If you wish to heighten the lustre, on the other hand, polish the surface with rottenstone mixed with crude or sweet oil to the consistency of light cream. It is applied with a pad of soft cotton waste very slightly dampened and should always be rubbed in long strokes with the grain of the wood.

86. Painting and Enameling

Paint and enamel are both opaque finishes which hide the grain of the wood and which come in a variety of colors. Enamel is a little more difficult to apply than paint, but gives a higher lustre and a harder surface. Before applying either of these to new wood, be sure to shellac all knots in the lumber or they will bleed through the finish. When applying several coats of paint or enamel, allow each to dry thoroughly and sand lightly with No. 00 sandpaper between coats.

87. Staining

Five kinds of wood stains are water, chemical, spirit, oil, and varnish. The last two are easiest to use and are recommended for the beginner. All types are transparent and add color to the wood without hiding the grain. Except in the case of varnish stain, they do not protect the surface of the wood and must be covered with one of the finishes below. Several coats of stain are generally needed, and the wood should be sanded lightly between each.

88. Shellacking

Shellac provides a very satisfactory transparent finish which is durable and easy to apply. White shellac is used over plain wood or over light stains, orange shellac over stains of dark color. Shellac dries fast and must be applied skillfully with long brush strokes. It is important that the surface be completely covered at each stroke since it cannot be touched up afterwards as with paint. Shellac should also be sanded lightly between coats.

89. Varnishing

Like shellac, varnish provides a transparent protective coat which may be applied over raw wood or stains. When used on raw wood, the grain should be sealed with a prepared wood filler, a colorless paste that is mixed with turpentine. On either stained or raw wood, the varnish should be preceded by a thin coat of shellac as a base. Several coats of rubbing varnish are then brushed on. Each coat is rubbed down when dry with the pumice and water mixture described above. If a dull finish is desired, no further treatment is necessary; for a high lustre, a final coat of finishing varnish is applied. The latter contains slightly more oil than the rubbing varnish and requires more time to dry. Varnishing should always be done in a warm room of at least 65° F.

90. Oil Polishing

Oil polishing may be done over a stain or on either filled or unfilled raw wood. It is heat and water resistant and gives a lasting semigloss finish. Equal parts of linseed oil and turpentine are mixed and applied with a pad of cotton waste. Use the oil sparingly and rub in vigorously. The process should be repeated several times at 24-hour intervals.

91. Wax Polishing

Wax in either liquid or paste form is one of the best protective coverings for wood. It is easy to apply and may be renewed at intervals without special preparation. It is frequently used over varnish or shellac and may also be applied to either filled or unfilled wood. Paste wax is generally considered preferable to liquid wax. It can be rubbed on with the fingers or a small lump of it may be folded inside a cheesecloth pad. As the pad is rubbed over the wood enough wax comes through to leave a thin coat on the surface. When this has dried, it must be polished vigorously with a soft cloth. Second and third coats are applied in the same way.

92. French Polishing

a. One of the finest of all finishes and one of the most difficult to handle successfully is the shellac process known as French polishing. While it takes time and skill to do, it results in a beautiful soft lustre which cannot be duplicated by simpler methods.

b. The initial step is to fill the pores of the wood with the wood filler described above under varnishing. Three coats are brushed on, each being sanded lightly with 00 sandpaper when dry. This provides the necessary base on which to work.

c. Three rubbers are now prepared by wrapping handfuls of soft cotton waste in pieces of clean muslin. Dip the stuffing of the first of these in shellac, wring it out and wrap it in its muslin cover. Rub it over the entire surface of the object with a circular motion, never permitting the pad to stop or rest on the surface at any time. As soon as this coat is dry, dust on a little powdered pumice and sprinkle a few drops of linseed oil over it. Then polish the surface with the second rubber using the same circular motion. When the coat has been evenly dulled, clean off the excess pumice mixture with a dry cloth.

d. At least two more coats of shellac must be applied in the same way, polished with pumice and cleaned as above. The most difficult step is the final one. Pour a little wood or denatured alcohol into a plate and dip the third rubber in it. Squeeze out the excess liquid on a scrap board and, with very little alcohol on the rubber, quickly wipe over the entire surface to remove all marks of polishing. Use a circular motion without pausing and lift the pad from the wood the instant the rubbing is finished. If too much alcohol is used or if the rubber rests for a moment in one spot, the alcohol will burn through the shellac and the entire finish is spoiled. If this happens there is no remedy. One can only scrape off the entire finish and start again from the beginning.

e. Many craftsmen feel that the rubbers used in French polishing improve with use and age. To keep them, remove the inner wads and store in tightly covered mason jars. The muslin covers should be washed in strong borax, rinsed, dried, and put away for future use.

CHAPTER 9

METAL WORK

93. General

Metal is one of the most varied and satisfactory of all the craft materials. It can be hammered, cut, and sawed; it can be chased, planished, and etched. A knowledge of the fundamental techniques outlined below is all that is necessary to produce a wide variety of objects from small jewelry to large bowls and trays. It is wise, however, to start with simple procedures which will give you the feel of working in metal. More elaborate forms and applied decoration can be undertaken as skill increases, but you will find that in many cases the plain, polished surface of the metal itself is more satisfactory than the application of too much design.

94. Metals

A number of handsome objects can be made from discarded tin cans. In addition to this easily procured material, the following metals are widely used in craft work: pewter, copper, sterling silver, aluminum, brass, and various ferrous alloys, or types of iron. They are listed in order of malleability, or ease of hammering, with the softest metals first. Almost any of them may be used in the projects below.

95. Annealing and Cleaning

a. Most metal work involves hammering. Except in the case of tin and pewter, this hammering will gradually harden the metal until it cannot be worked further without annealing. This is a simple process for softening the metal, which it is well to know although you may not need to use it in making small objects that require little shaping.

b. To anneal work, heat it in a hot flame or oven for about 2 to 5 minutes. Hold a piece of paper against the hot metal; if the paper smokes, the annealing is completed. This process generally raises small scales on the surface of the metal, which must be removed before work is continued. Aluminum may be cleaned with a solution of caustic soda. For other metals, mix in an earthenware or enameled container a "pickle" composed of one part sulphuric acid in eight parts water. Always put the water in *first* and add the acid very gradually. Immerse the annealed object in the pickle for 5 or 10 minutes until the scales are removed. Lift it out with a stick, wash thoroughly in cold water and dry with a soft rag. Remember that the acid solution must be handled with care; it will corrode metal and will burn skin or clothes.

96. Cutting, Sawing and Bending

a. Many objects can be made by the simple processes of cutting and bending metal to the desired shape. These techniques are demonstrated here in the making of a bracelet, but they can be applied to bill clips, book ends, paper knives and many other articles.

b. For the bracelet, nickel silver is a good metal to use. The tools required are a wooden mallet, a pair of metal shears or tin snips, an awl, a few small files, and a vise. You may need a hack saw or a jewelers fret saw to cut the harder metals. A steel anvil with a round horn is also convenient, but the bracelet can be shaped as well over a broomstick or a baseball bat held in the vise. This is known as a mandrel.

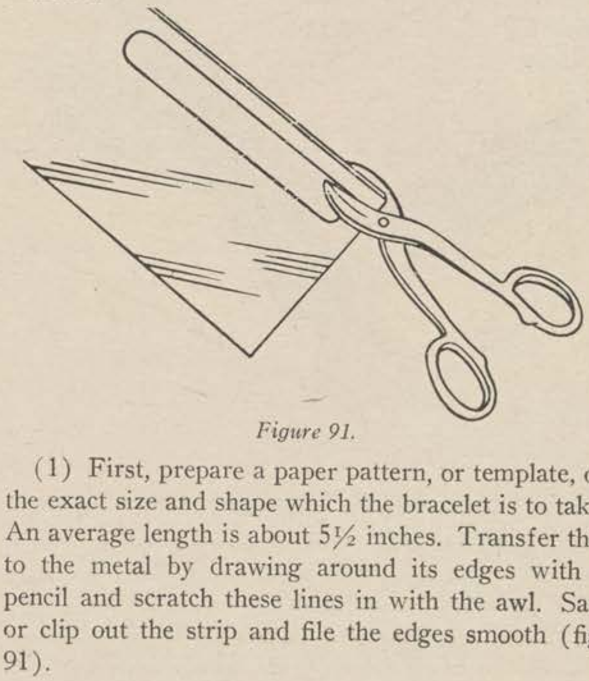


Figure 91.

(1) First, prepare a paper pattern, or template, of the exact size and shape which the bracelet is to take. An average length is about 5½ inches. Transfer this to the metal by drawing around its edges with a pencil and scratch these lines in with the awl. Saw or clip out the strip and file the edges smooth (fig. 91).

(2) In using the jeweler's fret saw, make sure that the blade is taut and that the teeth point downward toward the handle. Hold the saw vertical with the handle below the sheet of metal. Move it with short, quick strokes, sawing only on the downward one (fig. 92). Filing also should be done on the forward stroke, never in two directions.

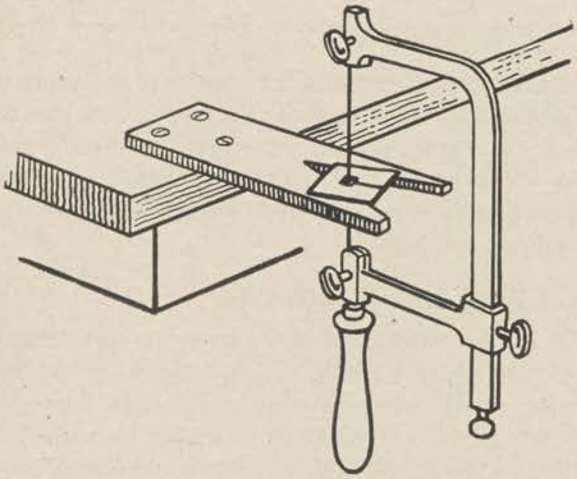


Figure 92.

(3) Now round the corners of the strip by clipping them off with the shears and filing them until they are smooth semicircles (fig. 93). The metal is then ready to be bent into its final form.

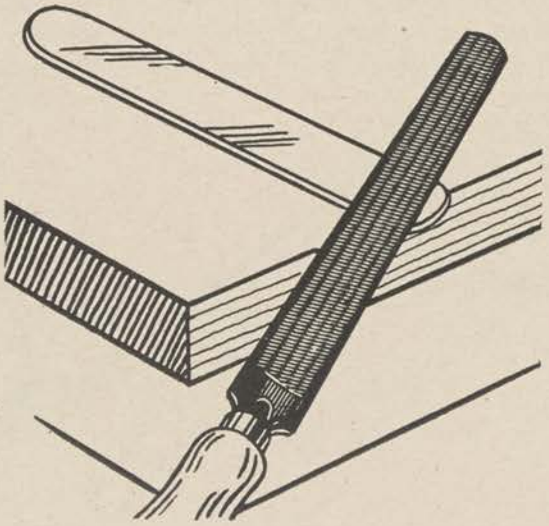


Figure 93.

(4) This is done by hammering it over the mandrel described above. Use a wooden mallet with a flat face. Lay the metal strip on the mandrel with about an inch protruding on the side away from you. Strike the metal just beyond the point at which it rests on the wood, drawing the stroke toward you at the moment of contact. When the first inch has been curved, move the strip forward gradually and continue hammering until you reach the middle. Reverse the bracelet and work from the other end in the same way (fig. 94).

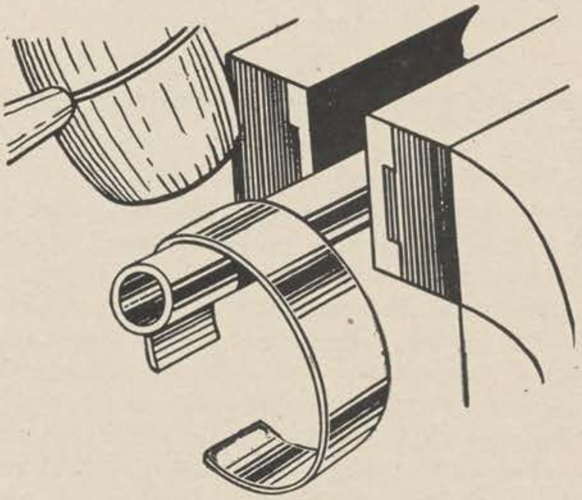


Figure 94.

(5) If the ends are still too far apart they may be pressed together with the hands, or the side of the bracelet may be hammered lightly to close them. Finally, it should be replaced on the mandrel and all irregularities removed by hammering it again with straight, vertical strokes. This will also harden the metal and make it springier. The bracelet is now completed unless you wish to add a design or monogram (see end of chapter) (fig. 95).

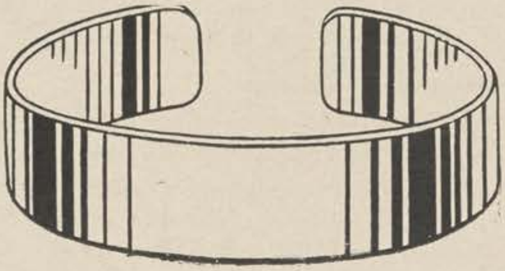


Figure 95.

97. Forming on a Hollow Mold

a. The easiest way to make ash trays, bowls, shallow dishes, or trays is by hammering over a hollow mold. This technique may be applied to any of the craft metals; it is demonstrated here in forming an ash tray from a tin can.

b. To make the mold, take a piece of soft wood 3 or 4 inches long and about 2 inches square. A piece of 2 by 4 will do. Using the round end of a ball pein hammer, beat a circular depression in one end about $\frac{3}{16}$ inch deep (fig. 96).

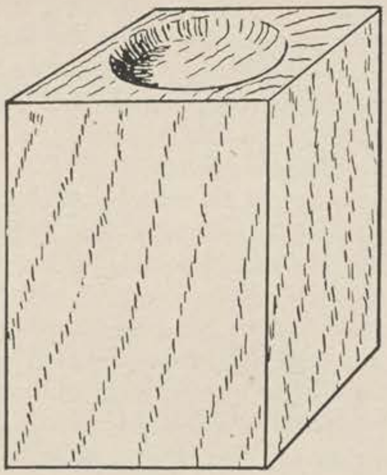


Figure 96.

c. The ash tray is made from the bottom of a can, which should be cut off smoothly with a rotary opener. Any irregularities or sharp edges may be filed down before forming.

d. Mark on the tin circle which is to be the flat bottom of the tray. Place the mold in a vise and hold the tin over the hollow depression in its end. Using the round end of the ball pein hammer, tap lightly along the edge of the circle marked on the tin. You will have to move the tray as you work to keep the area being hammered over the mold. Do not hammer inside the circle, or the bottom will be rounded instead of flat. Work only around the edge until the tray has taken its finished form (fig. 97).

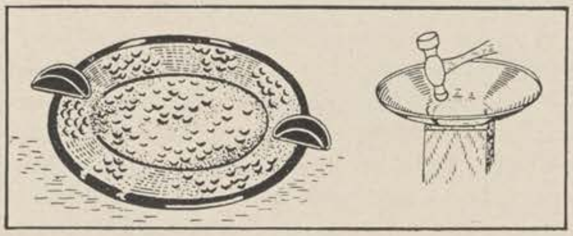


Figure 97.

e. The cigarette rests are cut from the sides of the can and shaped over a broomstick or other cylindrical object. They are then soldered in place. (See soldering below.)

f. Another type of mold for forming the ash tray may be made by cutting a circle the exact diameter of the bottom in a thin plank of wood. A coping saw is used in this operation. The plank is then screwed or nailed to another board which provides the bottom of the mold (fig. 98). The tin is held stationary over the depression and hammered as above. It does not have to be moved as work progresses, which makes it easier for the beginner to achieve regularity of shape.

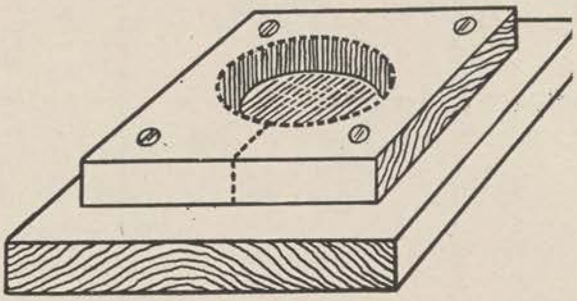


Figure 98.

98. Soldering

a. Absolute cleanliness is the secret of successful soldering. Polish with steel wool the metal surfaces to be joined, the tip of the soldering iron, and the solder itself. Heat the iron until it is hot, but never red hot. Hold the tip vertically on a cake of sal ammoniac and apply solder to the tip until it is coated. This is known as tinning the tip.

b. Now coat with flux both of the metal surfaces which are to be joined. Dip the tip of the hot iron in a little flux to clean it and apply it to one of the prepared areas. When the metal has been heated, touch a little solder to the tip. It will melt and adhere to the fluxed surface. Treat the other piece of metal in the same way and allow it to cool.

c. When you are ready to join the two pieces, place a little flux again on each and hold them together in the proper position. Reheat the iron, dip it in flux and press the tip on the upper piece of metal or on the joint itself. As soon as the solder begins to melt, remove the iron and hold the pieces together until the joint is firmly set.

d. While this method of soldering may be used in most instances, you will find that some metals require special treatment. A hard solder must be used with nickel silver, whereas a very soft solder and low heat are advisable for pewter. Aluminum is difficult to join unless a special solder made for the purpose is used.

99. Shaping on a Stake

a. While shallow bowls can be shaped most easily in hollow molds of the type described above, they may also be hammered over rounded stakes of metal or hard wood. The technique requires more skill, but has the advantage of making possible a great variety of forms with very simple equipment (fig. 99).

b. The rounded end of a small baseball bat held upright in a vise provides a good stake and can be made to curve a rim to almost any shape; it will

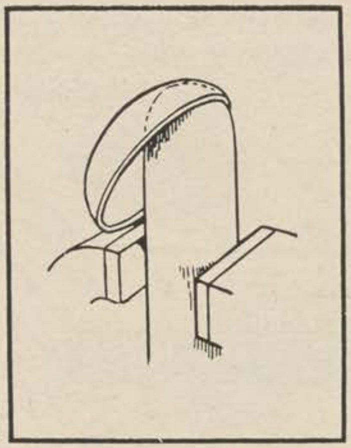


Figure 99.

also handle work in a wide range of sizes. The metal should be hammered over the stake with a round-faced wooden mallet. If a flat-faced mallet is used the striking surface should be covered with leather. Hit the metal just beyond its point of contact with the stake and draw the blow toward you at the moment of impact. A stake of this kind is also useful in removing kinks and folds from the edges of objects formed on a hollow mold.

100. Square Molds

Square or rectangular objects, such as the tray illustrated, can be hammered over a mold made by nailing two strips of half-round molding to a bench at a 90° angle. The corner joint should be tightly mitered. In hammering, hold the metal level and work around the edges gradually, turning the tray frequently (fig. 100).

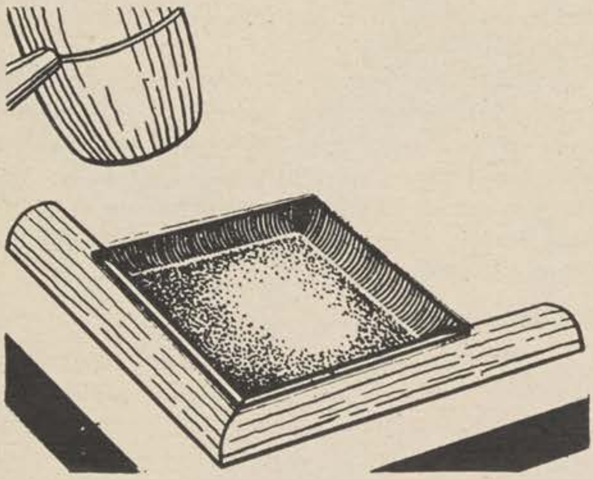


Figure 100.

101. Coloring and Finishing

a. When you have finished any of the above projects, you may wish to bring the surface of the article to a high polish or modify the color of the metal to some extent. The easiest method of hand polishing is to rub the object with a very fine grade of steel wool. Used with linseed oil, a softer effect can be obtained. The final work may be done with buffing powder and a chamois.

b. The colors of all the craft metals except pewter and tin may be darkened and mottled by the application of heat. The change is caused by oxidation and is particularly noticeable in copper. The article is held in a pair of pliers and passed through the blue flame of gas or a Bunsen burner until the desired color is reached.

c. Various acids will also produce oxidation. In mixing, always put the water in first and add the acid gradually. A weak solution of muriatic acid rubbed on pewter, aluminum, or tin plate will produce a beautiful dull-gray finish. A similar effect can be obtained on these metals by applying a little powdered graphite mixed with linseed oil and polishing with fine steel wool. Copper and brass can be darkened with a solution of potassa sulphurata (about 1 teaspoonful of acid in 4 ounces warm water for copper; a stronger mixture for brass). Apply with a rag until the desired color is reached. Rinse the article in warm water and dry.

d. Copper may also be given an antique green or verdigris color by immersing for an hour or more in a solution composed of 1 quart water, one ounce sal ammoniac and three-fourths of an ounce common salt. When it shows signs of changing color, remove it and allow it to stand over night without drying. Then wipe with a soft cloth and polish with wax. The verdigris color will not show at once, but will appear in the course of the next few days or weeks.

e. When a metal object has been finished, its surface must be protected from the slow oxidation caused by the action of the air. The easiest method is to clean the metal with steel wool, apply a coat of prepared floor wax and polish with a soft cloth when the wax is dry. Metal lacquer provides the greatest protection, but is difficult to apply.

102. Methods of Decorating Metal

a. Many objects may well be left with a plain polished surface. In some cases, however, you may wish to apply a monogram, a decorative design, or otherwise modify the smooth finish of the metal.

b. Planishing is one of the commonest methods of finishing metal. This consists of giving it an uneven surface by hammering it with the round end of a ball pein hammer (fig. 101). The article should rest on a metal surface, an anvil for flat work, a rounded metal stake for curved objects. Generally it is best to start at the middle and to work in a roughly circular fashion, letting the dimples caused by the hammering overlap each other to some extent. Planishing hardens the metal greatly and adds to its durability.

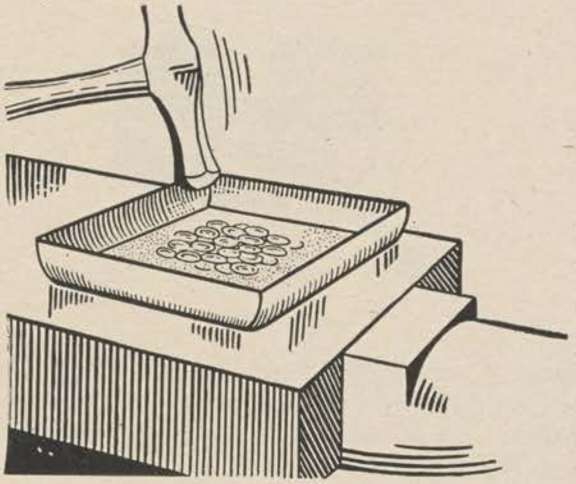


Figure 101.

c. Fluting is also a hammered form of decoration. It is applied chiefly to rims and edges. A wooden stake must be shaped to fit the rim of the bowl or tray. A groove is filed in the head of the stake to the shape of the flute desired. It may be of uniform width and depth, or it may taper at one end. The article is held over the stake and the metal hammered down into the groove with the narrow end of a wedge-shaped hammer (fig. 102).

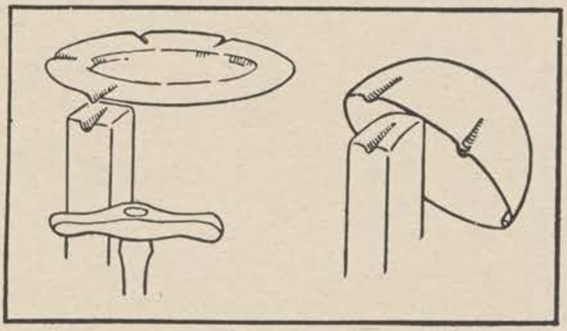


Figure 102.

d. Designs and monograms may be applied by chasing or etching. In chasing, the design is incised on the surface with special tools. They may be purchased or filed from strips of tool steel or discarded files. They may even be made from spikes if they are to be used on the softer metals. A few common designs are illustrated, but you can also make up patterns of your own (fig. 193).

(1) Chasing should be done on flat metal if possible. If a bracelet or small object is to be chased, it is best to do it before the article is formed. Place the metal on a fairly soft surface such as a piece of linoleum. Hold the chasing tool perpendicular to the metal and strike it lightly but squarely with the flat face of the ball pein hammer (fig. 104). You may chase either the design itself or the background around it. Metal may also be pierced and cut to form a fret work design (fig. 105). Each area to be cut out must first be drilled to accommodate the blade of the jewelers saw. Make a dent near one edge of the area, and resting a small drill (about No. 54) in this depression, drill a hole through the metal. Enlarge the hole with a heavier drill and saw out the area in the manner described at the beginning of the chapter.

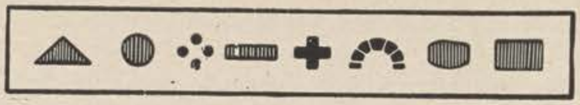


Figure 103.

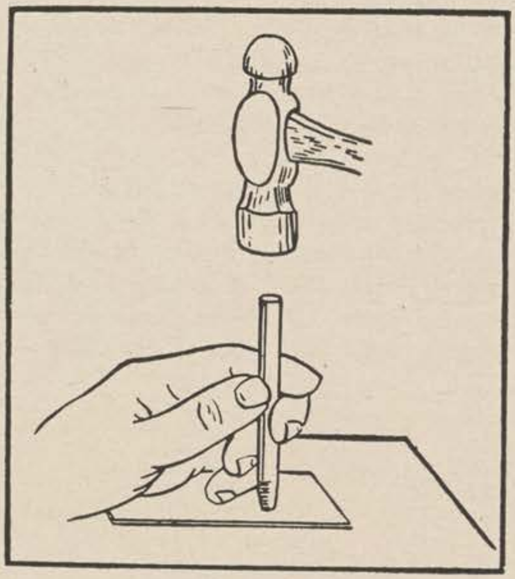


Figure 104.

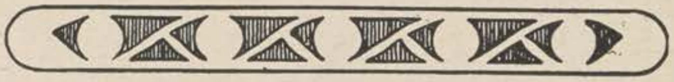


Figure 105.

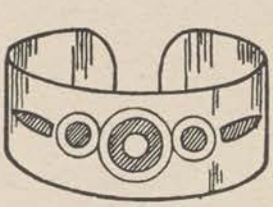


Figure 106.

(2) Finally, metal may be decorated by etching it with various acids (fig. 106). As this method re-

quires experience and fairly extensive equipment it will only be outlined here. The technique consists of eating with the acid, or mordant, either the design or the background surrounding it. All parts of the article which are not to be etched are covered with a protective "resist" so that only the exposed surface is attacked by the acid. The metal must first be thoroughly cleaned and polished with steel wool. All areas which are to be protected are then coated with a black asphaltum varnish brushed on evenly and allowed to dry (fig. 107). Prepare the mordant in an earthenware or enameled container. Always put the water in first and add the acid gradually. For copper and brass, a good solution is one part nitric acid in two parts water. The mixture should be strengthened for silver, weakened for pewter. Aluminum requires a perchloride of iron (also called chloride of iron) solution. Mix in the proportion of 1 ounce, dry measure, of the acid to 1 ounce, liquid measure, of water. Place the varnished article in the etching bath and watch it carefully. If no bubbles appear on the exposed metal, the solution is too weak and must be strengthened. If the mordant shows excessive action it must be further diluted or it will undercut and eat through the resist. Aluminum must be removed frequently from the acid and rinsed in water before returning. When the surface has been etched to the required depth, remove the object, wash in cold water and dry. Dissolve the asphaltum varnish with turpentine and polish the unetched portions of the piece as described above.

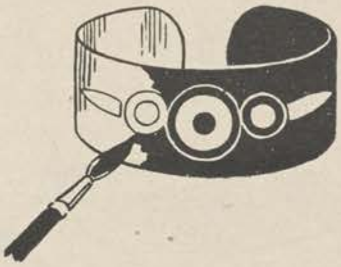


Figure 107.

CHAPTER 10

PLASTICS

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103. General

Although technically a "plastic" is any material that can be molded or formed, for the purpose of this manual the term will be applied only to synthetic resins which are capable of being worked with hand tools or light power tools. The appeal of plastics as a craft material is due to the ease of working, the brilliance of the finish so easily attained, and the rich colors available in various types of the material. Objects of plastics require no painting or other coatings, since their color and finish are inherent in the material itself. Wherever the cutting stops, a little smoothing and polishing will bring out a surface that is just as brilliant whether it is produced with a rag in the hands of a novice or with expensive professional equipment. In this material, more than any other, the craftsman can secure results that are the equal of professional work in every respect, with a minimum of equipment and experience.

104. Types of Plastics

a. A wide variety of materials is available, both from scrap sources and regular suppliers. The most common is acrylic resin (Lucite or Plexiglas), widely used in bomber noses and other aircraft parts. This is the most easily worked of all plastics, its only disadvantage being that it is not available in colors, although there are methods of tinting it. It comes in clear, transparent sheets of various sizes up to 40 inches wide, and in thicknesses up to 1 inch, with 3/16 inch and 1/4 inch most common. Round rods up to 1/2 inch in diameter are also available occasionally.

b. Almost as common and as easily worked is cellulose acetate (Lumarith, Acetate, Plastecele, Tenite, etc.). This is most frequently encountered in sheet form, from .005 to .040 inch thick, in clear and various transparent and opaque colors. Commercial objects such as combs, toothbrush handles, knobs, etc., can be used as a source of this material and carved into smaller objects, or cemented to make larger ones.

c. The third large class of plastics suitable for craftwork comprises the cast phenolic resins (Catalin, Bakelite, Resinoid, Marblette, Gemloid, etc.). These materials, while slightly harder to work, and not offering the freedom in heat-forming found in the above mentioned materials, are available in the most brilliant and variegated colors, hold their polish longer and are stronger. For these reasons they are preferred by many experienced workers.

d. Plastics definitely not suited for craftwork are those machine-molded materials containing mineral or other fillers. These can never be polished to a high finish because of the filler, and cannot be bent or heat-formed because they are "thermo-setting," that is, made rigid and relatively brittle by the heat applied in molding. While there are countless varieties and trade names for these materials, the public usually refers to them as "Bakelite". They may be identified by the rough, crumbly appearance of a fractured piece.

e. Various other plastics have been developed in recent years which are more or less suitable for craftwork, but the acrylics, cast resins and acetates mentioned above are the only ones commonly available. However, practically any plastic material which breaks with a clean, glass-like fracture can be worked by following the suggestions given here for the other materials. Among these are vinylite, urea formaldehyde, and others.

105. Tools and Equipment

a. The plastics mentioned above can be worked with almost any of the hand or power tools designed for use on wood or metal. They may all be bent or formed by the application of heat, and may be cemented by the use of solvent cements which make the joint of the material itself. Various operations possible include sawing, drilling, carving, turning, bending, engraving, tinting, inlaying, filing, sanding, and polishing. The only operations not possible are those commonly employing sharp-edged tools such as knives, planes, etc.

b. Equipment may be as simple or as elaborate as conditions permit. Minimum equipment required for handwork includes a fret-saw and hack-saw, a hand-drill, files and clamps. Power tools in the order of their desirability are a buffing and polishing wheel, a sander, a hand electric grinder, a metal or wood-working lathe, a drill-press, a jig-saw or band-saw and a circular saw.

c. The most necessary supplies are medium-fine and fine sandpaper, buffing and polishing compounds, cements and "findings," which include small drive-screws, hinges, metal ornaments, clasp-pins, and other items commonly used in the costume-jewelry trade.

106. Sawing

All of the rules for working soft metals apply to the working of plastics. Saw-blades should be medium to fine-toothed, with little set. The material breaks saw-blades easily if it is not securely held, but it should not be clamped in a vise without some protection, as it is easily marked by pressure. A simple method for holding flat sheets while fret-sawing is shown (fig. 108). In general, the type of blades intended for use with metal are preferable to the coarser wood-working blades. Moreover, the finer-toothed the blade used, the less filing and sanding will be required later to prepare for polishing.

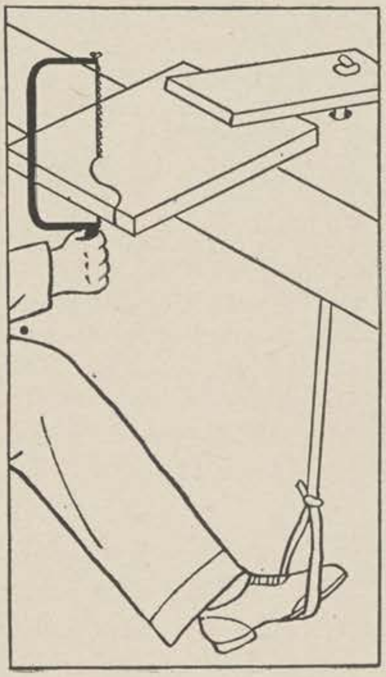


Figure 108.

107. Drilling

For all ordinary work, plain twist-drills are used at the usual soft-metal-working speeds. If much drilling is to be done with drills of ¼ inch and larger, the drill angle should be altered to 90° as for working in brass (fig. 109). Use only moderate pressure, backing out frequently on deep holes to clear chips and avoid heating, and slackening up on the pressure as the bit emerges from the under side. No lubricant or coolant is needed except for production-work.

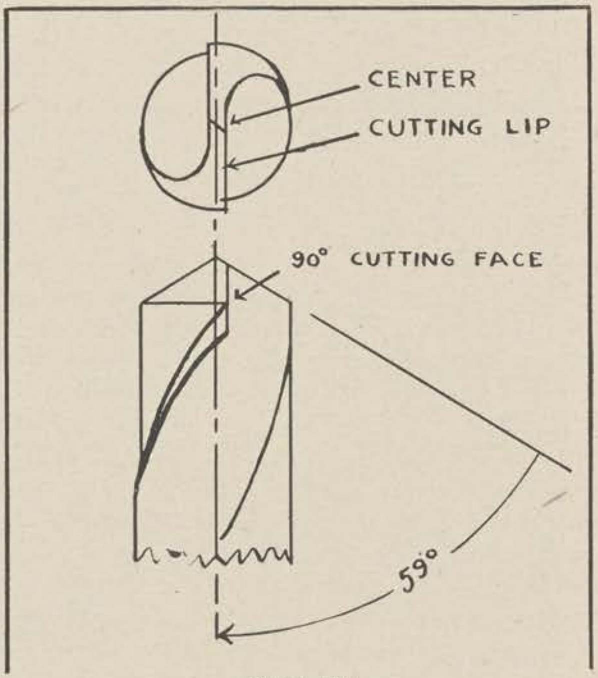


Figure 109.

108. Filing

Any type of file may be used in shaping the material, but the most necessary files are the finer ones of various shapes (flat, square, round and triangular) which are used to remove tool-marks prior to finishing. Files should be rapped frequently to clean them or rubbed across end-grain wood or a file-card, as they clog up quickly.

109. Carving and Engraving

a. Most interesting effects may be achieved by this method of decoration, using various systems. Outside curves, such as on the signet of a ring or around a bracelet, are most easily done with a file. The file point may also be ground to a point similar to that on a graving-tool and "pushed" in the same manner as a metal graver to engrave shallow designs or initials (fig. 110).

b. By far the fastest and most satisfactory method of carving, however, is with a rotary carving tool of some kind. The most convenient for light work are the small electric hand-grinders, for which many

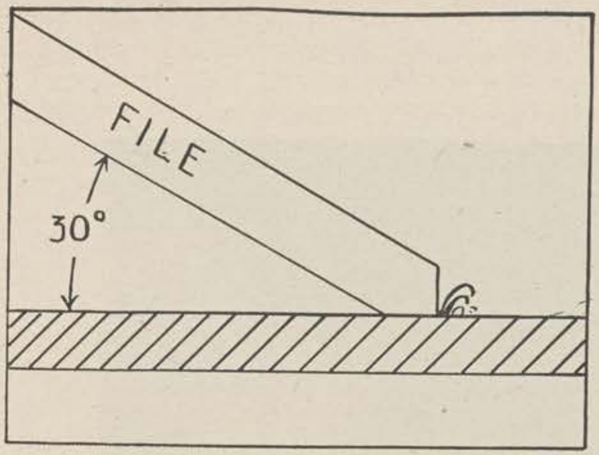


Figure 110.

shapes of cutters or "burrs" are available (figs. 111 and 112).

c. Interesting effects may be obtained by leaving deep carvings rough and unpolished, and also by carving on the back of transparent materials, leaving the carved portions "frosted" or unpolished, or filling them in with lacquers or dyes.

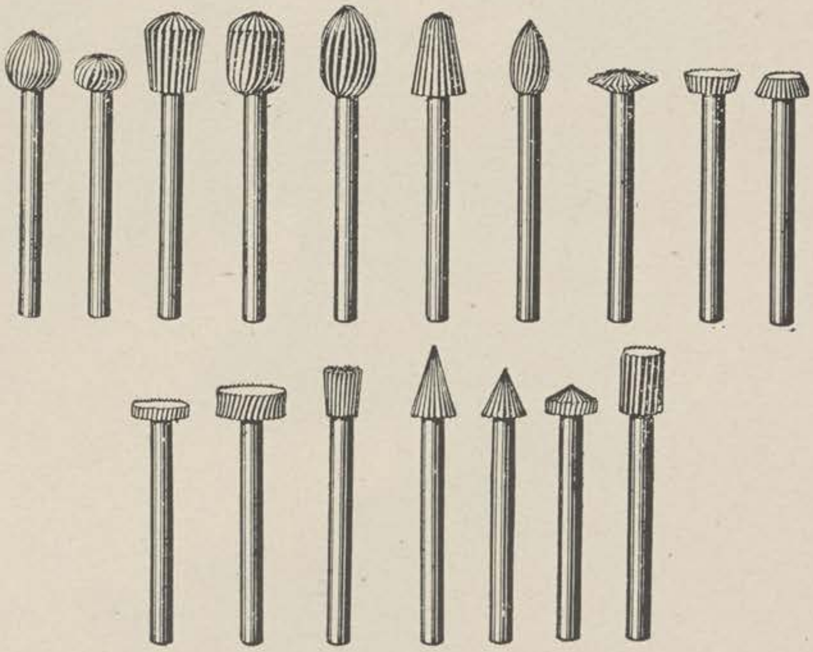


Figure 111.

110. Bending and Heat-forming

a. All of the plastics recommended can be heated and bent, retaining their shape on cooling. Cast phenolics are the least suitable for this type of work, as they will only take about a 45° bend without cracking and can only be reheated and bent once or twice before taking a permanent set. Acrylics and acetates however can be bent to any degree any number of times, and can be literally "tied in knots" without damage. Both have a "plastic memory" and will return to their original shape each time they are reheated, but once set in the new shape, will retain it without creep as long as they remain at normal temperatures.

b. Cast phenolics require about 3 minutes in boiling water for each ⅛ inch of thickness to become soft enough to bend. When bent to the desired shape, the material must be held with clamps until thoroughly cooled and set in the new shape, and the bends, as stated above, should not be over 45° Unless the clamps are padded or are very smooth, they make an impression in the face of the material, which will have to be filed and polished off after cooling.

c. Acrylic resins and acetate may be bent and formed much more easily. In addition, they can also be stretched considerably while in the hot state. When properly heated, they are as flexible as a sheet of gum rubber, and also have considerable "flow," so that they can be pressed into sharp corners or against carved molds, producing embossed effects. Acetate, especially in the thinner sections, may be formed or bent at lower temperatures, from 180° F. up to boiling point, and may be heated in water or by any other convenient method, such as by holding against a light-bulb, a half-hot electric iron, etc. If heated too much, however, they will shrivel or stick to the iron. Air-cooling will stiffen this material in a couple of minutes or it can be cooled by dipping in cold water. The material will take impressions very easily while hot, so care must be exercised in

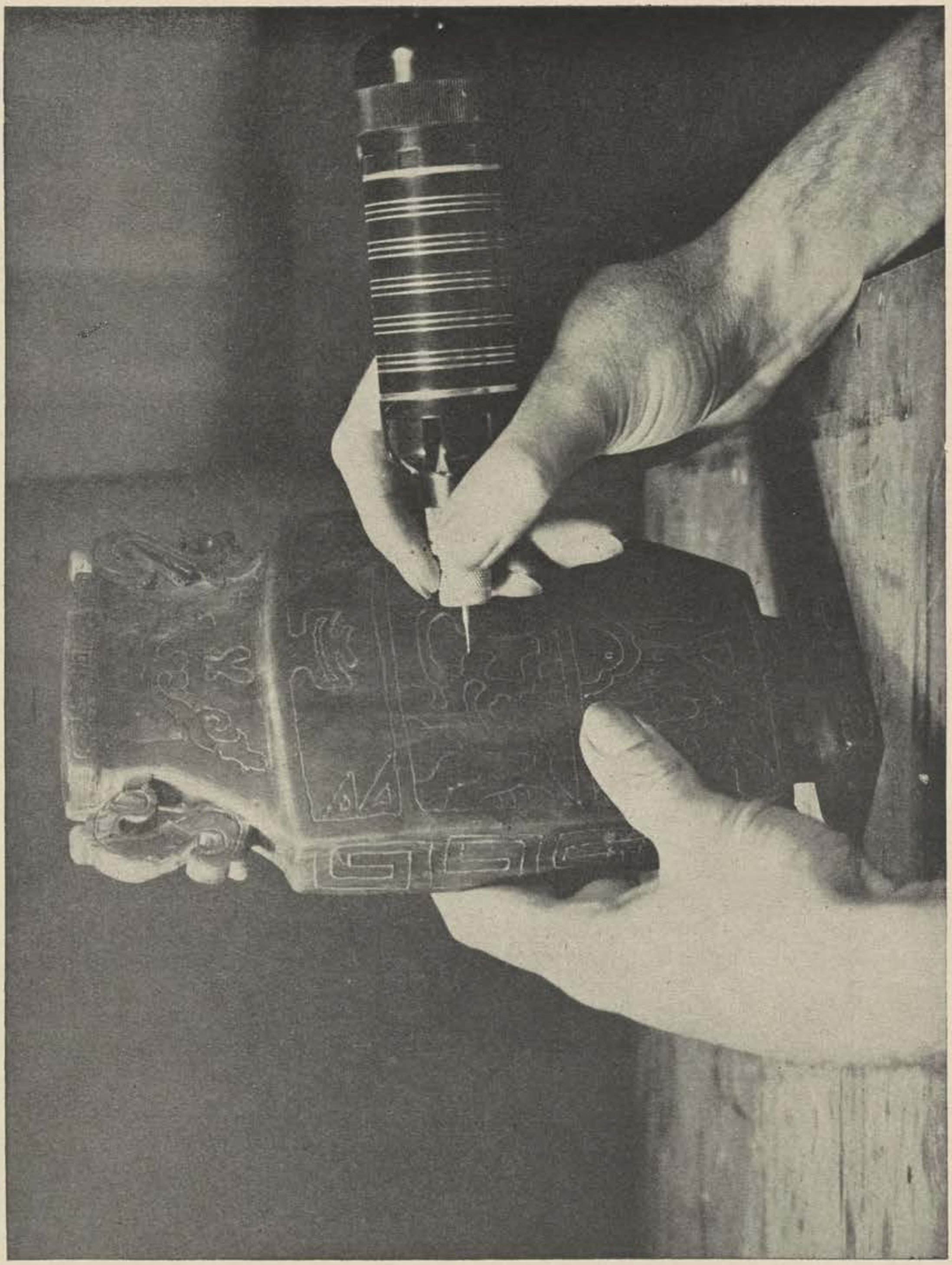


Figure 112.

handling so that it will not be marked by the fingers or by the forms against which it is pressed.

d. Acrylic resins must be heated to boiling-point (212° F.) or higher if possible. For the higher temperatures (required for thicker sections) either hot air blasts or hot oil baths are used. This material is extremely flexible and pliable when hot, its weight alone often being enough to form and stretch large sections over dome-shaped forms such as those required for bomber noses. Scraps of this plastic are often available in such formed or domed shapes and can be easily flattened by laying them on a hot plate for a few minutes or on the bottom of a pan of boiling water.

e. Small parts (up to 1/8 inch thick) can be quickly formed by hand by clamping an electric iron upside down in a vise and holding the part against the iron-face as it is warming up, first one side of the material and then the other until it becomes flexible. The material can then be pressed against a cold surface to form the bend desired; it should be held there a minute or two until it sets. Care must be exercised not to get the surface too hot, as blisters will form which must then be sanded or filed off and repolished.

111. Cementing

a. Each material requires its own type of cement. Cast phenolic resins are best cemented with a special preparation, supplied by the manufacturers, which consists of partially cured syrupy phenolic resin. A small quantity of this is mixed with two or three drops of muriatic acid, and used immediately, setting under clamps. This makes a chemical combination that is as strong as the material itself. The only other method of cementing is to use one of the all-purpose household cements, applied to roughened surfaces. This does not always provide a permanent bond, however.

b. The best adhesive for acetate is the film cement used for splicing moving-picture film. This comes in a convenient bottle with an applicator, takes hold immediately and disappears completely, leaving a physical union of the two pieces by means of its solvent action. Photographic film usually has a cellulose acetate base, and film is, in fact, often used as the raw material for articles which can be made of thin sheets. The gelatin-and-silver emulsion may be removed from films in order to obtain the clear plastic base by soaking them in warm water to which an alkali such as sodium carbonate, lye, ammonia or clorox has been added, and scrubbing them. Other common substances which will fasten acetate in the absence of film cement are acetone or glacial acetic acid. These solvents evaporate quickly, especially from thin sections, and the cemented article may be handled within a few minutes.

c. Various cements, of both the solvent and glueing types, are supplied by the manufacturers of acrylic resins, and these are especially recommended, but quite successful results can be obtained by the use of plain glacial acetic acid, a preparation used in photography and available at photographic stores. This is a solvent which evaporates completely in a few minutes to a couple of hours, depending on the amount used and the thickness of the material. Paint both pieces to be joined with the acid, allow it to soak in a minute or two, then clamp the two pieces together, being sure to squeeze out all air bubbles. If the surfaces are irregular and do not mate perfectly, the two parts should be soaked in the solvent until they have absorbed enough to soften the material so that when clamped both surfaces will flow into each other. In such cases, the joint must set several hours before it can be handled. Very little pressure is required when clamping.

d. Cementing is frequently used to build up larger sections of material from small or thin pieces. For instance, if a 3/4 inch round rod is desired and the only material available is a 1/4 inch sheet, three strips 3/4 inch wide are cut and cemented together to form the rod, which is then filed or turned to a round. Likewise, a string of washers may be cut out of thin material stacked and cemented together to form a bigger piece of any shape, which can then be worked. Cigarette holders are often made from tooth-brush handles, combs and other odd bits of acetate by cutting out a large number of small squares, drilling a hole through each one, stringing them on a heavy wire, soaking them in acetone and then clamping the string of them together on the wire until they set. When the wire is removed, this gives a rough tube with a hole through the middle, which is then filed round and polished. Alternating colors of washers may be used. Such holders will stand the heat as long as the live coal does not come into contact with the material.

112. Turning

Any of these plastics may be turned on a wood or metal-working lathe, using a brass-turning technique, that is, a scraping rather than a cutting action (fig. 113); otherwise, the tool will dig into the material. Woodworking chisels must be used as scrapers. The tool is held horizontal or with the handle a little above horizontal to get the proper action. When the material comes off in fine ribbons, rather than as a powder, the angle is correct. With metal-working tool-bits, there should be no back-rake or even a

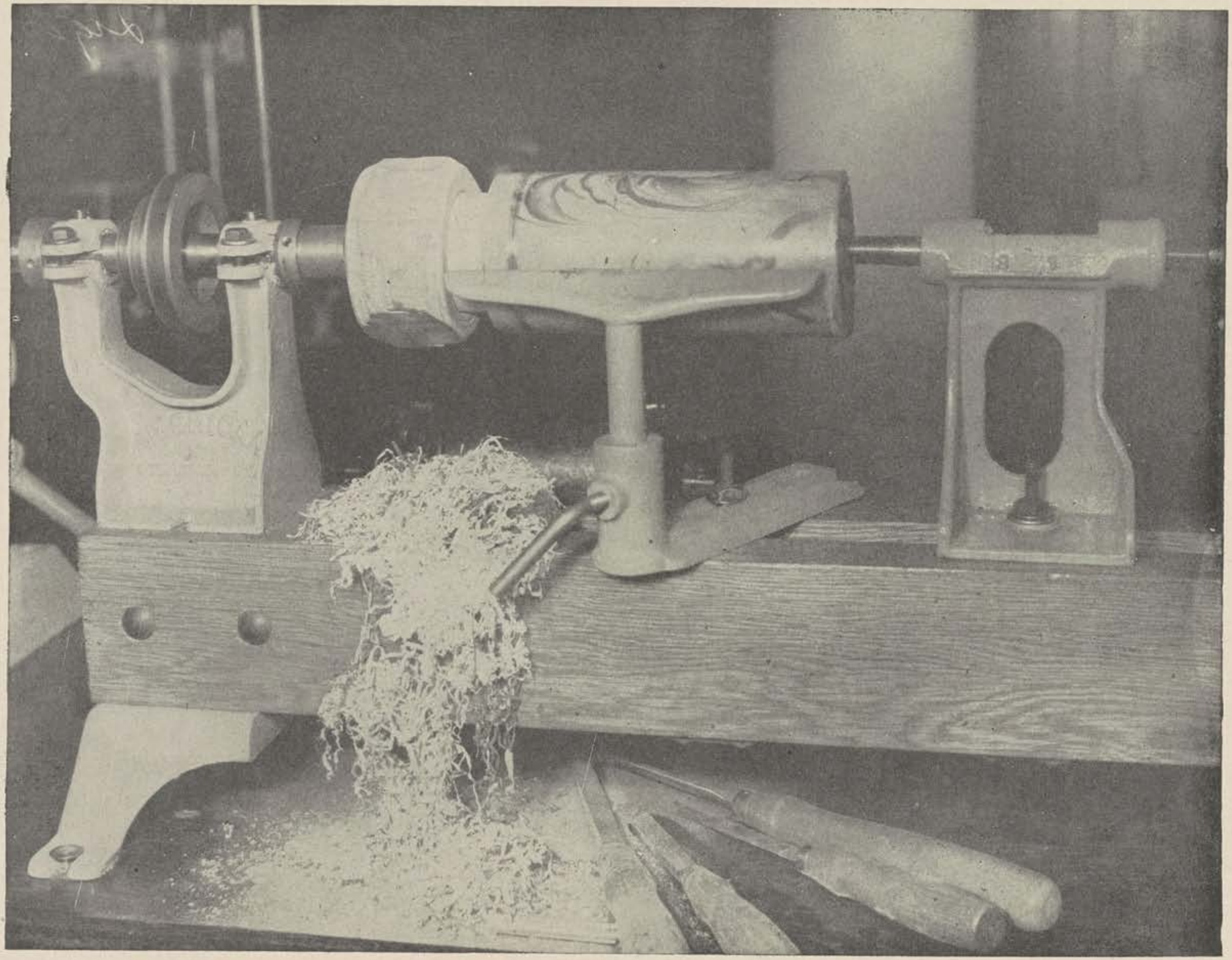


Figure 113.

little negative rake, and the tool should be at or below center. Speeds and feeds are the same as for soft metals.

113. Polishing

a. Polishing plastics can be very easy or very difficult, depending on the care that is taken with each succeeding step in the polishing routine. The roughly-worked portions must first be filed to remove every tool mark. Then the file marks must be removed with a medium-fine sandpaper and the sandpaper marks taken off with the finest sandpaper obtainable (about 7-0). These marks are in turn removed with buffing-compound, a grease stick containing fine abrasive. The last step is to polish the article with a wax-base polishing compound.

b. Experience alone will show when any of these steps may be omitted, but in 9 cases out of 10, time will be saved by going through each step carefully in order to insure success. If a power buffing-wheel is available, some of the preliminary steps may be omitted on the softer acrylic or acetate resins, particularly if the deeper scratches have been previously removed. The last step can likewise be omitted if a very high polish is not needed.

c. For hand polishing, rub the article with a rag, a piece of felt or brussels carpet lightly coated with the buffing compound and then with the polishing compound. Different rags must be used for each operation. Regular brass-polishing preparations or special compounds for plastics sold by the supply houses may be used. Even household polishes will work fairly well. The grease sticks are best, however, as the liquid preparations may contain ingredients with a solvent action on the surface. Deep scratches can be filled in somewhat by daubing them with a solution of acrylic resin or acetate chips dissolved in acetic acid, then sanding and polishing.

d. For power polishing, soft cotton buffing wheels should be used, with two or three outer rows of the stitching removed. A 6- or 8-inch wheel on a 1750 rpm, $\frac{1}{4}$ or $\frac{1}{2}$ hp motor provides about the proper speed, and care must be used to keep the object moving in order not to "burn" or soften the material by the heat generated. For best work, three wheels should be used, one for the buffing compound, one for the polishing compound and one clean wheel for the final polishing.

114. Tinting and Lettering

No solvent will attack cast phenolic resins, so there is no way of dyeing or lettering them except possibly by the use of colored lacquers, which will adhere only to roughened surfaces. Both the acetates and acrylics, however, can be tinted or lettered with inks or dyes containing solvents such as acetone or acetic acid. The dye only penetrates slightly below the surface, so that interesting effects can be obtained by cutting designs through the dye layer into the transparent material, or by masking the design with tape or grease-crayon and dyeing various areas in different colors. The dye should be filtered before use to avoid black spots, and the solution should consist of 80 percent acetone and 40 percent water, plus the dye. Household Duco lacquer may also be used on any of these materials.

115. Cleaning

Use only soap and water for cleaning plastics as many prepared cleansers contain solvents or abrasives which will attack the surface.

CHAPTER 11

CLAY MODELING

116. General

With very few materials and little special knowledge you can make a great variety of useful and decorative articles from clay. The new self-hardening clays are easily formed into vases, bowls, tiles, ash trays, book ends, flower holders, candlesticks, and human and animal figures. Even pottery making is now within reach of the beginner.

117. Clays

a. Plasteline is the easiest clay to use and is excellent for practice where permanence is not required. It never hardens and may be reused many times. A little carbolated vaseline mixed in thoroughly will make it sanitary. Plasteline may also be used by the advanced worker for molds in producing plaster or clay reliefs.

b. Where permanent objects are desired, it is best to purchase one of the commercial self-hardening clays. Regular pottery clay must be baked in a kiln at a very high temperature to make it durable, although there is now a modified type which hardens in an oven in 15 minutes at 250° F. The self hardening clays, however, will set without cracking if they are permitted to dry out gradually in a room of normal temperature. They may be kept plastic for as long as necessary by covering with a damp rag until the work is completed. Because they are easy to handle, require no special equipment and yield thoroughly satisfactory results, the present chapter deals only with this type.

c. There are a few terms that should be known to everyone who models. Clay is said to be "wet" when it is right for working. It should be putty-like in consistency and should not adhere to the fingers or crack when molded. Clay is "moist hard" when there is no moisture on the surface. Handles and spouts are put on at this consistency. Clay is said to be "leather hard" when a certain amount of moisture has evaporated from it. It is lighter in color and small pieces scratched from the edge will curl slightly. When clay is still drier it is said to be "white hard." In this form surface particles come off in a fine powder when the clay is scratched or scraped.

d. "Slip" is liquid clay of about the consistency of cream and is used to attach one piece to another. It is made by filling a mixing bowl full of water and pouring in the dry powdered clay until the water will not absorb any more. The mixture should be stirred thoroughly and passed through a fine sieve to eliminate lumps. Slip may be stored in a glass or earthenware jar with about ¼ inch water on the surface to retain the moisture. Wet clay must be kept in a noncorrosive container, covered with a damp cloth and stored in a cool place if possible.

118. Equipment

Clay modeling requires little equipment. The work table should be covered with oil cloth or linoleum, since clay sticks to wood. Use a separate, movable base, or "bat," on which to build each piece. It can be wood, cardboard, or any stiff material. Other tools should include a sponge or soft cloth for smoothing the surface when the clay is damp; some fine sandpaper for smoothing when the clay is hard; a knife; a few modeling tools (see instructions for modeling a clay figure), and some tin cans in which to mix the clay and keep it moist.

119. Coiled Pottery

a. The coil system of building pottery is the simplest way of forming round or cylindrical objects such as vases or bowls. The first step is to make a profile drawing of the object about 10 percent larger than the finished product to allow for shrinkage. From this, a template or pattern is made by tracing one half of the drawing on a piece of cardboard and cutting along the line showing the outside contour of the vase (fig. 114).

b. The next step is to build the base. Roll out a large slab of clay about ½ inch thick and cut the base out of this (fig. 115). Use a pattern to guide your knife. Roughen the rim of the base by scratching it with any pointed tool. This is known as "checking" or "small cutting" and is done to make a firmer joint between bottom and sides.

c. The sides may be built up of either long coils wound in spiral form or short coils, each going once around the vase. The former method is the commonest and will be described here. From the same slab of clay, cut a strip about ½ inch wide. Roll this gently under your palms until it is a smooth coil. Bend the coil to make sure that the clay is wet enough; if it cracks, add more water. Make each coil just before it is to be used and moisten your fingers occasionally as you work.

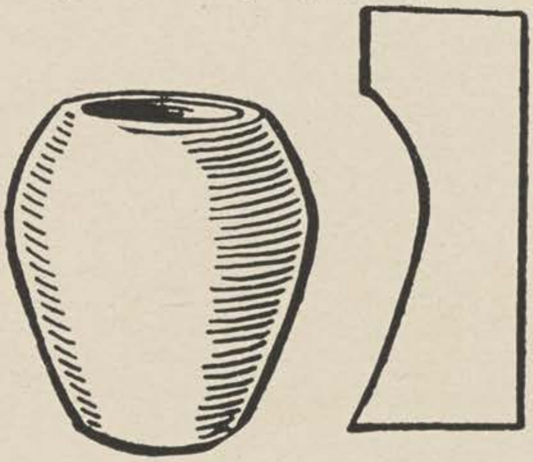


Figure 114.

d. To build the sides, taper the end of the first coil and weld it firmly to the roughened edge of the base. The joint may be cemented more tightly with slip. After the first coil is wound, join it to the second in the manner shown (fig. 116). Moisten and mold the two pieces together.

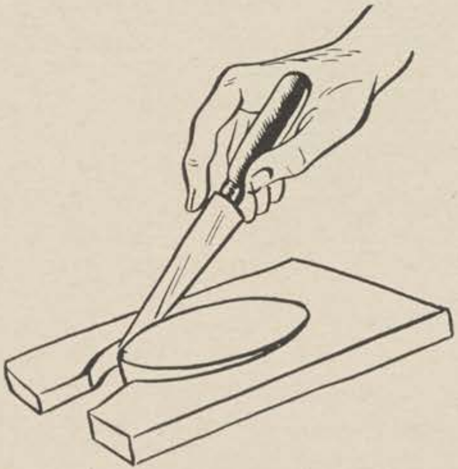


Figure 115.

e. When the vase is about half built up, smooth the clay both inside and out by rubbing with the fingers (fig. 117). Use the template frequently to make sure that the vase is assuming the correct shape. Hold the template against the sides at numerous points and press the coils in or out as needed. Work with your fingers on both the inside and outside as you do the coiling.

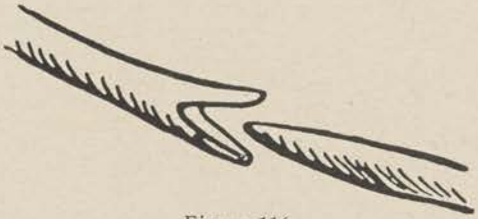


Figure 116.

f. When you come to the top, taper the end of the last coil and smooth all the coils of the upper half. Rest a piece of cardboard on the top to see if it is level. If necessary, add or remove some clay to even the rim. Slight irregularities can be smoothed with sandpaper after the vase is dry. A lid may be made in the same way as the base with a knob of clay added for a handle.

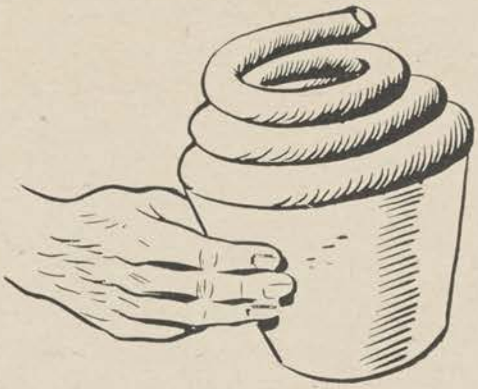


Figure 117.

120. Flat Strip Pottery

A variation of the coil method is the use of flat strips, each going once around the vase. They may be cut from a slab about ½ inch thick. Each strip should be approximately 1 inch wide with its ends trimmed diagonally to facilitate joining. The first strip is fastened to the base with the aid of a small roll of clay pressed into the joint (fig. 118). As

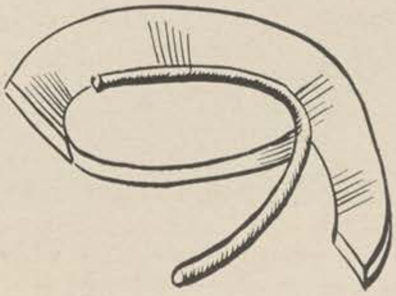


Figure 118.

the remaining strips are added, the seams are smoothed and the shape molded to conform with the template.

121. Hand-drawn Pottery

a. The hand drawn method may be used in forming many small objects. Start with a lump of clay about the size of a tennis ball. It should be well kneaded to get rid of air holes and formed into as evenly spherical a shape as possible. Put the ball on a bat or piece of material that can be easily turned while working. Moisten the right thumb in water and press it into the center of the ball (fig. 119). With the left hand turn the bat on which the clay is resting, continuing to press with the right thumb. Then put both thumbs in the hole and, with the fingers outside, begin to press the sides upwards and outwards, turning the pot as you work (fig. 120). Continue in this manner until the thickness of the sides is about ¼ inch and uniform throughout.

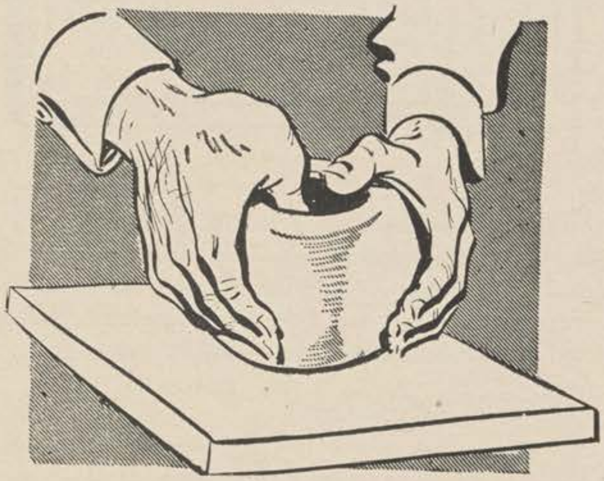


Figure 119.

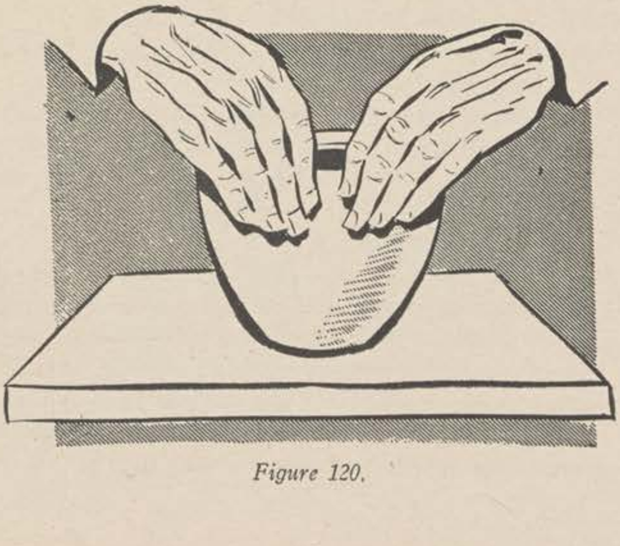


Figure 120.

b. Watch the following points particularly. There is a tendency to leave the clay too thick where base and sides join. The rim must not be left thinner than the sides. You may need to fold it in occassionally to increase its thickness. It also has a tendency to crack and such cracks should be smoothed over at once. It is important to keep an even edge at all times.

122. Slab Pottery

a. Square or rectangular objects may be made from solid slabs of clay (fig. 121). To construct the ash tray illustrated, paper or cardboard patterns are first prepared for the sides, ends and bottom. Clay slabs of corresponding shape are cut out and assembled in the following manner.

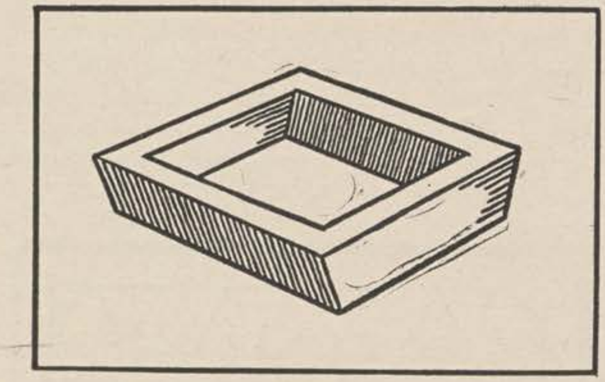


Figure 121.

b. Join one side and one end piece at right angles. This joint and all others should be secured by checking and cementing with slip. Fasten the two sides to the base. Join the other two sides and add them to the base in the same way. In slab pottery, the base should always fit *inside* the slabs that form the sides, not underneath them. The tray may be reinforced if necessary by running a thin coil of clay along all inside joints. You may also strengthen the corners by dipping your fingers in clay slip and rubbing them on the outside of each corner.

123. Decorating Pottery

a. Pottery made of self hardening clay may be decorated with painted designs or by incising and relief. The illustrations show these types of decoration on tiles, but they may be applied to any of the above objects.

b. Ordinary poster paints or the so-called tempera paints may be used on pottery (fig. 122). They dry with a flat finish and may be left thus or given a glossy surface by painting them with a nonfiring glaze. This is a varnishlike medium which makes the pottery water-proof and imitates the effect of

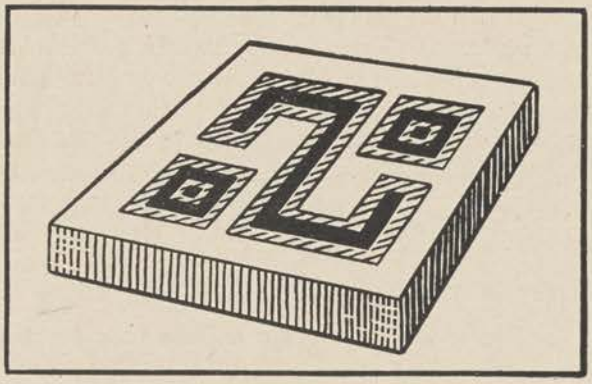


Figure 122.

the regular fired glazes. There is also available an imitation glaze which comes in sheets and can be applied to the surface of the tile with a coating of slip. Its mottled colors, high gloss and cracked finish duplicate very closely the results of firing.

c. Incising consists of scratching designs in the clay with a sharp tool (fig. 123). It should be done when the article is almost leather hard. The incised grooves are generally about 1/16 inch wide and the same depth. It is advisable to draw your pattern on paper first and to transfer it to the object while the clay is still soft. This is done by placing the drawing on the clay and tracing over it with a sharp pencil. When the clay has hardened, the faint indentations on the surface may be strengthened with a pointed modeling tool.

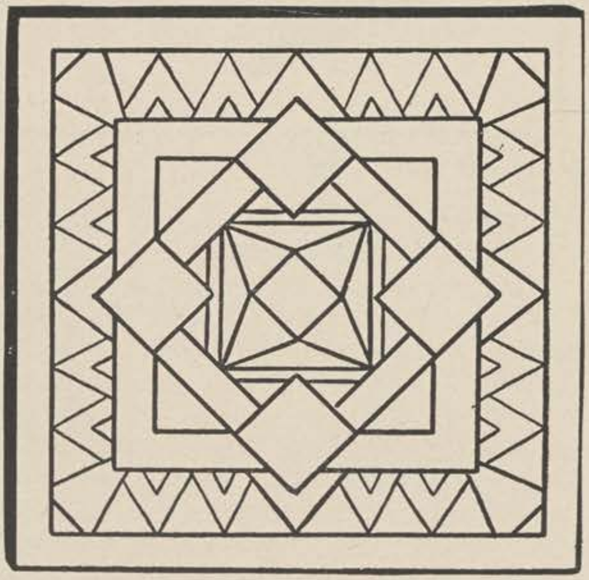


Figure 123.

d. In relief decorations the design is raised from the surrounding surface by cutting away the background clay with a modeling tool (fig. 124). Clay may also be added to the raised areas if a high relief is required. A special kind of self hardening clay made specifically for carving is best adapted to this treatment. It may also be cast in rectangular blocks and carved into three-dimensional figures.

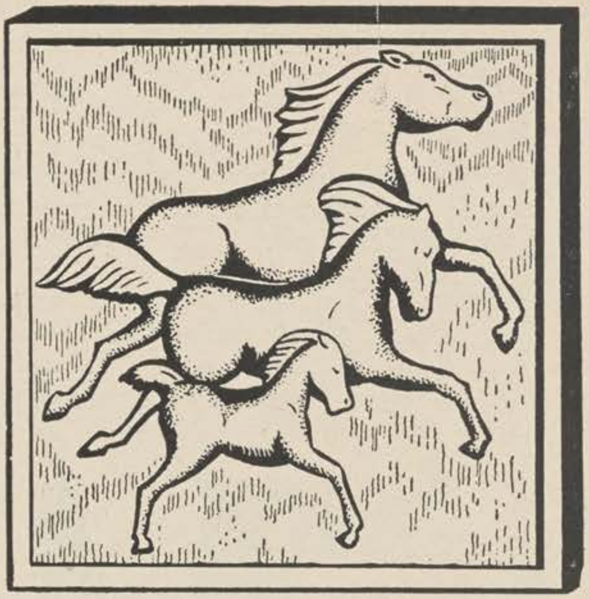


Figure 124.

124. Modeling Clay Figures

a. You need only a few modeling tools to form clay figures. Orangewood sticks or improvised tools whittled from wood will do. The most useful shapes are shown in the illustration (fig. 125). The tool with wire loops is chiefly for removing clay. The others are used for making depressions, lines and for smoothing the clay into form.

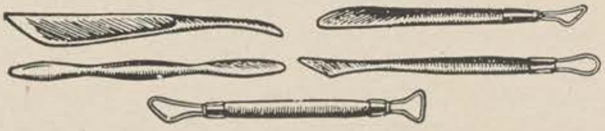


Figure 125.

b. Clay for figure modeling should be moist hard. The illustration shows a number of fairly simple figures which can be modeled by a beginner, but the range of subjects is limited only by your skill and imagination (fig. 126).

c. Start modeling by rolling a piece of clay into a ball about the size of the finished piece, or slightly larger. Press or mold it into the approximate shape desired, scraping parts away and making indentations where needed with a modeling tool. When small pellets of clay must be added to build up some part of the figure, make certain that they are thor-

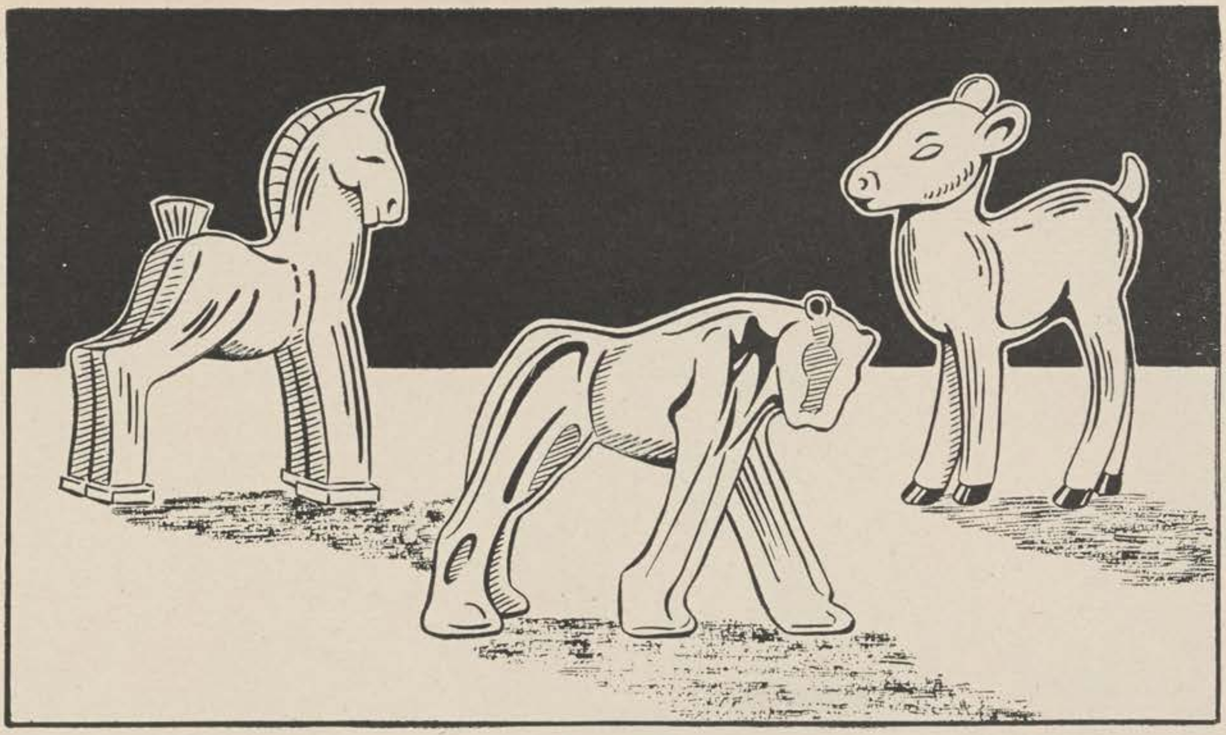


Figure 126.

oughly merged with the original mass. As in pottery, the pieces will adhere better if you check or scratch the surfaces to be joined and moisten them or add a touch of slip.

d. After the clay has been worked to the approximate dimensions of the finished figure, model each part to its correct size and shape. Round the various forms as required, put in the eyes and other features with a modeling tool, and incise any lines that are needed to bring out different parts of the figure or indicate texture. In small figures such as animals it is a good idea to strengthen the legs and necks with toothpicks inside the clay. Larger forms are usually built on armatures, or skeleton forms, made of wire (fig. 127).

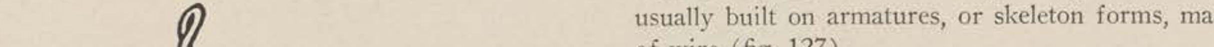


Figure 127.

CHAPTER 12

PUPPETS

125. General

Puppets appeal both to the craftsman and the theater man. They give an opportunity to design and build and to put on a play. Because a puppet may be constructed very simply out of almost any sort of material, one need never be stopped for lack of something so long as one uses ingenuity. A puppet may also be made with endless pains to give it the highest degree of finish; it can be a work of art. But no matter how simple or how finished it is, it will come to life and become an actor in the hands of a manipulator with a sense of the theater. An elaborate stage is not necessary for it. It can be made to act over the back of a chair or on a table. But if a full stage presentation with special lights and scenery is possible, it can give the illusion of the full-scale theater with a fraction of the space and expense demanded by that theater.

126. Types

a. For informal entertainment a puppet can be improvised of a ball or small potato stuck on the end of the index finger over a cloth which covers the hand. The thumb and second finger working under the cloth suggest arms. Or the first two fingers can serve as legs for a small figure supported on the hand. Such puppets as these depend upon the skill of the manipulator more than anything else for their effect (fig. 128).

b. For skits, dances, and plays more formally worked out, more highly developed puppets are desirable. Among the types most often used are shadow figures, string-puppets, rod-puppets, and hand-puppets. Each has its own virtues and limitations. Shadow figures are flat, made of cardboard or other opaque material, casting a silhouette, or of celluloid or other translucent material, casting a colored shadow. They maye be jointed, and are generally worked from below by rods and strings. As they move only in the plane of the cloth or paper screen on which their shadows are cast, they are best for processional movement such as parades. In plays with long dialogue their action is apt to become monotous (fig. 129).

c. String-puppets are jointed, three-dimensional figures, ranging from one-quarter to one-third human size for audiences of up to 500, made of wood, cloth, wire, and a variety of other materials, and worked from above by strings attached to a controller. Their workability depends in a large measure upon the smooth construction of their joints, the balance of the parts of their body, and the automatic movements imparted by the stringing and controller.

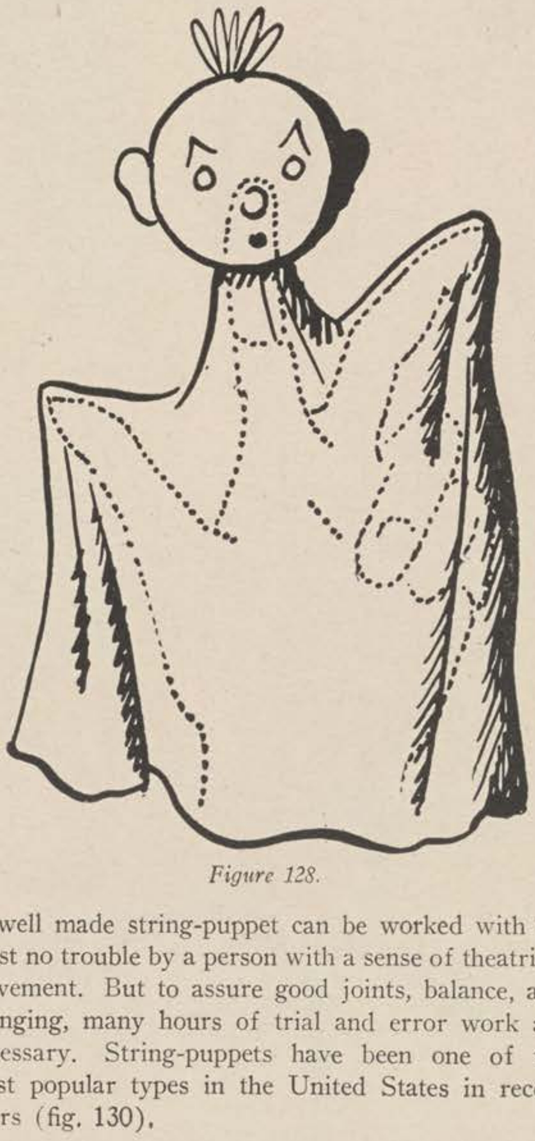


Figure 128.

A well made string-puppet can be worked with almost no trouble by a person with a sense of theatrical movement. But to assure good joints, balance, and stringing, many hours of trial and error work are necessary. String-puppets have been one of the most popular types in the United States in recent years (fig. 130).

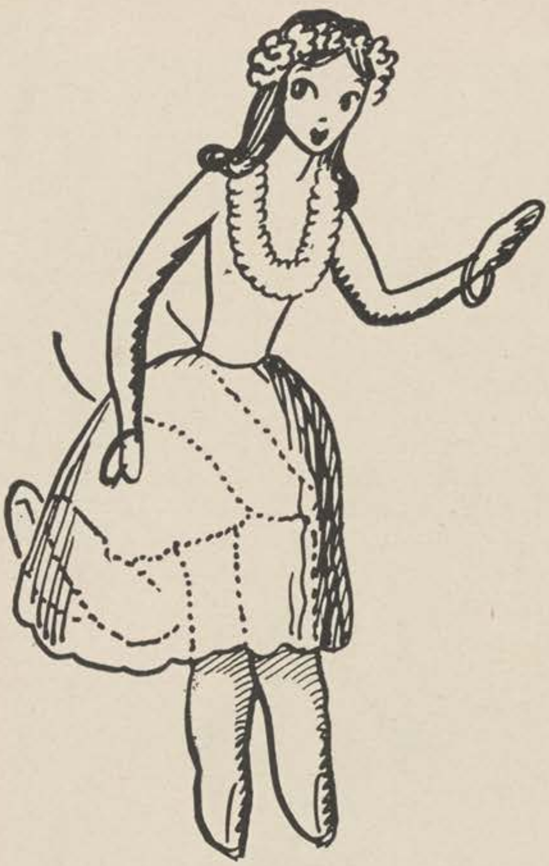


Figure 129.

d. Rod-puppets are also jointed and three-dimensional. They may be worked by a suspending rod from above, which gives more responsive action than a string, though it makes for stiff head movement, or by a supporting rod and supplementary animating rods from below. While it too requires good articulation, it need not have the precision of balance in its parts of a string-puppet because it is more rigidly supported. It is easy to work because each impulse of the operator's hand is transferred directly to one of its parts by a rod. There is never the hazard of tangled strings. Rod-puppets are an increasingly popular type (fig. 131).

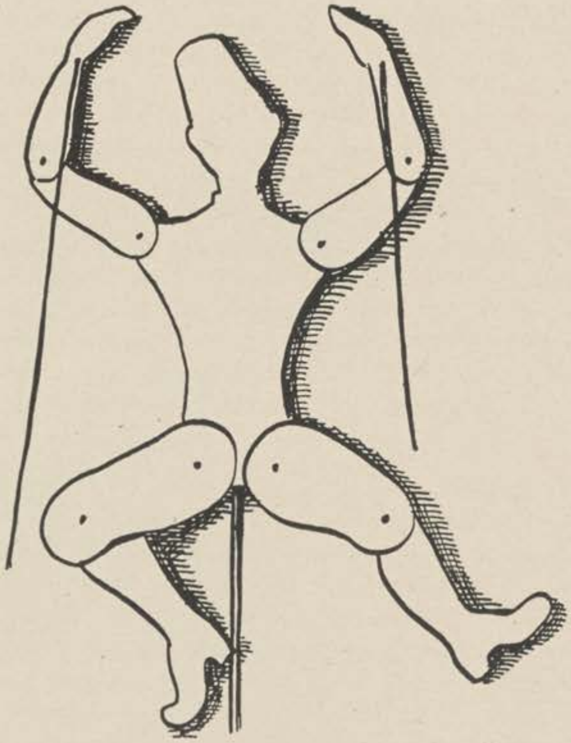


Figure 131.

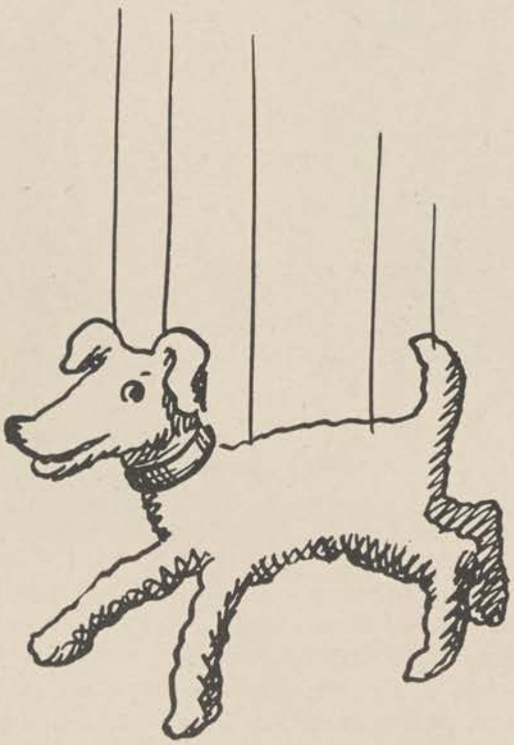


Figure 130.

e. Hand-puppets are hollow figures that fit over the hand and forearm. They may be made very easily because they consist of little more than a bag, head, and hands. But they are of the most difficult types to work well. Since movements of the head and arms depend upon the deft action of the operator's separate fingers he requires something of the coordination of a pianist. Since hand-puppets are held above the puppeteer's head, he must have practice in keeping his arms straight up for the duration of a scene. Hand-puppets are excellent for rapid; slapstick action. They are easy to pack away and to transport. But unless they are worked skillfully, they may seem wooden and undramatic (fig. 132).

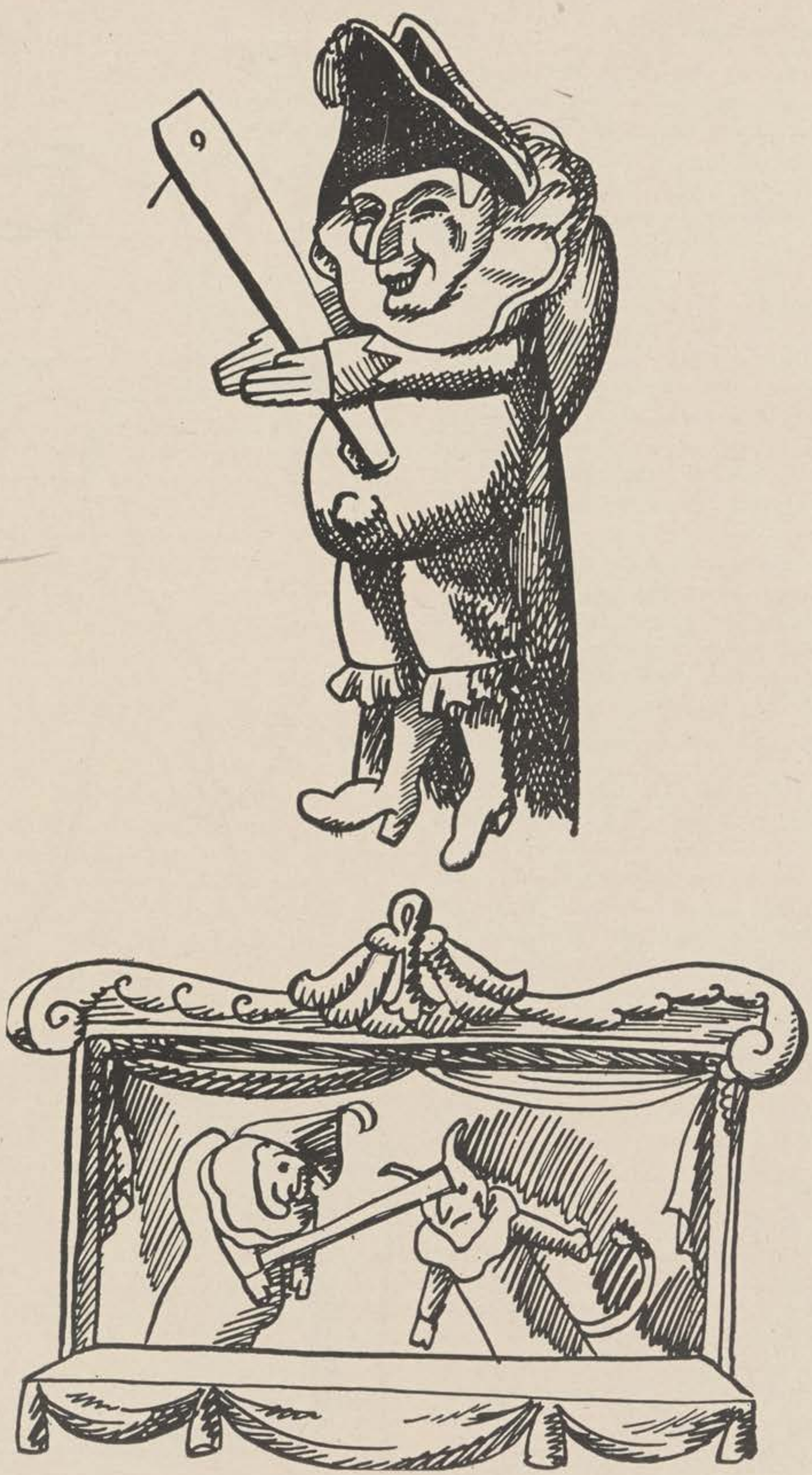


Figure 132.

127. Making a Shadow Figure

Sketch the outline of the character to be made. Exaggerated noses, hats, paunches, or other details may be used, as in caricature, for comic effect. Determine which parts are to move. Mark the spots where these parts will pivot. Transfer the figure, part by part, to cardboard, sheet metal, or transparent sheet plastic such as celluloid or vinylite. Cut the parts out with a knife or scissors. Cardboard or metal may be painted if the pupet is to appear as itself rather than a shadow. Plastic may be given a rough surface with sandpaper, tinted with water color, and lacquered. Or quick-drying lacquer may be applied directly to it for color. The pivot spots are punched with a blunt instrument or nail, and the parts are fastened together with grommets, metal staples, or cord knotted against the surface on both sides. Wires or umbrella ribs are attached with loops of wire to the moving parts. As a rule it is sufficient to have one supporting rod, attached near the center of gravity of the figure, or above it, and rods to the hands to work the arms. The legs may be swung by the motion of the whole figure imparted by the supporting rod (fig. 133).

128. Shadow Screen

Shadow figures 18 inches tall will need a screen about 1 yard high by 2 yards long. Make a frame of 1- by 3-inch clear soft wood, mitering the corners. Stretch a sheet or other piece of white seamless cloth over it tightly. Pull the cloth over the frame and tack it against the back temporarily with just a few upholstery tacks or thumb tacks. While it is held in place, begin at the center and stretch the cloth as taut as possible toward two sides of the frame, tacking it permanently against the back and removing the temporary tacks while working along toward the ends. Thus the cloth should be stretched without wrinkles (fig. 134).

129. Shadow Figure Show

Place a bright floodlight above the screen and not too far behind it, shielding it from the front and making sure that it does not glare into the eyes of the audience. This will cast clear shadows, and if the control rods are held off at an angle from the screen their shadows will disappear. Always move the figures tightly against the screen and keep them walking on their proper ground level. They can vanish into air when pulled away from the screen. If a figure enters from one side and must exist at the same side, either back it out or flip it quickly around to walk off heading forward. It is difficult to cross one figure over the other, and such action should be avoided when possible. Set-pieces of gates, trees, furniture, and houses can be cut out and tacked at the base or side to the frame. Properties on rods

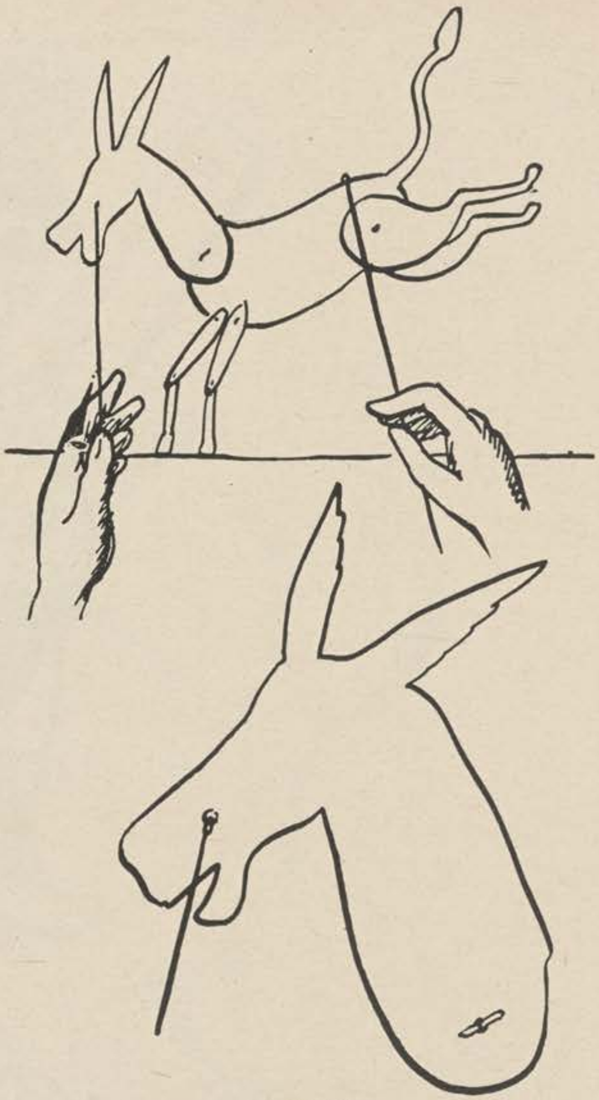


Figure 133.

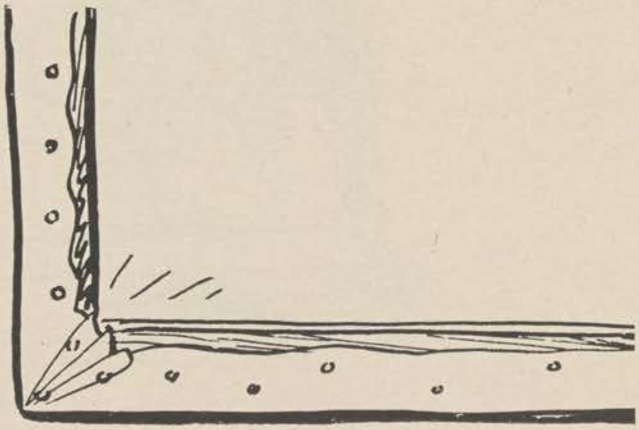


Figure 134.

can be handled by characters. Birds, clouds, airplanes all can sail through the air supported by a rod. A shadow figure show obviously permits unlimited fantasy. It was a precursor of the colored sound film; the Chinese had "talkies" with colored moving images on a screen some centuries before Hollywood (fig. 135).

130. Making a String-puppet

a. Draw a full-size diagram of the character to be built, marking its joints and mechanical details. To be seen by an audience of 500 it should be about one-third life size; that is, a 6-foot man would be a 24-inch puppet. Larger puppets become unwieldy to support. For smaller audiences one-quarter life size suffices. For comic productions the figure can be as tall as six of its heads. For more serious ones it is better seven heads tall. The larger the head compared with the body, no matter what the scale of the puppet, the dumpier the puppet looks. A dumpy comedian is permissible; not a dumpy heroine. If the head is too large the puppet becomes dwarfish no matter how big it is (fig. 136).

b. A head may be whittled of wood, moulded of papier maché or wood pulp, or built up of paste and paper or clay over a core. Light wood such as sugar pine is best for whittling. Porous wood such as balsa is unsatisfactory; hard wood is slippery save for the expert carver. Find a block big enough for the head, draw front and side views on two of its faces, and cut off the corners. Then whittle out the features. Try the head against the diagram to make sure it is the same size. Hands, legs, and other parts may be whittled in the same way.

c. To mould a head of papier maché make a two-piece plaster mould from a sculptor's clay (plasticene) model. The pieces may join in a line running over the crown of the head, down along the ears and the sides of the neck. Avoid a break through any modeled detail such as an ear. Wet inch-wide strips of white newspaper or typewriter paper and drop them loosely, side by side without much overlap, into the two halves of the mould. Now work another layer of paper strips, this one covered with flour-and-water or white paste, laid crosswise over the first, into the moulds. Continue to lay in pasted layers each across the other until there are six or eight. Work them well into the hollows of the mould with the fingers and a blunt stick. Strips may project half an inch out of the moulds around the edges. Set aside to dry. When dry pull the paper shells out of the moulds, trim their edges till they fit together, then paste together with strips of paper over the crack. Wood pulp (prepared, such as plastic wood, or home-made, of sawdust, glue, and whiting) can be pressed in by the same method. Soak plaster molds in water to act as a nonstick agent for plastic wood, or dust them with powder to prevent wood pulp from sticking (fig. 137). For a built-up head make a core of a wad of paper or cotton, cover it with glued paper, and continue to add glued wads until the features are achieved. This head must be set aside to dry two or three times in the building-up, or it will wrap out of shape.

d. Limbs and body can be made of whittled wood, padding over wire, or stuffed cloth (fig. 138). The best joints are carefully fitted of wood or metal, but for arms, hips, and waist, cloth tubes without stuffing will serve.

e. Try each part over the diagram to test its correctness of size. Assemble the parts when all have been made, paint the head, hands, and other uncostumed surfaces with opaque water colors (show-card colors) or oil paints, and attach strings of black fishline or warp to support the figure at the shoulders, to turn its head (one on each side near the ear), to support it from the small of the back, to work its arms and legs from the hands and knees, or to control any special movements. These strings are attached at the other end to a controller, a simple flat piece of wood which keeps them in order (fig. 139). Animals, fabulous creatures, animated furniture and vegetables, all are possible as string-puppets.

131. String-puppet Show

a. While a complete miniature stage with scenery can be built in scale with the puppets (an elevated bridge for the puppeteers keeps their hands out of sight above the proscenium frame) it is necessary only for extended productions that require scenic illusion. String-puppets which enact skits, dance, or do tricks, can perform on the same floor where the puppeteer stands, emphasized by a spotlight while the puppeteer is in semidarkness, or separated from him by a background. A good musical accompaniment from a recording or "live" band helps to make a dancing or trick string-puppet lively. A rack on which to hang the puppets as they finish their turn or an assistant to take them, is necessary.

b. The puppeteer should consider himself as background to the puppet while he is working. Anything bright or gleaming on his uniform will tend to catch the light and be distracting.

c. Among the popular string-puppet turns which have been seen on the stage or in night clubs in recent years are Latin-American rhumba or samba dancers, tap dancers (often in darkey costume), jitterbugs, ice skaters, strip teasers (their costumes held

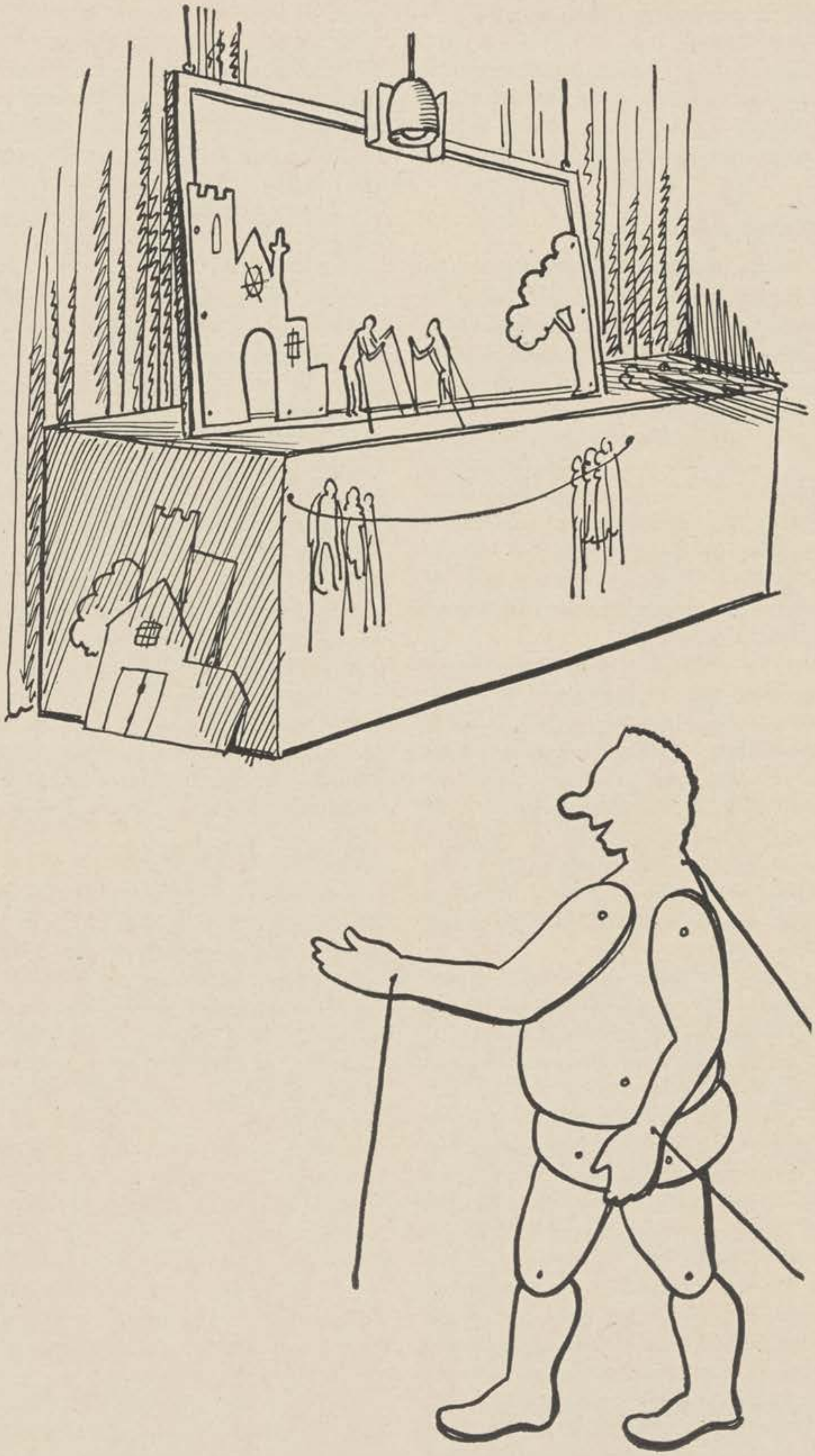


Figure 135.

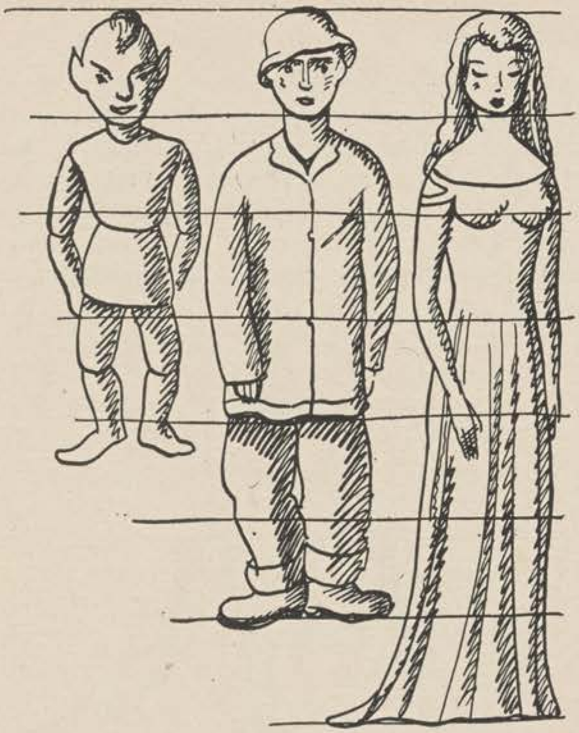


Figure 136.

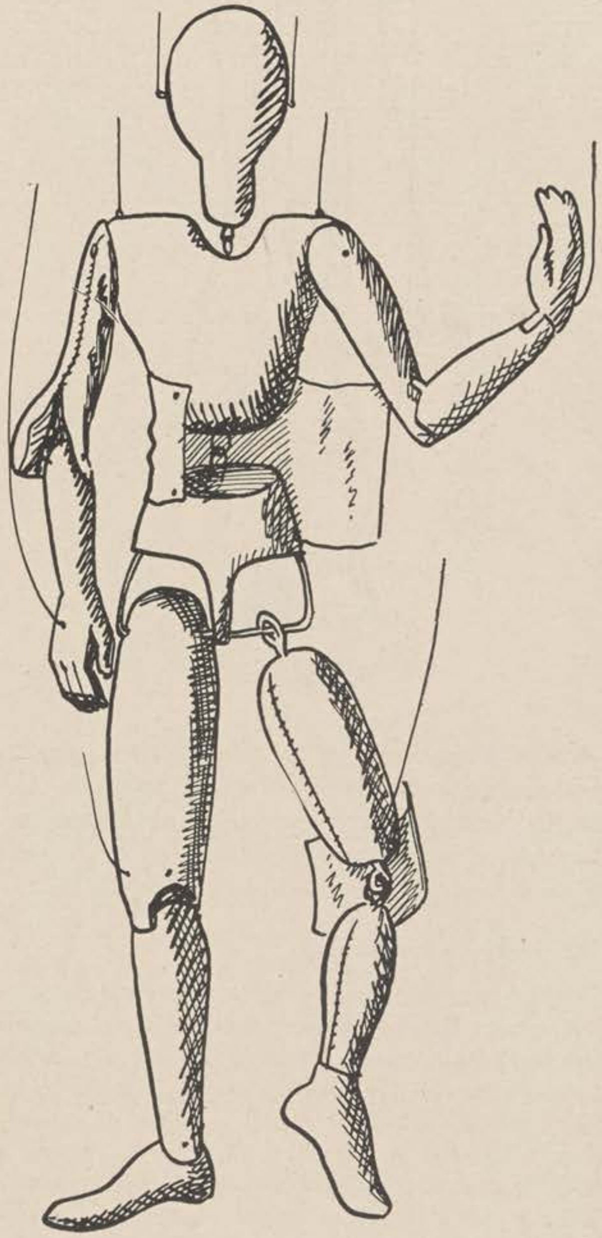


Figure 138.

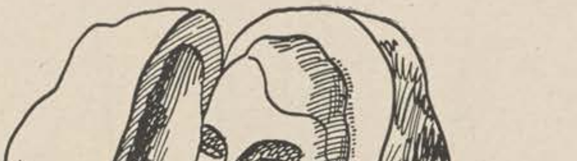


Figure 137.

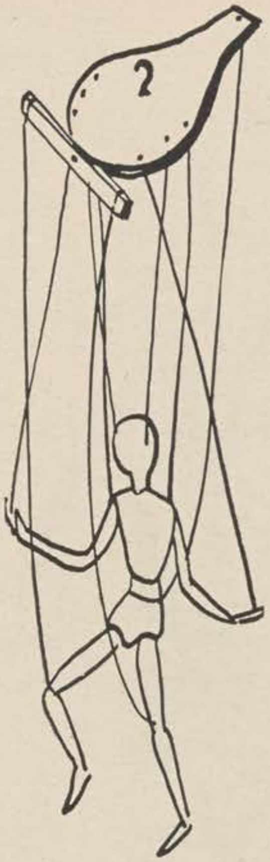


Figure 139.

on with pins pulled out by strings), comic pianists and opera singers, clowns which do acrobatics, balancing, or trapeze work, and other established features of circus, vaudeville, and floor show. A series of such turns may be worked by a solo puppeteer.

132. Making a Rod-puppet

Proceed as with a string-puppet, drawing a diagram to the desired size. Like string-puppets, rod-puppets can be one-quarter or one-third life size, depending upon the size of the audience which is to see them. They are subject to the same principles of proportion. They are supported from below by a rod, a stick or dowel (a ½-inch thick one will serve, but if nothing else is handy a broom handle may substitute), and this is built up through the body. The body may be no more than a shoulder block and a hip block hung together with a heavy spring; the supporting rod is attached to the hip block. Arms and head are attached to the shoulder block, legs to the hip block, and the costume covers the spring. Paint the supporting rod black if the costume does not cover it. Use umbrella ribs for hand rods (fig. 140).

133. Rod-puppet Show

Again as with string-puppets, rod-puppets may be manipulated in full view, the operator disappearing into shadow when the puppet is spotlighted. But they gain in effect for being shown above a screen, as do hand-puppets. Their legs usually have no rods. Rotating the supporting rod gives them a swing for walking or dancing. Full control over heads and hands is maintained by the rods attached at the wrists and the back of the head. The puppeteer holds the supporting rod in one hand, securing with that hand the head rod when the head is not moving; in the other he moves the hand rods or the head rod. While it is possible to manage the three rods of head and hands together in one hand, in most action the hand rods can be secured in the hand holding the supporting rod while the other hand moves the head.

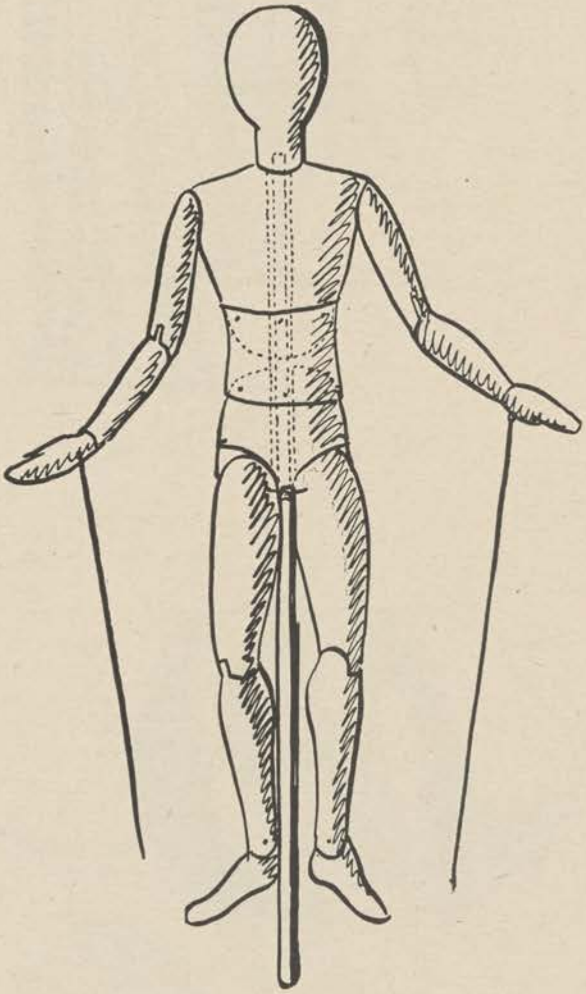


Figure 140.

134. Making a Hand-puppet

Again a diagram is the best starting point. Do not draw a figure of human proportion. Put your hand on a piece of paper with the thumb, forefinger, and second finger spread as they would be in working the puppet, and mark a line around them. Use this outline as the basis for the puppet, placing its head over the index finger and its arms over the other two. The neck opening should come at the first joint of the index finger; if it is lower, head action will be impeded. Whittle, cast, or build up the head and hands, leaving sockets in the neck and wrists to receive the operator's fingers. Make the costume as a bag to fit over the hand and tack, glue, or tie the head and hands to it. Sleeves that are too long will make arm control difficult. At the hem of the skirt of the costume sew a ring or loop with which to hang the puppet up. Puppets hang upside down so that the operator can thrust his hand into them and lift them from their peg in one movement. The skirt of the puppet must come well up the forearm almost to the elbow. Both men and women puppets wear skirts of necessity. But if trousers legs must be shown, they can be sewed on at the front of a dark-colored skirt, with feet to weight them. The movement of the whole body will swing the puppet's legs (fig. 141).

135. Hand-puppet Show

The puppeteer may squat on a stool or rolling platform or stand up, but the proscenium opening must be just above the tip of his head. He holds his arms overhead and must not allow them to sag while the puppet is on stage. If there is scenery, puppets can enter through doors or from behind wings, but if there is none, they enter by popping up and exit by dropping. Their action can be brusque and rapid. The operator's wrist is their waist, which allows them to bow and bend realistically. They can grasp properties between their arms. While they nod their heads (to say "yes") they do not shake them (to say "no") without turning the entire body.

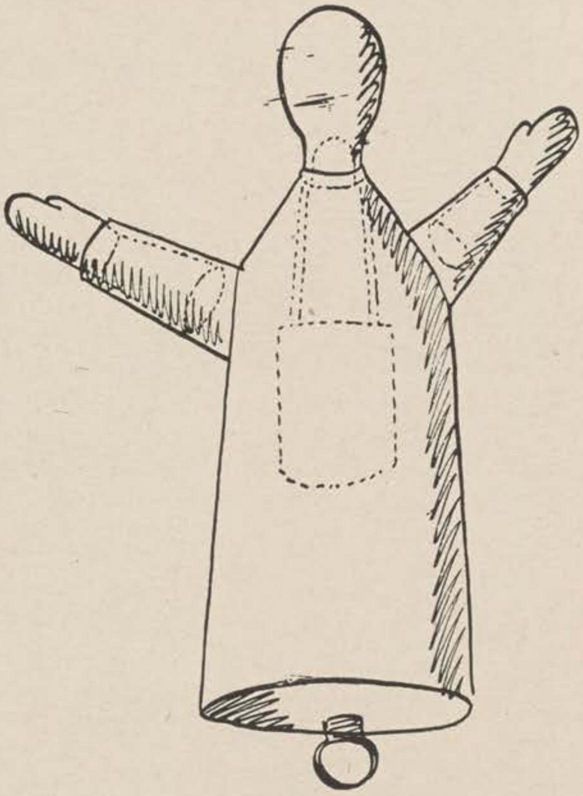
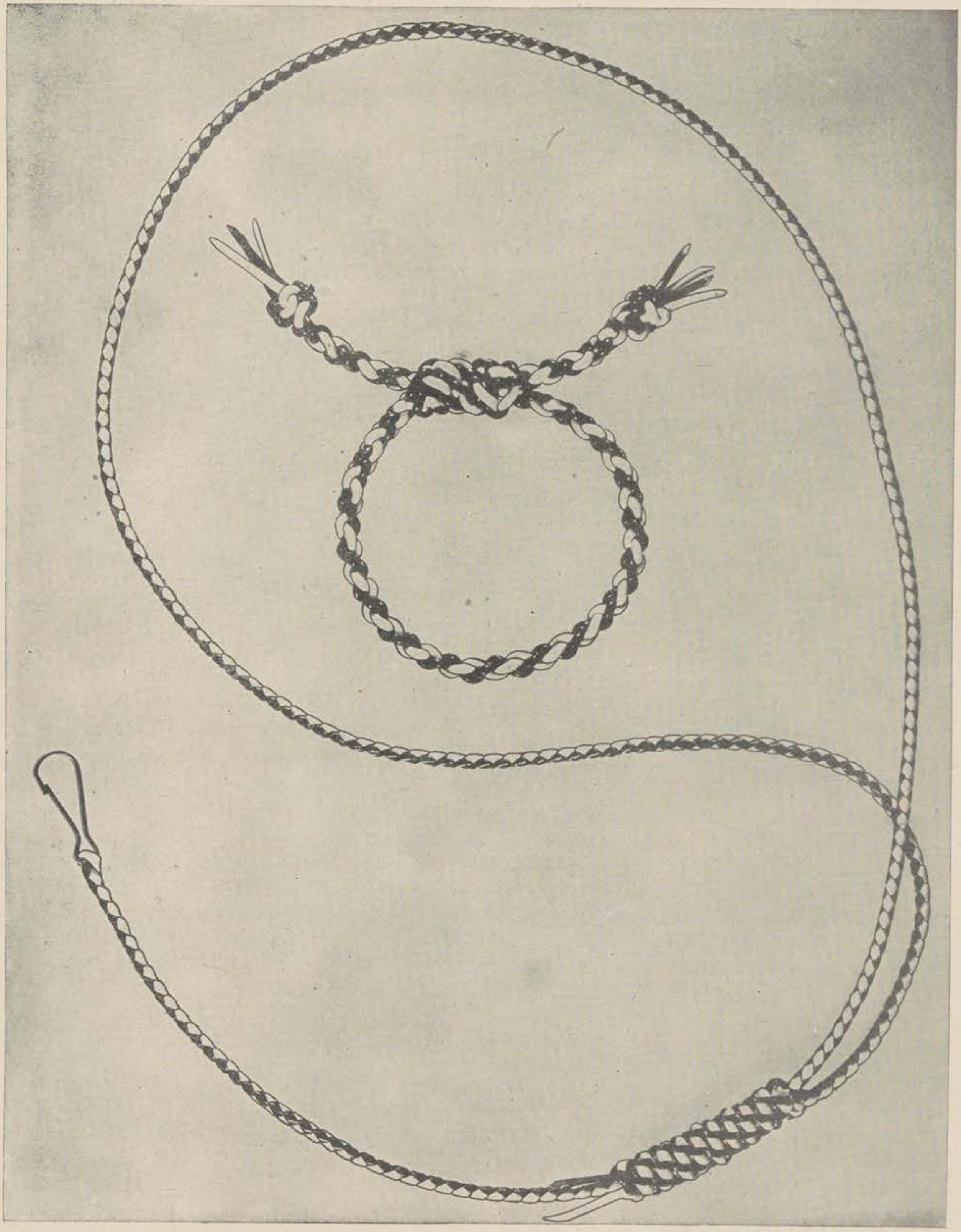


Figure 141.

136. Choice of Plays

Puppets can perform serious drama. It has been written for them by writers of the stature of Goethe and Maeterlinck. American puppeteers have staged full-length productions of Shakespeare. But for the beginner short pieces are less taxing. There can be improvised dialogue, with the puppets speaking directly to the audience as well as among themselves. Or special plays can be written to suit their capacities. Collections of published plays exist.



CHAPTER 13

BRAIDING AND KNOTTING

137. General

a. Braiding and knotting are closely related crafts which are easily mastered by the beginner. They have the great advantage of requiring no special equipment; all that is needed is the material used. This may be any kind of flexible strip such as string, yarn, raffia, paper, cloth, or leather. A coated gimp, prepared commercially for braiding, is now popular because of its high gloss and bright colors. It comes either round or flat in several sizes.

b. The techniques described below can be used to make a variety of useful and decorative articles such as lanyards, bracelets, necklaces, leashes, belts, etc. The text and illustrations show the basic procedures, but it should be emphasized that there are many variations which your own imagination and ingenuity can supply. Strips of different colors, for example, may be combined in a single project to provide a more interesting pattern. Similarly, different kinds of braiding or knotting can be used on the same article either for decoration or for functional purposes such as the square braid which acts as a slip knot on a round lanyard, or the round loop which sometimes forms the buckle on a flat belt.

138. Braiding

a. The first step in any kind of braiding is to secure the ends of the gimp so that they will not unravel. This can be done by tying them together or fastening them with a paper clip. If one end of the braid is to be attached to a buckle, snap, or similar fastener, the easiest method is to double the length of gimp required and pass each strand through the loop of the fastener so that the two ends hang down an equal distance. Thus, three strands of gimp, for example, will provide a six-strand braid.

b. The end of a braid should also be fastened to something solid before you start work. They can be held in a vise, closed into a drawer, or tied to a rail or other object. If they have been passed through a buckle, the latter can be slipped over a nail. This is important as it permits you to keep an even tension as you braid. Braiding can be done either tightly or loosely, but the pull should be uniform throughout. If you are doing a very long braid and the ends tend to tangle, roll each into a loose ball and secure with an elastic. These can be gradually unrolled as the braid progresses.

c. In estimating the length of strips needed for a given article, the following rule may help. An average braid is approximately ⅔ the length of the strips from which it is made. This can vary considerably, however, as it depends on the tension and the number of strands used.

139. Flat Braiding

a. The simplest type of breading is done with three strands (fig. 142). You start with the outer left strand and pass it over the center one. Then take the outer right strand and pass it over the first, which is now in the middle. This process is repeated until the braid is finished.

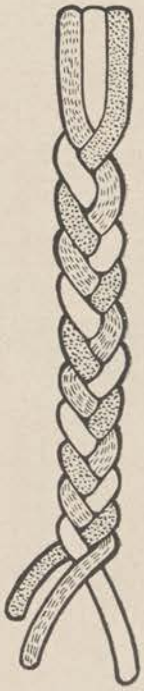


Figure 142.

b. Exactly the same principle is followed in braiding five, seven or any odd number of strands. Find your center one, then weave the outer left strand over and under the other strands at the left until it crosses the center one. Then take the outer right strand and weave it to the center in the same way (fig. 143). The braiding is always done with the outer strands, which are woven over and under their neighbors until they cross the strip in the center.

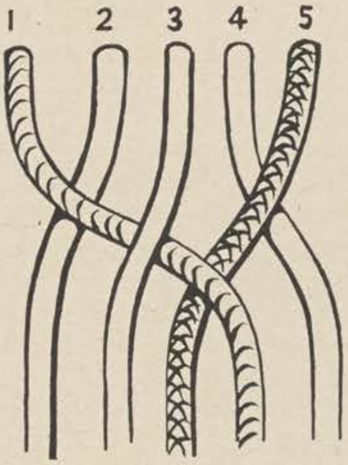


Figure 143.

c. To braid four strands, start with the one at the outer left and pass it over the one next to it. Then take the outer right strand and pass it *under* one and over one (fig. 144). The process is repeated with the outer left strand going always over one, while the outer right goes under and over two.

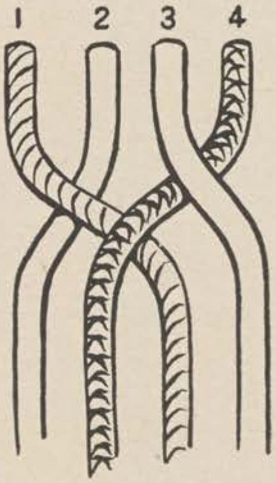


Figure 144.

d. The same principle applies to braiding all even numbers of strands. The outer left strand always starts by passing over its neighbor, while the outer right always goes under. The outer right is always woven through one more strand than the outer left. The reason for this can be seen if you take six strands and weave each outer one through its two neighbors only, instead of weaving across three with the right hand one as directed above. The braid divides into two as there is no extra stitch to hold the two halves together (fig. 145). This is sometimes done purposely to vary the pattern. The braids can be rejoined by adding the extra stitch with the right hand braid.

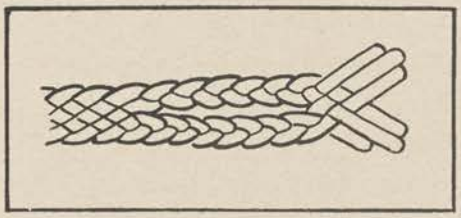


Figure 145.

e. To finish a flat braid, the ends are generally reversed and woven back into the preceding stitches. In finishing belts, the loose ends are sometimes sewed between two strips of leather which are the same width as the braid and form a tongue for the belt.

140. Flat Braiding with Double and Triple Strands

a. The simple over and under pattern described above can be varied in a number of ways. Treating two neighboring strands as a single strand is one method. Six strands, for example, may be divided into three pairs consisting of the two at the left, the two at the right and the two in the center. The braiding is then done exactly as in the three-strand method above (fig. 146). Five strands can be divided into two pairs and a single strand. Five strands might also be divided into one pair and three singles, in which case the braiding would be done as in the four strand method described above. Triple strands are also used occasionally.

b. In the above method, the same two strands are kept together as a pair throughout the braid. A pair that starts at the middle will thus be sometimes at the right and sometimes at the left side of the braid. A further variation is illustrated here in a five-strand braid, but the principle can be applied to greater numbers.

c. In this method, two of the center strands are always considered a pair although they will be composed in turn of all the strands used. They do not move to the right and left edges of the braid as above, but always maintain their position in the center. The first step in the example illustrated is to pass strand No. 1 over Nos. 2 and 3. No. 1 now lies between 3 and 4 and has become one of the center

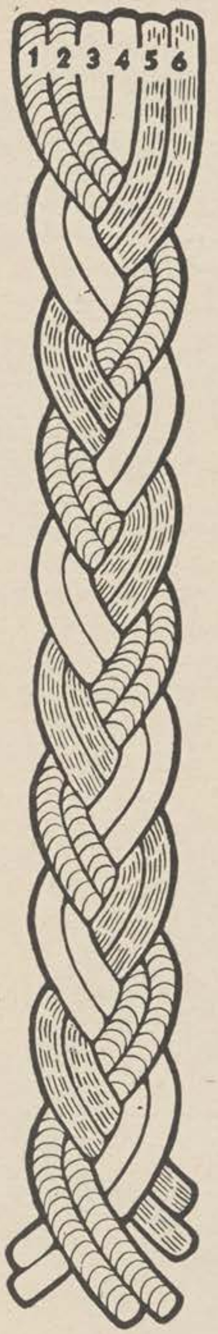


Figure 146.

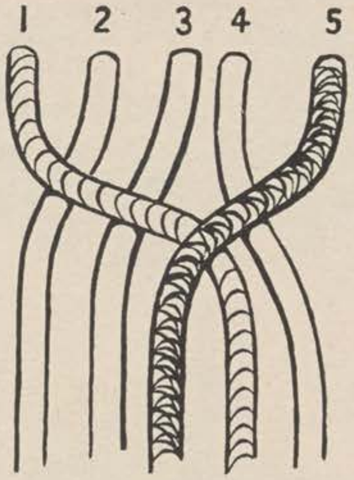


Figure 147.

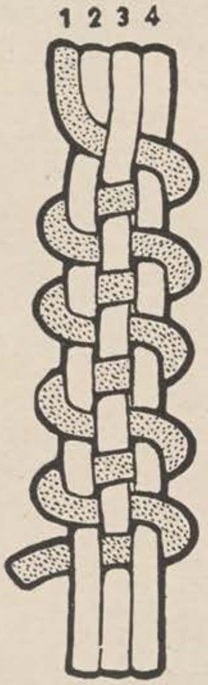


Figure 148.

strands. No. 5 is then passed over Nos. 1 and 4. The braiding is continued by alternately passing each single outer strand over its two neighbors (fig. 147).

d. Still another variation is achieved by weaving one of the outer strands back and forth across the whole width of the braid while the other strands remain stationary (fig. 148). This is particularly effective if the working strand is different in color from the others.

141. Flat Braiding on a Solid Core

Bracelets and napkin rings are often braided over flat, circular steel bands, which act as rigid cores. A variation of the weaving method described immediately above is used (fig. 149). Three or more strips of flat gimp are cut long enough to go around the circumference of the band with about ½ inch extra. These are fastened to the core with a paper clip. The working strand should be five or six times as long as the others and is woven through them in the manner shown (fig. 150). It is then passed through the ring, and the weaving is continued until the core is covered. The paper clip is of course

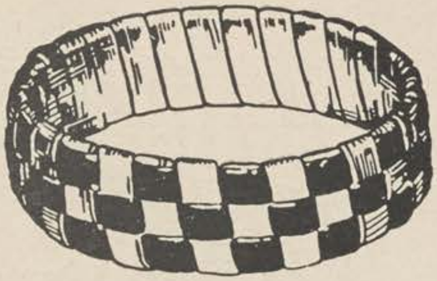


Figure 149.

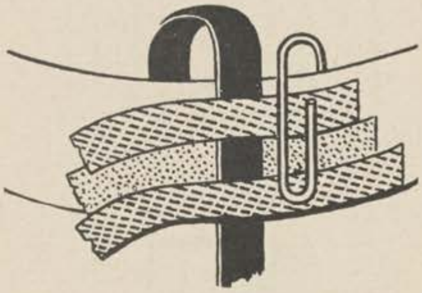


Figure 150.

removed and the weaving carried right over the loose ends which it was holding. When the pattern is complete, cut the end of the working strand to a sharp point and work it through the first row of stitches taken. It is then tucked under a strand on the inside of the bracelet, pulled tight, and cut off.

142. Square Braiding

a. Square braiding is generally done with four strands. It is often used to finish off round braiding, but may also be started with loose cords as illustrated. The ends must first be clipped or tied together and are held pointing downward in the left hand (fig. 151). The same illustration shows the remaining steps in completing the first row. This is repeated until the braid reaches the required length when it is finished with a lock knot, made as follows (fig. 152): No. 1 is carried around No. 2 and is tucked through the loop which holds No. 2 in place. No. 2 is then carried around No. 3 and is tucked through the loop which holds No. 3 in place. Nos. 3 and 4 are handled in the same way. This brings all four strands together in the center of the knot and makes a neatly finished end when they are drawn tight. An inch or more of the loose strands may be left protruding as a tassel, or they may be cut off close to the knot.

b. If you have to do square braiding with six strands, select four with which to do the braiding as above and form the knots around the other two, which are thus concealed in the center of the braid.

c. Square braiding is frequently done on a solid core. In this way it can be used as a slip knot on a lanyard (fig. 153). The braid is formed loosely around the shank of the lanyard so that it will slide easily on the round braid.

d. Square braiding can be given a spiral pattern in the following manner. The first square is formed as above. In making the subsequent squares, the strands are carried diagonally across instead of straight over (fig. 154).

143. Round Braiding

a. The illustration shows the method of round

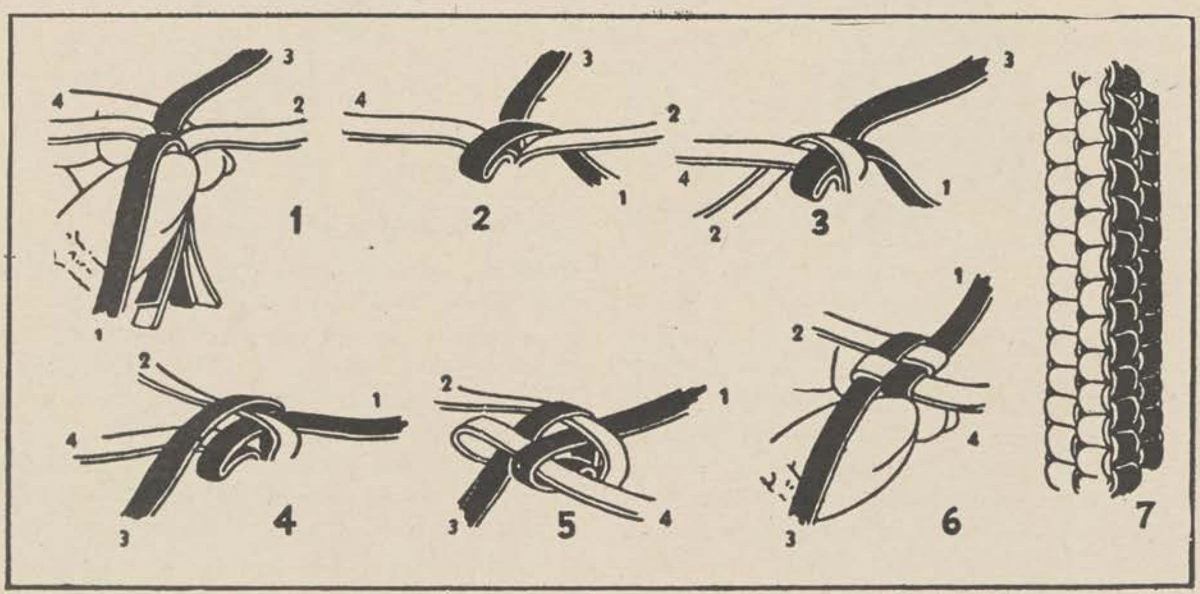


Figure 151

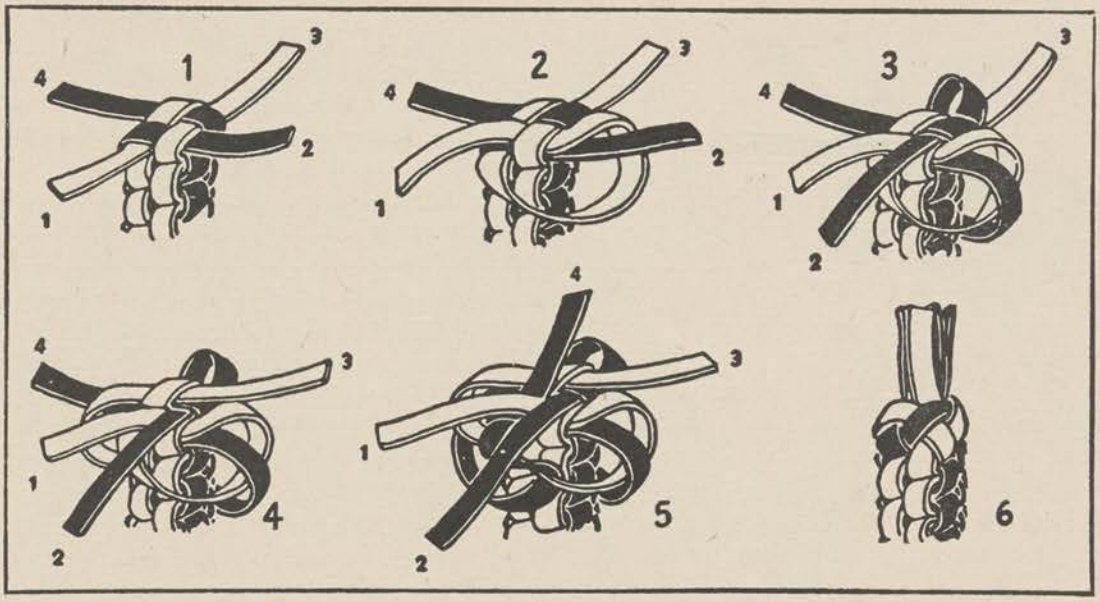


Figure 152.

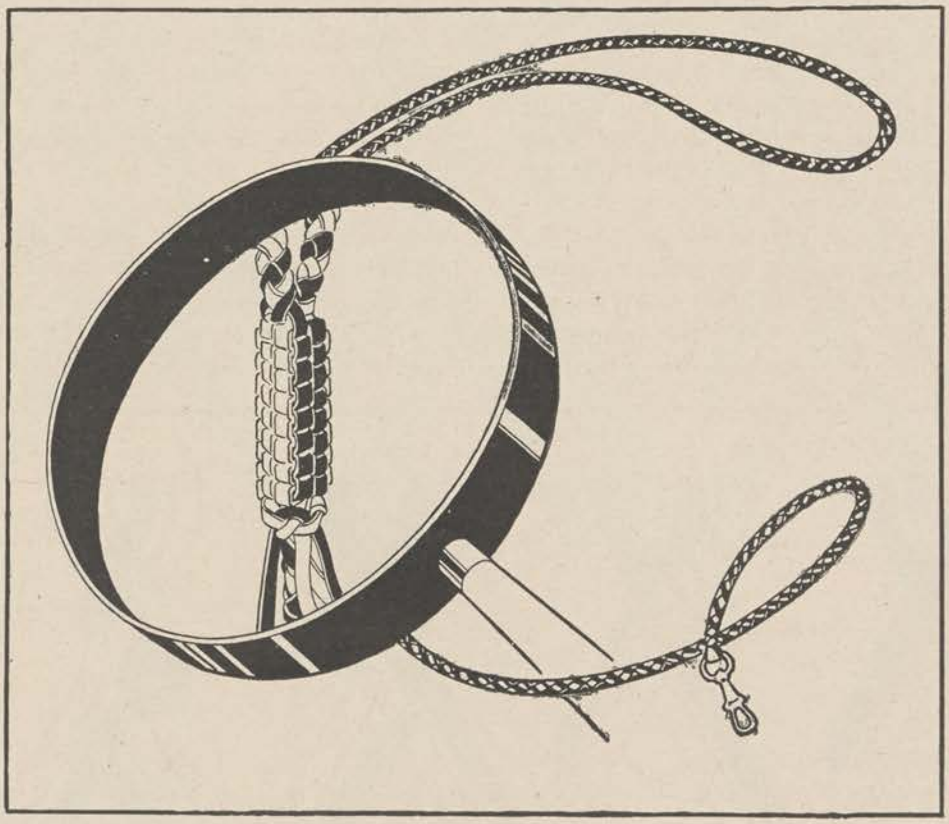


Figure 153.

braiding with four strands (fig. 155). The first step is to arrange the strips in the position illustrated. To do this, pass No. 2 over 3 and under 4. Then pass No. 1 under 3 and over 4. This gives you the diamond-shaped pattern shown, with the two left hand strands now at the right. From this position, the braiding is done as follows.

b. The outer left strand is brought around behind the others and through the space between the two strands at the right. It is then carried back to the

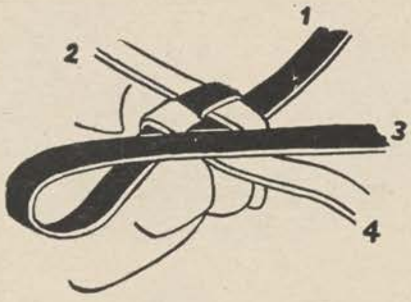


Figure 154.

left so that it lies beside the one strand remaining at the left. This is shown in the second step of the illustration.

c. The third step is to take the outer right strand and carry it in the same way behind its two neighbors and out between the two strands at the left. It is then brought back next to the outer right hand strand. Continue in this manner until the braid is the required length. To finish it off, do one or more rows of square braiding ending with the lock knot described under square braiding above.

d. Round braiding can also be done with six or eight strands (fig. 156). The first step is to interweave them as in four strand braiding until all the left hand strands are carried over to the right. The method of handling the strands thereafter is clearly shown in the illustration. Note that in six-strand braiding the working strip is brought up between the last two strips on the opposite side, while in eight-strand braiding it is brought up between the second and third strips of the opposite side.

144. Round Braiding on a Solid Core

a. Braiding of this sort can also be done over a flat or round core and is frequently used for bracelets. The core may be metal as in flat braided bracelets, or it may be a double thickness of the gimp itself. For an eight-strand bracelet, use four strands of gimp, double the length required. They should be passed through the ring of the bracelet and interwoven in exactly the same way as in the eight-strand method described above (fig. 157). The braiding is also done in the same manner. Each working strand is passed through the bracelet and brought up between the proper strands on the opposite side.

b. When the core has been covered and the pattern is completed, the bracelet is finished by weaving the eight strands through the open stitches at the beginning of the work. Start with the lower right strand and work it alternately under and over the four beginning stitches at the right (fig. 158). The illustration shows the remaining strands pulled aside. Do the same with the lower left and continue until all eight are woven through the start of the work and protrude at the edges. Then carry them to the inside of the bracelet, tuck them through the stitches there and clip off their ends.

145. Knotting

Knotting is done with any thread or cord that will hold when drawn into an ordinary square knot. Belts, mats, purses and similar articles can be made by this technique as well as hammocks or bags of open net design. Knotting is generally done on a

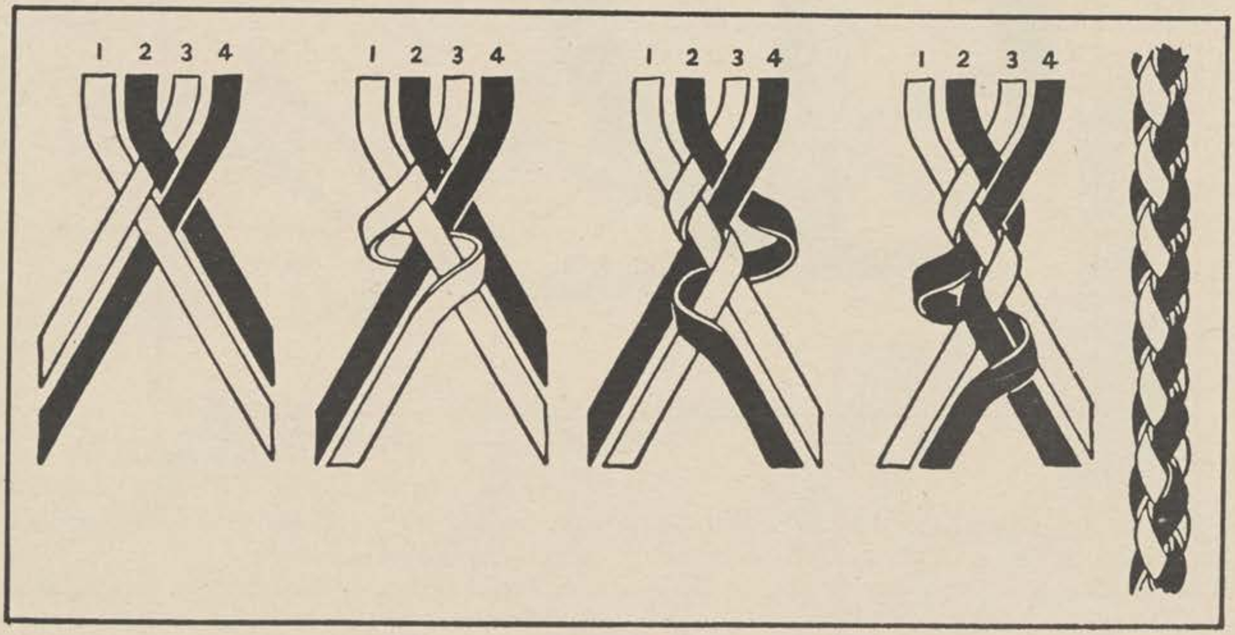


Figure 155.

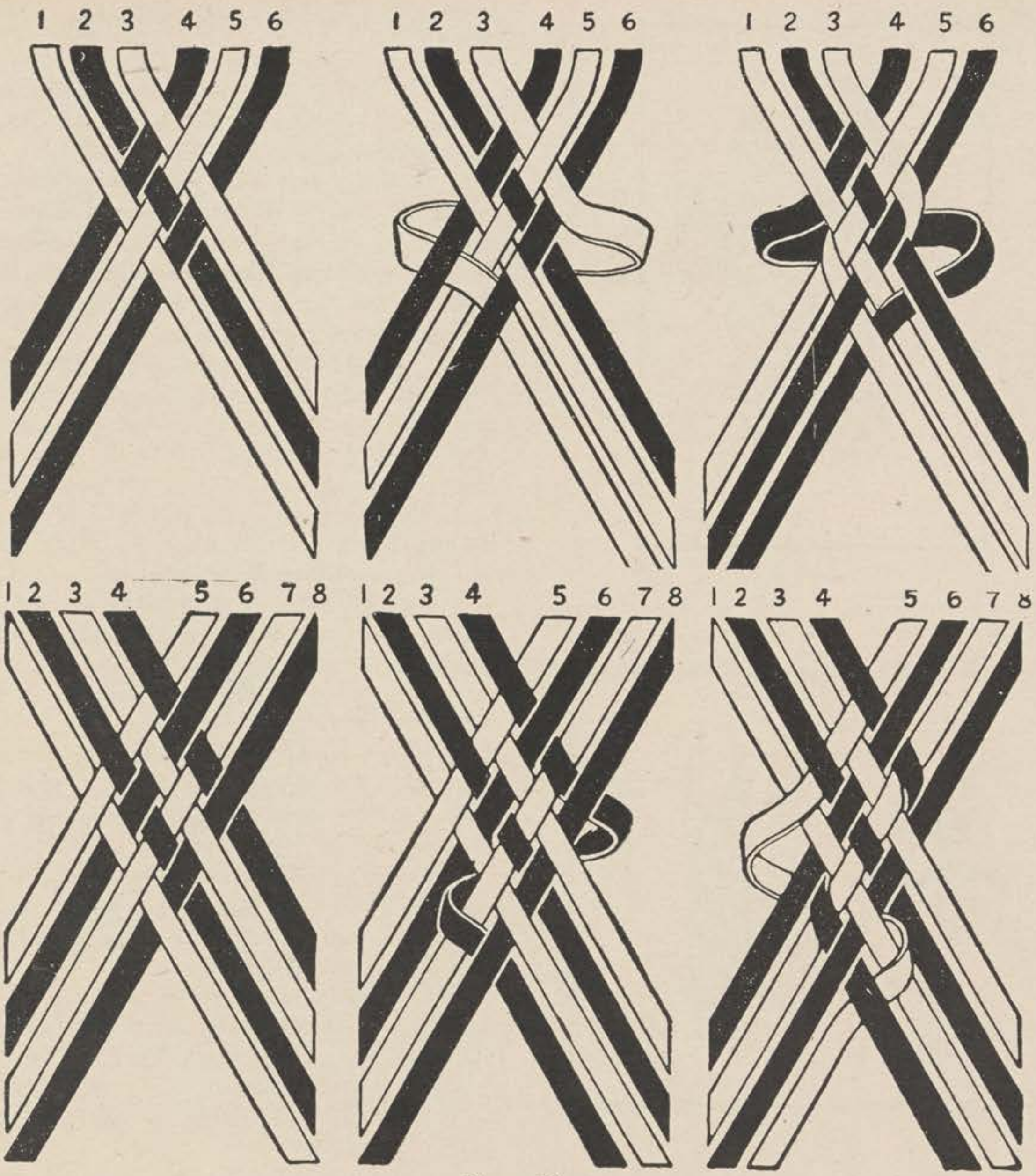


Figure 156.

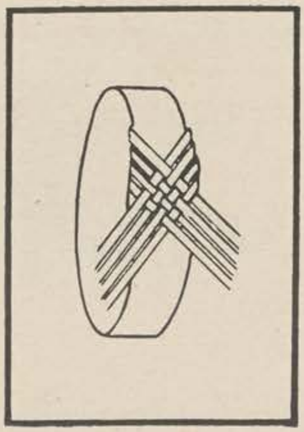


Figure 157.

core of the same cord that is used to make the article. It is important that this core always be kept taut as you work. One easy way to do this is to twist it once around a button on your clothes. The other end of the work must, of course be fastened to something stationary as in braiding.

146. Square Knotting

a. Most knotting is done with the square knot, which is tied around a core in the manner shown (fig. 159). The same illustration demonstrates the appearance of a row of these knots tied continuously over the same core. In practice, however, knotting is generally done with eight or more strands in order

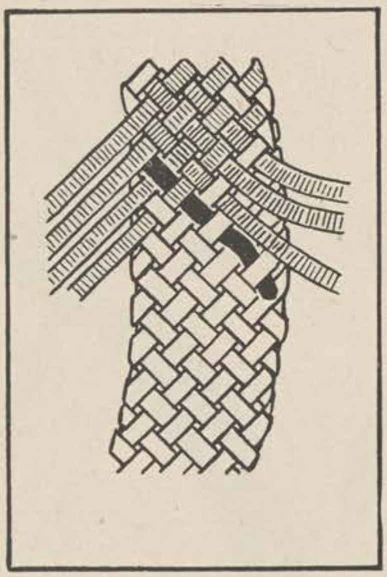


Figure 158.

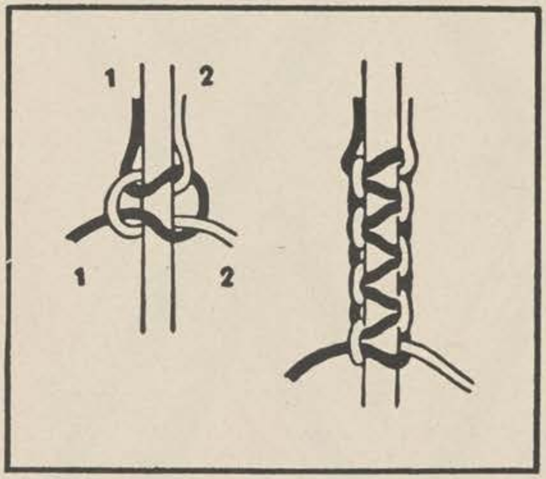


Figure 159.

to produce a finished strip wide enough for a belt or similar object. The easiest way to start is to take four pieces of cord double the length required and fasten them to the buckle (or to a plain bar) in the manner shown (fig. 160).

b. In the second step, the eight strands are divided into two groups of four. The two center strands in each of these groups are the cores on which the knotting is started. Thus a square knot is made with Nos. 1 and 4 around strands 2 and 3; also with 5 and 8 around 6 and 7.

c. The third step is to tie the two groups of four together. This is done by discarding for the moment the two outer cords of each group and knotting the four remaining ones in the above manner, that is, with the two center cords as a core.

d. The fourth step is a repetition of the second, and the fifth step is the same as the third. Continue alternating steps until the strip has reached the required length. Wider strips can be knotted by adding more cords at the beginning and following the same procedure.

147. Half Hitch Knots

a. Half hitches are also made over a core. They are often used in rows to finish off a square knotted belt or to add variety in the body of any piece of square knotting.

b. The basic knot consists of at least two hitches or turns of the cord around its core (fig. 161). The illustration also shows how a series of half hitches can be tied with the same cord.

c. When half hitching is done with a number of strands, one of the outer ones is generally used as the core, and each of the other strands is half hitched over it in succession (fig. 162). The same method is used in combining half hitching with square knotting.

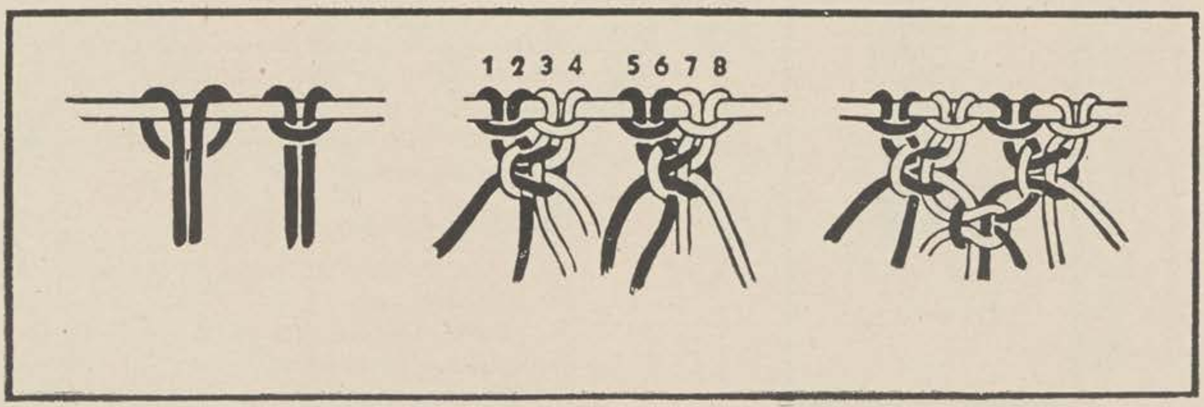


Figure 160.

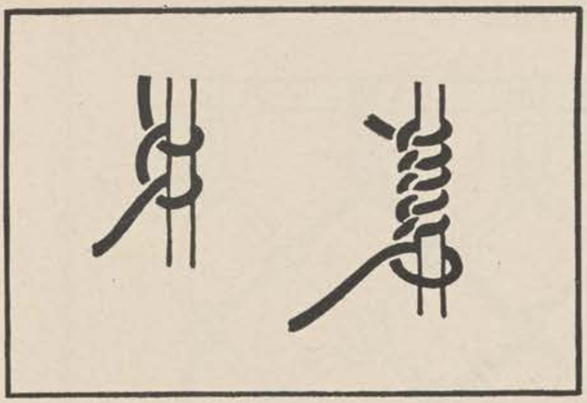


Figure 161.

d. The chain stitch is a variation of straight half hitching. It is done with two cords, each of which is alternately the working strand and the core (fig. 163). The right strand is first looped in a half hitch over the left, then the left over the right, and the knotting is continued thus until finished. A heavier chain can be made by doubling the strands and manipulating each pair as above.

148. Netting

An open mesh pattern can be made with either the triangle stitch (fig. 164), or the square stitch (fig. 165). The illustrations show diagrams of the knots and their use in eight-strand nets.

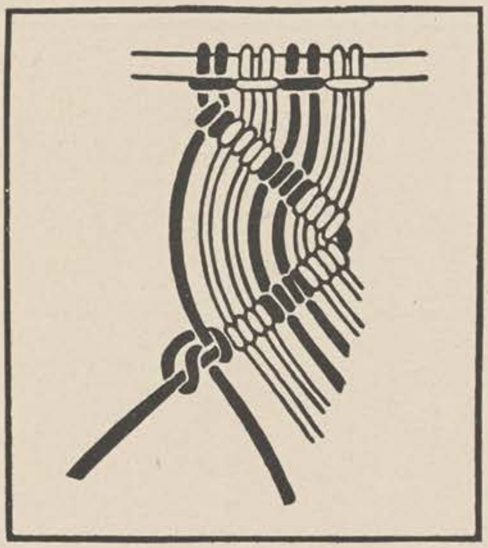


Figure 162.

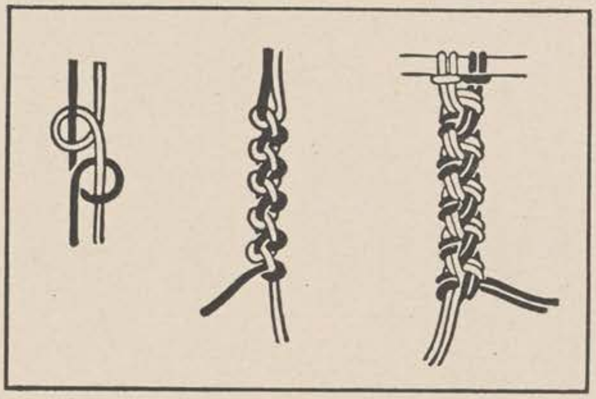


Figure 163.

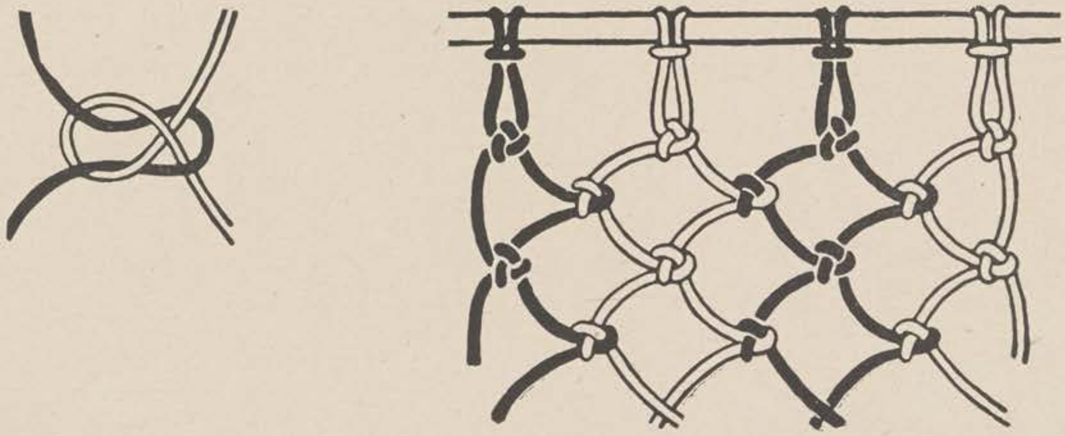


Figure 164.

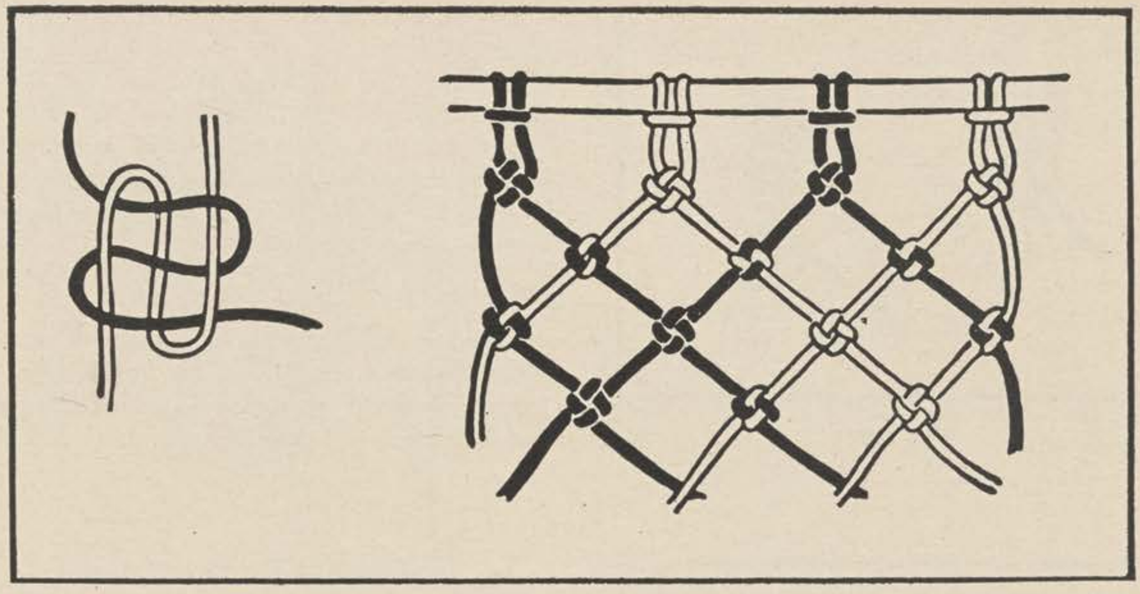
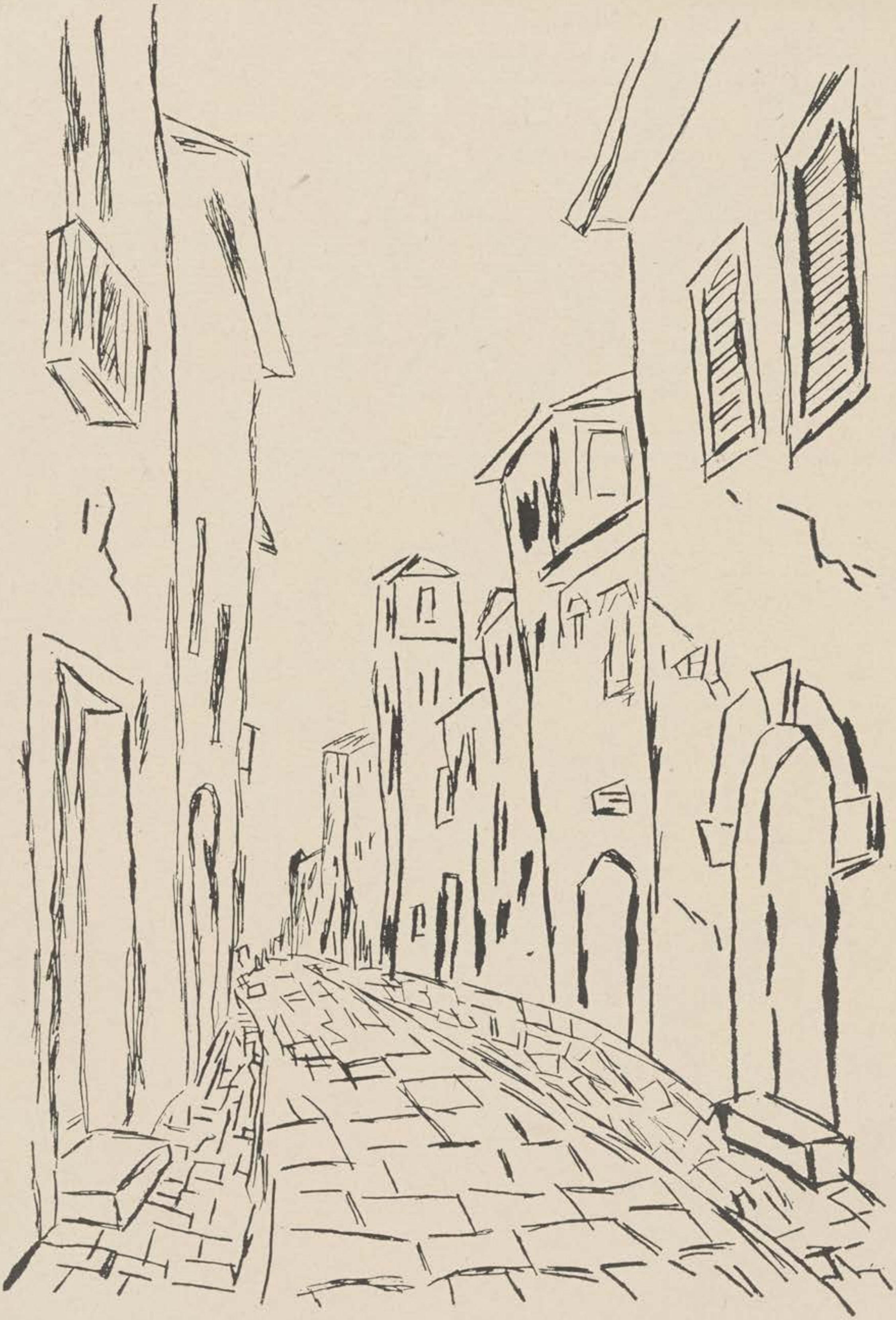


Figure 165.



CHAPTER 14

CELLULOID ETCHING

149. General

a. Celluloid etching is one of the easiest print processes for the beginner; it yields professional results with a minimum of equipment and experience. The technique is not actually one of etching (which is done with acid) but of engraving or "dry-point," in which the design is incised on a transparent plate of celluloid and printed from this plate on either paper or fabric. The celluloid is easy to scratch or cut and its transparency permits the artist to copy with little difficulty the design which he has created or selected.

b. The materials needed for making the plate consist of a scriber, or fine etching needle; some ordinary celluloid or some cellulose-acetate material about 0.020 inches thick; a drawing board; a sharpening stone; some thumbtacks; and a piece of white paper. The scriber is made of a pin vise with a point that can be reversed for carrying. The cellulose-acetate material is made especially for etching and may be bought at an art supply house. When choosing the subject for the etching it should be remembered that the final print will be the reverse of the design on the plate. A snapshot, a clipping, a reproduction of a good etching or best of all your original drawing offer good possibilities to the beginner.

150. Etching Process

Place the picture selected on the drawing board. Lay the celluloid over it (fig. 166). The celluloid should be large enough to allow a ½-inch margin on the sides of the picture and 2 inches at the top for practice space. If the celluloid has a tendency to curl, tack it down with the convex side up. Make some practice strokes before starting. The tool must be held absolutely erect at all times. Strokes may be made in any direction. The greater the pressure, the greater the depth and width of the line and the blacker it will print. The correct method of holding the scriber is illustrated (fig. 167). If a line is to be softened in shade run the thumbnail along the line previously drawn with the scriber. A sharp-pointed knife such as a scalpel may also be used after the worker is proficient with the needle. The resultant line is very clean and smooth. Parts of

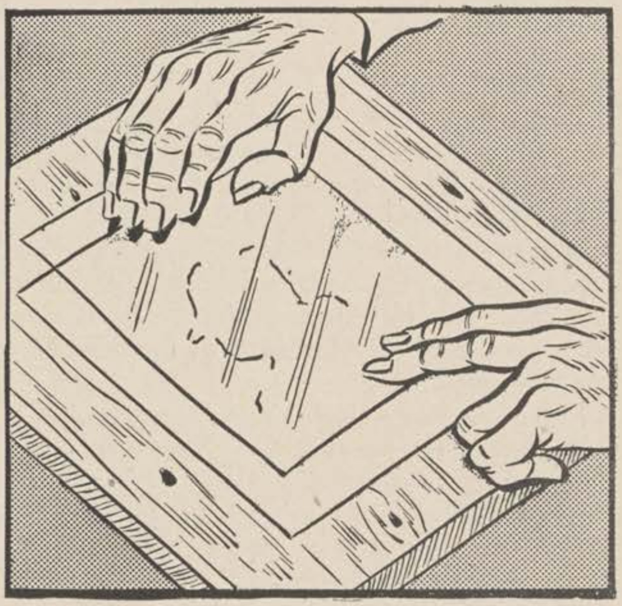


Figure 166.

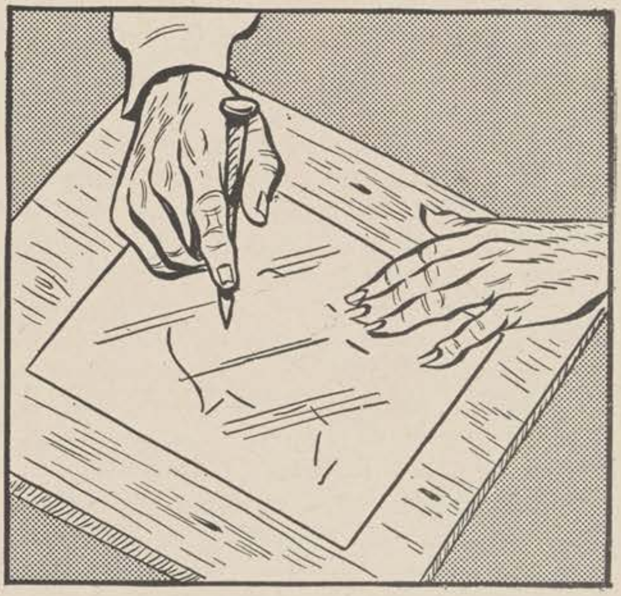


Figure 167.

the design done in this manner will appear sharper or "colder" than work with a needle. Depth in a picture is achieved partly by reducing the size of the more distant objects, partly by scratching them in with lighter strokes. This gives them a grayer tone and heightens the impression of atmospheric depth. Occasionally, insert a sheet of plain paper between the picture and the plate to enable you to gauge the extent of your work. When the plate is completed remove it from the board and score a deep line around the edges of your picture with a ruler and a very sharp knife. Be sure that the scoring is clean cut at the corners. Bend back the edges until they break away cleanly, leaving the finished plate ready for printing.

151. Printing Process

a. The plate may be printed in a standard etching press or one devised from a clothes wringer, but entirely satisfactory results can be obtained by hand printing without any special equipment. The first step is the preparation of the paper, which must be soaked in water to soften the fibers. The best papers are those sold specifically for etching, but a good grade of water-color or drawing paper will do about as well.

b. Take as many sheets as you plan to use and immerse them in a pan of water. A heavy rag paper should soak for several hours, while a wood-pulp paper will be ready for use after a few minutes. When ready to print, place the paper between blotters to remove surplus moisture.

c. Now squeeze some etcher's ink on a sheet of glass and work it with a paddle or palette knife to a smooth consistency. If the ink is too stiff, add a few drops of plate oil, mixing constantly. The oil and the ink in several colors can be purchased from a printer or at an art supply store.

d. Make a dauber by tying cotton or soft ravellings in a lint-free rag such as a much-laundered handkerchief (fig. 168). Next, fold a piece of tarlatan until it forms a ball with no loose ends. Another wiper should be made of cheesecloth in the same fashion. When not in use the rags should be kept in air tight containers to prevent the ink from drying and hardening. Transfer the ink to the plate with the dauber. Use a rocking motion to roll and press the ink into the lines. Do not twist or scrub with the dauber. When the plate is completely covered, stroke off the surplus with the cheesecloth pad. Grasp firmly in the hand, press it against the plate at one of the lower corners, bend the hand back and push the pad in small circles at an angle of about 45° to the plate. This alternately increases and decreases the pressure as the pad is pushed forward. This movement will require some practice, but is necessary if the ink is to be reduced gradually and evenly (fig. 169).

e. When the plate has been wiped down exposing the image to the desired degree the circular wiping should be changed to straight strokes across the plate. In finishing use the soft cloth or cheesecloth to remove any spots of ink. A rag very lightly charged with ink is called a "thin" rag; one heavily charged is called a "fat" rag. The latter makes a

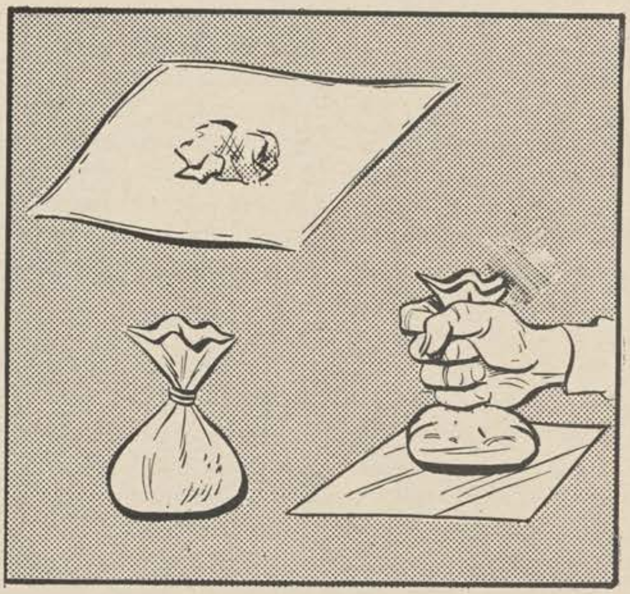


Figure 168.

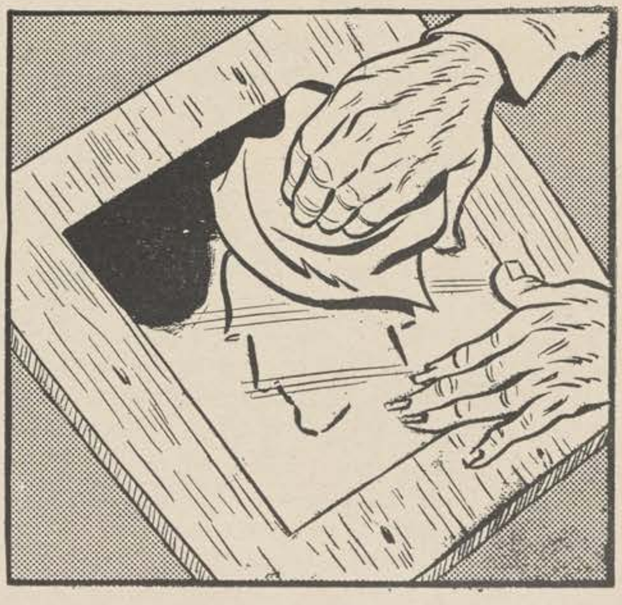


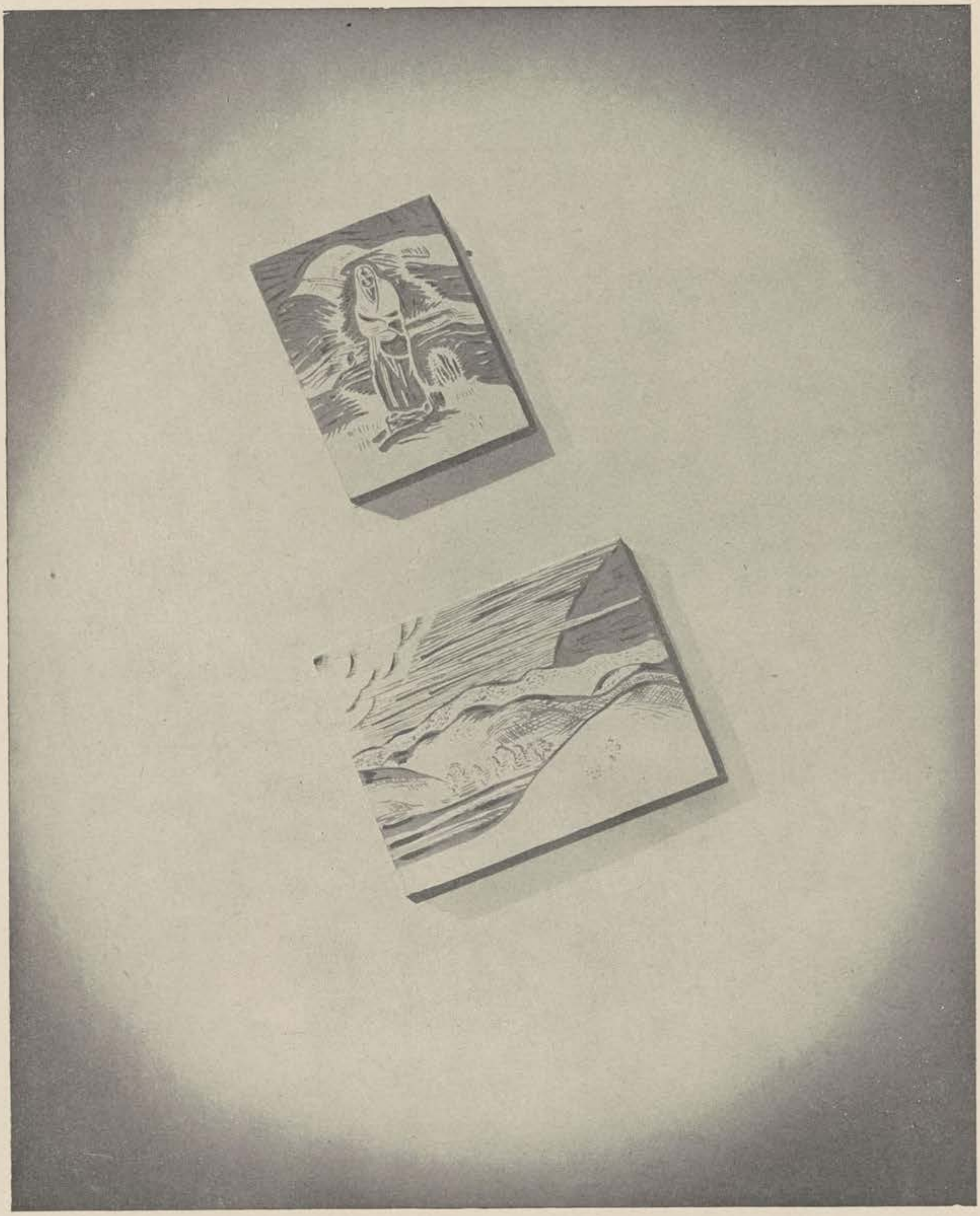
Figure 169.

better print because it leaves a more perfect tone. But a thin rag is useful in finishing a wipe where less tone is desired.

f. The plate may now be printed, but an additional hand wipe will produce an even clearer impression. The motion of the hand is circular and then parallel, as with the rags. To prepare the palm put a slight amount of ink on it with the dauber.

g. Now place a sheet of the damp paper over the inked plate, cover it with a piece of dry paper and rub this vigorously with any hard, cylindrical object such as the side of a pencil or the back of a comb. Pressure must be even and care taken not to move the paper on the plate. When the rubbing is completed, lift off the finished print and attach it to a piece of cardboard with gummed tape until dry. This will prevent shrinkage and wrinkling. Re-ink your plate and continue in the same manner until you have as many prints as you want.

h. After printing, clean the plate thoroughly with turpentine or benzine if you expect to use it again. This must be done immediately, before the ink dries in the lines. Facial tissues are excellent for drying the plates.



BLOCK PRINTING

152. General

Linoleum block printing, like the old woodcut method from which it grew, offers an easy means of producing strong bold designs either in fine prints or on greeting cards, letterheads, and monograms. Little skill is needed to cut the blocks, and the printing can be done on paper, cloth, cardboard, wood, or any material which will absorb ink. Colored prints are also possible as the worker's skill improves.

153. How to Carve the Block

a. The medium for carving is battleship linoleum, a substance which yields easily to the sharp edges of a knife or gouge. For best results, it should be mounted on a wooden block. This may be done by the individual, or prepared blocks may be purchased; in these the face of the linoleum has already been painted white, thus saving the worker another preparatory step. The cutting may be done entirely with a knife but the best results are obtained with the use of three or four gouges such as wood carvers use. The tools are inexpensive and may be obtained at any art or hardware store. Four basic tools will be found sufficient for all types of work. They are: the large **V**-shaped tool for general work, the small **V**-shaped tool for outline work, the **U**-shaped tool used for cutting wide lines and the big spatula gouge for removing large areas (fig. 170). All tools must be sharpened to a very fine edge at a slight angle extending back into the hollow part of the blade. This gives the tool a beveled edge, essential to making clean cuts in the linoleum. A dull gouge or knife will make a rough, unsatisfactory cut.

b. The design for the worker's first effort should be simple with large solid areas and strong lines. A silhouette picture is ideal or a simple form such as a monogram, bird, or tree. Trace this on a sheet of thin tissue or tracing paper as shown (fig. 171). When the initial tracing is finished turn it over and trace the design again, on the other side of the same sheet. This reverse drawing is necessary because a linoleum block prints in reverse. It is particularly important if there are letters in the design. The next step is to glue the linoleum to a wooden block and paint the surface with a coat of Chinese white, obtainable at any art store (fig. 172). This is of course unnecessary if a prepared block has been used. The block is then set aside until the white is thoroughly

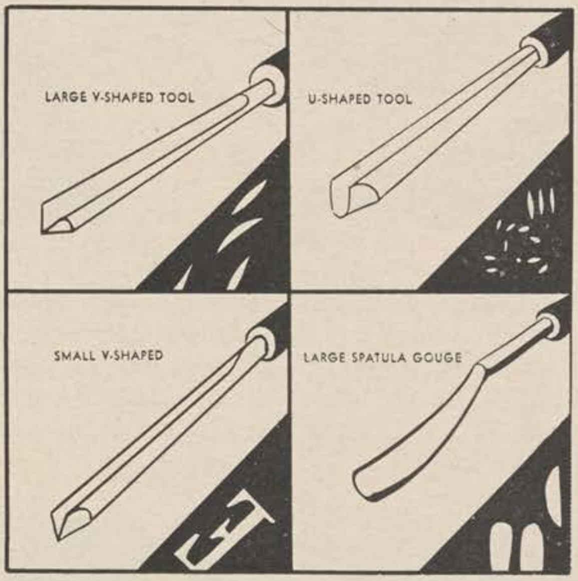


Figure 170.

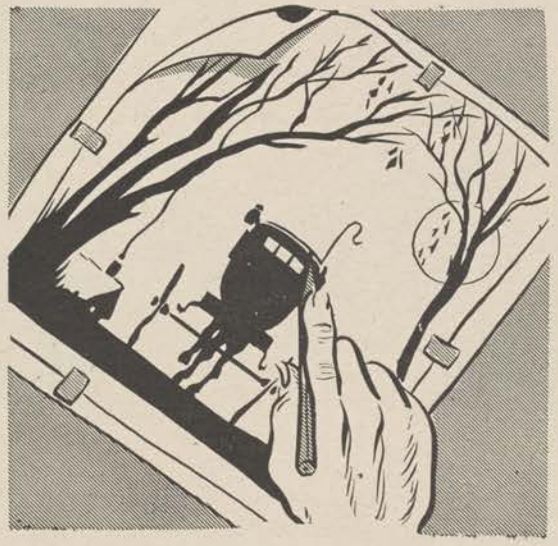


Figure 171.

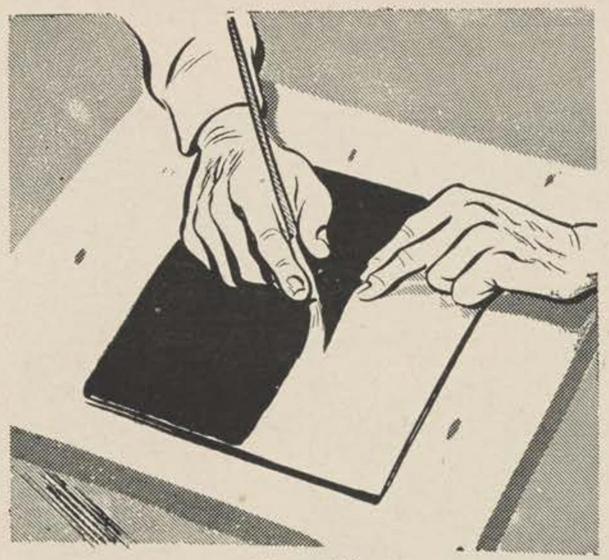


Figure 172.

dry. The design is then transferred to the whitened surface by placing a piece of carbon paper between the block and the design and going over the latter with a hard pencil (fig. 173). Any indistinct lines should be strengthened since strong guides are needed when carving.

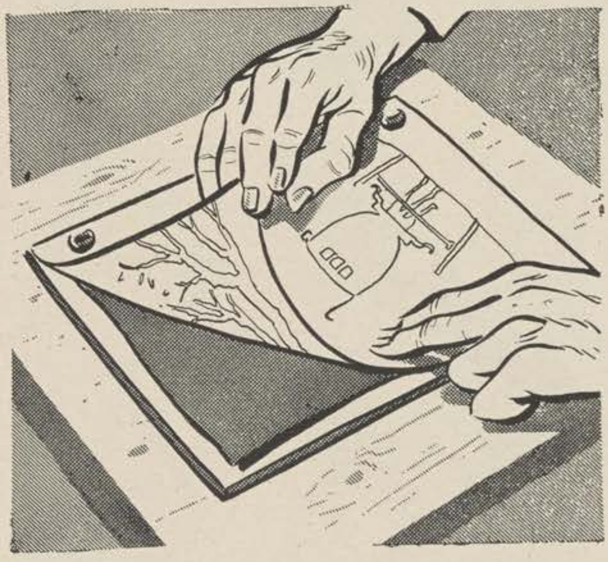


Figure 173.

c. Now comes the actual cutting. First, line up the job in your mind. The object is to remove everything except the lines and areas which you wish to print. These are left in relief. Start incising with a knife. Hold the blade so that it cuts at an angle away from the relief portion of the design. This will make a fine outline-cut around all the parts that are to be left. Having done this, reverse the slant of the knife and complete the cut into a **V**-shaped groove around the design, carefully removing the sliver of linoleum that results from this cut so that all edges are sharp. Now it is a simple matter to clear away with the gouge the parts that are not to be printed (fig. 174). These "dead" areas must be well cleared, or they will pick up ink and print where it is not desired. When the carver becomes more experienced it will be found quicker and more interesting to cut the entire block without using the first knife-incised guide line. Freer and more spontaneous work can be produced in this way, but it should not be tried until the workman is proficient.

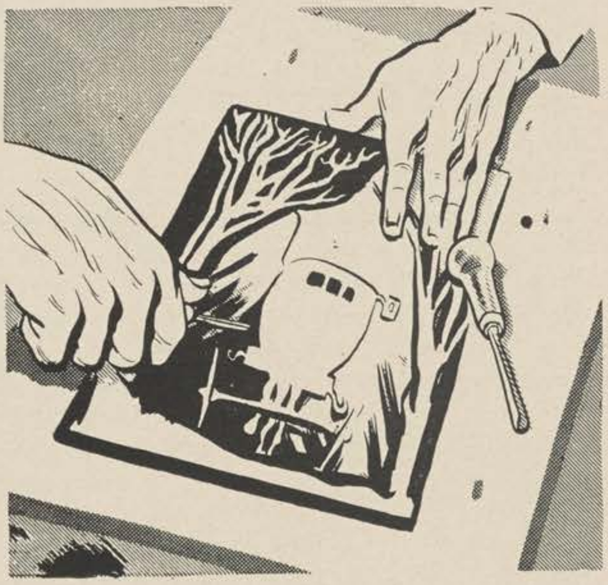


Figure 174.

154. Printing the Design

a. The next step is printing from the block. The most satisfactory results are achieved by using a small press, such as a letter press, although hand printing is also practical. Other supplies needed are ordinary printer's ink (of either the oil or water soluble kind) and some fairly absorbent paper. The ink can be purchased in large cans or small tubes from any printer or art supply house. The primary colors, red, yellow and blue should be bought in addition to black and white. Any other color or shade can be made by mixing these primaries on a sheet of glass. To obtain the desired hue, see the chart (fig. 175). All colors in the first column may be obtained by mixing colors in the second column with those in the third. To obtain darker or lighter shades of color, add black or white.

b. The ink is now rolled out on the glass with a rubber covered roller until it is evenly and well distributed. The roller is then run over the linoleum

HOW to MIX	ADD	TO
GREEN	BLUE	YELLOW
ORANGE	RED	YELLOW
PURPLE	BLUE	RED
GRAY	BLACK	WHITE
BROWN	BLACK	RED & BLUE

Figure 175.

block, first in one direction, then the other (fig. 176). Care should be taken not to apply the ink too heavily or the print will be smudgy. The paper is laid on the linoleum block and both are placed in the press. If none is available, the paper is laid on the inked block and rubbed with the back of a tablespoon. Pressure must be uniform to cause the ink to adhere evenly to the paper.

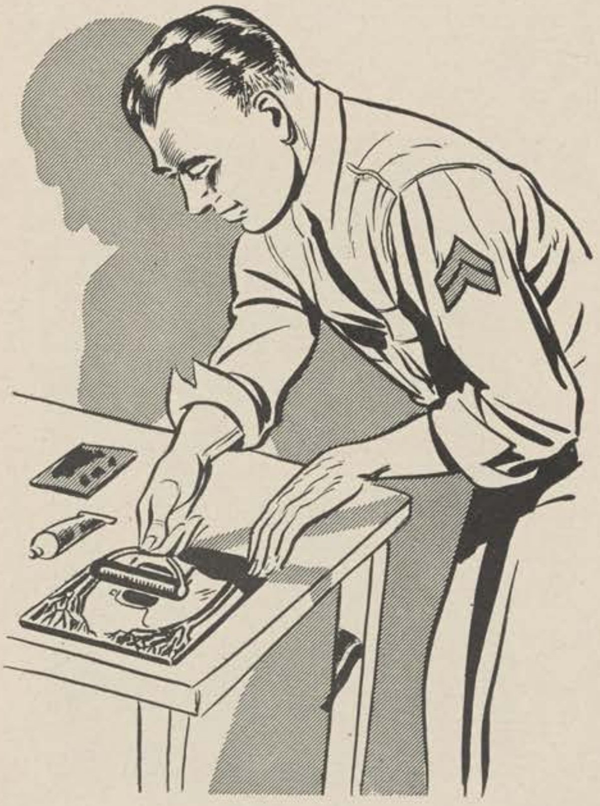


Figure 176.

c. As the craftsman becomes more proficient, prints may be made in several colors. To do this, separate blocks must be cut for each of the color areas desired. In carving these, use the same master drawing and make sure that the portions left in relief for each of the colors are cut with precision and come together accurately on the paper with no overlapping. In printing you will need guides to hold the blocks and paper in exactly the same position on the press. Print one color, allow plenty of time for the ink to dry, then run your second block through the press in the same way. Continue until all colors have been printed.

d. Linoleum blocks may be used for many purposes, one of the most interesting being the production of printed fabrics. For this purpose special inks have been developed which do not stiffen the cloth and are reasonably washable and colorfast.

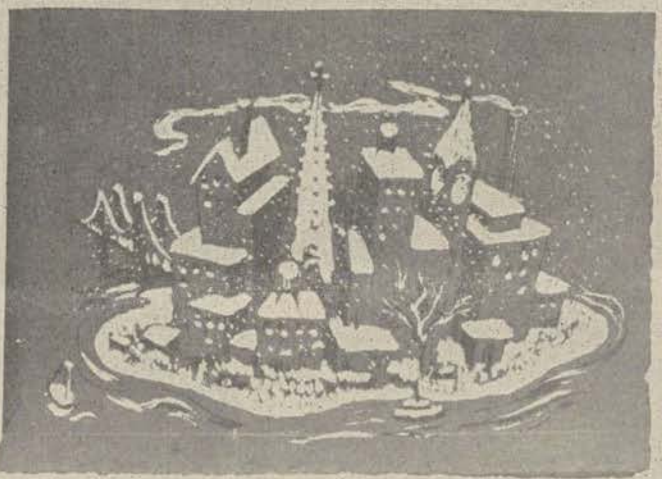
155. What Not to Do

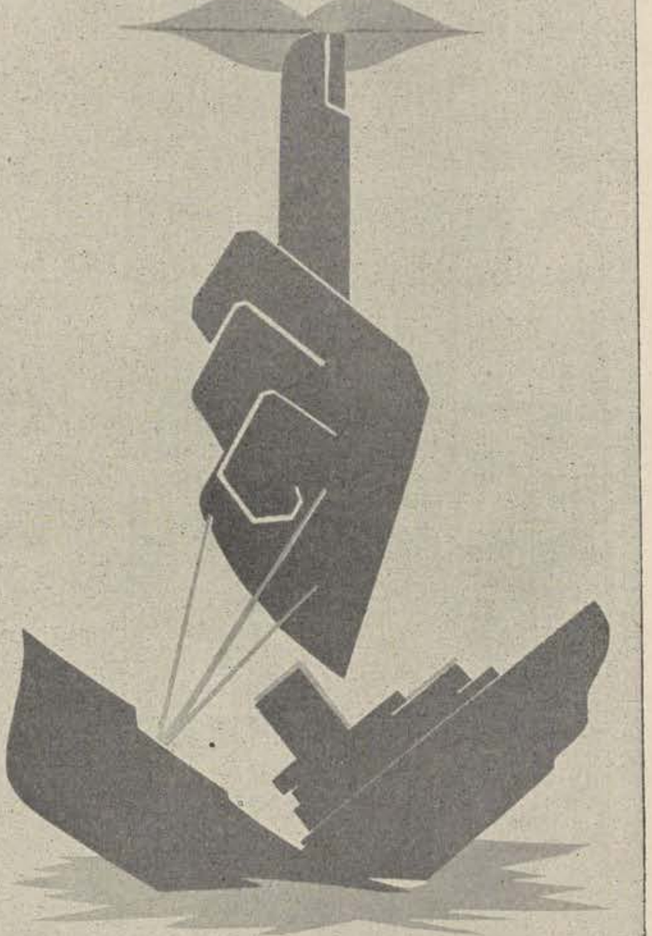
DON'T let the ink dry on the roller. Wipe it off as soon as you have finished using it. It should be washed periodically with turpentine, benzine or gasoline.

DON'T lay the roller down when not in use. Stand it on its side or hang it on a hook leaving the roller free on all sides.

DON'T leave the covers off the paints. They will dry up and lose their consistency.

DON'T use gouges and knives when the points are dull. They should be honed frequently.





CHAPTER 16

SILK SCREEN PRINTING

156. General

a. The silk screen process is a stencil technique which offers the amateur an easy method of making prints, greeting cards, posters, book covers and many other printed objects. It may be done on wood, cardboard, cloth, paper, metal, or celluloid in one or more colors. The set-up is simple. A wooden frame is used on which is stretched a piece of stencil silk or organdy. This frame is hinged to a baseboard with two pin hinges so that it may be detached with ease (fig. 177). The silk screen is blocked out except for

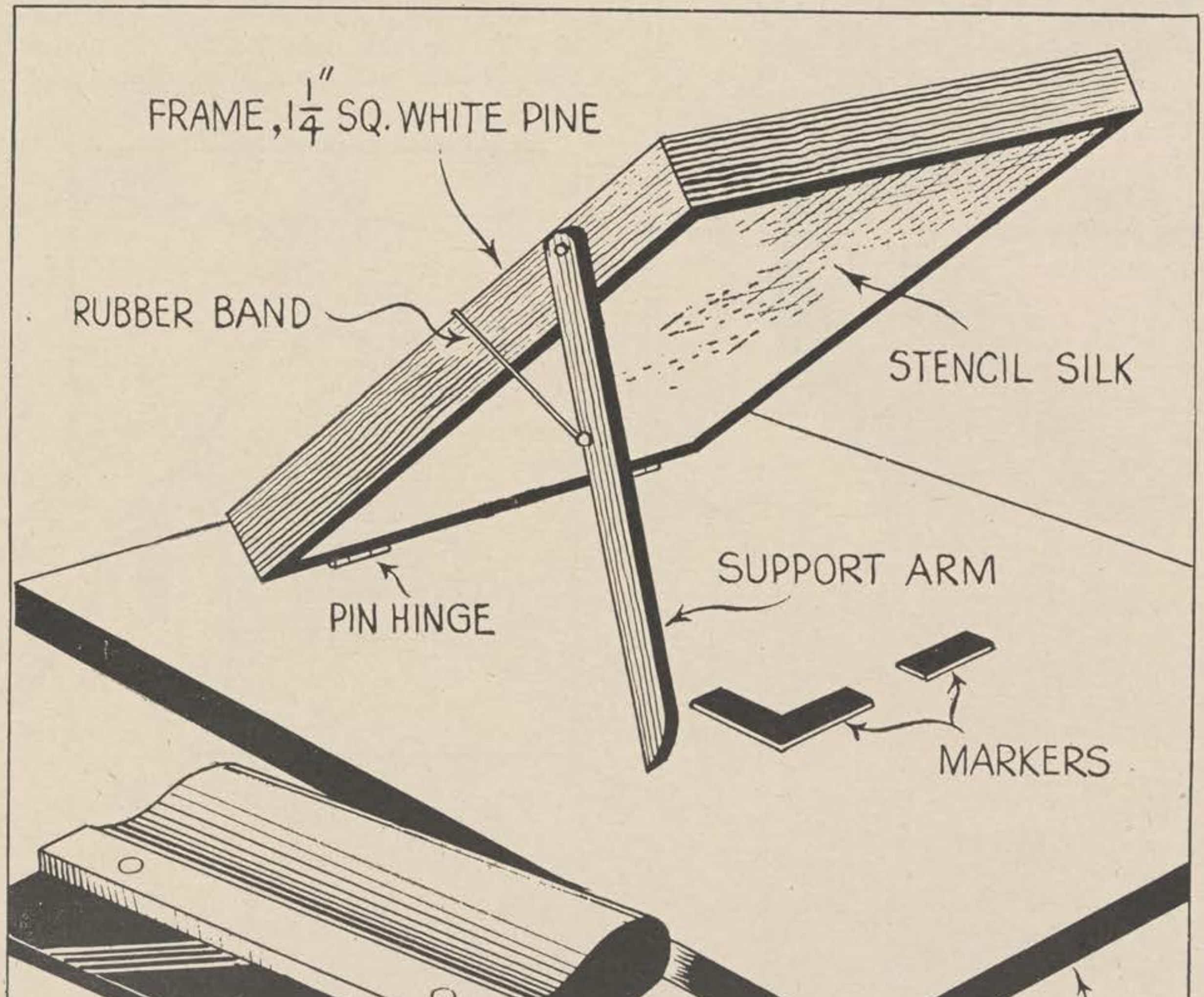

FRAME, $1\frac{1}{4}''$ SQ. WHITE PINE
RUBBER BAND
STENCIL SILK
SUPPORT ARM
PIN HINGE
MARKERS
BASE - $\frac{3}{4}''$ PLYWOOD
SQUEEGEE
③

Figure 177.

the area of the design. Printing is done by forcing paint through the open mesh of this area with a rubber squeegee.

b. The frame for work of average size is made from 1¼-inch square white pine. Its dimensions should be about 2 inches wider and 6 inches longer than the design. There are two types of frames which differ only in their provisions for stretching the silk. In the first the frame members are mitered and grooved (fig. 178). The silk is fitted to the frame by tacking it loosely in place along the outside edges of the frame. Then, four ½-inch square cleat sticks are pushed into the grooves, over the silk, stretching the silk drum-tight (fig. 179). The second type eliminates the use of grooves and cleat sticks. In this case the frame is plain with mitered corners. The silk is placed over the frame and tacked evenly in place along one side. Next, the loose edge of the silk directly opposite the tacked portion is stretched tight and fastened with one tack in the center of the frame edge. To stretch the silk evenly, it is pulled taut and tacks are inserted alternately on each side of the center one. After the two sides are finished the same procedure is applied to the ends of the frame, tacking alternately from the center until the silk is stretched smoothly and tightly over the entire frame. The surplus fabric at the corners is folded and tacked to complete the process. The screen is now ready for the design.

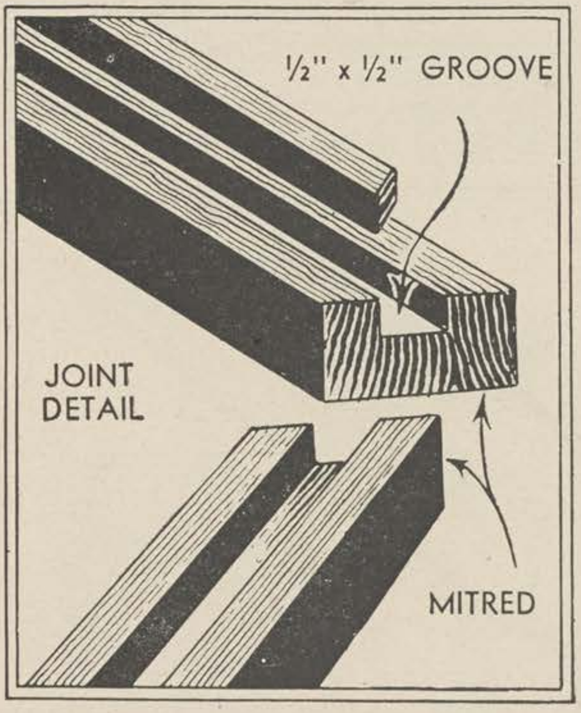


Figure 178.

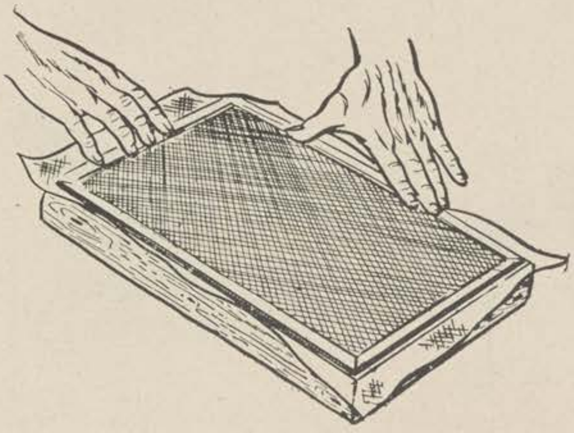


Figure 179.

157. Stencil Method

a. One of the simplest means of applying a design on the screen is the paper mask or stencil method. The picture or lettering to be reproduced must be drawn full size (fig. 180). Next a plain sheet of tracing paper, large enough to cover the screen, is coated with shellac (fig. 181). While this is drying the design is coated with wax. The thin film necessary may be rubbed on with the fingers (fig. 182). A good wax for the purpose can be made from equal parts of beeswax, kerosene, and linseed oil. The tracing paper, shellacked side up, is now placed over the waxed drawing. Run a roller over both until they adhere (fig. 183). Then, with the wax coating

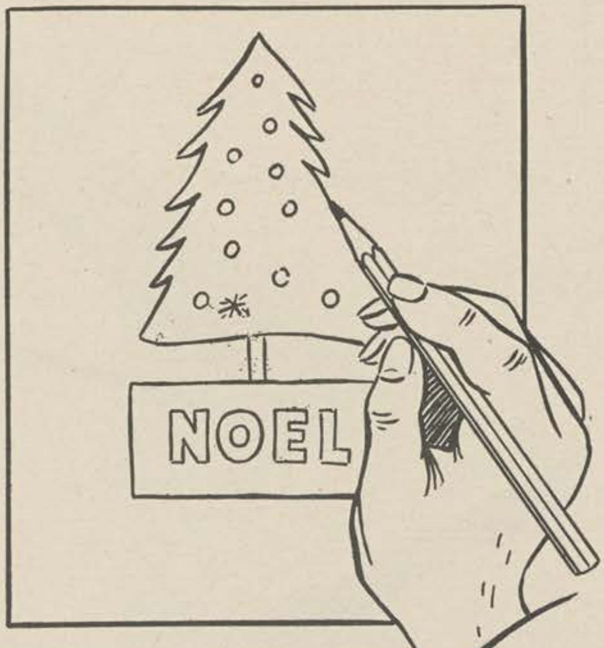


Figure 180.

holding the design in place, all parts of the design that are to print are cut out of the tracing paper with a razor blade or stencil knife and stripped away (fig. 184). After completing the cutting, place the silk screen over the design and use a thin, soft

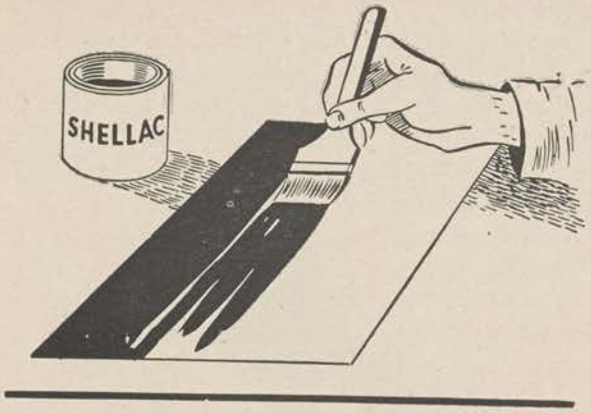


Figure 181.

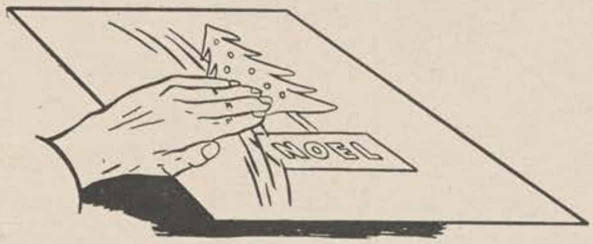


Figure 182.

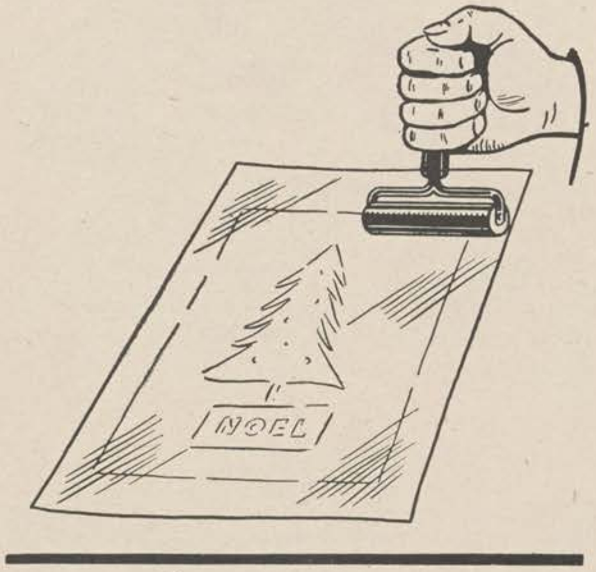


Figure 183.

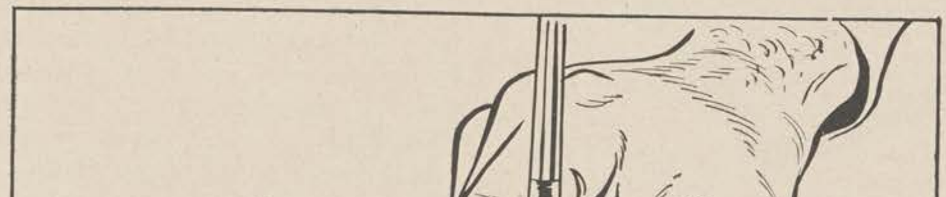


Figure 184.

pressing cloth and a medium hot iron to attach the design to the screen (fig. 185). Peel off the drawing from the bottom of the stencil, line the edges of the screen with masking tape to prevent the paint from leaking through and the screen is ready for use (fig. 186).

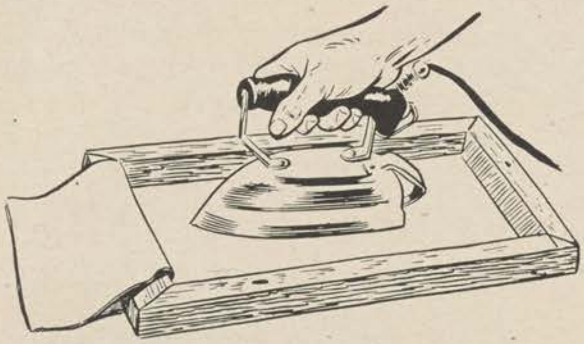


Figure 185.

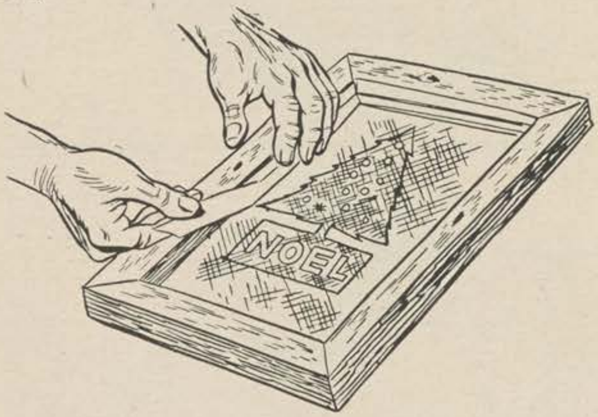


Figure 186.

b. Now that the screen is completely blocked off except for the area to be printed, place a piece of paper beneath the screen, pour in a quantity of paint, and wipe it from one end of the frame to the other with the rubber squeegee (fig. 187). A variety of paints are made specifically for silk screen use and may be obtained at art supply stores. They come in a heavy paste-like consistency and for best results should be mixed with one or more of the special media provided for this purpose. The commonest are the transparent base, extender base, retarder, and reducer; experience will soon teach you the best to use for various types of work. The illustration shows the screen in a raised position with the work in place (fig. 188).

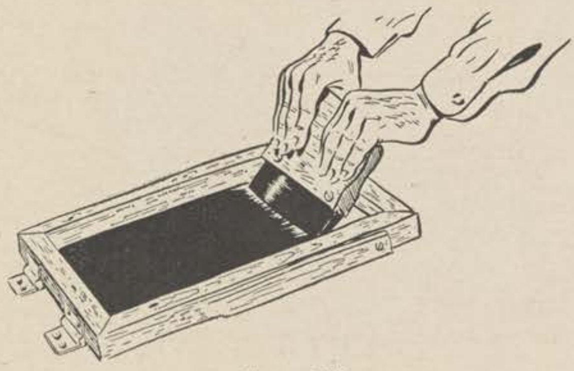


Figure 187.

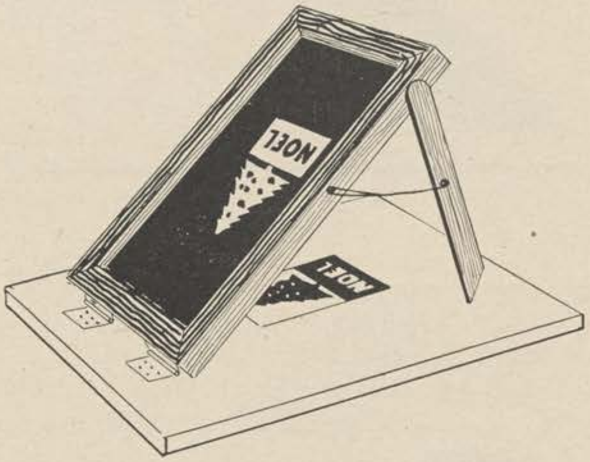


Figure 188.

c. When you have printed as many copies as desired in this manner, the screen should be cleaned with turpentine or kerosene to remove the paint, and with alcohol to dissolve the shellac which holds the stencil. In both operations, place several thicknesses of newspaper under the screen to absorb the cleaning agent. As each sheet becomes saturated discard it, leaving a fresh one exposed.

158. Stencil Method with a Prepared Film

a. A variation of the paper stencil method described above calls for the use of a prepared film made specifically for silk screen work. The film takes the place of the shellacked paper; it is easy to handle and yields more professional results.

b. One side of this film is covered with waxed paper, and the drawing should be taped securely to this side. The design is cut out with a knife, as above, care being taken not to cut through the waxed paper which holds the "islands" in place. When the parts of the design which are to print have been stripped away the film is attached to the screen in the following manner. Place the screen on top of the film and wet a small portion of it with lacquer thinner. As soon as the dampened area begins to darken, remove any surplus with a dry rag, rubbing and pressing vigorously. Since the film has a thin coating of lacquer on it, it adheres to the silk as soon as the thinner renders it tacky. Continue this operation until all parts of the film have been covered,

strip off the drawing and the waxed paper, tape the edges and print in the manner described above. When cleaning, use kerosene to remove the paint and lacquer thinner to dissolve the stencil.

159. Tusche Method

a. This method is generally favored by artists because it permits free brushwork and a variety of effects such as shading, stipple, or spatter. A finished print, done in several colors, looks very much like a gouache painting; the method may also be limited to one color and used for lettering, poster work, etc.

b. To prepare the screen, the design is traced or painted directly on the silk with a brush dipped in tusche, an oily liquid which may be purchased at any art supply house (fig. 189). It is advisable to go over the design several times to make sure that the meshes of the screen are well filled. Next make a solution of glue and water in equal quantities and add a few drops of glycerine. Pour a little of this mixture on the screen and spread it over the entire area with a straightedged piece of cardboard. When the silk is entirely covered, remove any surplus and let the glue dry.

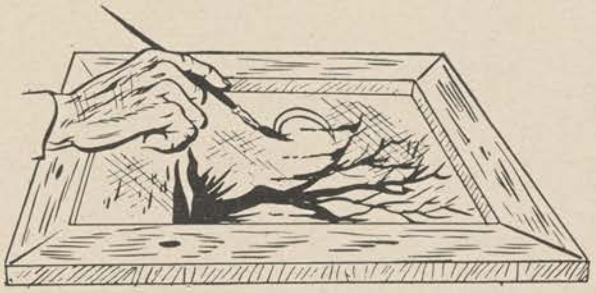


Figure 189.

c. The screen is now washed on both sides with a rag dipped in turpentine or kerosene. The tusche, having an oil base, is dissolved by the turpentine thus opening the meshes of the silk in the area covered by the design. The glue solution, which is only soluble in water, is not affected and remains on the silk as the "resist" of the stencil. If you have trouble opening some portions of the design, try brushing them gently with a small bristle brush, but be careful not to break the edges of the glue background.

d. The printing is done exactly as in the first method. When you have finished, clean the screen by washing it first in turpentine or kerosene to remove the paint, then in water to dissolve the glue (fig. 190). If handled with care, the same screen may be reused many times.

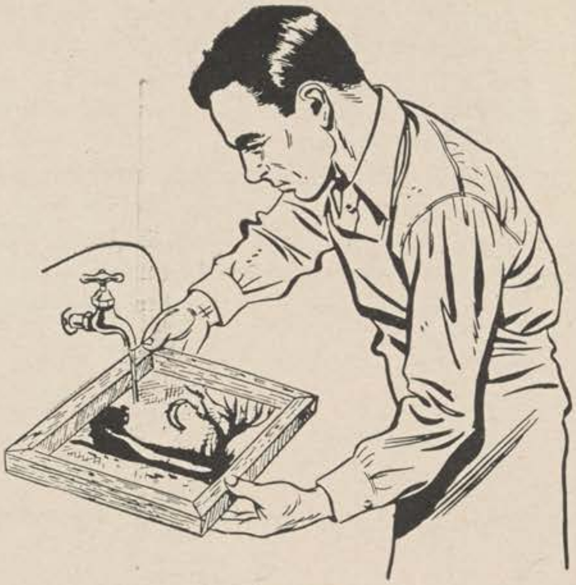


Figure 190.

e. To print in two or more colors the same procedure is followed, but a separate stencil and printing must be done for each hue. Start with a detailed drawing of your design, place it against registry guides on the baseboard of the frame and trace on the silk the parts to be done in the first color. When the stencil has been made and printed, clean the screen and trace from the master drawing the areas for the second color. Proceed in this manner until the print is finished. If two colors are widely separated in the design, it is sometimes possible to print them at the same time by placing a cardboard bridge across the frame and using two squeegees with different colors in each half of the frame (fig. 191).

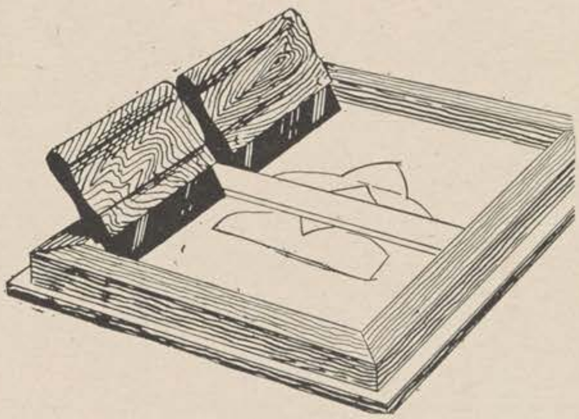


Figure 191.

160. What Not to Do

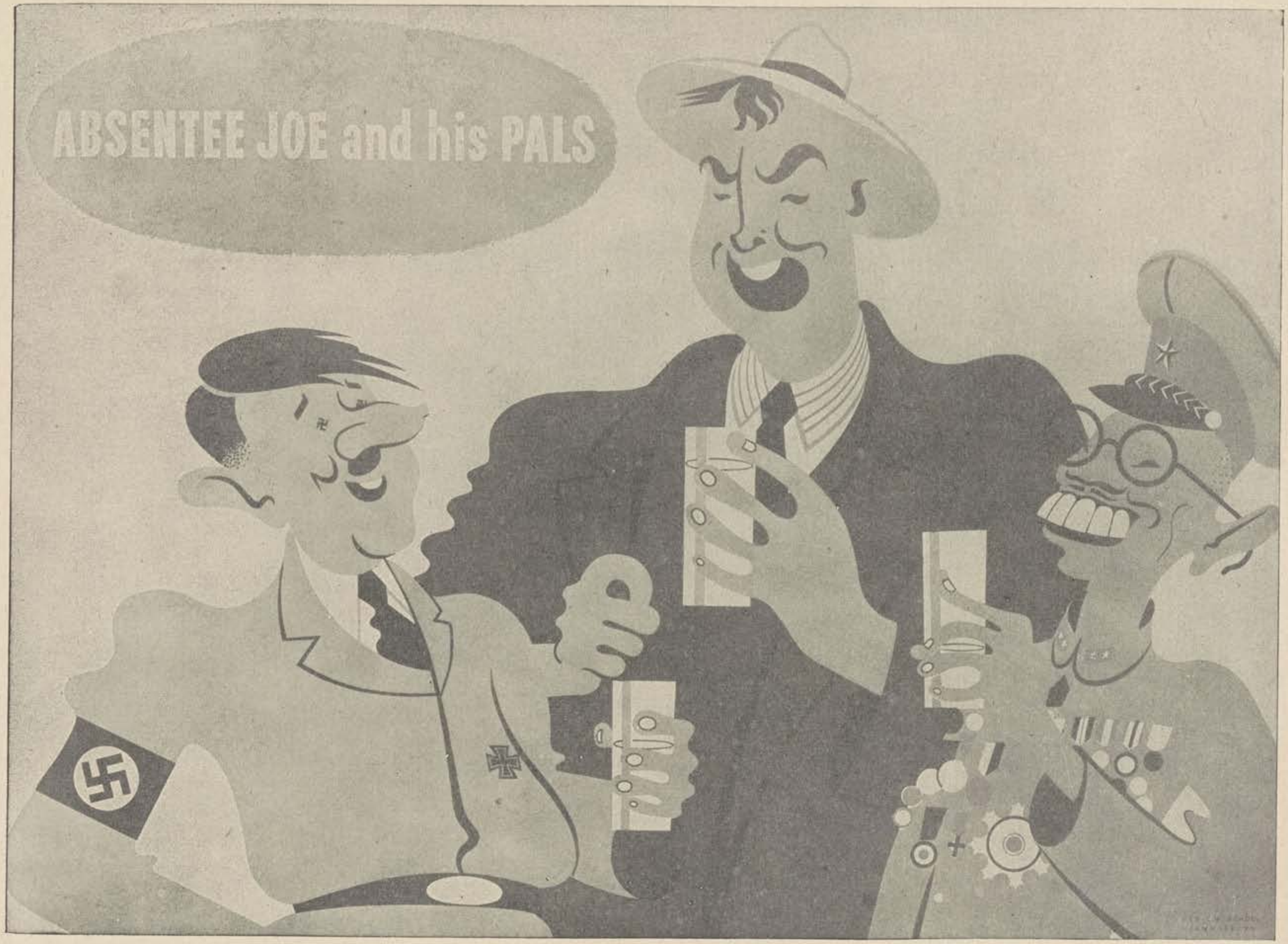
DON'T fail to clean the screen immediately with turpentine after using oil colors. Apply this with a soft rag after placing absorbent paper under the screen. Each top sheet should be removed when it becomes saturated. The same applies to water colors except that the screen is washed with a soft rag and water.

DON'T put the squeegee away until you have cleaned it. Apply turpentine on a soft rag and rub off all paint. Keep the blade sharp at all times by rubbing it on an emery cloth or fine sandpaper, holding it on a 90° angle.

DON'T dry the squeegee in a warm place or in the sun. Set it in a cool place where an air current will get at it.

DON'T leave paints, tusche, etc., open when not in use. Too much contact with the air spoils them.

DON'T forget to wash the brushes thoroughly when the job is completed. Dry paint spoils them.


ABSENTEE JOE and his PALS

CHAPTER 17

POSTER DESIGN AND LETTERING

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161. General

Anyone who can write can learn to letter. No unusual talent is needed. Those who invest sufficient time in learning the five fundamental steps presented in this chapter will master a craft that is highly enjoyable as a hobby and rich in opportunities. It is much easier to become an expert letterer if, at the very outset, you concentrate on knowing the tools and how to use them. Hold your pen properly, make your strokes correctly and you'll be off to a good start.

162. Tools

a. The two most popular style pens and their use are style "B" to meet the demand for single stroke round Gothics and style "C" developed to duplicate the work of the Italian handcut read pens used in designing the graceful roman and italic alphabets.

b. The best pens are equipped with triple reservoir ink retainers. The ink is fed to the auxiliary reservoir above the tip as it is used. This also acts as an automatic check to prevent blots by spreading the ink evenly over the entire surface, thus insuring perfect strokes at any speed.

c. The best way to handle any tool is to become familiar with its limitations as well as its good points. Choose the size and style pen for each of the two principal alphabets. Don't try to form letters with the wrong pen or brush. You'll only waste time and effort. Every letterer's kit should include two or more red sable show-card brushes, sizes 10, 12 and 14, to take care of letters too large for the pens. The use of a **T**-square, ruler, and compass in drawing some letters is necessary. The **T**-square or ruler is always recommended for guide lines. Letters that are ruled look mechanical and are a poor substitute for hand work.

163. Inks Are Important

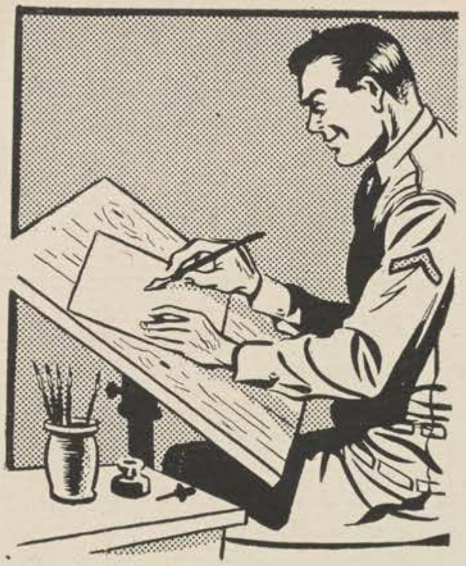
Without the proper inks it is difficult to get the best results from any pen. Thin, watery inks or heavy, gummy, sticky masses never produce good results. Most standard brands of water-proof black drawing ink can be used for lettering purposes. When good inks are not available, opaque colors will be found more practical for show-card work than the transparent colored inks. Show-card colors prepared for brush use will work satisfactorily in pens when thinned to a free-flowing consistency with this solution: water, 9 ounces; alcohol, 1 ounce; mucilage, 1 ounce; and a few drops of glycerine. Show-card colors must be kept well stirred. They should flow easily from your pen. Don't prepare large quantities. They work best when freshly mixed. When using white or opaque show-card colors or opaque inks, brush pens occasionally with a wet tooth-brush to prevent the feeder from clogging. Crusted pens should be scraped or brushed clean before using.

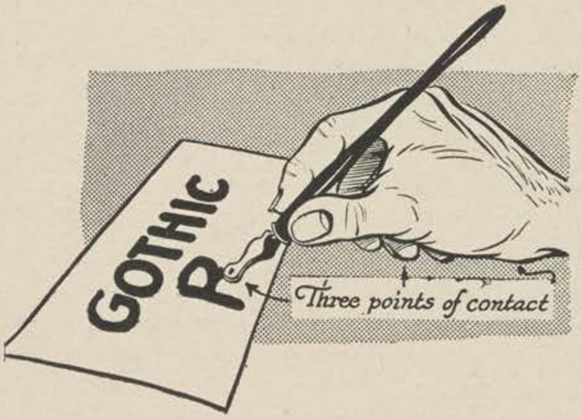
164. Fundamental Strokes

Before you think about making your first stroke, get into the proper position. Do not lean on your pen or workboard. Sit erect. Hold your pen or brush correctly. This is extremely important (fig. 192). When you know how to hold your pen you are ready to practice your first strokes. The fundamental strokes in lettering are: down stroke, that is, toward you; horizontal stroke, left to right in most cases. But you will soon become adept with the right-to-left stroke which must be used frequently. Practice the exercises (fig. 193). Don't contract your fingers. Your arm and hand should be relaxed and comfortable, yet firm enough to give you clean, straight lines. You cannot do these exercises too often. They are the fundamental movements in all show-card work. Practice them again. You will be surprised at the progress you can make.

165. Pen Lettering a Gothic Alphabet

a. With the strokes of the above exercise, you can form any of the letters in the Gothic alphabet illustrated (fig. 194). Use a pen with a round, turned-up point which will make a line of uniform width regardless of the direction of the stroke. Start with the alphabet at the top. Practice the individual letters between guide lines an inch apart. Then try combining capitals and small, or lower case, letters.





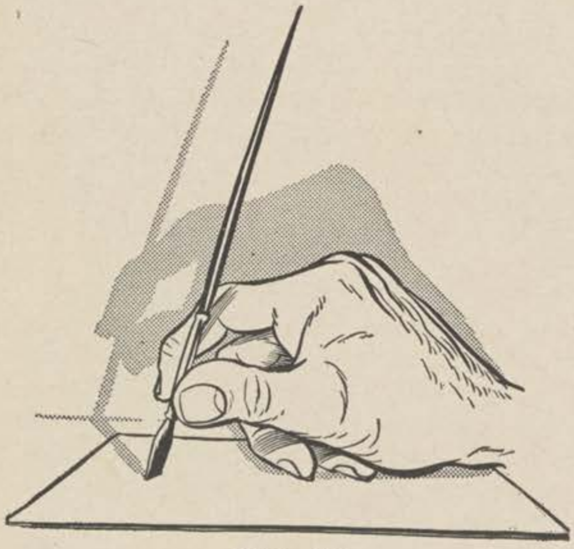


Figure 192.

To do this, draw a third guide line about half way between the first two and use it to establish the height of the lower case letters.

b. The character of this alphabet can be changed by adding seriphs (the small cross bars or tails) and by altering the slant and proportions of the individual letters as shown in the same illustration. Slanted letters are known as *italics* and are frequently used for emphasis or for variety.

166. Brush Lettering a Roman Alphabet

a. Roman is one of our oldest and most widely used alphabets. As roman letters became standardized and were adapted to printing, the most noticeable change was the spur, or seriph, added to the terminals, increasing their legibility and beauty.

b. The single-stroke roman illustrated can be done with a pen, but for instructional purposes brush lettering is indicated (figs. 195 and 196). Note that the square-tipped brush is manipulated at different angles to produce strokes of varying width. Generally, each letter is started at the top, and the brush is drawn toward you by the action of the fingers alone. The correct motion requires practice and skill, but is well worth mastering. An alternate method of producing heavy letters is to outline them lightly in pencil, then ink them in with either pen or brush.

c. Now practice words and group them as they would appear on a show card. Round out the circular letters. Never crowd a word unnecessarily. When you can produce these letters with a brush, try them proportionately smaller with a pen. Then make a few simple posters with this alphabet. Pictures may be original designs or illustrations clipped from magazines. If you use the latter, add a few touches of color to take away the "stuck on" effect. Rubber cement, if available, is best for pasting.

167. Spacing

a. Good spacing is more important than good lettering. Many beginners who can make a fair alphabet have trouble with letter spacing. If you will make an effort to equalize the space between the letters while learning their construction, you will avoid much trouble later. Using a yard-stick to measure the distance between letters seldom produces good results. The experienced letterer achieves correct spacing by eye. These simple suggestions may help. Different letters and dividing areas seldom occupy equal spaces. Words read better when the spaces between the letters are less than half the spaces occupied by the letters themselves.

b. For convenience, divide letters into three classes: regular, E-H-I-M-N and U; irregular, A-F-J-K-L-P-R-T-V-W-X-Y and Z; circular, B-C-D-G-O-Q and S (also & and ?). Ugly gaps between irregular letters can be avoided by fitting them closer together according to their shapes. Circular and irregular letters can be cut into the spaces between

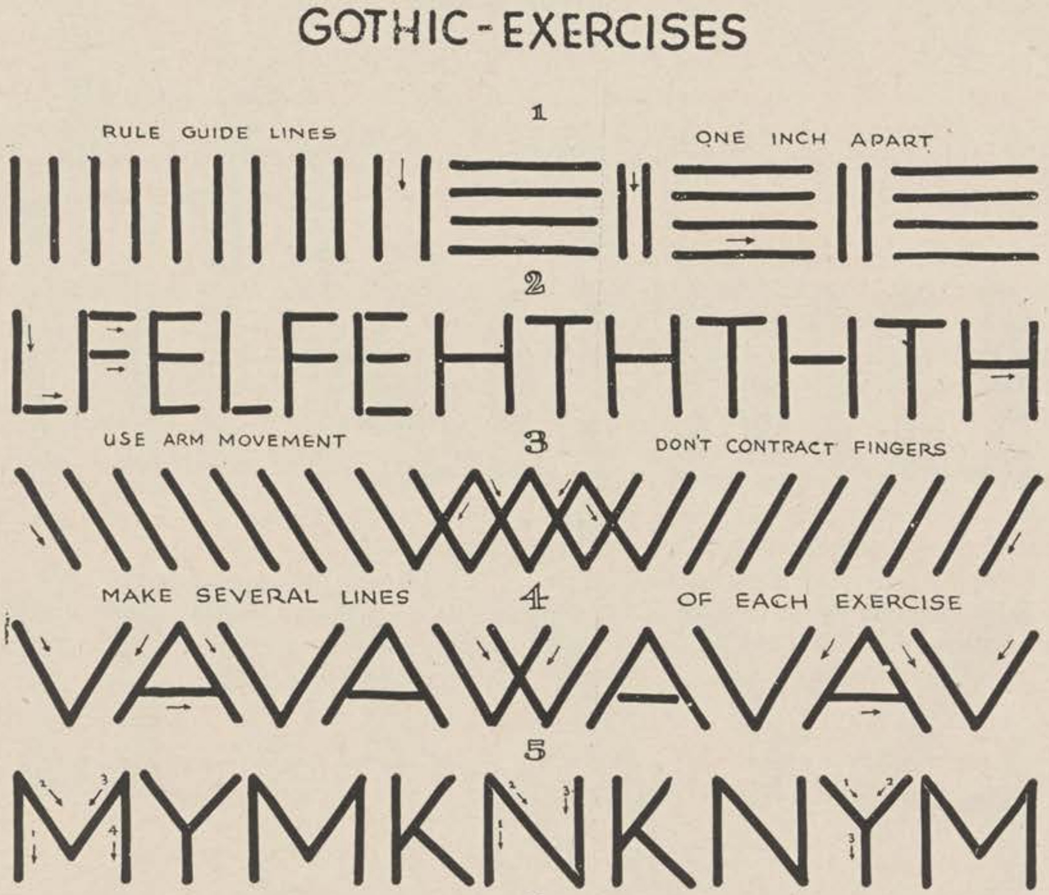

GOTHIC-EXERCISES
1
RULE GUIDE LINES
ONE INCH APART
2
LFELFEHTHTHTH
USE ARM MOVEMENT
3
DON'T CONTRACT FINGERS
MAKE SEVERAL LINES
4
OF EACH EXERCISE
VAVAWAVAV
5
MYMKNKNYM
6
GIVE SPECIAL ATTENTION
7
TO THE DOWN STROKES
8
GDBPRDBPRGD
9
QQQQSSS88

Figure 193.

them and the spaces adjoining their curved or irregular sides. The amount thus taken from the dividing areas helps compensate for the extra space created by the form of the letter.

c. Letters can also be grouped as narrow, B-E-F-I-J-L-P-S-T-Y and ?; normal, C-D-G-H-K-O-Q-R-U-V-X-Z and &; and wide, A-M-N and W. Compressing a wide letter to fit into a space suiting a narrow or normal letter causes it to appear blacker than the rest of the letters. Stretching a narrow letter into the space of a wide one makes it appear lighter than the rest.

d. The chart illustrates how different combinations should be spaced (fig. 197). The full space as it appears between two straight letters is shown by the stippled block marked "A." Block "B" shows the dividing area between two circular letters. Note how the letters cut into it. Block "C" shows how the area appears between a circular and a straight letter. Block "D" shows the area between an irregular and a circular letter. (Note that the extra space at the top and bottom of a circular letter approximately equals what the letter cuts out of the dividing area. The irregular letter offers a similar example that requires closer fitting to compensate for the shape.) The examples shown here illustrate how the different combinations work out in use. In the word, "Spacing," letters of the same size and shape are spaced both ways. Note how legibility and unity are destroyed by mechanical arrangement. The yard-stick spacing of "Minatown" shows what happens when letters are all fitted into like areas with the same distance between them. Note how spotty the different letters look, especially M, A and W, and how unrelated the irregular letters appear. By making the M, N, A, O and W wider and fitting the irregular letters optically an even tone is obtained.

168. Sample Alphabets

In addition to the alphabets already shown, three popular variations are:

a. Single-stroke Letters (fig. 198). The customary types for mechanical drawing. An ordinary ball-point pen works best for these letters, and a speedball pen for heavier lettering.

b. Formal Script (fig. 199). A favorite letter with a hundred uses. It is very flexible, has many variations.

c. Speedball Script (fig. 200). A letter that attracts attention and has a smooth flowing line. It can be drawn very easily. A timesaver in newspaper and general lay-out work.

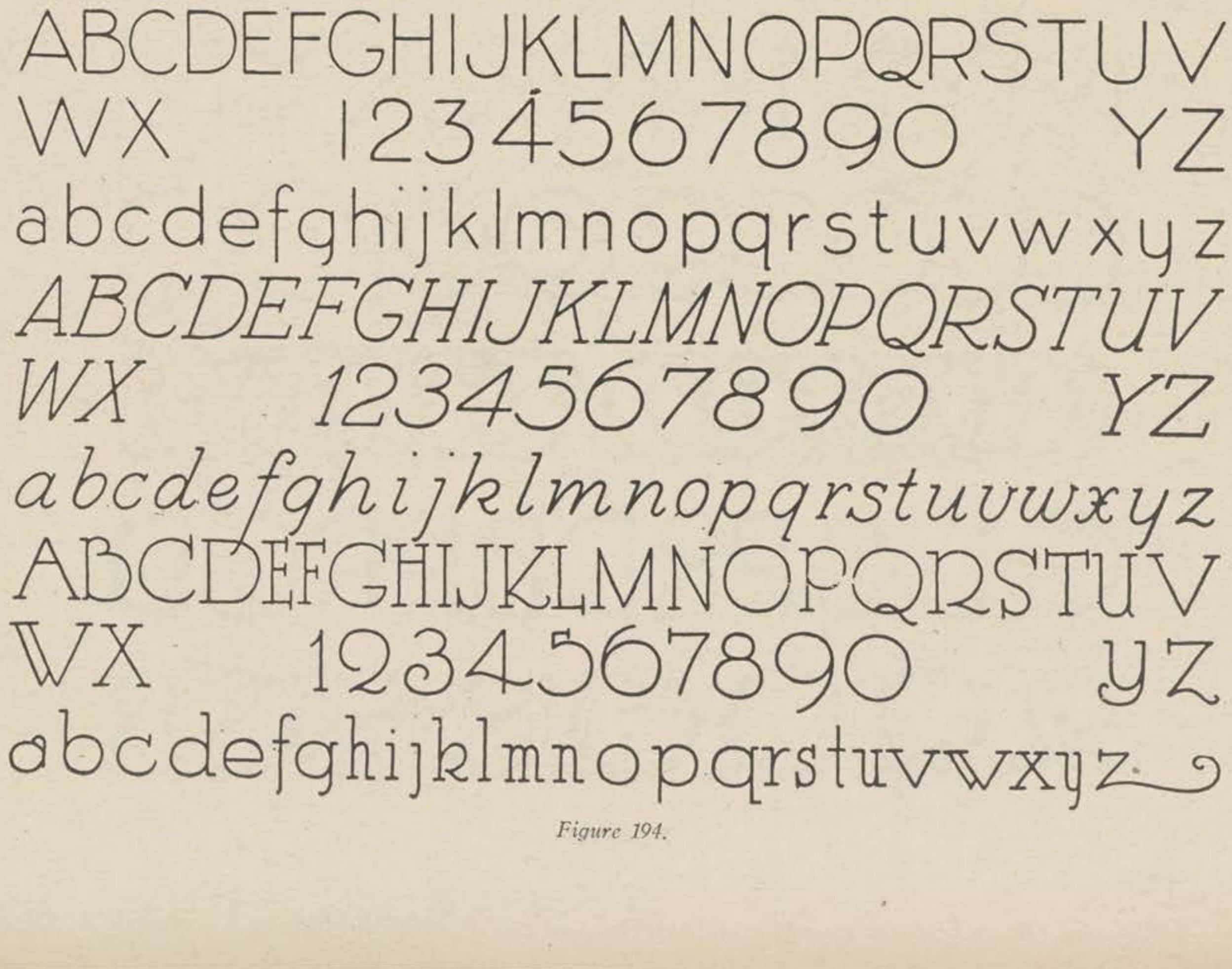


Figure 194.

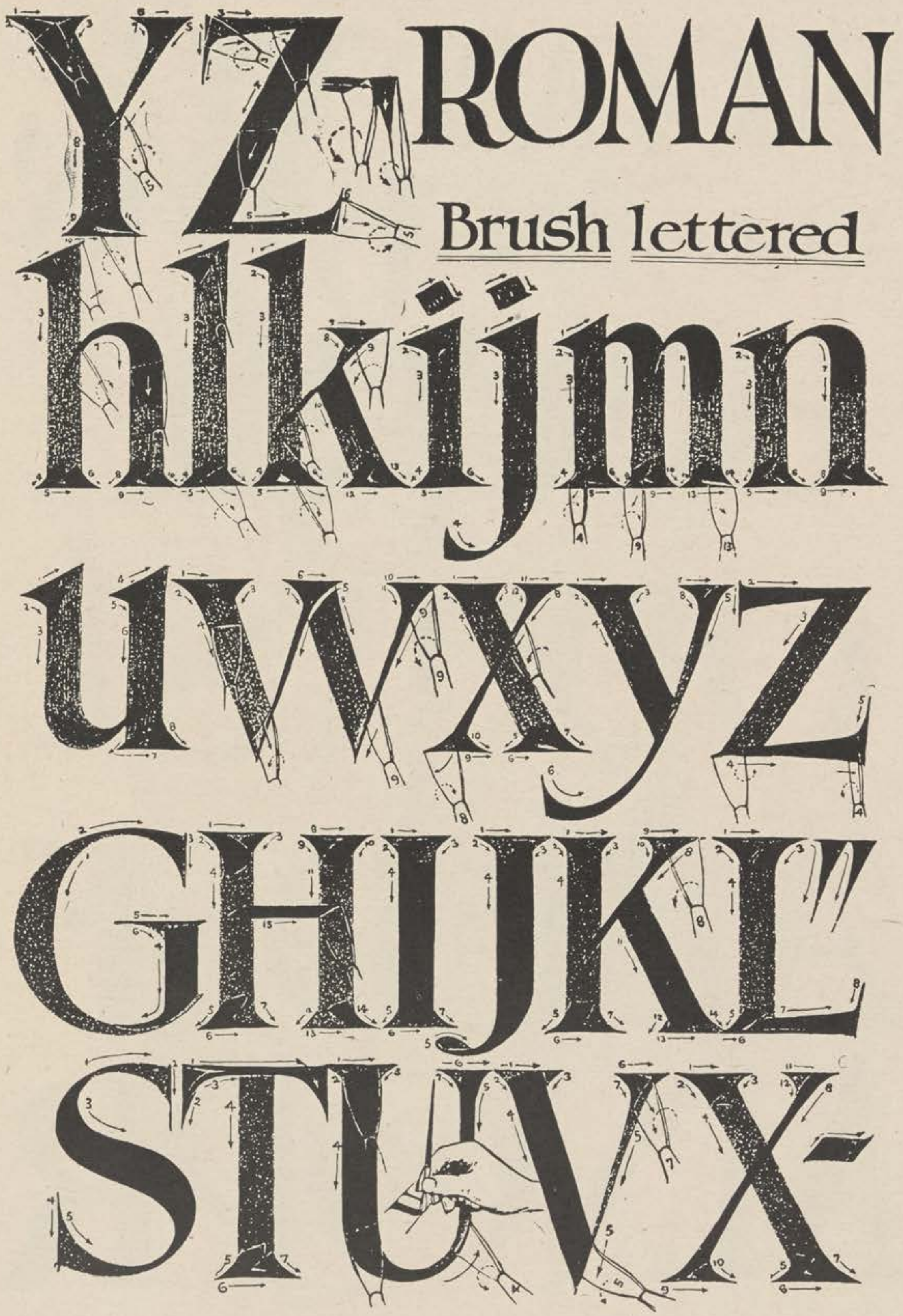

YZ ROMAN
Brush lettered
hlkijmn
uwxyz
GHIJKL
STUVX

Figure 195.

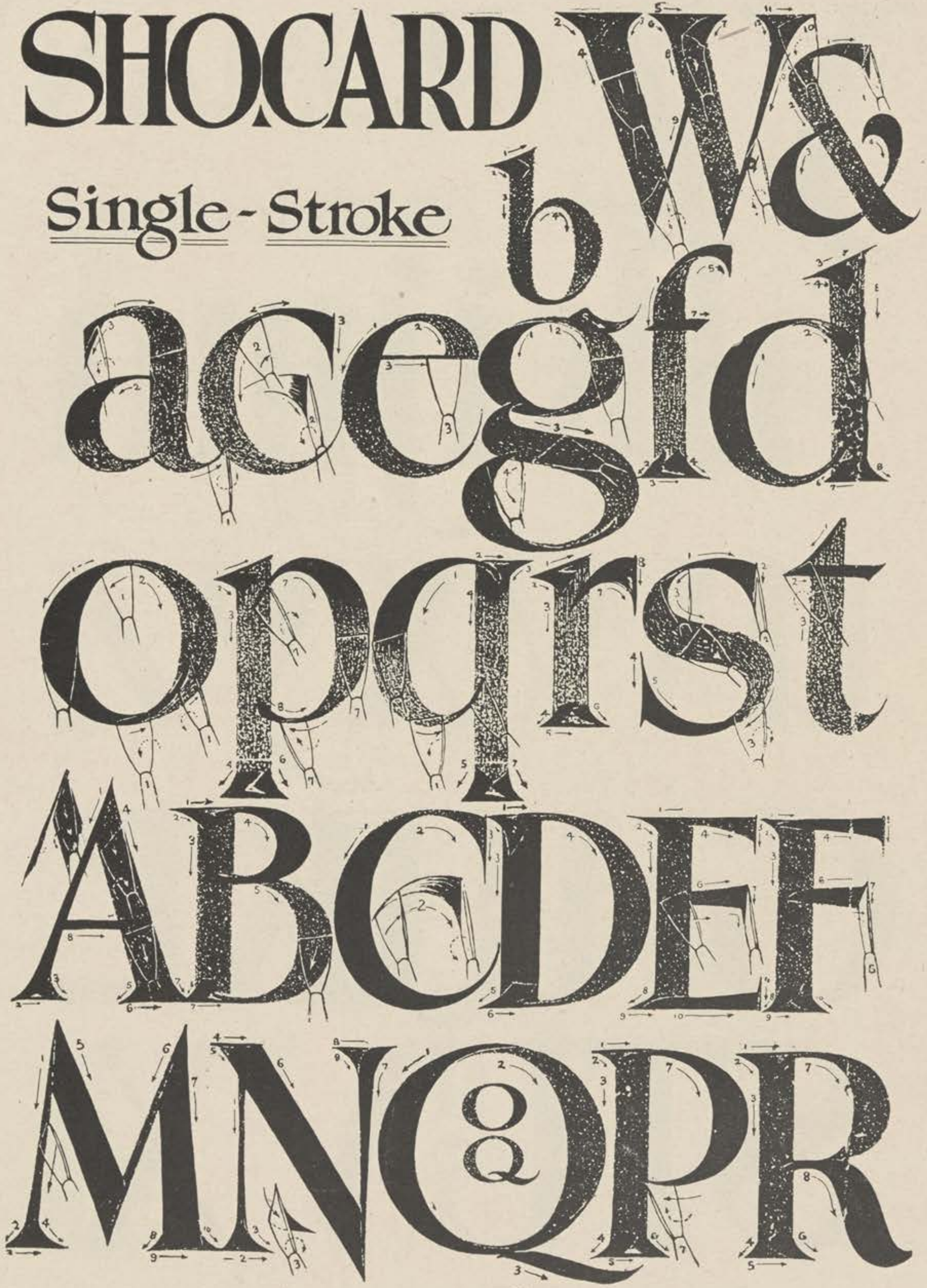
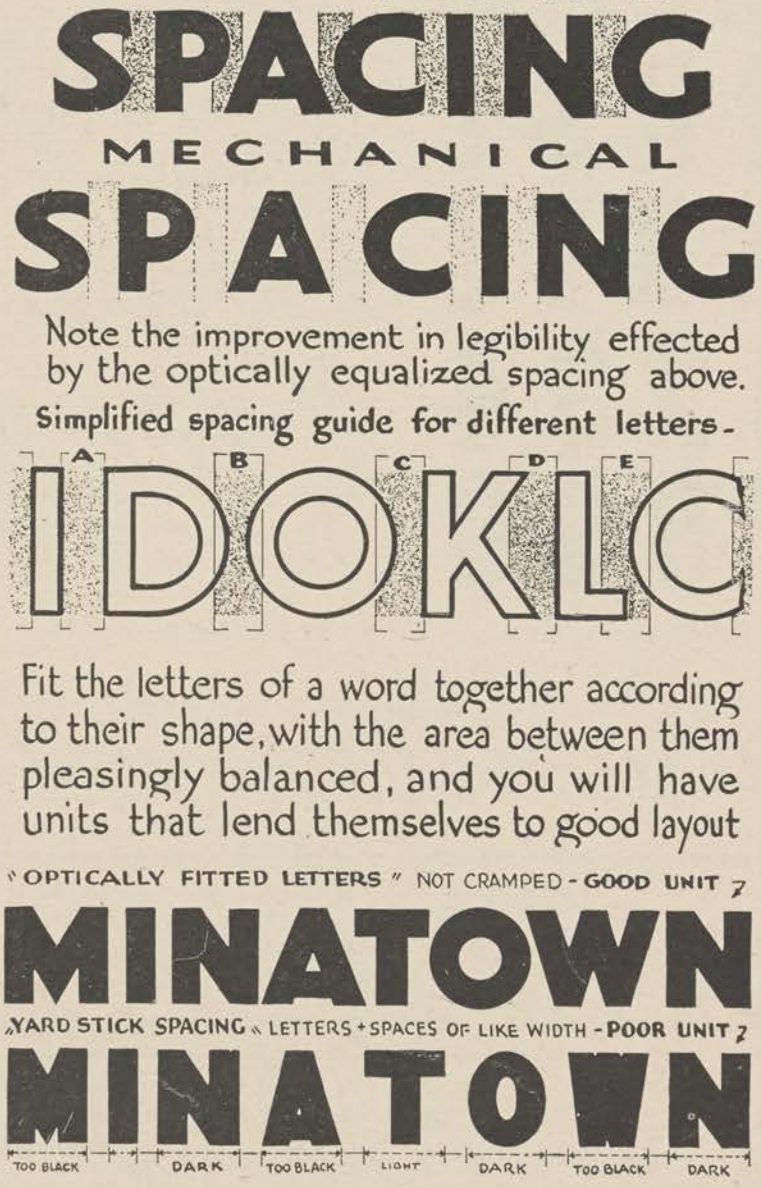

SHOCARD
Single-Stroke
W&
b
acegfd
opqrst
ABCDEF
MNOQPR

Figure 196.


OPTICAL
SPACING
MECHANICAL
SPACING

Note the improvement in legibility effected by the optically equalized spacing above.

Simplified spacing guide for different letters-

A
B
C
D
E
IDOKLC

Fit the letters of a word together according to their shape, with the area between them pleasingly balanced, and you will have units that lend themselves to good layout

"OPTICALLY FITTED LETTERS" NOT CRAMPED - GOOD UNIT
MINATOWN
"YARD STICK SPACING" LETTERS + SPACES OF LIKE WIDTH - POOR UNIT
MINATOWN
TOO BLACK
DARK
TOO BLACK
LIGHT
DARK
TOO BLACK
DARK

Figure 197.

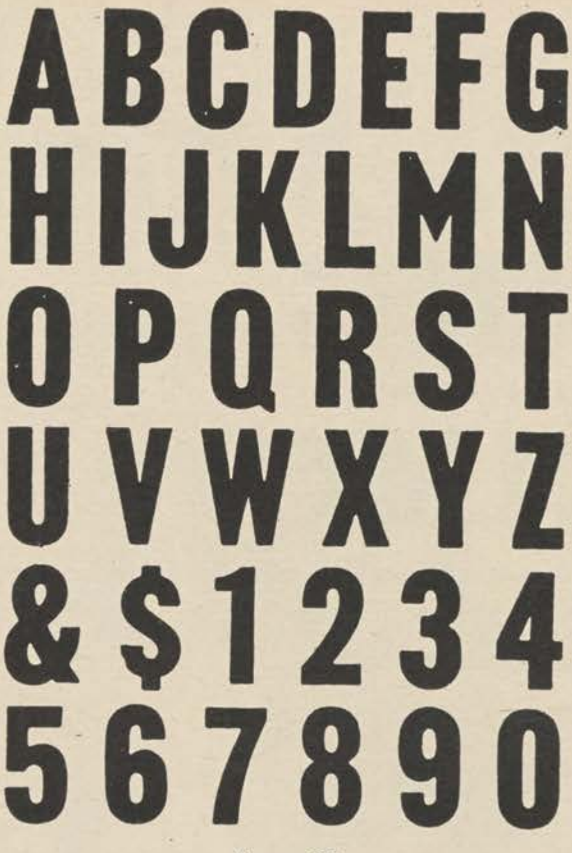


Figure 198.

169. Lay-out

a. The lay-out is the arrangement of words and illustrations on the page. It is the first step in making a sign, a poster or an advertising drawing. On its quality depends the effectiveness of the finished work.

b. In making a lay-out, the artist examines and analyzes the problem before him. He may decide first what illustrations are needed; there will probably be a main one which will dominate the arrangement and there may be others, such as diagrams, charts, directional arrows, decorative borders, etc. At the same time he assembles all the copy required and determines what shall be the main headline. Other text may include subheadlines, descriptive paragraphs, dates, places, etc.

c. With all the elements of his finished work before him, the artist visualizes both words and illustrations as shapes of varying texture and weight. They may suggest to him at once a logical and effective combination, or he may try them in many different arrangements before reaching a final solution. This can be done either through numerous trial sketches or by use of a dummy on which cut-outs are moved around. The essential point is to see every element as a mass and to bind these masses together in an integral design.

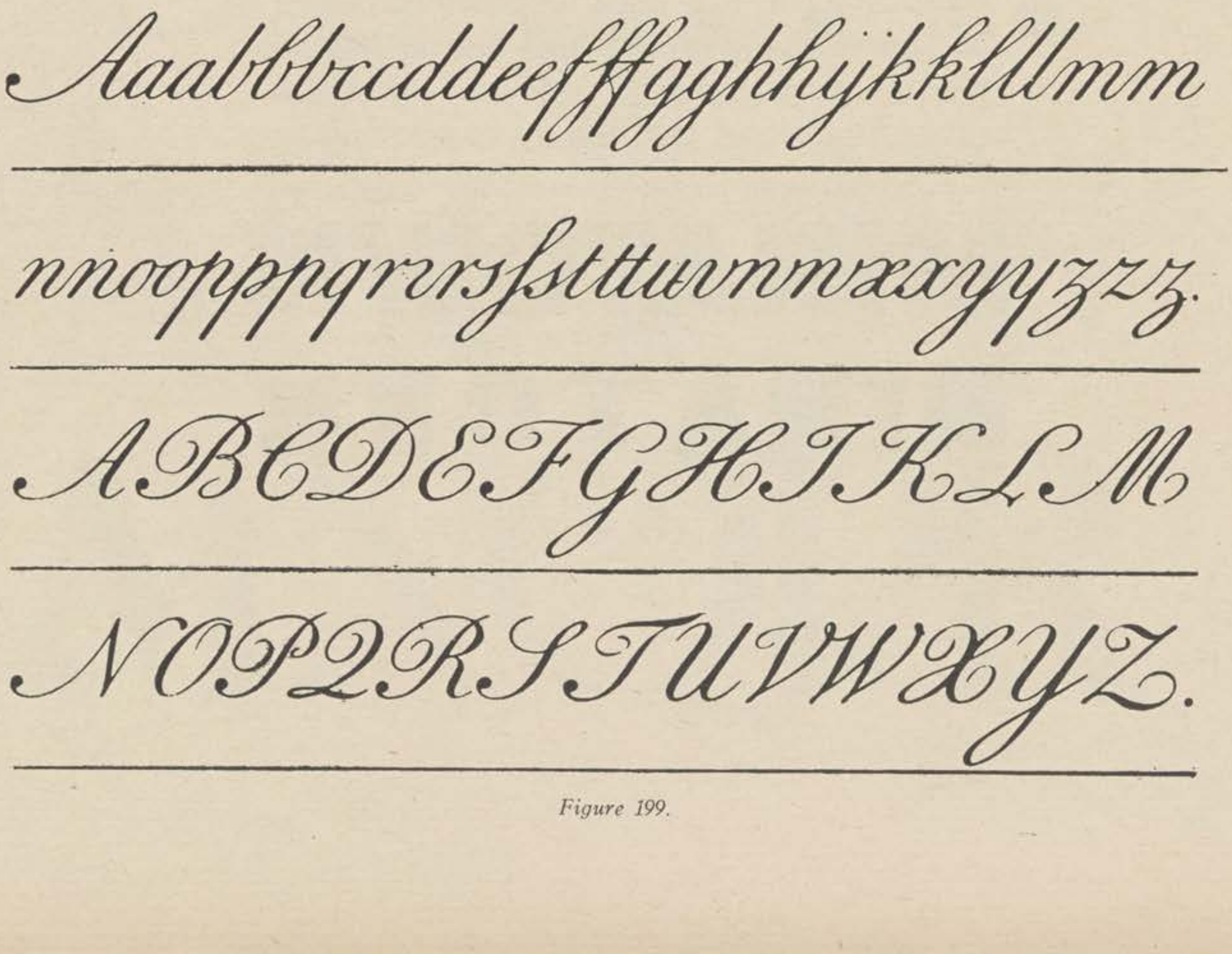


Figure 199.

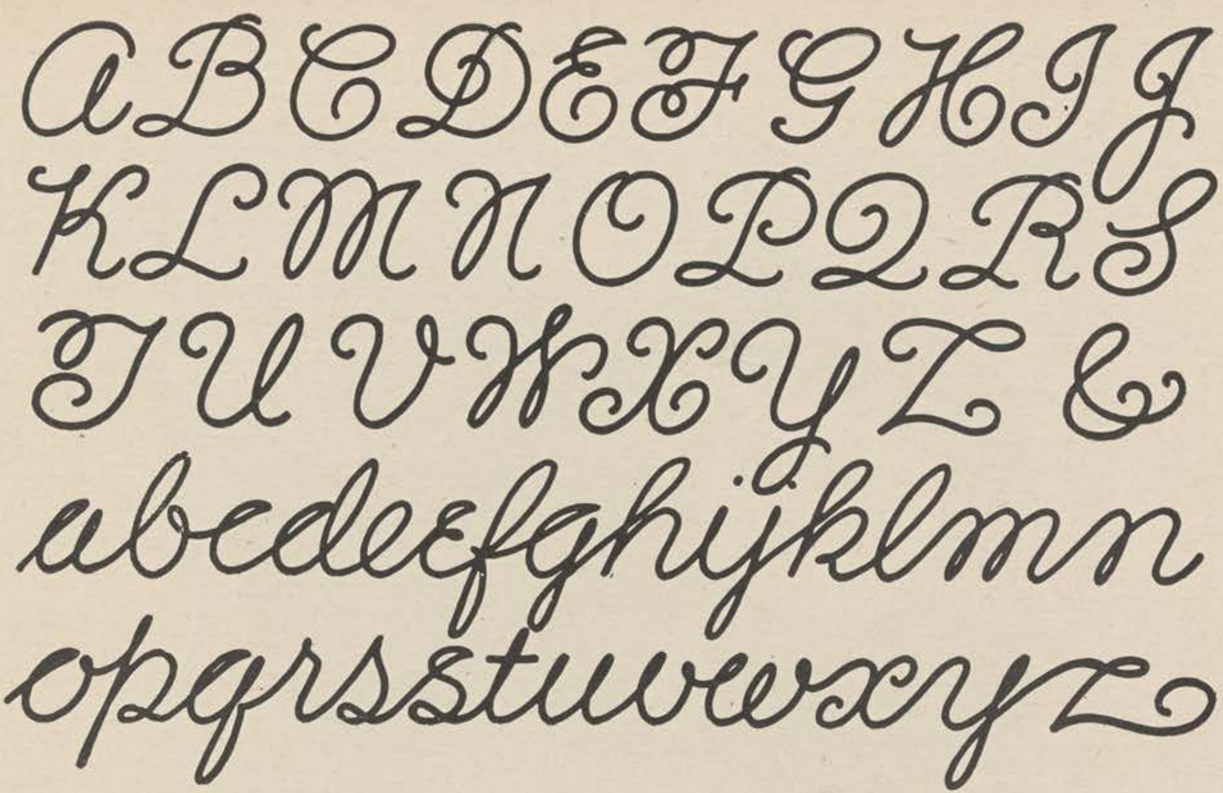


Figure 200.

170. Posters

a. In general, the poster combines lettering with painting or drawing and is laid out to put across a message with the utmost economy of means. It must be striking enough to catch the attention at first glance and simple enough to tell its story quickly and concisely. There is no formula for producing successful posters; it is largely a matter of the imagination and originality of the artist. As a rule, you will find that the subject to be treated will suggest the most effective approach. The grim message that loose talk costs lives is appropriately embodied in the ghost-like shape and the choice of red and black for colors (fig. 201). This poster is also a good example of economy in presentation, as no words are necessary to explain the illustration.

b. "Be Alert" demands a different kind of treatment and is appropriately conveyed in cartoon form (fig. 202). "He Wouldn't Dig" employs obvious symbolism to tell its story (fig. 203). "Waste Means Want" is a more difficult subject to dramatize; symbolism has also been used effectively here (fig. 204).

c. The lay-out of a poster can be endlessly varied. The main problem is to make the letters and illustration work together as a single design. The above illustrations show a few of the many ways in which this can be accomplished. In "He Wouldn't Dig" and "Waste Means Want" the words and design overlap and have been treated as a single pattern.

d. In "Be Alert," the same unity is obtained largely through color. The black letters are balanced against the black patch of ground on which the figures stand. These three posters are more or less symmetrical in lay-out, while the fourth uses a diagonal design which is deliberately placed off center to emphasize the irregular shapes.

e. Poster lay-out is one of the most fascinating problems which the artist can undertake and is a constant challenge to his imagination and ingenuity.

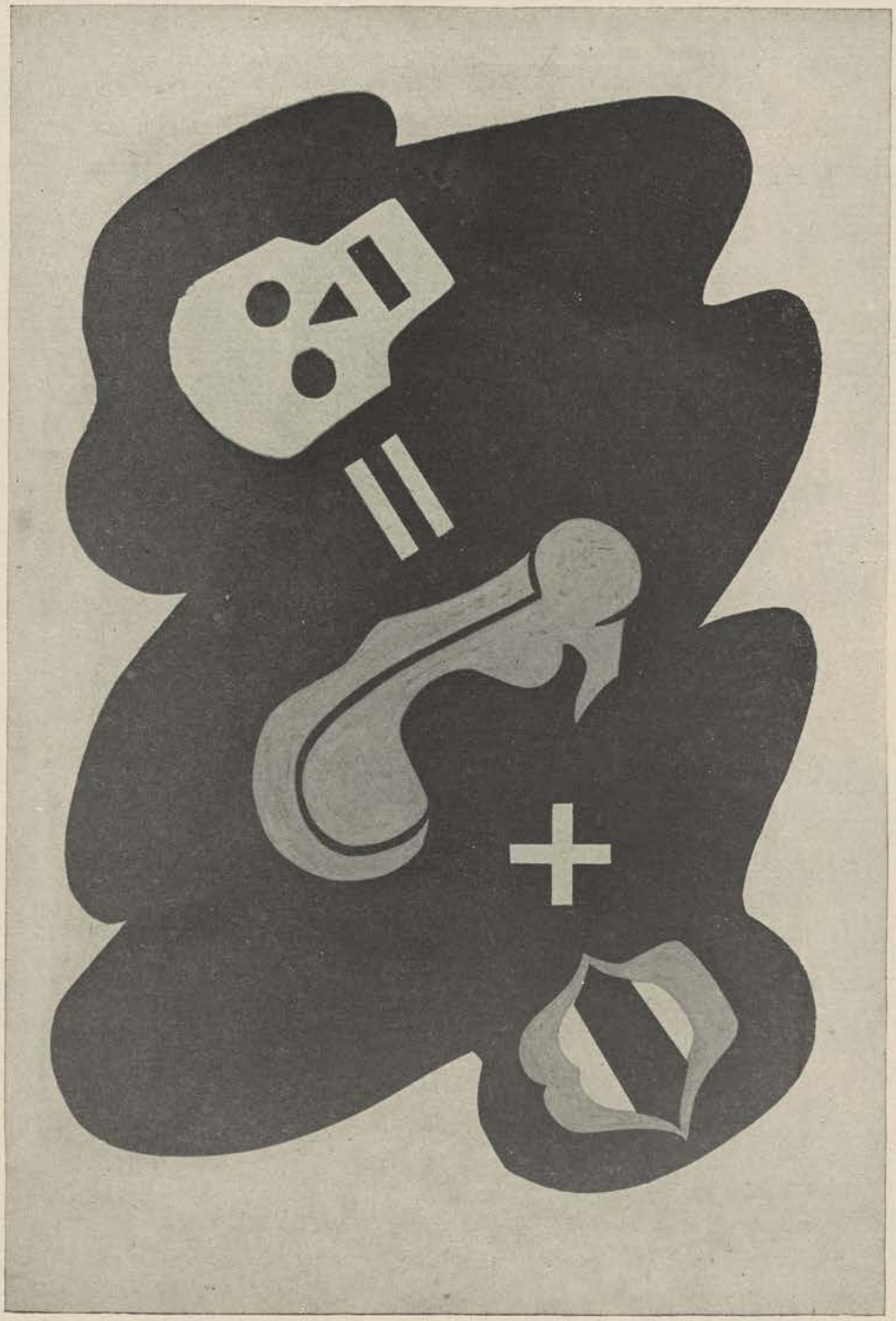


Figure 201.

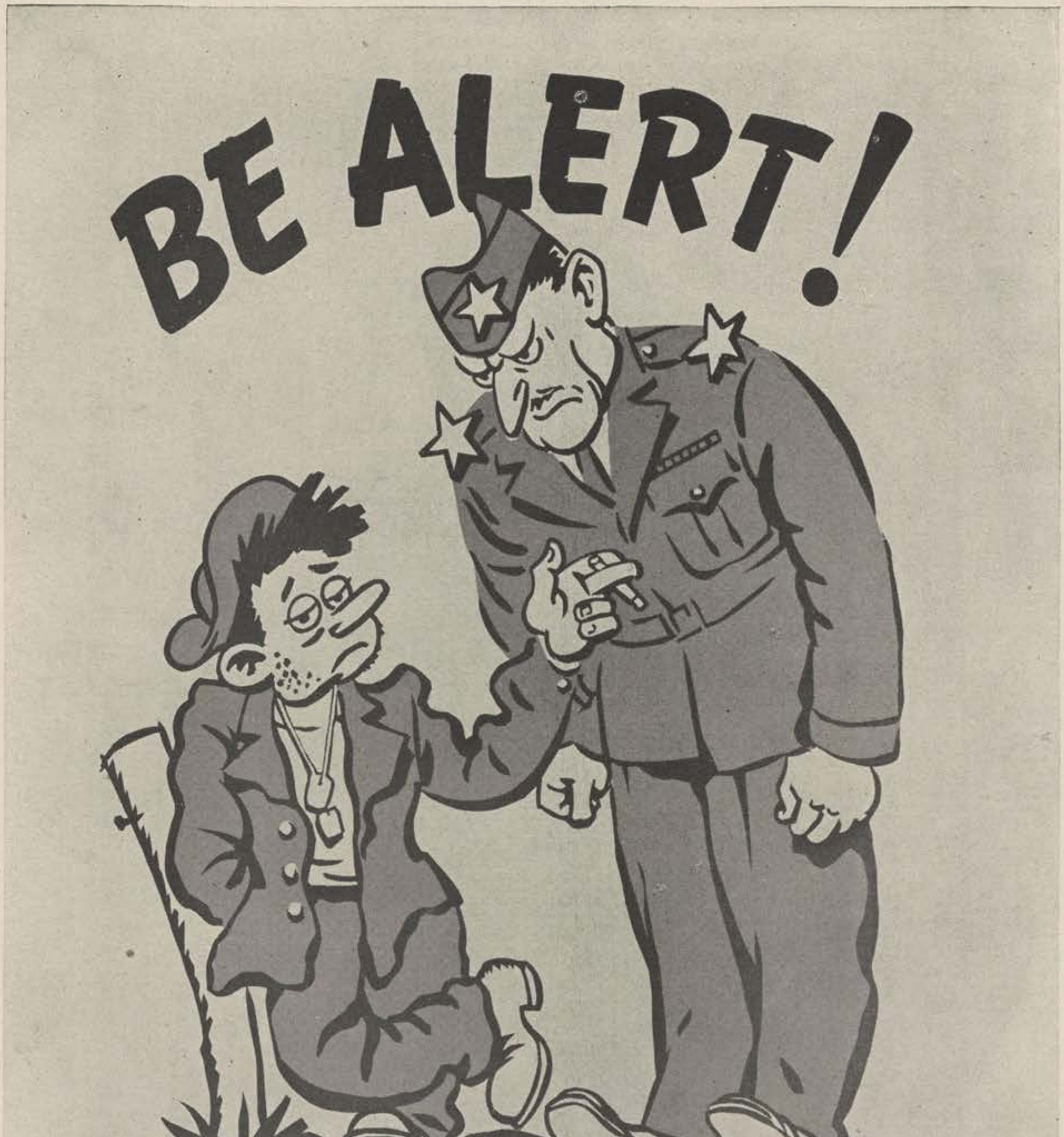


Figure 202.

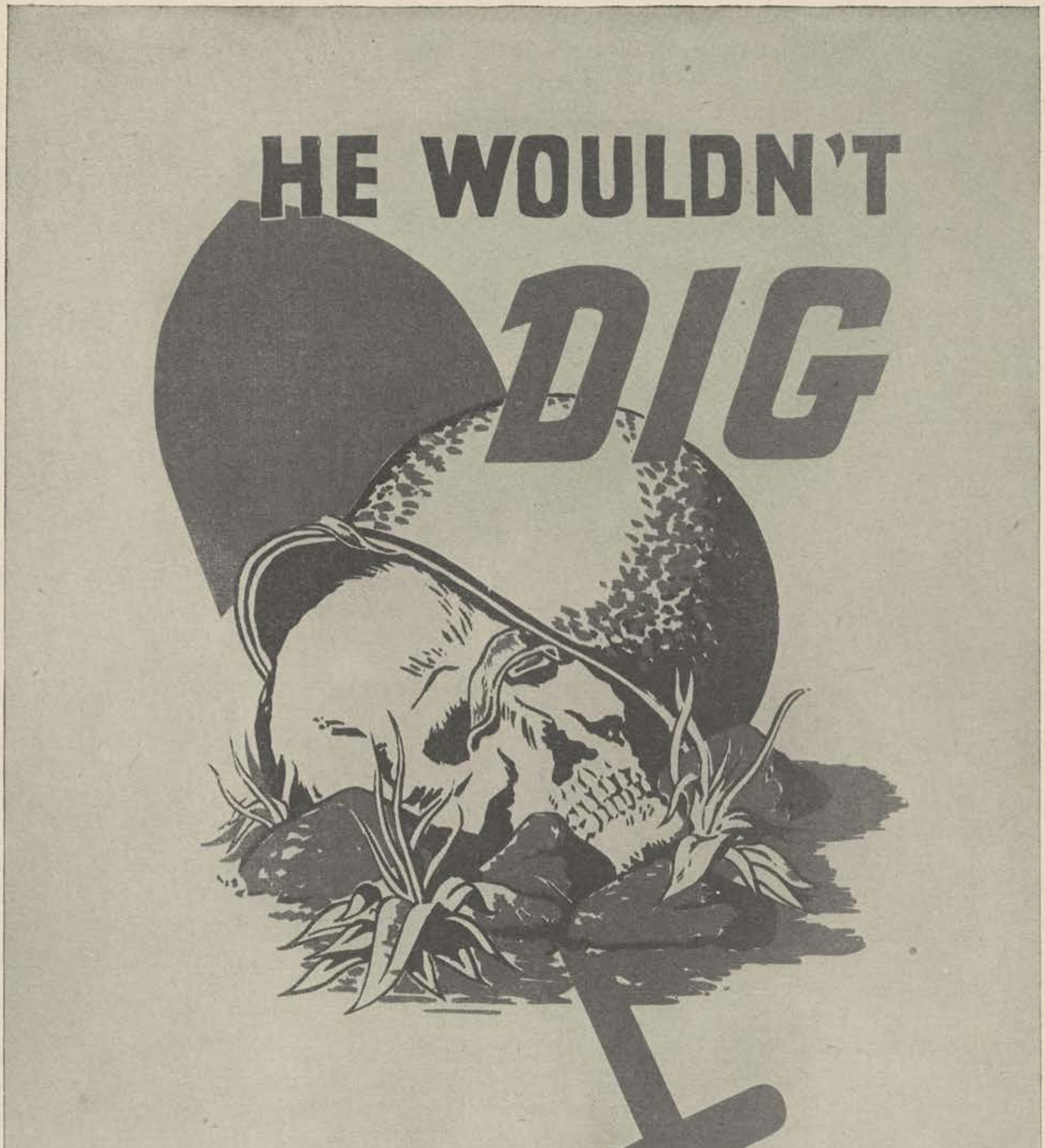

HE WOULDN'T
DIG

Figure 203.

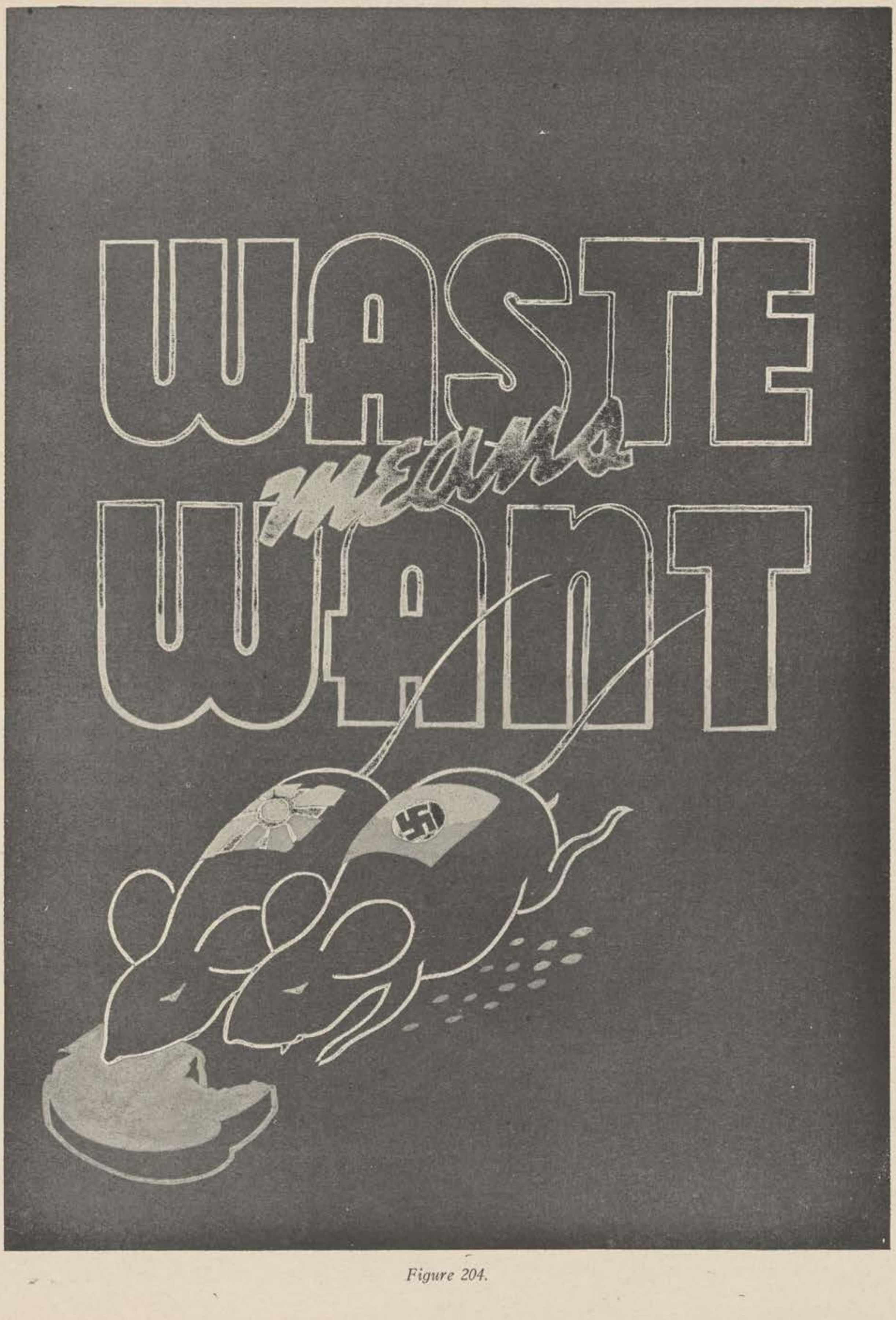

WASTE
means
WANT

Figure 204.

CHAPTER 18

CARTOONING

171. General

Anyone who has ever doodled with a pencil is a potential cartoonist. With practice and some knowledge of how to construct figures and faces, you can create caricatures and cartoons which will amuse everyone. The basic principles, outlined below, are remarkably simple. If you can follow them, you will have laid the foundation for a lot of fun. And if you have the imagination to apply them to the people and the scenes around you in an individual way, a little different from that of anyone else, there is a good chance that your work will find a ready outlet in posters, camp papers or Army magazines. In any case, cartooning is an entertaining pastime in itself and a good starting point for the more serious forms of drawing and painting which you may wish to take up later.

172. How to Build Forms

a. All you need to start is a soft pencil and some paper. The simplest of all plans is based on the use of forms that are already known to you, and which you can easily draw. From these simple forms, we build other forms, which without some constructive plan would be too complicated for the beginner. For example, the top of the head is nearer to a ball in shape than anything else. So we start with a ball (fig. 205). Then we add the shapes we want. You can't draw the final outlines at first, and that is why most people give up drawing as too tough. But you can use a simple procedure of construction which will take you where you want to go and make drawing easy.

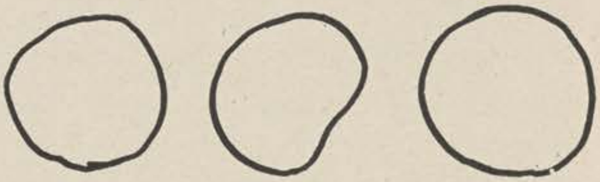
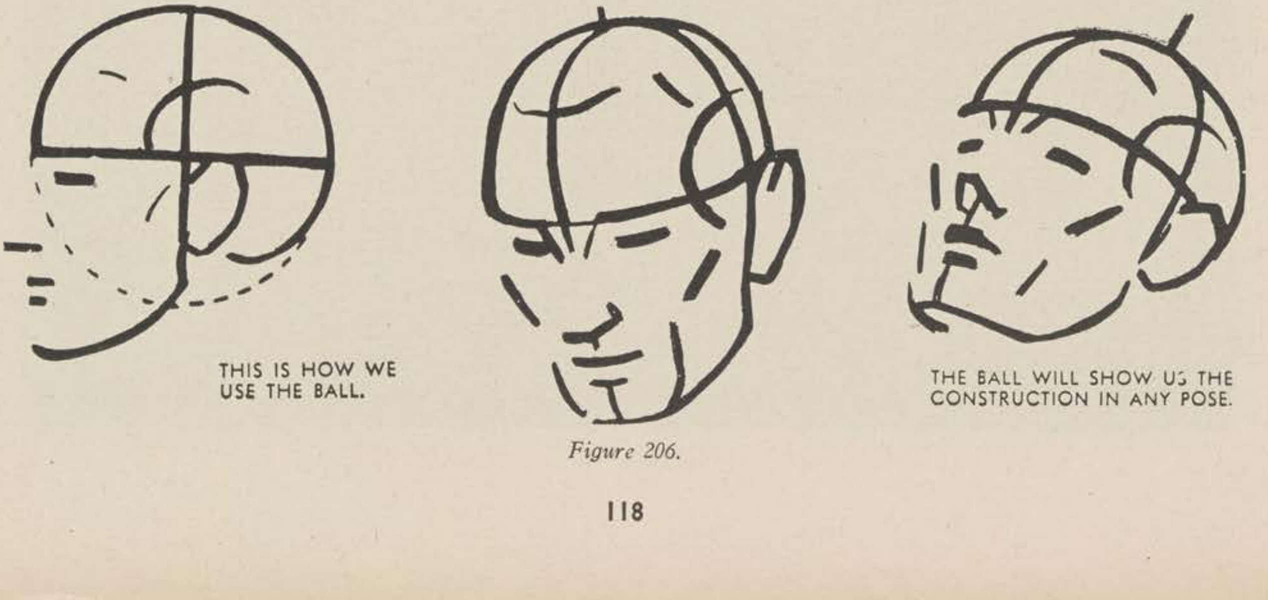


Figure 205.

b. The rule is this: by building preliminary shapes and developing the outlines on them, we know where to draw our real lines. Every form is like some simpler form, with this or that variation added on. The simplest forms we know are the sphere, the cube and the egg. If we say, "Draw a line," you don't know what we mean. But if we say, "Draw a ball, cube or egg, a cylinder, block, or cone," you get a perfect image. As you proceed to build all sorts of shapes out of simpler ones you'll be amazed at how accurate and solid the resulting drawings will appear (fig. 206). When the construction lines are erased very few will be able to guess how it was done.

c. Get a pencil and paper. Draw lightly all you see printed lightly in the following sketches. Take



THIS IS HOW WE USE THE BALL.

THE BALL WILL SHOW US THE CONSTRUCTION IN ANY POSE.

Figure 206.

one stage at a time, on one drawing, until the last stage; then finish with strong lines over the light ones, the lines we have printed darkly. That is all there is to learn.

173. Start with a Ball

a. You don't even have to draw a perfect ball. A lopsided one will do. Do the best you can even if it looks more like a potato (fig. 207). These are "happen heads" (fig. 208).

b. If your drawings are not too good, don't get discouraged. You'll soon get the idea. When you begin to sense the form you'll have the whole works. Then you can polish up. Draw a lot of balls. Draw them in any position and shape you wish. The line from the top to the bottom is the middle line of the face. The horizontal line, which looks like the equator, is the eyeline and also locates the ear (fig. 209). Soon you'll be able to create any character you wish, tall, short, fat, skinny, jolly, sad, gawky, but just now concentrate for a while on the heads. They're important.

174. How About Expression

a. For the laugh, squeeze the cheek high against the eye, tilt eyes at outside corners. Fold under the eyes. Pull corners of mouth well up. Show upper teeth only (fig. 210).

b. Really furious. Pop the eyes. Distend nostrils. Show teeth. Pull cheek forward and down. Open corners of mouth wide and pull down (fig. 211).

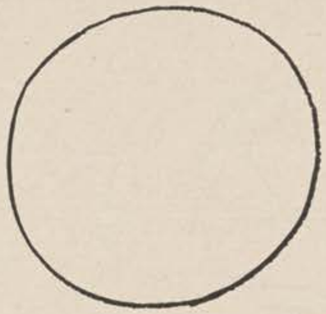
c. Blocky shapes always combine well with round ones. It's a good idea to make the final lines angular even around curves. There's no limit to the variety (fig. 212).

d. Construct the head from the cranium down, always. There's no other satisfactory way. You can see by now that the position of the ball determines the pose of the head. The pieces you build on determine the character.

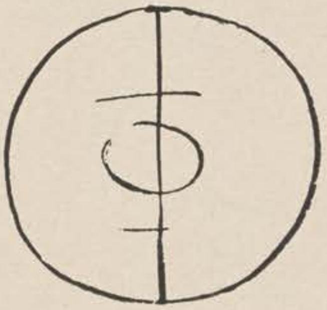
175. Start on the Figure

a. Put them into action at once. There will always be movement of the parts. Draw these carefully and become familiar with the movement of each part (fig. 213).

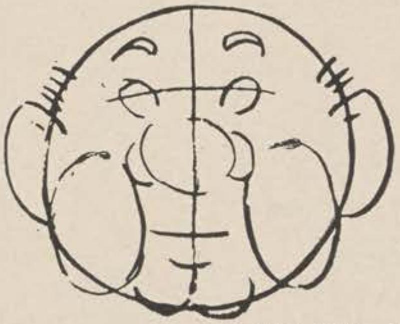
b. Choose a pose from a magazine, photograph, or from life, or maybe you can find an old doll, or toy animal or something that will give you movement of the limbs. Draw the framework of the approximate action. Build on each part as you see it. Note whether lines at joints curve up or down, how the part is tipped toward or away from you.



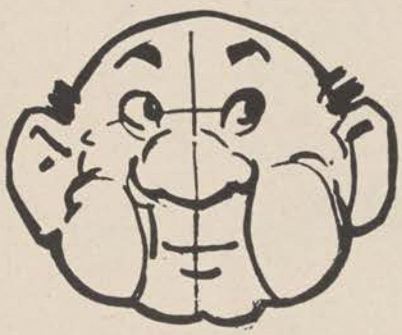
PRETTY GOOD!



DIVIDE THE BALL ANY WAY YOU WISH. ADD NOSE IN MIDDLE. ADD CROSSLINES ABOVE AND BELOW THE NOSE.

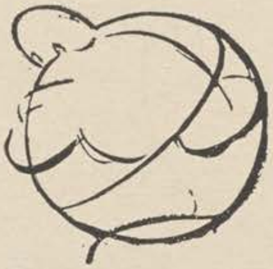


ADD EYES, EARS, MOUTH, BROWS, ETC. ATTACH A COUPLE OF BALLS FOR CHEEKS. DRAW LIGHTLY. THEN SELECT THE LINES YOU WANT TO KEEP IN. DRAW IN HEAVILY.

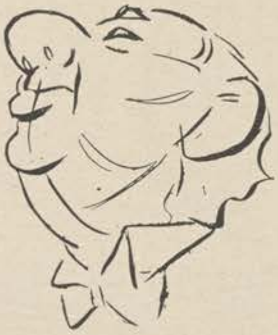


THIS IS "BUILDING."

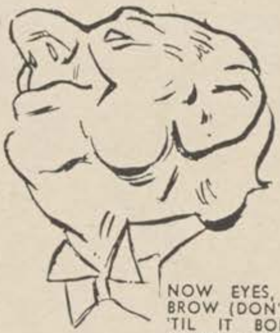
Figure 207.



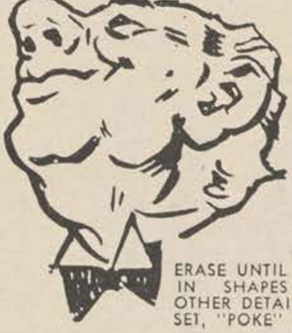
DRAW THE BALL. TILT IT AT ANY ANGLE. CONTROL THE TYPE OF FACE BY SELECTING SHAPES THAT GIVE YOU THE EFFECT YOU WANT.



ATTACH NOSE, EARS, CHIN.



NOW EYES, MOUTH, CHEEKS, BROW (DON'T DRAW ONE FACE 'TIL IT BORES YOU. RAISE, LOWER, FATTEN, DIMINISH . . . INVENT THE SHAPE YOU WANT AND VARY IT.)



ERASE UNTIL FAINT. THE BUILT IN SHAPES WILL SUGGEST OTHER DETAILS. WHEN IT'S ALL SET, "POKE" IN THE BLACK.

Figure 208.

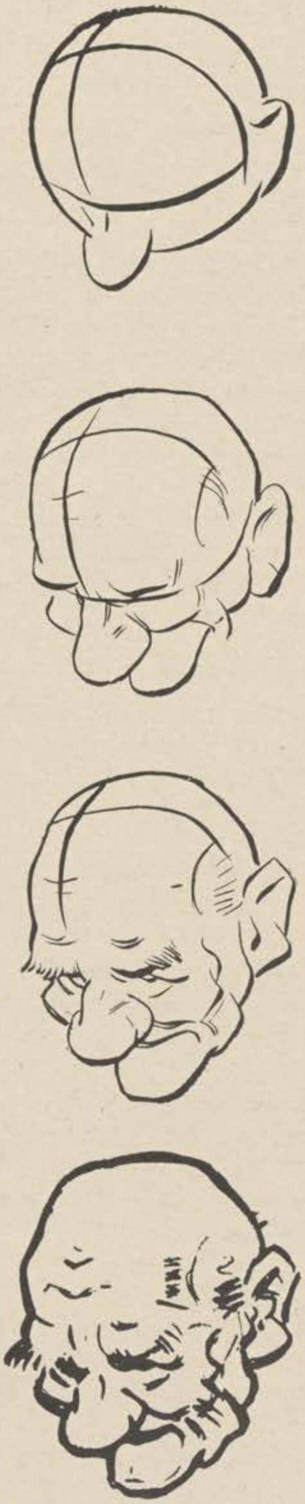


Figure 209.

THE LAUGH

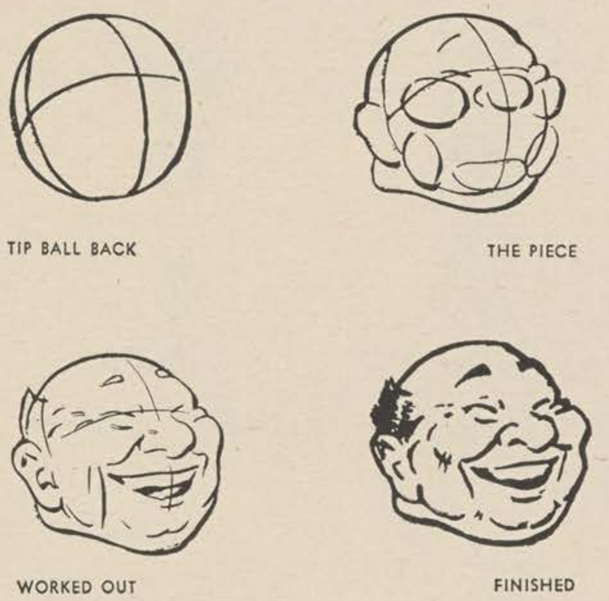

TIP BALL BACK
THE PIECE
WORKED OUT
FINISHED

Figure 210.

REALLY FURIOUS

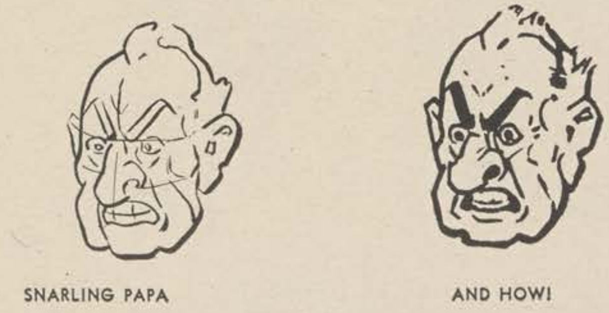

TIP BALL DOWN
THE PIECES
SNARLING PAPA
AND HOW!

Figure 211.

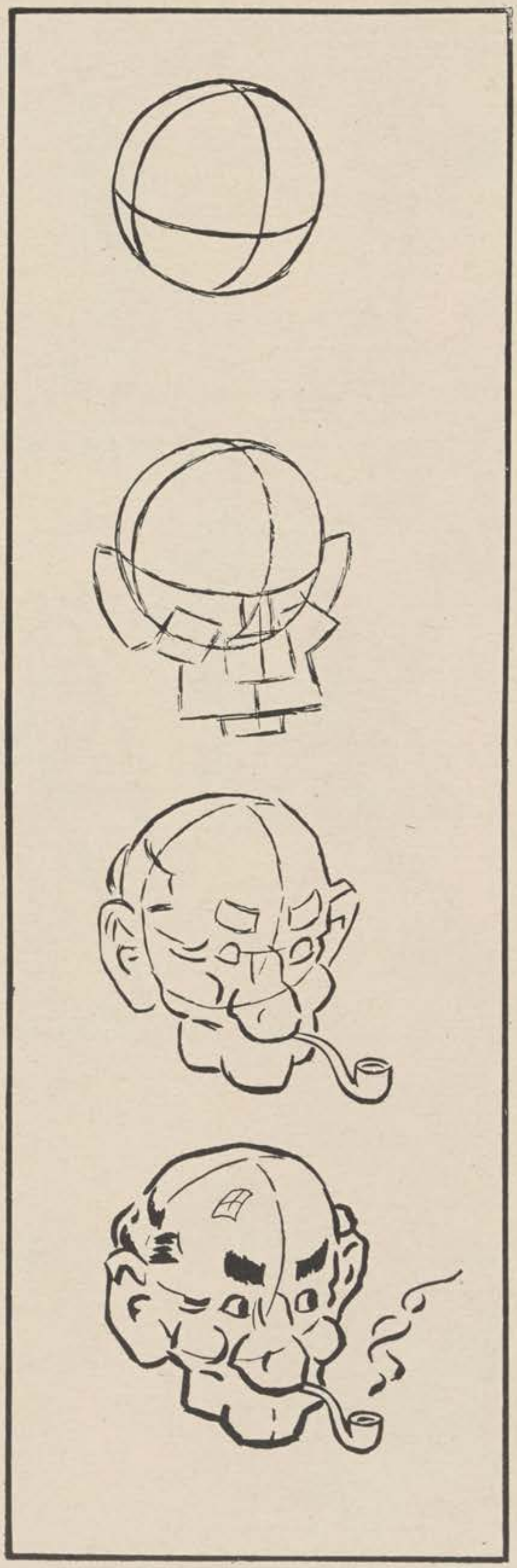
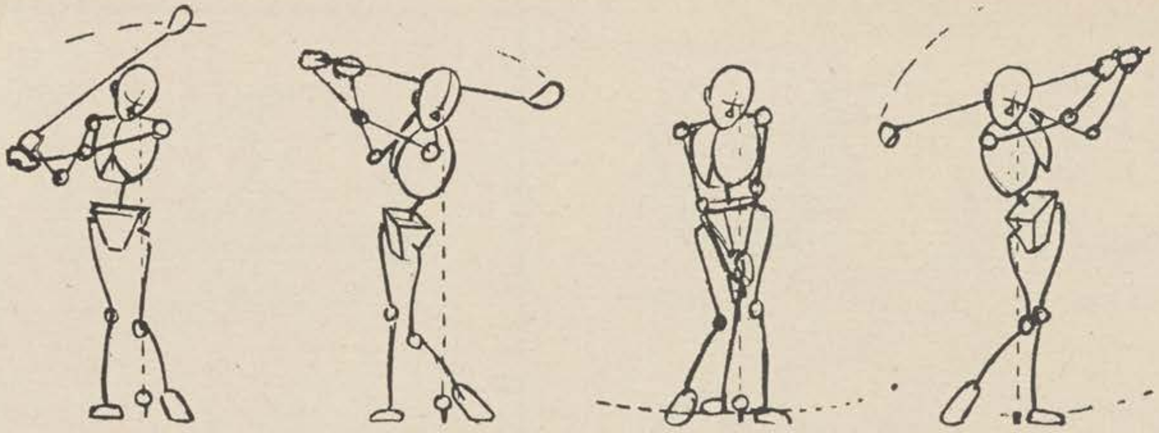
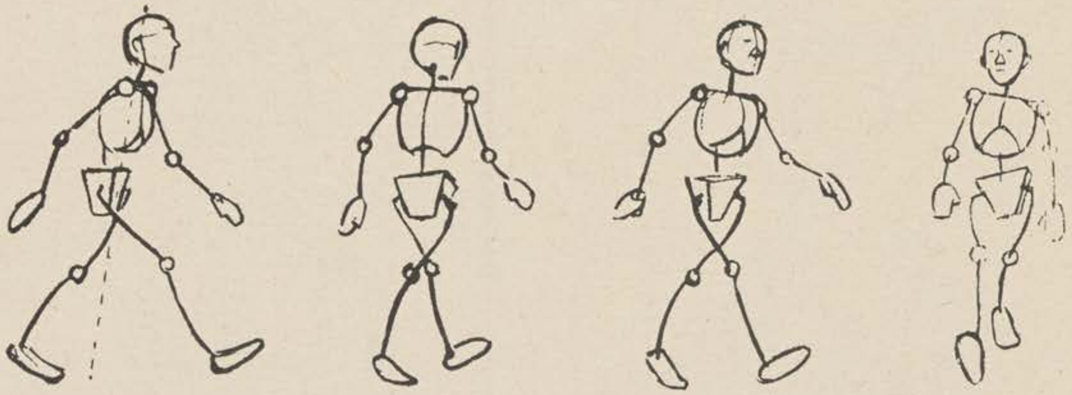


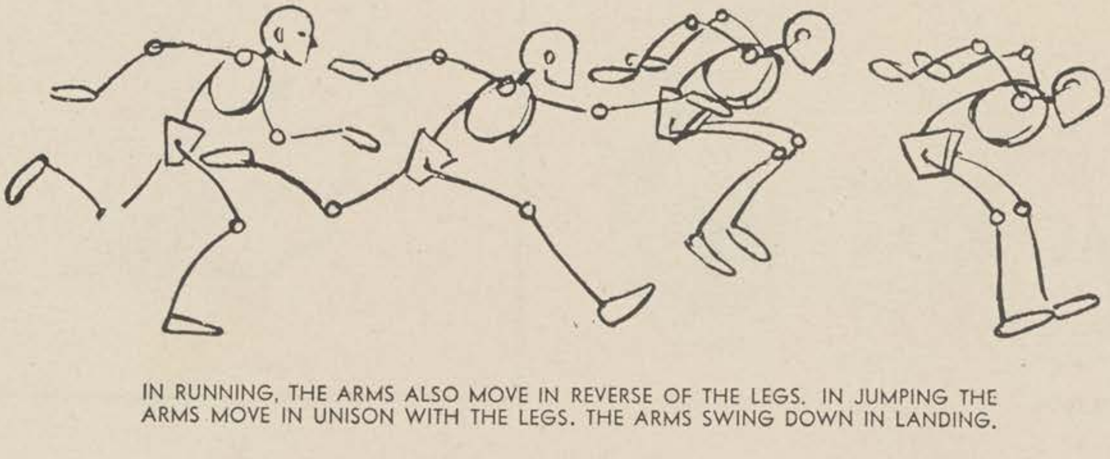
Figure 212.



MOVEMENT OF THE SHOULDERS, HIPS, SPINE, AND PELVIS. TWISTING. BENDING.



IN WALKING, THE ARMS MOVE IN REVERSE MOTION OF THE LEGS. THE WEIGHT IS TIPPED FORWARD, CATCHING BALANCE WITH EACH STEP.



IN RUNNING, THE ARMS ALSO MOVE IN REVERSE OF THE LEGS. IN JUMPING THE ARMS MOVE IN UNISON WITH THE LEGS. THE ARMS SWING DOWN IN LANDING.

Figure 213.

Build a dozen or so such drawings and you will be able to set up figures of your own in almost any action. The correct assembling of the parts or masses of the figure is much more important than actual knowledge of the bones and muscles. Here's the way you go about it (fig. 214).

176. Tricks (fig. 215)

177. Build Soundly

If you have grasped the fundamental principles of building your drawing on soundly constructed forms, there is no limit to what you can do. Use your imagination. No matter where you are, you will find endless material for your pencil and a source of enjoyment for yourself.

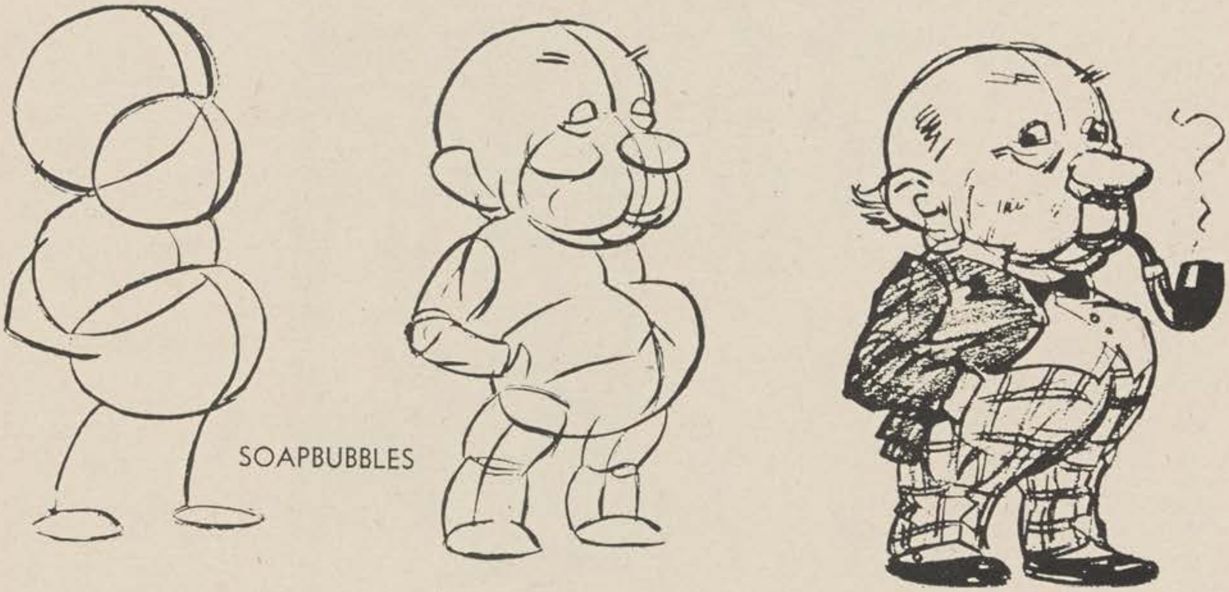


Figure 214.

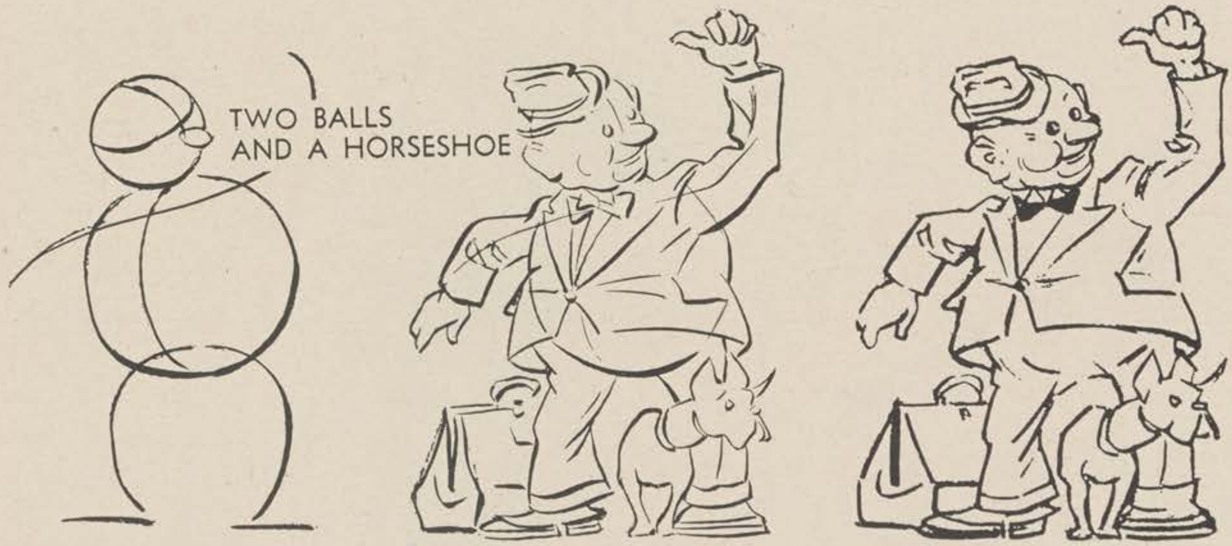
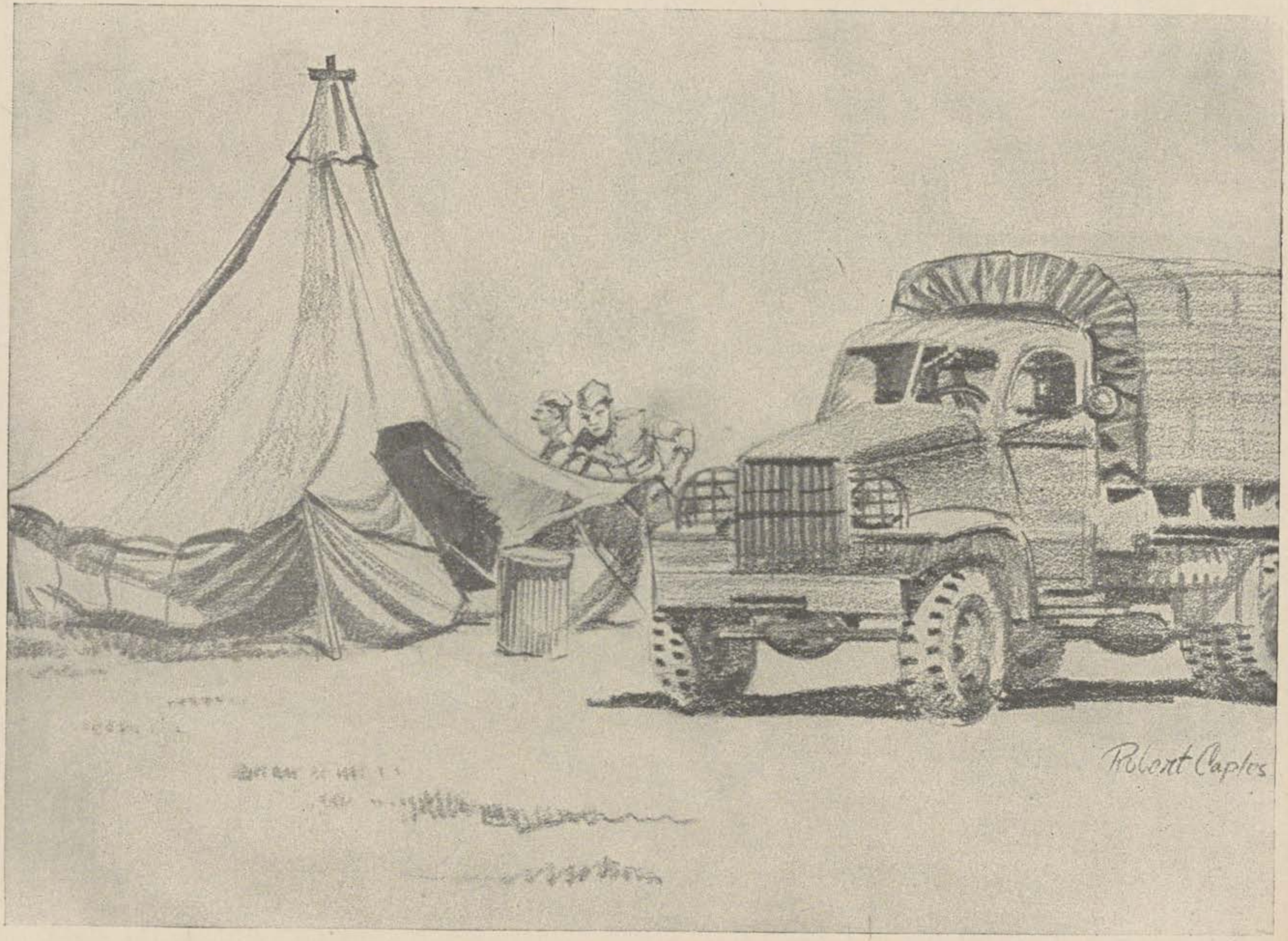


Figure 215.


Robert Caples

CHAPTER 19

DRAWING

178. General

a. The comic figure and the funny face are good starting points, even for the serious artist, just as pencil and paper are the easiest and most accessible tools for doing them. But as you continue, you will find that these have their limitations. Eventually, you will want to draw figures that are nearer to reality, portraits that convey likeness and character, landscapes that are built on a sound knowledge of perspective.

b. You will find, too, that by using other drawing tools you can achieve a range of effects that are impossible in pencil. As you experiment with charcoal, lithograph crayon or pen and ink, your whole style of drawing will change and expand to make use of the special quality of the material. Some techniques will seem particularly adapted to what you want to do; others you will discard as being unsuited to your needs. Some you will use often and for many purposes, others only occasionally for special types of work. Here are a few of the commonest which it will be worth your while to try.

179. Charcoal

This is perhaps the oldest known drawing material. Soft and very brittle, charcoal is obtained from wood by a special heating process. The point of a piece of charcoal wears down almost at once. The line made on the paper is broad and soft. It does not adhere strongly to the paper, may be easily wiped, and does not lend itself to the rendering of detail. It is valuable when the artist wishes to formulate his ideas in a broad, general style.

180. Conte or Red Crayon

A natural soft stone, of varying bright to dark red hues. It comes in various degrees of hardness and is more brittle than charcoal. However, it crumbles easily, wears quickly and is also used in a broad manner. It may be washed into the paper with a moistened brush so that it will seem almost like water color.

181. Pencil

Graphite (pencil lead) is pure carbon and comes in various grades of hardness. It may be sharpened to a fine point which does not wear away as quickly as charcoal or crayon. It adheres to the paper, does not crumble. The pencil line is precise, good for detail.

182. Black Crayon (Lithograph or Conte Crayon)

An artificial product made from lampblack, charcoal or other matter mixed with linseed oil and water. Produces jet black lines that are broad and heavy. Used for strong, impressive effect.

183. Pen and Ink

a. The effect obtained in a pen and ink drawing depends on two things:

(1) The ink (either India ink, or common commercial ink of various shades from black to blue).

(2) The pen (steel, quill, or reed pen).

b. The pen you'll most likely use for the present is the steel pen. Its line is thin, sharp and very flexible, permitting light, soft effects as easily as the harsh, pointed ones. The pen line is even in color. It is thinner or broader, never blacker. Many drawings begun in charcoal or pencil are finished in pen and ink, thus achieving definite outline after the original conception.

c. India ink is made from lampblack and gum arabic. Its rich blackness compares to that of a printer's line. The usual commercial inks may be obtained in many colors and are useful for special effects.

184. Drawing the Figure

a. Most people prefer to begin by drawing the human figure. It is undoubtedly the best method since man occupies the most prominent place in art and daily life. After you learn to draw the figure you'll have the required skill for reproducing all other subjects, landscapes, buildings, animals, water scenes, still life and so on. Before you make a line on your paper, form a clear idea of what you want to draw. Decide what your figure is to be doing. By all means use real life models. You'll have little trouble persuadinng people to "sit" for a drawing. Everybody enjoys being drawn, sketched, painted, and photographed.

b. After you have studied the nature of your subject's action (or inaction) you're ready to begin. Consider the placing of your drawing on the paper, for balance and arrangement. Make two marks to indicate the length of the drawing (fig. 216). Block in with straight lines the outline of the head. Turn it carefully on the neck, marking its center by drawing a line from the Adam's apple to the pit between the collarbones (2). Draw a line through this point to establish the slant of the shoulders (3). Indicate the direction of the body by outlining to the hip and thigh, at its outermost point, the side that carries the weight (4) (fig. 217). Follow this by outlining the opposite inactive side of the body (5). You can get the correct width by comparing it with the size of the head. Then, crossing again to the action side of the figure, drop a line to the foot (6). You now have determined the balance of the figure. Carry the line of the inert side to the knee, over and upward to the middle of the figure (7). On the outer side, drop a line to the other foot (8).

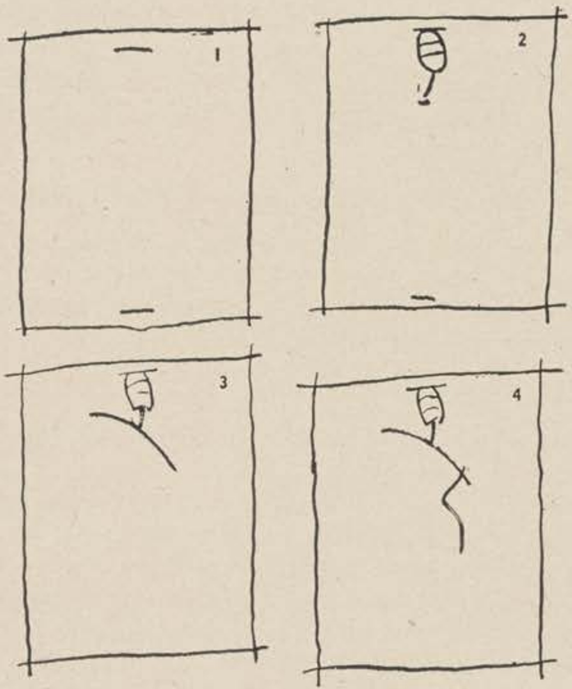


Figure 216.

c. These few simple lines place the figure. They give its proportions, indicating its active and inactive sides, its balance, unity and rhythm. Bear in mind that the head, chest and pelvis are the three large masses of the body. They are in themselves immovable. Think of them as blocks having four sides. They may be placed and balanced, one directly above the other. In this case, as you can see, the figure would have no movement. But when these masses bend backward, forward, turn or twist, the shifting of them gives action to the figure. Though these masses may be violently drawn together on one side, there is a corresponding gentleness of line on the opposite, inactive side, a harmony flows through the whole, which is the rhythm of the figure (fig. 218).

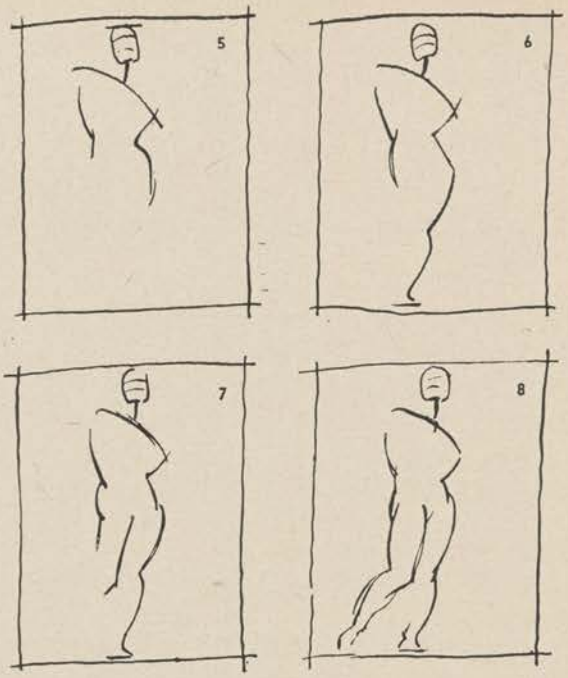


Figure 217.

d. Starting again with the head, and thinking of it as a cube with front, sides, top, back and base, draw it on a level with the eye (93). Outline the neck and from the pit of the neck draw a line down the center of the chest (10). At the right angle to this line, where stomach and chest join, draw another line and then draw lines to indicate the rib cage as a block twisted, tilted or straight according to its position (11). Now draw the thigh and the leg which supports the greatest weight, making the thigh round, the knee square, the calf of the leg triangular and the ankle square. Then draw the arms (12).

185. Building

With the masses (head, chest and pelvis) represented by three blocks, unmoving in themselves,

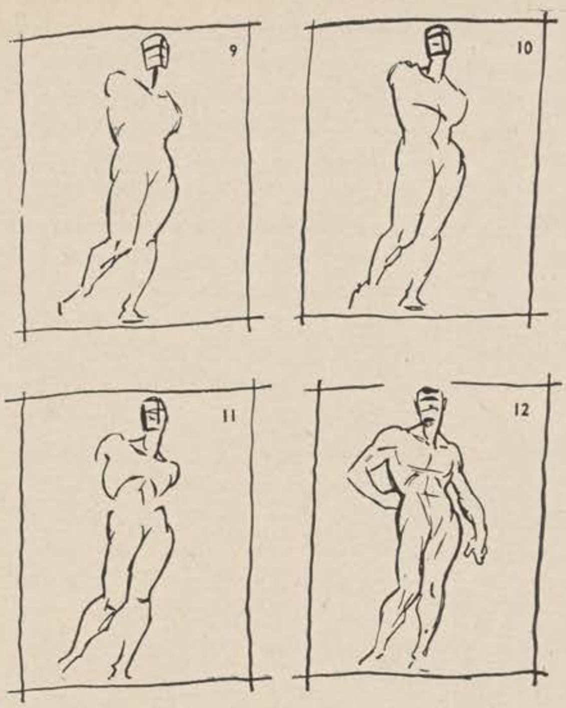


Figure 218.

think of these blocks in relation to each other. Forget, for the moment, any connecting portions other than the slender wire of the spine. A soldier standing at attention would be an example of the symmetrical balance of these blocks one above the other. But this balance never exists when the body is in action. It seldom exists even in repose. Movement of the figure is determined by the shifting of one block in relation to the others. As a rule each is turned or twisted to some extent. The spine allows such movements, which are controlled by the muscles (fig. 219).

186. Balance, Rhythm and Motion

When several objects are balanced at different angles, one above the other, they have a common center of gravity. In a drawing there must be a sense of balance between the counteracting forces regardless of where the center lines of gravity may fall. This is true no matter what the posture may be. A standing figure, thrown to one side, is stationary. The center of gravity passes from the pit of the neck to the supporting floor or feet (fig. 220).

187. Light and Shade

Shade gives the impression of solidity and depth. It is best to avoid all elaborate tones. The fewer the tones the better. No two tones of equal size or intensity should appear side by side or directly above one another.

188. Drawing the Head

a. Forget everything that distinguishes one head from another and think of the masses common to all heads. Heads are about the same size. Four distinct forms compose the masses of the face (fig. 221).

(1) The forehead: square and passing into the cranium at the top.

(2) The cheek-bone region: flat.

(3) An erect, cylindrical form on which are placed the base of the nose and the mouth.

(4) The triangular form of the lower jaw.

b. Begin by drawing in straight lines the general contour of the head (fig. 222).
Then draw the direction of the neck from its center, above the Adam's apple, to the pit, at the junction of the collar bone; now outline the neck, comparing its width and length with the head (2). Draw a line through the length of the face, passing it through the root of the nose, and through the base of the

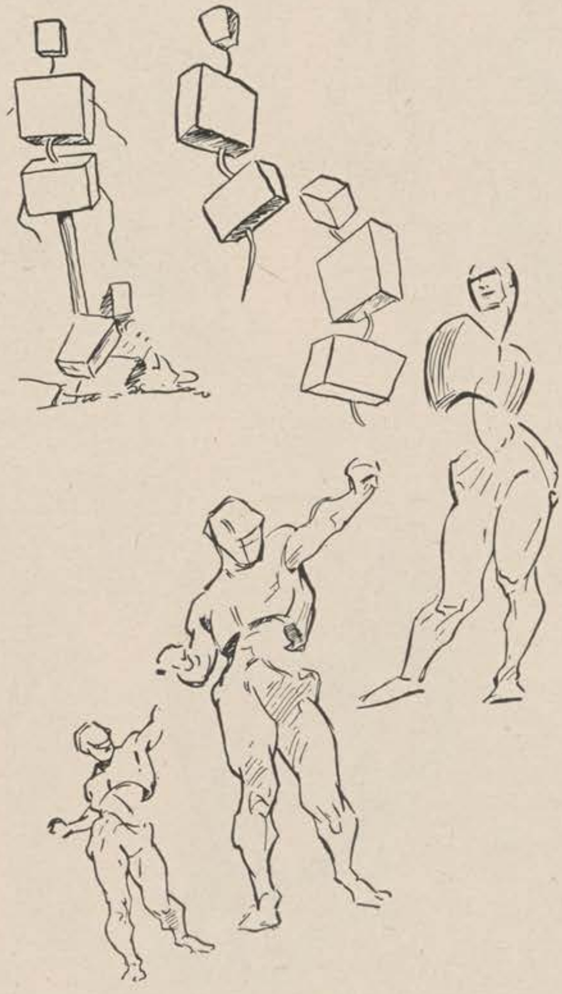


Figure 219.

nose where the nose centers in the upper lip (3). Draw another line from the base of the ear at a right angle to the one you have just drawn (4). On the line through the center of the face, measure off the position of the eyes, mouth, chin. A line through these will parallel a line from ear to ear, intersecting at right angles the line through the vertical center of the face (5). With straight lines, draw the boundaries of the forehead, its top and sides, and the upper border of the eye sockets. Then draw a line from each cheek bone at its widest part to the chin, on the coresponding side, at the highest and widest part (6). Then, depending on whether the head is below or above the level of your eyes, it will be foreshortened upward or downward as the case may be. You now have the boundaries of the face and the features may be drawn in (7, 8).

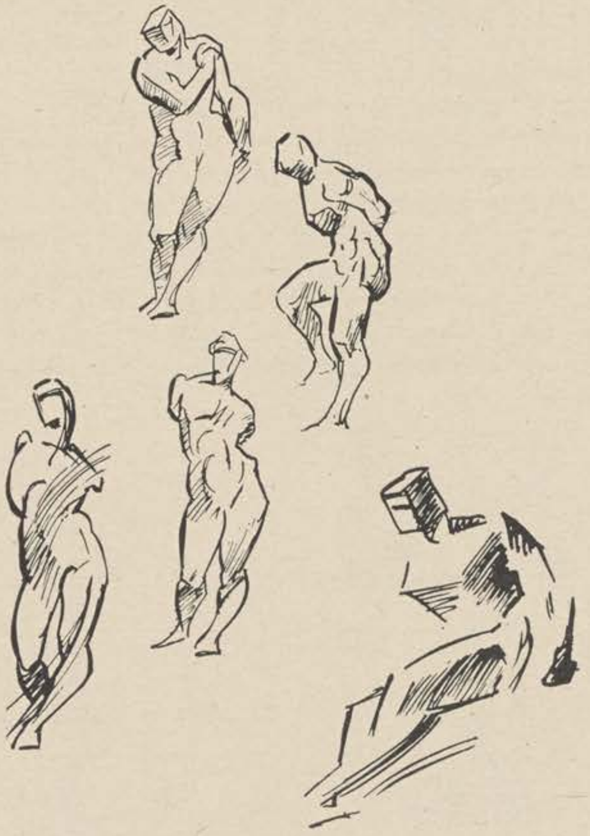


Figure 220.

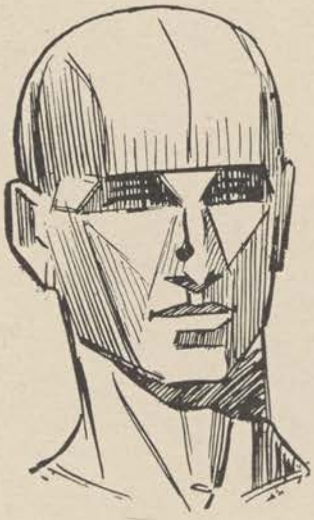


Figure 221.

189. The Eye (fig. 223)

The eye is the most expressive feature of the face. It is protected by the frontal bone and cheek bones. Its exposed portions consist of the pupil, iris, cornea, and "the white of the eye." The cornea is the transparent covering which fits over the iris much as a watch crystal fits over a watch. Only the upper lid moves, the lower remaining quite stable. The bulge on the upper lid, caused by the raised cornea, travels with the eye-ball as it moves, whether opened or closed.

190. The Nose (fig. 224)

The nose, wedgelike in shape, has its root in the forehead and its base at the center of the upper lip.

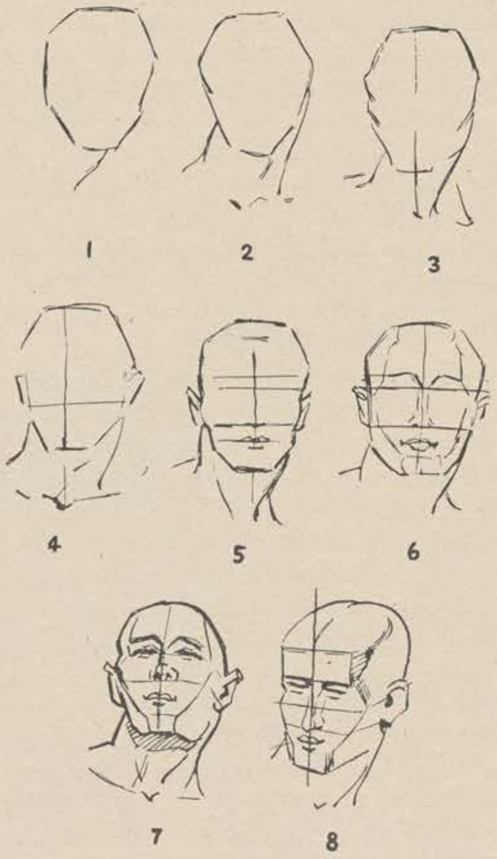


Figure 222.

As it descends from the forehead it becomes wider and larger. The bony part extends only half way down from the root, the end being held up by cartilages.

191. The Mouth (fig. 225)

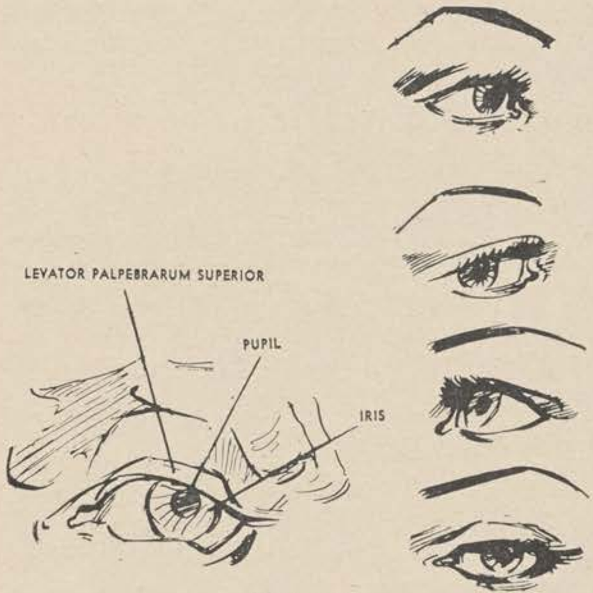
That part of the jaws in which the teeth are set is cylindrical in shape and controls the shape of the mouth. If the cylinder is flat in front, the lips will be thin and the mouth a slit. The greater the curve of the cylinder, the fuller will be the mouth and lips.

192. The Ear (fig. 226)

The ear is irregular in form. There is an outer rim often bearing the remains of a tip. There is an inner elevation behind the hollow of the ear, and the canal's opening is protected by a flap in front and by smaller flaps below and behind.

193. The Neck (fig. 227)

The neck is cylindrical in shape and follows the curve of the spinal column. Even when the head is thrown back the neck curves slightly forward. From behind each ear a muscle descends inward to the root of the neck. These muscles almost meet each



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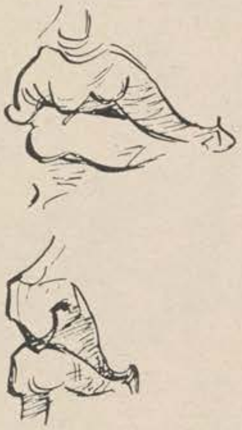

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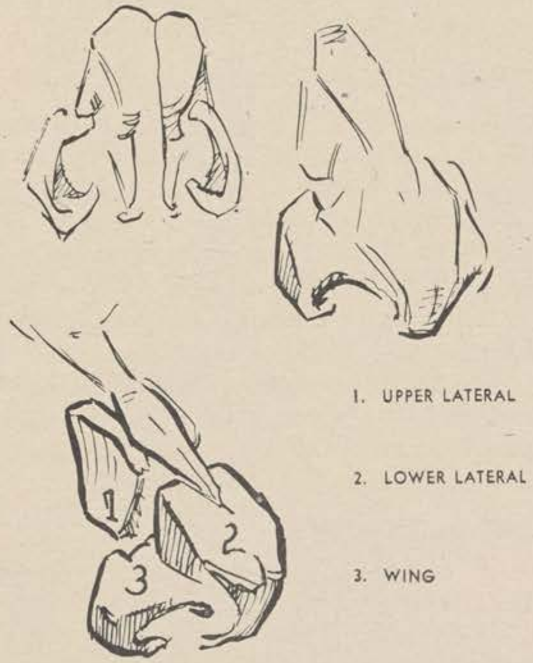


Figure 224.

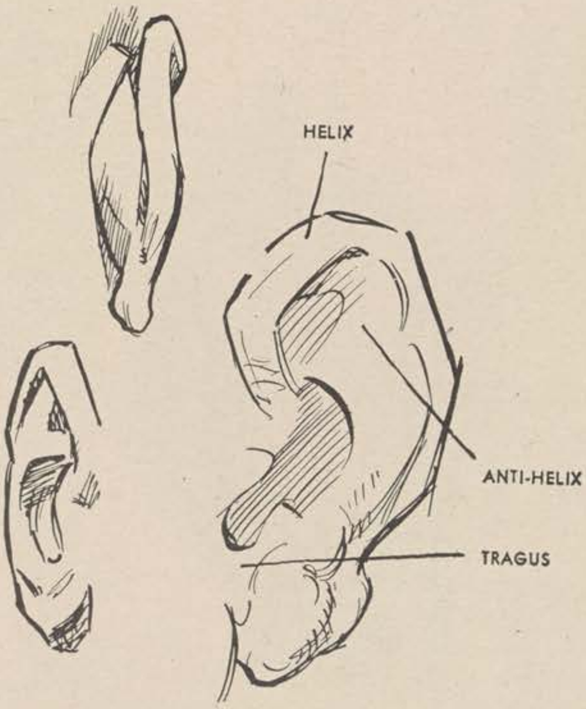


Figure 226.

other, making a point at the pit; they form the sides of an inverted triangle whose base is the canopy of the chin. The neck has the following action: up and down, from side to side and rotary.

194. The Torso (fig. 228)

The thorax or chest is composed of bones and cartilage. It is designed to protect the heart and lungs, much in the way a baseball mask protects the face, and to permit turning and twisting of the body. The pelvis is the mechanical axis of the body. It is the fulcrum of trunk and legs, and is large in proportion. Its mass is inclined a little forward. Compared with the trunk above it is somewhat square. The abdominal arch, formed by the false ribs going outward and downward from the end of the breastbone, separates the abdomen from the thorax.

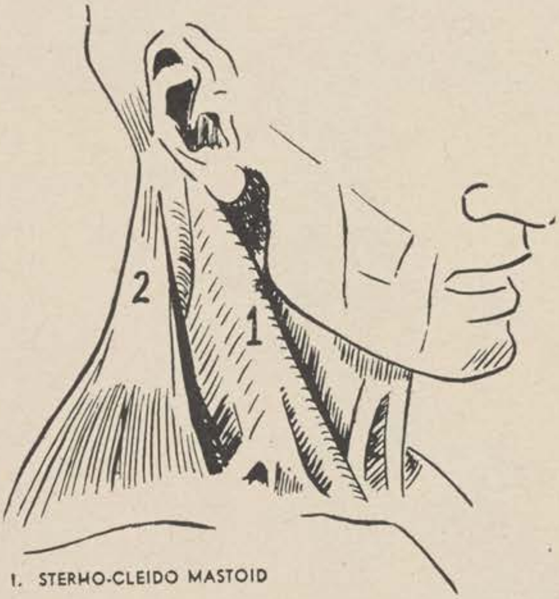


Figure 227.

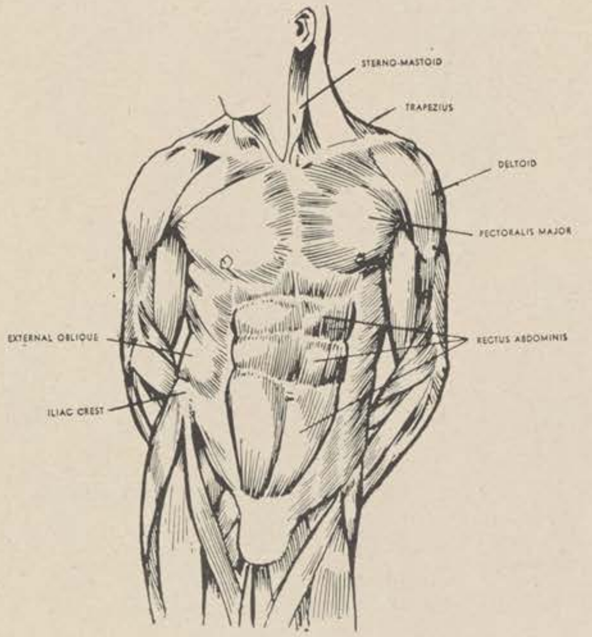


Figure 228.

195. The Upper Limbs (fig. 229)

The arm has its base in the shoulder girdle. The forearm is rounded or oval, depending upon whether the bones of the forearm are crossed. The wrist is twice as wide as it is thick. The accompanying sketches give you a general idea of the construction of the arm, both front and rear views.

196. The Hand (fig. 230)

The bones of the hand are blended with those of the wrist, making one mass, the hand moving with the wrist. The width of the wrist diminishes where it joins the arm. The hand has two masses: that of the hand proper and that of the thumb. The back of the hand is nearly flat except in the clenched fist. The tendons of the long extensors are superficial and may be raised sharply under the skin.

197. The Fingers (fig. 231)

The bones of the finger are narrower in the shaft than at either end. The joints are square, the tips triangular. The middle joint of each finger is the largest. In the back view, the fingers as a whole arch toward the middle finger. In the profile view, there is a stepdown from each segment to the one beyond, bridged by a wedge.

198. Thigh and Leg (figs. 232, 233)

The thigh bone ends at the knee as a hinge joint. The leg requires only a backward and forward movement for which a hinge is sufficient. The column of the thigh and leg diminishes in thickness as it descends to the foot. From any view it also has a reverse curve that extends its length. The leg at the calf is triangular, at the ankle it is square. From the back, the hips and buttocks are square and overhang the pillars of the thighs. The thigh is rounded in from half way down to the knee, and then it it becomes square to just below the knee. The calf of the leg is triangular, the ankle square.

199. The Knee (fig. 234)

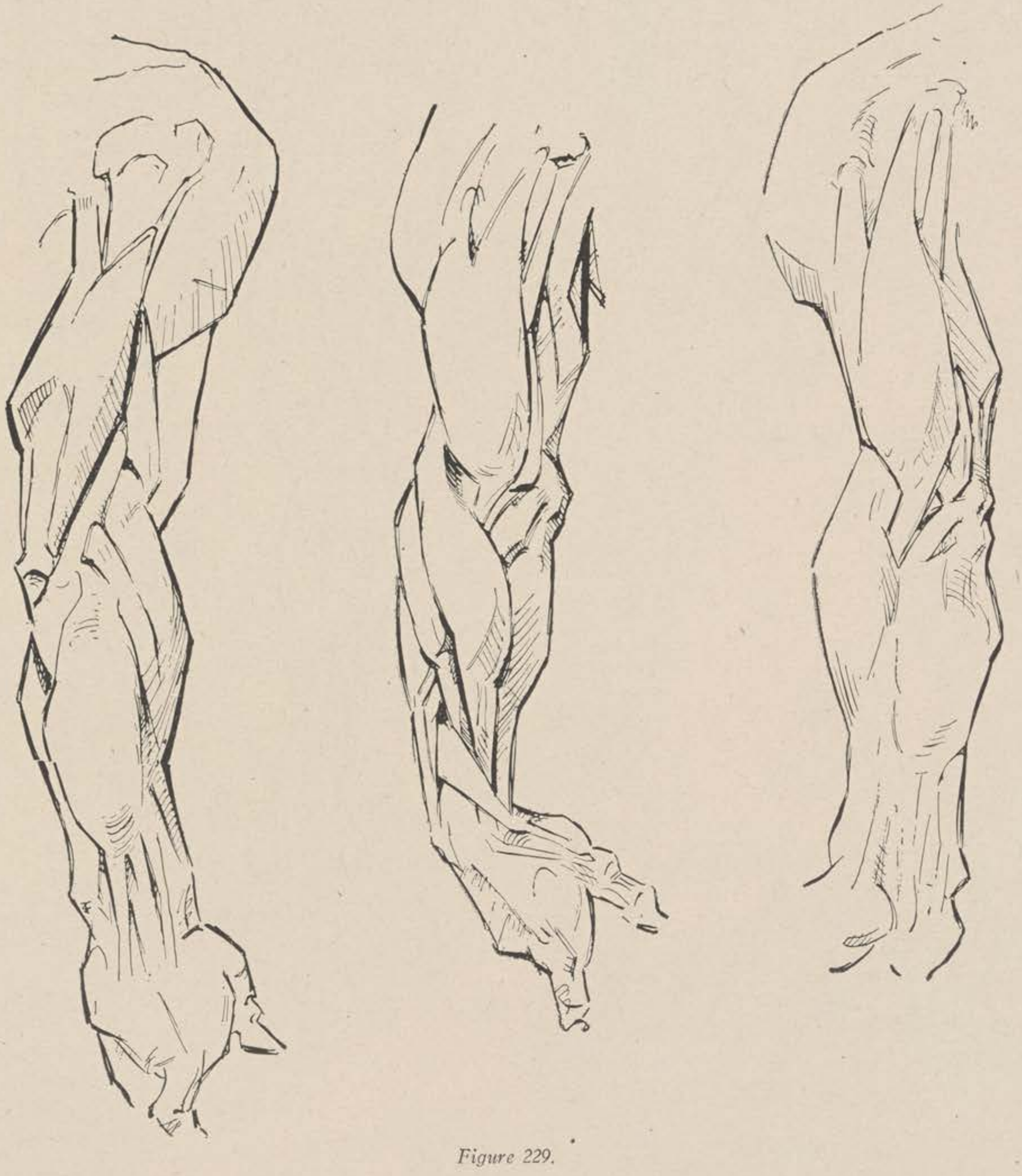
Think of the knee as a square with sides beveled forward, slightly hollowed in back and carrying the knee cap in front. When the knee is straight, a bulge forms on either side exactly opposite the joint itself. The back of the knee, when bent, is hollowed by the hamstring tendons on either side. When straight, the bone becomes prominent between them, making, with these tendons, the knobs. The inside of the knee is larger, and the knee as a whole is bent convex toward its fellow. The hip socket, the knee and ankle are all in line when the leg is straight.

200. The Foot (fig. 235)

The foot is arched, buttressed at either end by heel and toe. The keystone of the arch moves freely between the bones of the leg.

201. Perspective

All we need to know about perspective is the simple fact that things look smaller as they get further away from the eye. When you see a column of soldiers at attention, the nearest soldier looks tallest; down the line each man seems to dwindle in size until the last one may be a mere speck. The size of the image bears a relation to the distance of the object from the eye. While we do not need to know the mathematics involved, this is the first important law of practical perspective. In the case of the upright



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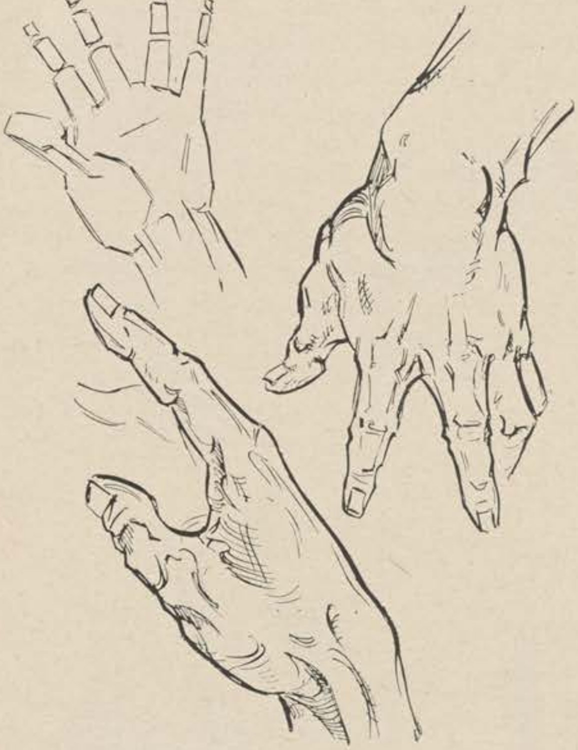
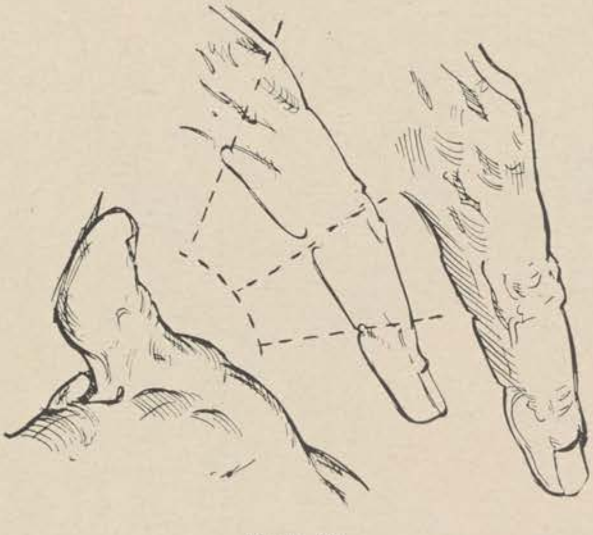


Figure 230.



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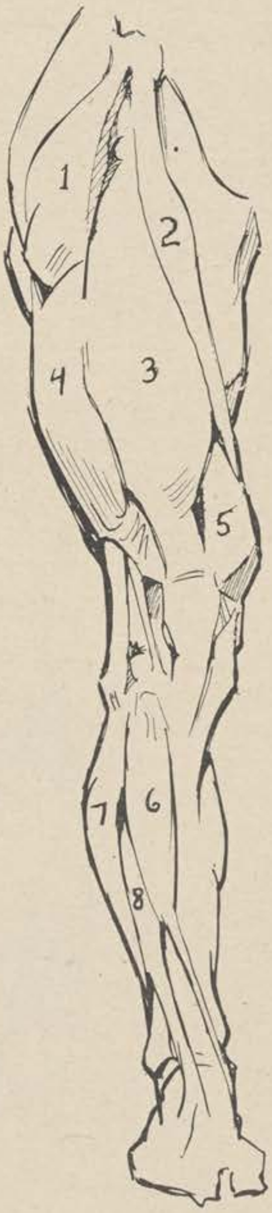
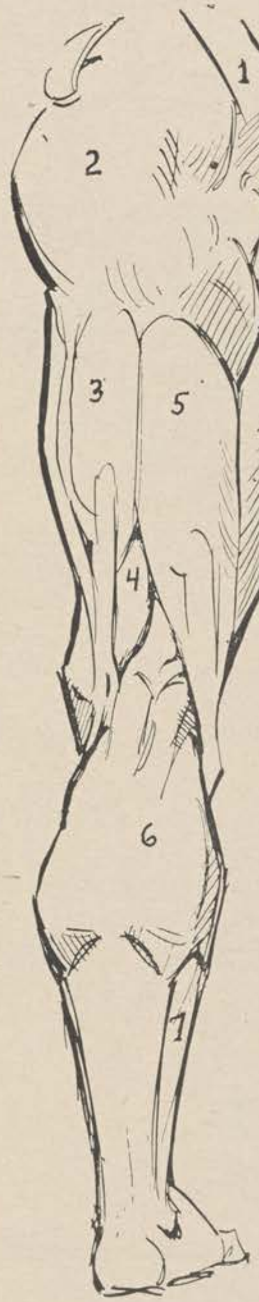


1. TENSOR OF THE FASCIA LATA
2. SARTORIUS
3. RECTUS FEMORIS
4. VASTUS EXTERSUS
5. VASTUS INTERNUS
6. TIBIALIS ANTICUS
7. PERONEUS LONGUS
8. EXTENSOR LONGUS DIGITORUM

Figure 232.



1. GLUTEUS MEDIUS
2. GLUTEUS MAXIMUS
3. SEMI-TENDINOSUS
4. SEMI-MEMBRANOSUS
5. BICEPS FEMORIS
6. GASTROCNEMIUS
7. SOLEUS

Figure 233.

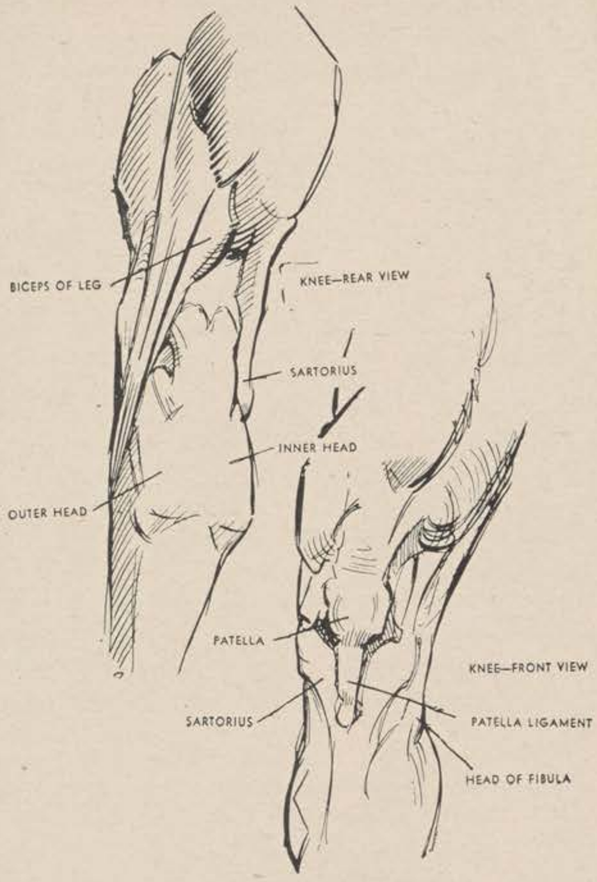

BICEPS OF LEG
KNEE—REAR VIEW
SARTORIUS
INNER HEAD
OUTER HEAD
PATELLA
KNEE—FRONT VIEW
SARTORIUS
PATELLA LIGAMENT
HEAD OF FIBULA

Figure 234.

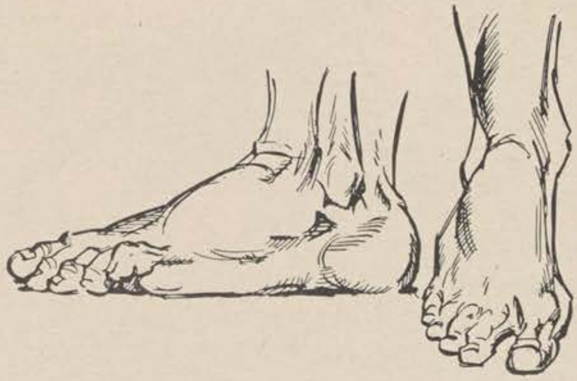


Figure 235.

candle, we have a very simple image, with all parts of the object an equal distance from the eye (fig. 236). Suppose the candle falls over backward so that its length is no longer parallel to your eye. Things immediately begin to happen to the shape of your image because different parts of it are now different distances away from you. Just as distance affects the size of any whole image, it plays tricks with the shape of the object when the object's parts are unequal distances away. Examples of this may be seen in everyday photography (fig. 237). Everyone is familiar also with the phenomenon of the railroad tracks as they appear to converge on the horizon (fig. 238).

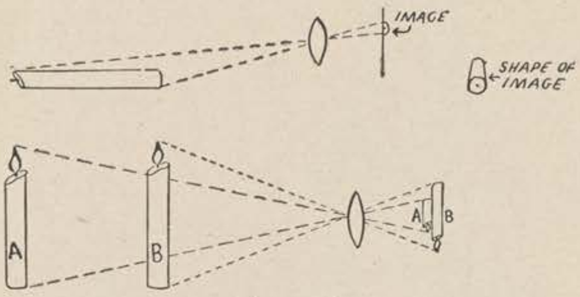


Figure 236

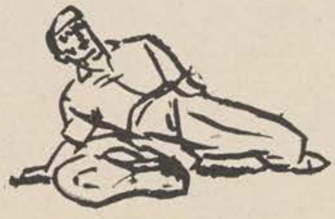


Figure 237.

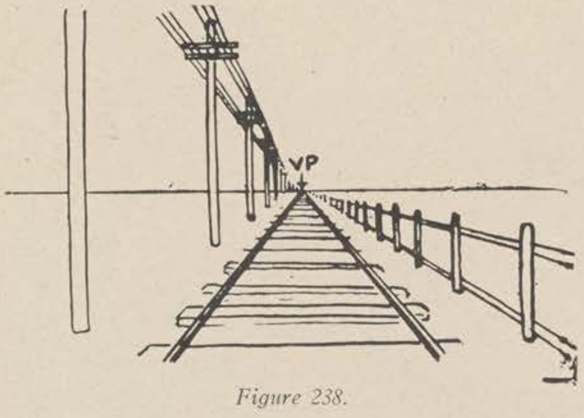


Figure 238.

Thus we see that perspective is simply judging the correct relation of one part to another. As you draw, you can train your eye to do this, but the following rules and simple measuring devices will help you at the start.

202. One-point Perspective

If you are looking down a street, you will notice that the retreating lines of all regularly shaped objects converge at a single vanishing point if you extend them far enough (fig. 239). This vanishing point (VP) is on the horizon line. While there may be no actual horizon visible, this is simply an arbitrary, horizontal line marking the eye level of the spectator. Surfaces which are parallel to the horizon line, such as the near side of the building at the left, will of course be drawn in their normal shapes, since all parts of them are approximately equidistant from your eye.

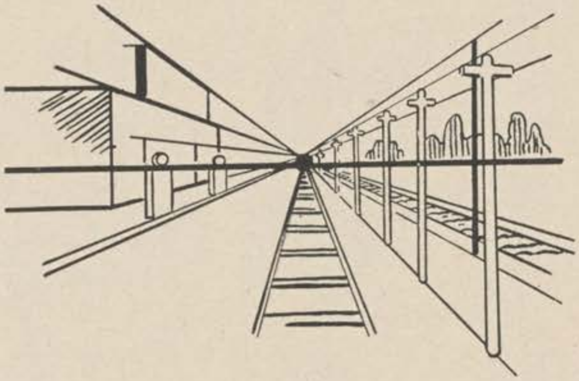


Figure 239.

203. Two-point Perspective

Now if you move so that you are looking at the corner of a rectangular form, you find that the projected lines of its right side converge at a point somewhere on the right hand portion of the horizon line, while the lines of its left side have their own vanishing point at the left (fig. 240).

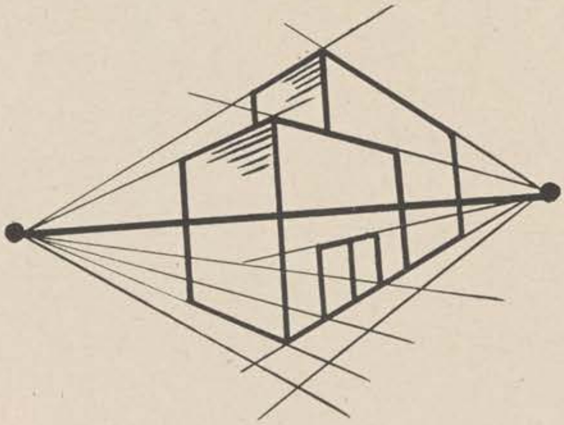


Figure 240.

This is two-point perspective, the commonest variety. If you move your eye level up or down, the horizon line moves accordingly and the perspective changes. As an example, if you lie on the ground all lines converge downward (fig. 241).

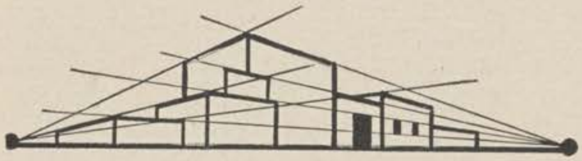


Figure 241.

If your vantage point is high, the opposite will take place (fig. 242).

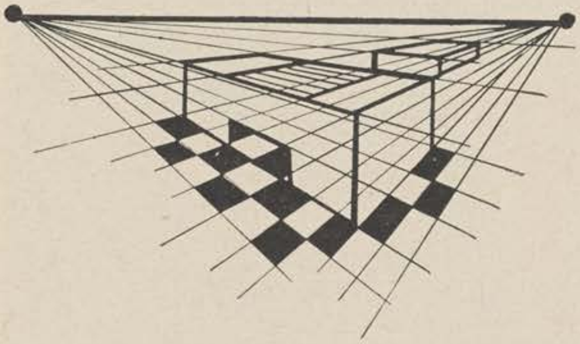


Figure 242.

204. How to Measure Figures at Varying Distances

A simple method of determining the correct height of several figures in relation to each other is the following (fig. 243): One, establish the horizon line of your picture and draw your first figure at whatever place and height you wish. Two, mark with a dot, A, the spot you select for your second figure.

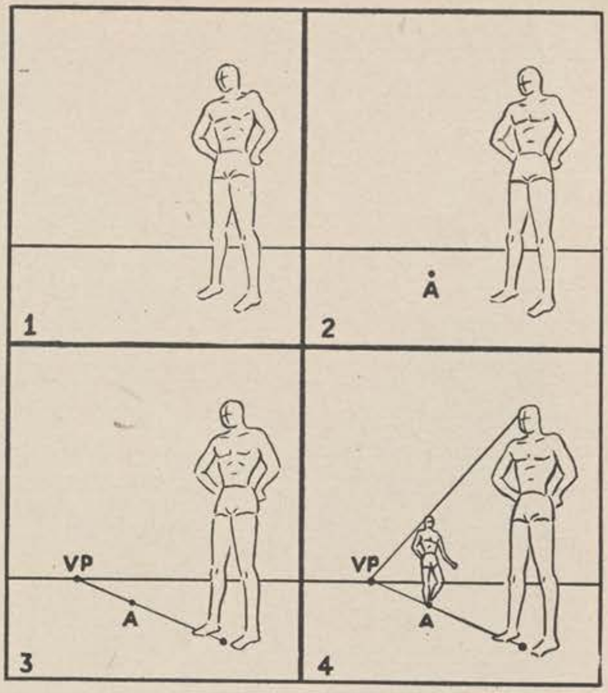
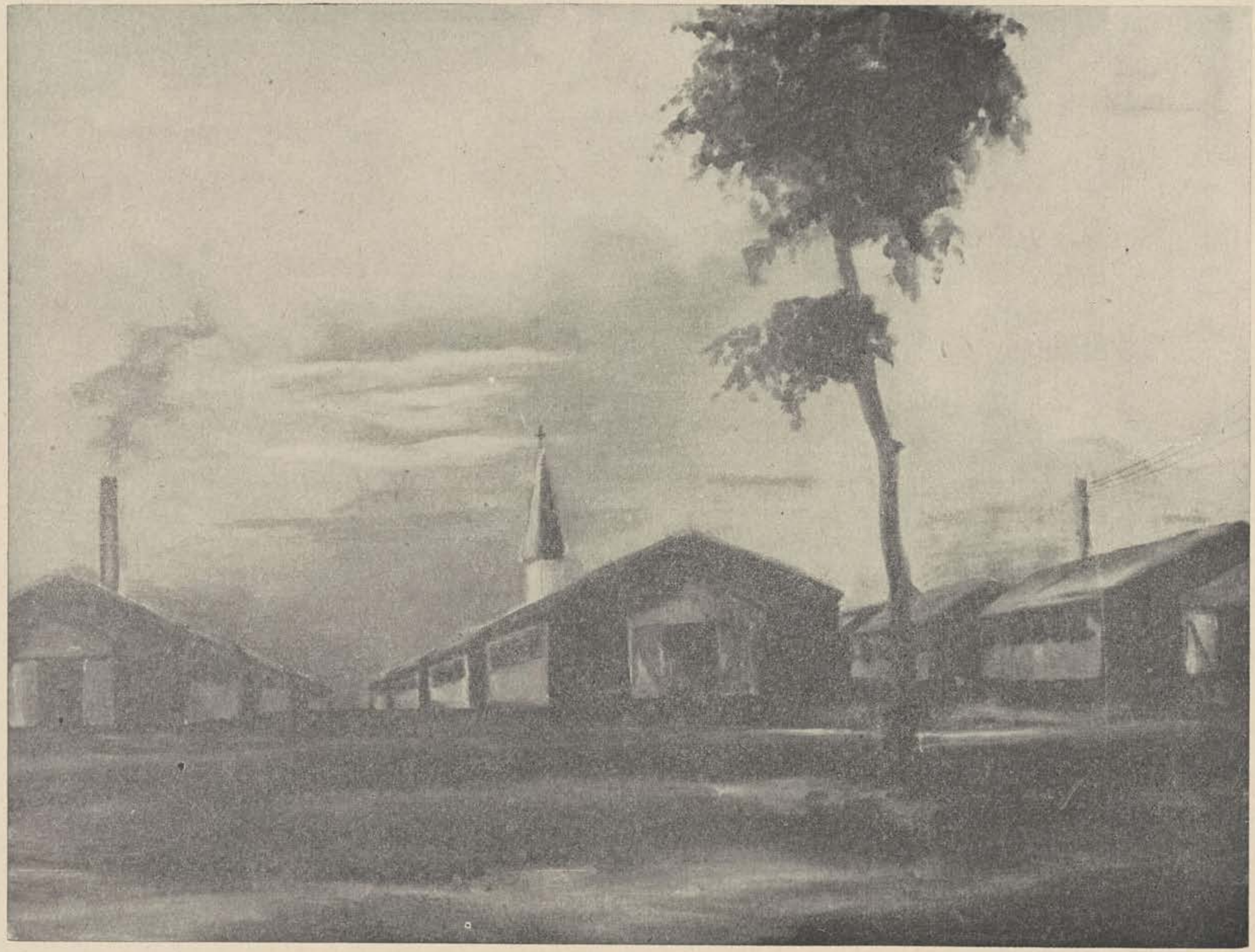


Figure 243.

Three, run a line from the feet of your first figure through A until it intersects the horizon. This is your vanishing point (VP). Four, draw a line from VP back to the head of your first figure. Your second figure should measure the distance between the two lines at A. The whole study of perspective is fascinating and full of surprises for the student. Once the normal kind of perspective is understood, you can investigate the freakish kinds caused by close-ups, height, depths, curves, and other unusual angles.



OIL PAINTING

205. General

You need only three things to paint a picture—the paint, something to apply it to, and something to apply it with. These can all be purchased at commercial art stores; generally the modern artist elects to buy his materials prepared and ready for use. There are occasional advantages, however, in making at least some parts of your own equipment. In any case it is advisable to understand both the special properties and the limitations of the many materials available. This will help you decide which to select for a given job and how best to use them.

206. Oil

a. The use of oil as a painting medium has been traced back to the 11th century. It has become increasingly popular among painters and has undergone many changes in handling and use. Paint consists of a dry powder or pigment, ground in an appropriate liquid medium. The pigment gives body and color while the liquid carries the pigment in suspension and on drying acts as a binder. In oil painting the liquid used is called a drying oil. Linseed oil is the common variety. As it dries it absorbs oxygen to the extent of 13 percent of its weight and is converted into a solid. This process of oxidation is much less rapid than the drying, by evaporation, of moisture in water-color painting. An oil painting may be dry to the touch in 24 hours but the oxidation continues for several years. Driers are often added to linseed oil to increase its rate of hardening. These substances, manganese or cobalt, are dangerous to the permanence of the painting unless used sparingly.

b. The pigment which is ground in the oil may be of organic or inorganic origin. Pigment composed of different colored earths and minerals are inorganic; those in dyes extracted from the plants are organic. Such colors are vermilion, yellow ochre, terre verte, malachite green, azurite blue, ultramarine, and Venetian red are found in the earth and need only grinding to be used in painting. They are extremely permanent. The chemist has added such inorganic and permanent pigments as the cadmium reds, oranges and yellows, oxide of chromium greens, artificial ultra-marine, zinc, white, cobalt blues and yellows, and zinc yellow. Some painters object to the use of chemically manufactured pigments, believing them to lack permanence. Modern chemistry, however, is able to produce pigments of the same quality and purity characteristic of the natural products.

c. In the past, painters ground their own colors, and for those who still prefer to do so a simple method is outlined in chapter 25. But today most artists buy their colors already ground and in tubes. Often the ingredients are completely noted on the labels.

207. The Canvas

a. What does the oil paint need as a support? The most generally accepted material is a canvas of linen, hemp, cotton or jute, stretched on a framework. Canvas may be obtained in various weights, from a smooth closely-woven material to one of coarse, heavy grain. Cotton canvas tends to stretch after painting. Linen is more acceptable and quite durable. Hemp and jute, coarse and of heavy ground, are suitable for large paintings. Oil paintings have been made on panels of wood, sheets of metal, and slabs of stone, but size and weight render them generally impractical. At the present time some of the light, strong wall boards and plastics are coming more and more into favor for painting in oil.

b. The canvas or board must be prepared for painting. The acid in linseed oil rots linen, and the porous quality of the material requires a dressing of some insulating material. It is usually a thin coating of size (gelatin, glue, or casein). The linen may be further prepared by being primed with a filler. This does two things: It hides the weave and gives it greater body. The priming is generally made of size and a filler of finely ground chalk, gypsum or zinc white. One of the oldest forms is gesso, a mixture of whiting and size, which yields a dead white, absorbent ground and can be smoothed with abrasives to an ivory-like finish. Some painters feel that priming increases the danger of cracking in a picture, but gesso grounds in Renaissance paintings have stood the test of time remarkably well. Prepared canvas, already sized and primed, can be bought at art supply stores either by the yard for mounting on stretchers, or glued to cardboard panels. Such canvas has usually been treated with an oil or chalk ground and a plasticizer to insure pliability. They are ready for the painter's use without further preparation.

208. Applying Oil Paint

a. The technique of applying paint to canvas is personal to the painter. He has brushes of various sizes, shapes, and degrees of stiffness and the palette knife. These all affect the appearance of the paint as it is applied to the canvas. A stiff bristle brush will leave a ridged mark that is clearly discernible and quite different from the stroke of a soft sable brush. Paint smoothed on the canvas with a palette knife retains the broad mark of the blade, but this method is not widely used and is generally limited to certain parts of the picture.

b. Different effects may also be obtained by varying the consistency of the paint and the depth to which it is built up on the canvas. This is known as impasto and may run from translucent washes of color radically diluted with turpentine and oil, to heavy layers of unthinned paint used as it comes from the tube.

c. While "direct" painting is perhaps the commonest method in use today, the technique of "indirect" painting (a combination of under-painting, glazing, and scumbling used with success by the great Venetian masters) is still favored by many of our modern artists. A glaze is a thin transparent film of color superimposed on another color to modify the tone or enhance its effect. The undertone appears through the glaze which is often darker than the color upon which it is laid. Scumbling, on the other hand, is achieved by going over the work with a stiff brush containing very little paint, the tone of which is opaque and often produced by a mixture with white. The brush is drawn loosely over the previous painting, which must be dry and firm.

d. There are many variations in the use of glazing and scumbling. The commonest method is to start with an underpainting in various shades of gray or of a single color (monochrome). This gives the entire modeling of the forms, their lights and shadows. Over this the colors of the finished picture are glazed in thin transparent washes of paint diluted with an oil or varnish medium. Scumblings of white are then applied, picking out the highlights, which in turn are reglazed with less color. Great richness and depth of tone may be obtained in this way.

e. When a painting is sufficiently dry, about a year after it is completed, it is varnished. If you varnish too soon you are apt to produce cracking in the paint film. Varnish protects the surface of the painting from dirt, humidity, and injurious gases in the atmosphere. It must be colorless, transparent, and easily removable, since all varnishes darken in time.

CHAPTER 21

A PAINTING LESSON

209. General

a. There are several ways of painting. But in starting out to study the craft there is nothing better than simple, direct painting. This method has the great advantage of permitting changes and corrections as you proceed. Later you can experiment with the indirect method, in which an underpainting of your subject is permitted to dry, then covered with transparent glazes, scumblings, etc. Direct painting, however, will give you the fundamentals of your craft and will lay a sound foundation for your future work.

b. Begin by selecting a suitable subject. A still life, an arrangement of flowers, a bowl of fruit, a pile of books, a radio set, a group of military objects are all good. In arranging the objects, use your imagination. Think of them in terms of contrasting shapes, textures and colors; move them around until they make a design of some interest. Then place them in a strong light against a medium toned background. Make sure that there are clearly defined lights and shadows. Daylight is best, but artificial light will do.

c. Spend some time in studying your subject before you begin. Nothing is done on canvas that is not conceived in the mind beforehand. Considering your subject as an arrangement of masses, you will observe varying degrees of lightness and darkness. Between the darkest mass and the lightest mass you will observe many intermediate tones. These tone masses are highly important. Paint them in their correct relation to each other. As you work, remember always that the middle tones must come first. Don't make the mistake of many new painters. Their eyes are attracted to the accents of extreme lights and darks, and they can't resist putting them in at once. In painting you must leave the dominant accents, which attract the eye first, until you have constructed the other parts around them. There is no short cut to this method.

210. Painting a Horse's Head in One Color

a. For instructional purposes we have selected a cast of a horse's head made of plaster (fig. 244). The masses are clearly defined and there is a minimum of confusing detail. Let's assume that you are painting it in monochrome, or one color, so that you can concentrate on the tone values. Raw umber is a good color to use. It has body, works well and is an excellent dryer.

b. Begin by blocking out the general shape of the principal masses in charcoal. This should be done roughly and should not be carried too far, as we will achieve our tone masses chiefly with paint.

c. Now settle what amount of the scale from dark to light you are going to use. The highest light will be very near pure white, and the darkest part (the base) requires the straight raw umber. If the cast did not have a black base, the shadow behind the horses's nose might be the darkest note. Having found the two extreme tones, place a dab of each on your canvas in the spots which they occupy. Then you can judge all the other tones by these two extremes.

d. Now paint in the mass of the background. Take great care to get the right degree of tone. If your paint is too stiff for free handling, mix in a little linseed oil with an equal part of turpentine. The first lay-in should go on easily and solidly, but no thicker than need be. Paint the background as evenly as possible. A brush too full of paint is difficult to control. Paint up to the commencement line of the shadows and well up to the edge of the masses of the head. Avoid "paint-in" parallel streaks. In the case of a background it is well to let the brush-work go in various directions.

e. After the background, do the ground, that is, the table top on which the cast rests. Now paint the general tone of the shadow thrown by the head on ground and background, and also the shadow thrown by any object not in the picture. There may be some variety in the tone of these shadows, but ignore this at present. Paint the general average of tone that may be found by half closing your eyes. The varieties can be worked in later.

f. Having laid these tones as evenly as possible, turn to the edges where the shadows come against the ground and background. Study these carefully and paint them as completely as you can. In these early stages, keep the tones simple and empty, but not the edges. Complete the edges with all variety and shape. Work with as large a brush as possible and hold it far up on the handle for better control.

g. Now lay in the base with a simple flat tone. Note the shape of its silhouette and its accents. At this point, the most difficult part commences. How to see the head in a simple statement of tones? What to ignore and what to put in is a problem at first. Half closing the eyes will be helpful. Leave out the details and reduce it to the simplest possible statement. Usually tones can be divided into three degrees: the lights, the half tones, and the shadows. Paint the average range of each of these three in perfectly flat tones (fig. 245).

h. As you work down toward the end of the horse's nose, you will find that its outer edge is completely lost in the shadow on the background. It is not the edge of the object, but the edges of the tone masses which make up the visual impression.

i. In painting the back of the head, which stands out against the darker background at the left, notice that its light edge is slightly darker at the top and not as pronounced as below. On this side the background has been painted well up to the edge and loosely across it. This is better than painting along the contour, as it avoids ridges of paint. Thick painting on the background destroys any sense of depth, though it may be used on the object itself.

j. If all the tones are the right shape and have been placed correctly, the details in the lights and shadows can now be added. But if you have made some mistakes, this is the time to correct them. Suppose, for example, that the edge of the shadow on the cheek bone is not in the right place. It will be much easier to move it if none of the detail around the mouth has been put in to interfere with a free sweep of the brush. If small details are in the way the modeling of the mass is wrong, it is best to scrape the whole area out with a palette knife and start over again.

k. In finishing the picture, guard against the tendency of the paint to come off the brush in an uneven, varied tone. Practice will do much to overcome this, although it is often due to the slippery, soapy

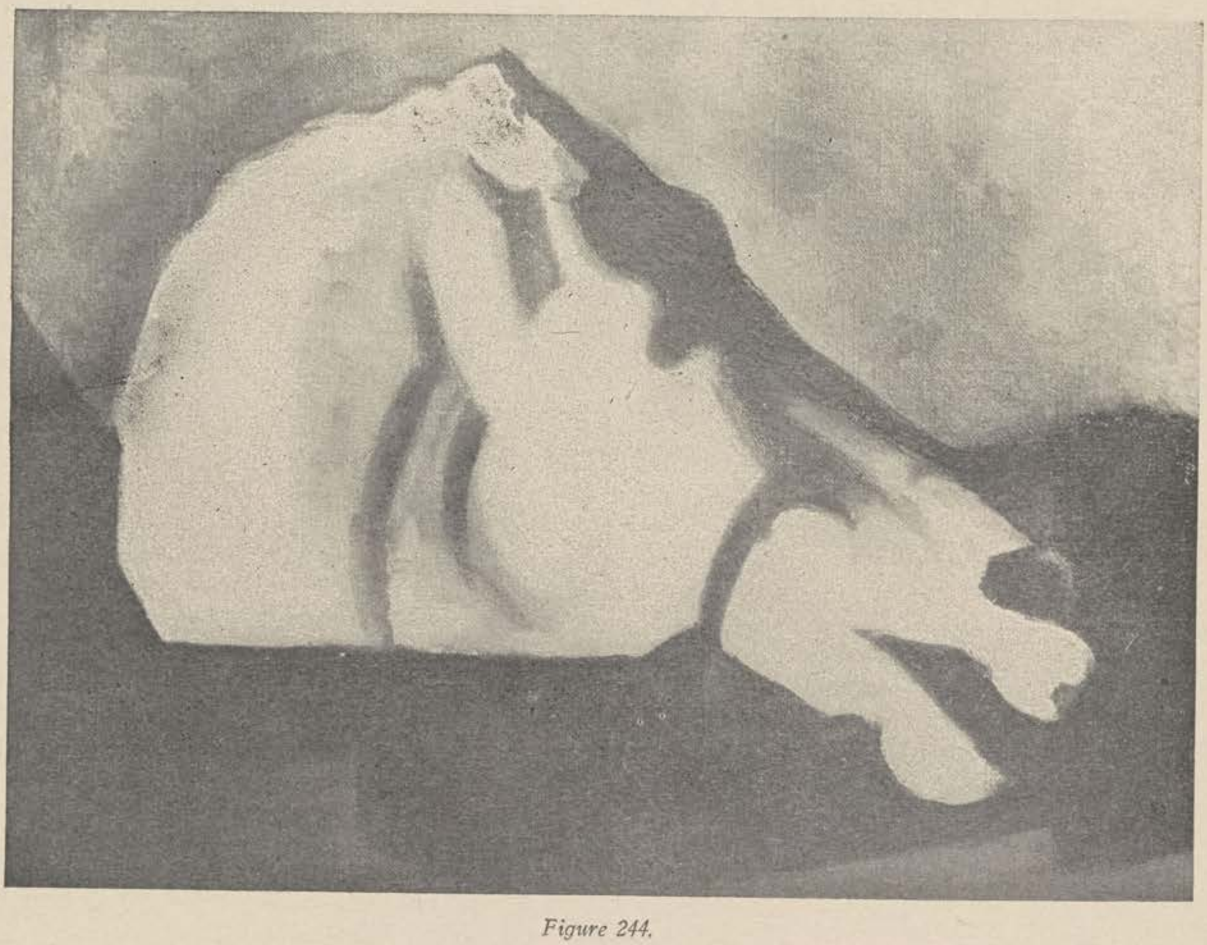


Figure 244.

surface of some canvases. The quality of "tooth" in a good canvas serves to pick the paint off the brush evenly. If the paint is properly mixed, with no light and dark streaks in it, and you learn to use just the right quantity on the brush, you will be well on the road to good painting.

211. Painting a Still Life

An excellent example of still life is the wine bottle with two saucepans. Many similar subjects are easy to arrange. The same procedure should be followed in reducing the subject to simple tone planes (fig. 246). Ignore at first the textures of the shiny and dull surfaces and consider only the arrangement of tone masses of varying shapes and degrees of light and darkness. When dealing with the shiny lights on the bottle and saucepan lid, flick them on with a well-loaded brush. Practice this light touch forgetting the shape of the marks for a moment. They can be trimmed up afterwards by cutting them off with the surrounding tone (fig. 247). In painting, do far more with your head and less with the brush at the start. Remember, you are handling a tool for the first time. Take it slowly at the beginning. You will make greater progress.

212. Painting from Life in Two Colors

a. A head provides a good subject for two-color work, which is the next step in learning to paint. If you can do this, you will have mastered the fundamentals of the craft and can apply them to figures, landscapes and larger compositions. In the following demonstration, keep in mind the lesson in tone values given in the section on painting a horse's head. These are the pigments needed for flesh painting:

(1) White.
(2) Cold black (ivory black).
(3) Warm black (lamp black).
(4) Yellow ochre.
(5) Indian red.
(6) Red (a mixture of Indian red and burnt sienna). When the instructions call for "red" in the following lesson, it is this mixture which is indicated.

b. Pose the model for your painting with the same

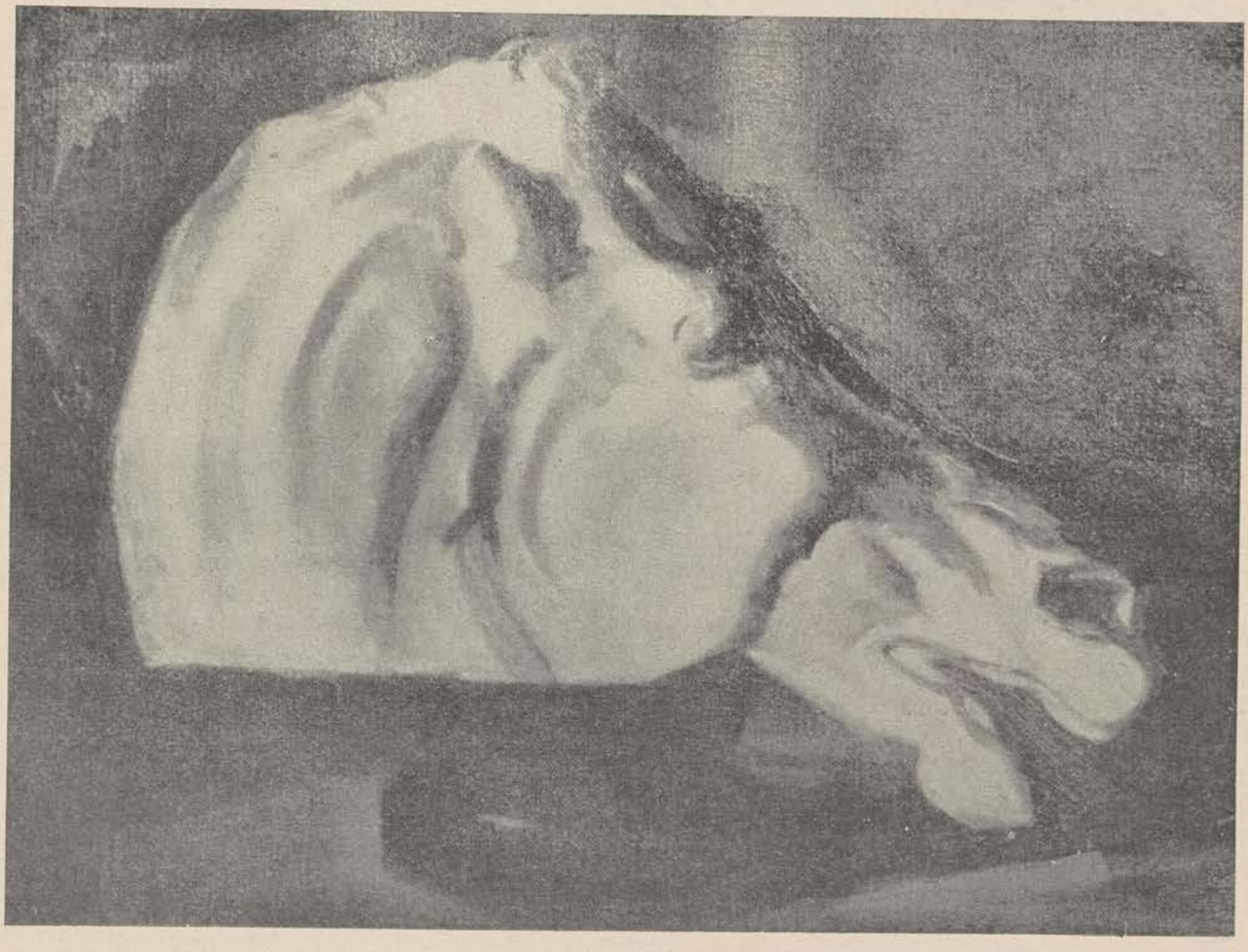


Figure 245.

care used on the still life. Examine the head from a number of angles until you find the most interesting one. Then move the model around in relation to the light source. Lighting can change the whole character of the head; it can soften and round the features or throw them into sharp relief. Used with imagination, it will be one of the most expressive elements in the picture.

c. First Stage (fig. 248). Sketch the outline of the head on your canvas in charcoal. Indicate lightly the placing of the main features. Do not attempt a finished drawing; this is only a guide which will soon be painted over. Rub in the background thinly in a medium tone of gray (warm black and white). Its tone should be somewhere between the lightest and darkest values of the head itself. Do not leave a hard edge where it comes against the head. Paint the forehead in a light middle tone (red and white with a slight touch of cold black). Now fill in the frontal plane of the face below the forehead (red, white and a little more cold black than used above). Note that this plane is divided from the sides of the face

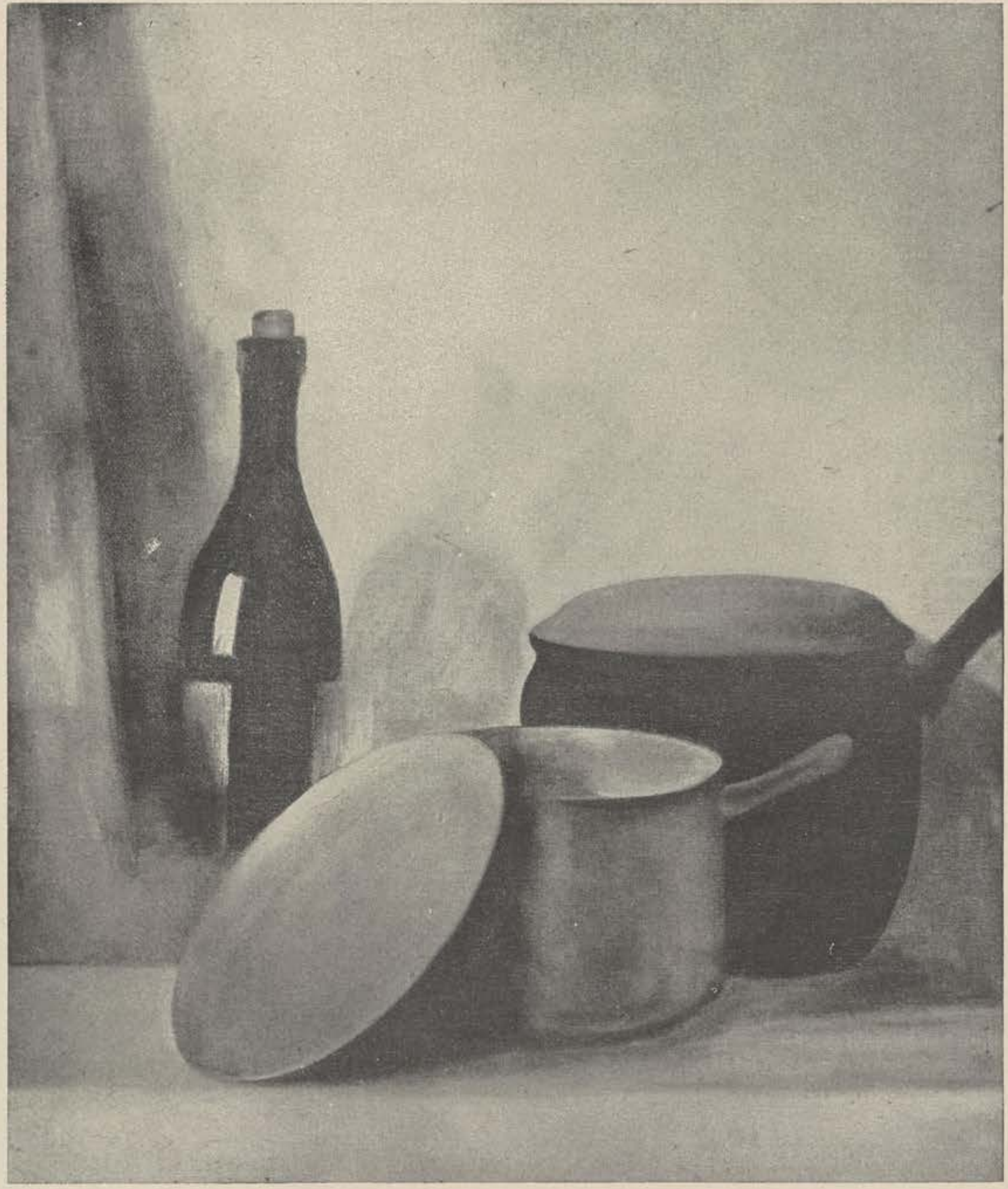


Figure 246.

along a line which runs around the outside of the eye socket, circuits the cheekbone and curves around the mouth to about the middle of the jaw bone. Paint the sides of the face and the neck in a darker tone (warm black, yellow ochre and white). Paint the shadow cast by the jaw directly over this tone (red and warm black). Put in the eye sockets (yellow ochre, warm black and white). A darker shade of the same mixture with more yellow ochre added can be used for the more shadowed parts.

d. SECOND STAGE (fig. 249). Work lighter tones into the corner of the eye and on the center of the cheekbones (red and white). Lighten the area where the mouth is to be (cold black, white and a very little red). Introduce a darker tone under the cheekbone (red and white toward the front; yellow ochre and warm black toward the ear). Paint the nose in a warmer tone than the cheeks (red, white and a touch of warm black). The dark half tone at the tip of the nose and the nose's shadow on the upper lip are cooler in color. The half tone at the wing of the nostril is much warmer (red, yellow ochre, white

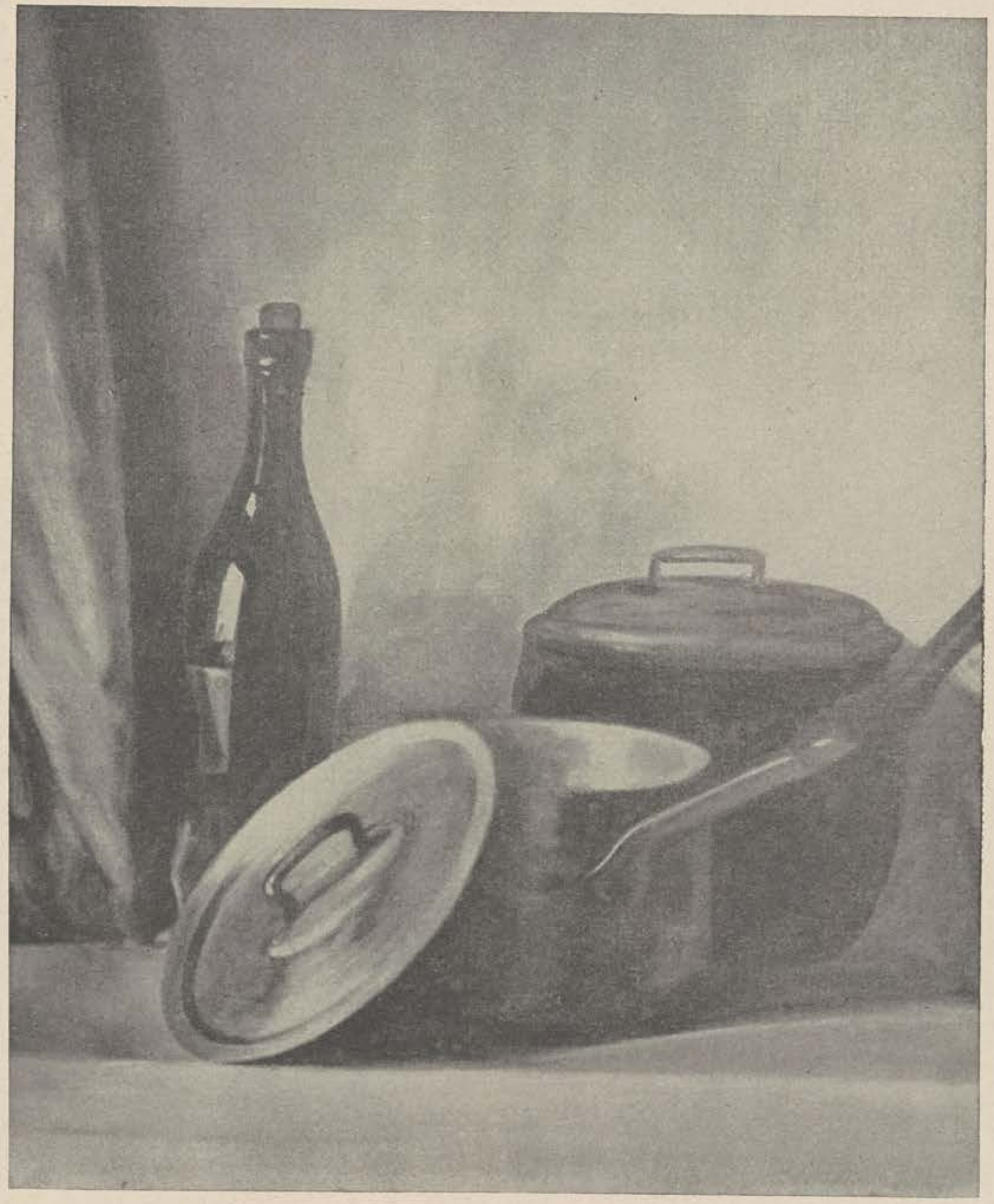


Figure 247.

and a very little black). Now do the ear, noting the undercurrent of warm color that always runs through it (yellow ochre, red and white with a darker tone of the same colors at the top). At this point, establish the lightest tone of the whole picture, the one from which all other lights will be judged, by brushing in the highlight on the forehead (white, yellow ochre and cold black). Some work around the eyes comes next. Concentrate on the edges of the sockets. Note that there is only one fixed point of light in the eyes themselves and that another prominent light lies on the checks just below them. The eyebrows are colder along their edges than in the center. Do the edges first (cold black, yellow ochre and a little white). Carry the modeling of the nose a little further, bring out the differences in tone of the bridge, the side and the darker tip between the nostrils. Paint in the mouth lightly, making the lower lip lighter than the upper (Indian red and a little white). Do the shadow beneath the under lip (yellow ochre and warm black). Brush the highlight of the chin and the corners of the mouth into the colder tone already there (red and white). Throughout the second stage, put your efforts into refining the edges of features and planes and the contours of the whole head. It can be done well only when the paint is still wet.

e. Third Stage (fig. 250). Now it is time to do more detailed work around the eyes, nose, and mouth. Start by working darker tones into the shadows at the corners of the eyes and along the tops of the eyelids (warm black, red and a little yellow ochre). The edges of the lids next to the eyeball are quite reddish (Indian red and white). Toward the nose there is a cool edge (cold black and white). Note that the lids follow the spherical surface of the eyeballs and tuck in at the outer corner of the eye. Work on the soft shadow which runs beneath the lower lid for its entire length. Now give more attention to the nose. Put in the warm shadow around the wing of the nostril (red, white and a little yellow ochre). Do the nostril itself, blending the tone into the shadow beneath the nose (Indian red and yellow ochre). Don't make too much of the band of light that often runs from the check into the side of the nose. Finish this stage with more work around the mouth. The edge of the under lip where it comes against the shadow of the upper lip is very red. The mouth was first painted in pure Indian red and white; this must be modified and varied in parts (cold black and Indian red). Also brush in the shadows at the corner of the mouth and between the two lips (red and a very little white).

f. Fourth Stage (fig. 251). This is devoted chiefly to accenting those portions of the face where you wish to focus attention. It is largely a matter

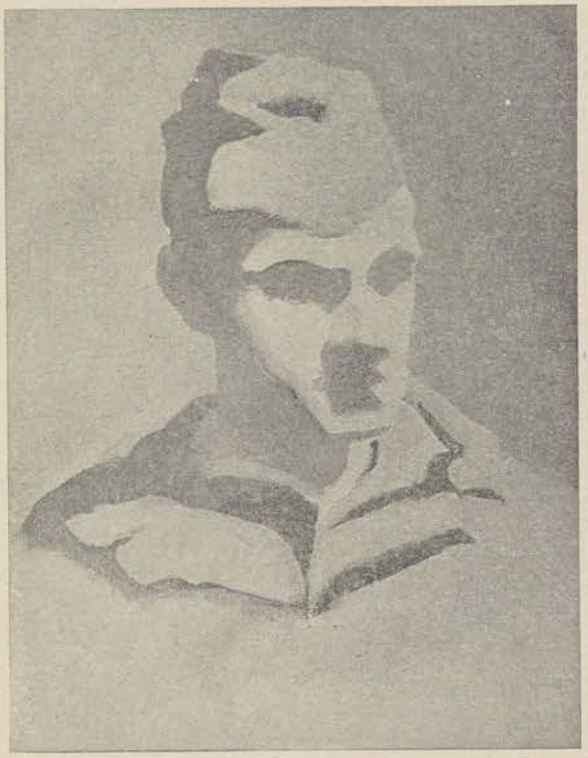


Figure 248.

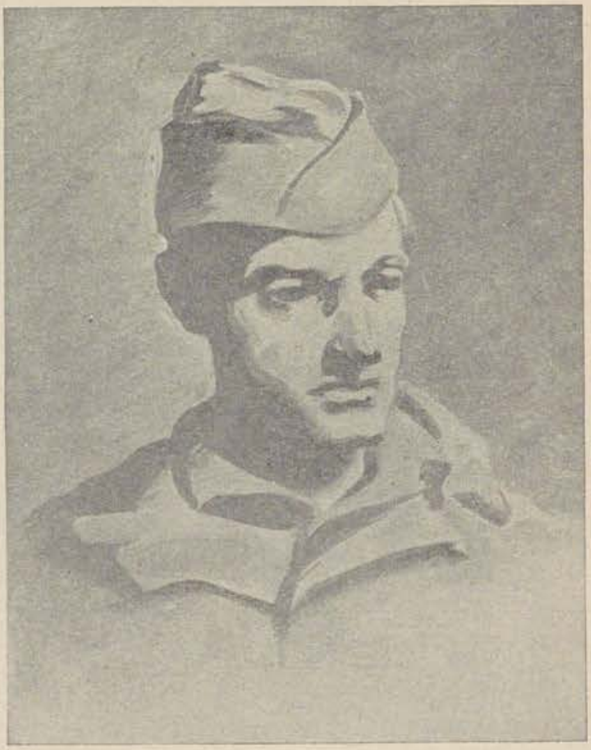


Figure 249.

of personal choice, but the following suggestions may help. The eyes are generally one of the focal points. Emphasize the little edge of light which runs along the top of the lower lid. It is best to put it in with a broad stroke, letting it extend further down than it should; then cover the lower part of it with a darker tone until you cut it down to the right shape. In painting the iris of the eye, notice that it has a dark center and a dark outer edge with a lighter tone between. Do the whole iris in the darker color first, then add the lighter band. Other accents of color or tone can be introduced in forehead, cheeks, nose or chin as the artist desires.

g. Fifth Stage (fig. 252). You are now ready to put on the finishing touches. Always remember that finishing does not mean adding details as much as refining the modeling. Study the picture carefully. The transitions from one plane to another will probably need to be softened in several places, such as the forehead, where they were first blocked in sharply. Don't do this by simply brushing the adjoining tones together. Make a new tone and place it between them. It will add richness and impart a better sense of form. Finally, do not work the picture over too much in striving for perfection or it will lose its freshness. Be content with a measure of success and correct the major faults you see in your later attempts.

213. Things to Remember

a. Always paint with the least amount of paint needed for the effect you want. Halftones in the flesh should always be cool except in the ear and along the bridge of the nose. Remember that after the first stage every touch will be modified by the tone already there. In mixing colors, take this into consideration.

b. In painting a darker tone over a lighter, note that the edge, where the paint is thin enough for the undertone to show through, will be warmer. When you paint a lighter tone over a darker, the reverse is true; the edge is cooler. Take this into consideration when you plan how your tones are to overlap. When two edges come together with much variety on one side and little on the other, paint the varied side first. Trim up the edge between the two when painting the simpler tone of the other side.

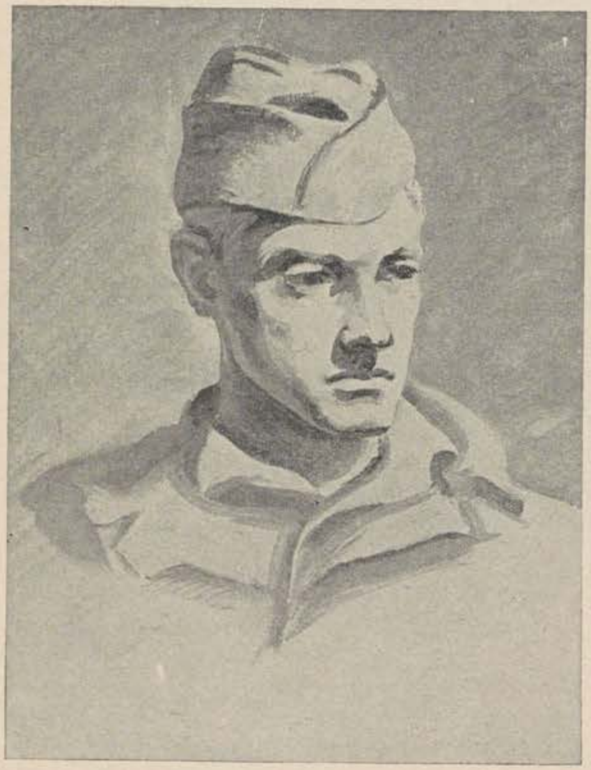


Figure 250.

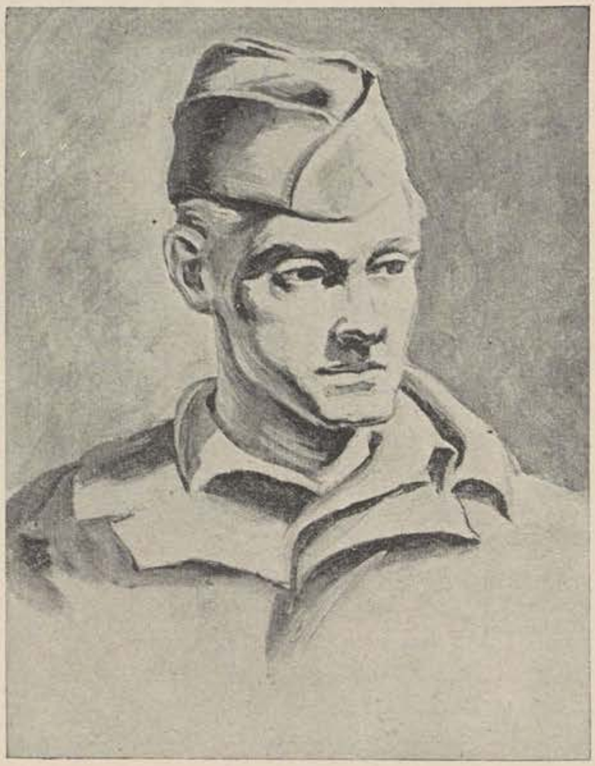


Figure 251.

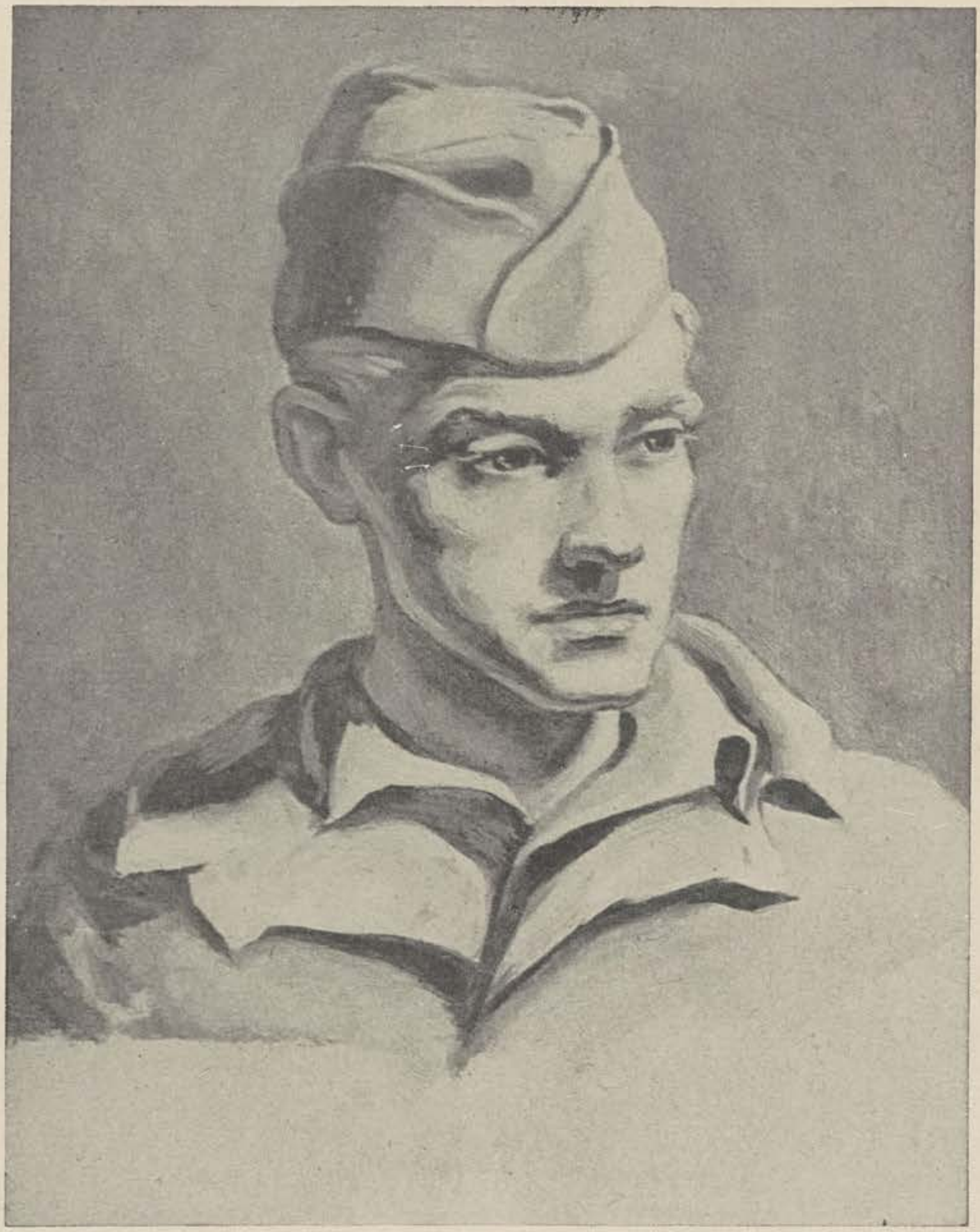


Figure 252.

CHAPTER 22

TEMPERA

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214. General

a. "Tempera" means any medium used to temper dry pigments so that they may be applied and bound to a surface. Usually tempera signifies only media containing egg or glue. Other types are classified as oil or water color. The use of tempera goes back many centuries. The basic medium is composed of egg-yolk, to which an equal amount of water has been added. On a glass slab, the pigment is ground with this medium by means of a spatula. It is most often used at the consistency of heavy cream. Because of its oil content, egg yolk may be regarded as closely related to the oil medium. As it drys the water content evaporates, causing the paint to set quickly. In time, the albuminous substances become insoluble, and the oil dries quite slowly, leaving a strong flexible film.

b. The oil content of the egg medium may be increased by the addition of a drying oil or oil varnish, the result being known as an "emulsion medium." (See ch. 25 for a description of how this is made.) In a similar manner a water solution of gum arabic may be added, making an egg and gum medium. The American tempera painters prefer these media to the pure yolk of egg. Glue and size are similar substances, softening easily in cold water and soluble in hot water. Glue and size contain no oil, being composed of nitrogenous matter; hence the film formed by them is always soluble unless covered with varnish. Preservatives and plasticizers are added to glue and size media to prevent putrification and cracking.

c. The support for tempera painting may be wood, canvas, or some of the modern wall boards. In many cases cardboard and paper are used, especially in commercial art where temperas are largely employed. A priming of gesso on the support is used for tempera painting. Its smooth luminous ground is particularly adapted to this technique, since it increases the brilliance of the picture. The gesso is sometimes coated with a weak solution of size to render it less absorbent. Illustrators' board and tinted drawing papers usually need no priming when used with glue tempera. The medium does not contain oil, and the paint remains opaque with little tendency toward translucence.

d. Pigments used in tempera are the same as those used in oil or water-color work. The medium is regarded as more permeable to moisture and gases than oil, and the fugitive, changeable pigments are avoided. Pigments containing lead and copper are also excluded; they may be affected by sulphur in the albumen of the egg yolk.

e. In the Renaissance, tempera was applied with a very fine brush and the forms built up by a series of hatched lines. Today it is used more flexibly and has occasionally been employed as an underpainting on which oil glazes are superimposed. Tempera has its own distinctive quality, however, and is quite different from oil in the soft, flat brilliance of its tones.

CHAPTER 23

WATER COLOR

215. General

a. Water color is a brilliant and flexible medium. It has several practical advantages in that the equipment needed is small, compact and easily carried. A finished water color can be painted much more rapidly than an oil, and the nature of the technique lends itself well to quick sketching in the field.

b. In water-color paints the usual binding material for the pigment is gum. Gum arabic, the one most frequently used, is a product of the acacia tree and is soluble in water. Other water solubles such as gum tragacanth, dextrin, fish glue, and egg white are occasionally used. Glycerine and sugar of honey added to the medium in small amounts keep the color moist and in easily workable condition. They also act as plasticizers to prevent cracking of the paint film. Because the nature of the medium does not lock up the color as firmly as oil, only pigments of the most permanent structure should be used. Fugitive or chemically active pigments quickly fade or change color. In order to prevent colors which have been mixed together from separating, the pigments in water color should be very finely ground. The task is difficult and it is not advisable for the artist to prepare his own water colors. Those prepared by manufacturers are sold in cakes, porcelain pans, or put up moist in tubes.

216. Paper

a. Although parchment or silk may be used, the commonest support for water color is paper. The paper should be very light in color or white; the ground on which water color is executed greatly affects the luminosity of the work. Paper made of linen is the best. It is strong, tough, and unchangeable in color. It takes water very well. Papers made of wood pulp are usually poorly sized, darken easily and become brittle. Color holds best on paper with a grained texture. In cases where the paper has been manufactured without sufficient glue in its structure, it is advisable to size the surface with a thin gelatin solution. Otherwise the paint may run.

b. Water-color paper should be kept flat. Any creases will make the washes appear uneven and pigments adhere poorly. The paper must be stationary. Tack loose sheets of paper to a drawing board, or mount them on a stretcher. The water-color paper blocks sold at art stores eliminate the trouble of mounting your paper. Some artists feel that the block paper has a tendency to bubble when wet, and prefer the stretching or mounting system.

217. Brushes

The brush used is important in water-color work. The hairs of the brush should form a point which will not divide when used. The best brushes are made of sable. Flat-bristle brushes, broad-wash brushes and camel's-hair brushes are also used for many purposes. The most accurate palettes for water color are white enamelware. Water color always dries lighter than it appears when wet; this change of tone must be taken into consideration.

218. Applying Water Colors

a. Pure water color is transparent. Washes of diluted color are placed on white paper to produce tints. Where a white tone or highlight is desired, the paper is left uncovered. Water-color paint may be laid on the paper in various ways. Large areas of flat tone are applied in washes with a large brush fully charged with water and color. Technical skill and practice are necessary in laying an even wash. While the wash is thoroughly wet the paper is tilted back and forth at an angle until the pigment settles out into solid spots. This gives granulated textures to the color surface.

b. Dark detail may be applied over a lighter wash, completely covering the color underneath. But the possibility of obscuring a dark tone by placing a lighter color over it is very limited. When this is required you may either remove the dark portion, or cover it with an opaque paint. Opaque color kills the translucence of water color and it is customary to remove or lighten the dark tone by the wet methods of "wiping out" and "sponging" or by the dry methods of "scratching out" and erasing. In "wiping out," the paint film to be removed is redissolved by flooding it with water; the color in the solution is drawn off by the application of blotting paper. The tone will be lighter after each wetting, and continued operations will leave the paper white. In "sponging" you go lightly over the paint film with a wet sponge. The sponge should be washed frequently during the process. "Scratching out" is the process of removing the color by scraping the surface of the paper with a knife. It is used mainly as a finishing touch, since it destroys the surface of the paper for further work in that area.

219. Using Water Colors

You can use water colors for highly finished work or for recording rapid impressions (fig. 253). A sketch in pencil, pen or crayon is usually executed on paper before any painting is done. The picture may then be built up in various ways. A series of very liquid washes may be used and superimposed on each other until the general local colors of the subject have been obtained. At this point, with paints less diluted, the details of form and shadows are introduced and carried as far as the artist desires. Very liquid effects are sometimes achieved by wetting the entire surface of the paper or a limited area before beginning to paint. This allows the colors to spread, running into one another. The opposite effect is obtained by painting on dry paper with very little water on the brush.

220. Gouache

The method of painting with opaque water color is known as gouache (fig. 254). Commercial gouaches, such as poster paint, are rendered opaque by the addition of white fillers of barites or clay. Much the same effect can be achieved by mixing water color paint with Chinese white, a tube color of zinc white ground in a gum medium. The appearance of gouache is somewhat that of pastel executed in a wet rather than a dry fashion. In gouache you are not limited to white or tinted grounds but may use extremely dark paper or cardboards. The opaque colors easily cover the dark ground which in some places may be left unpainted as one of the tones of the picture. Gouache is much lighter after it has dried.

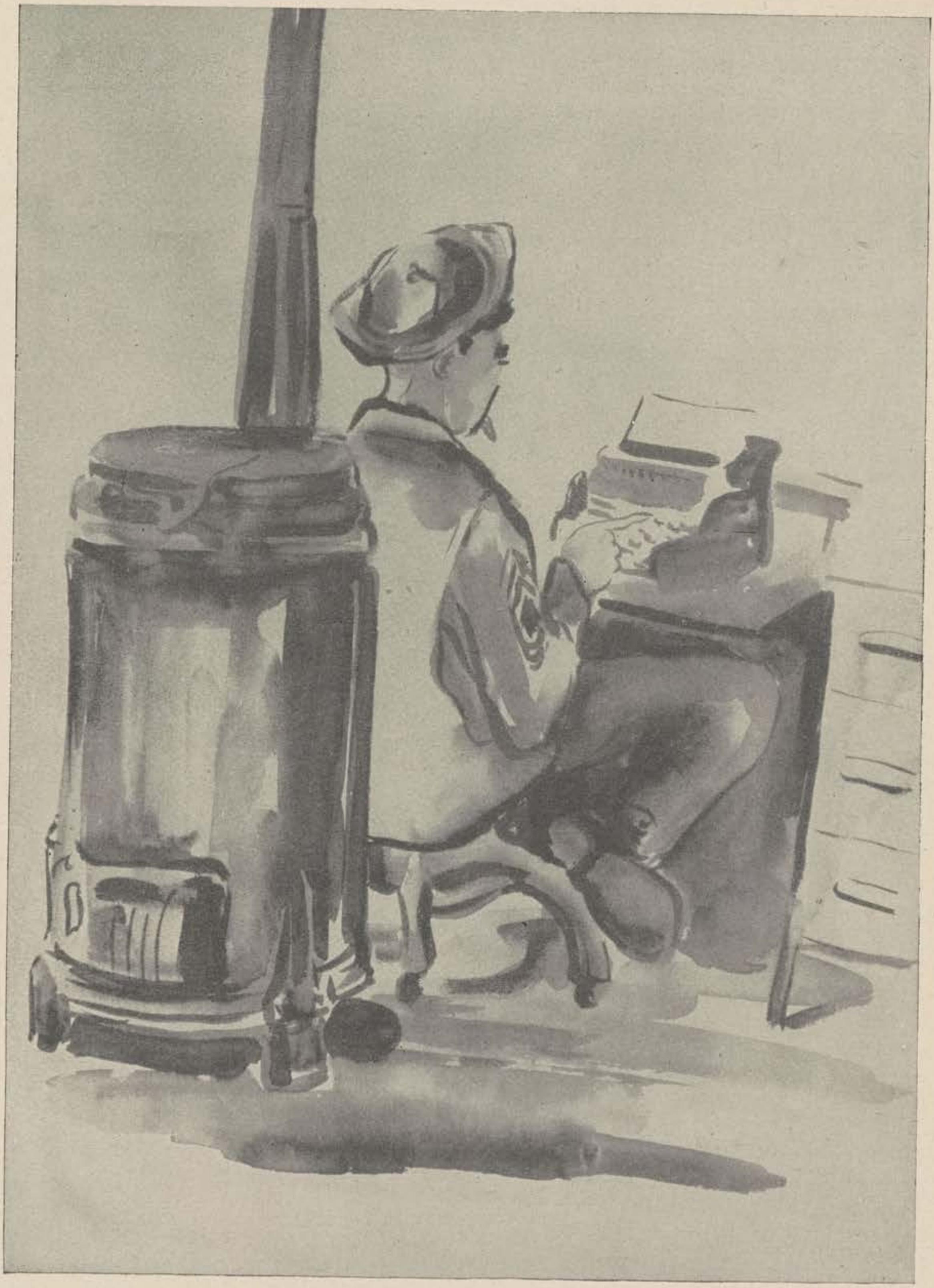


Figure 253.

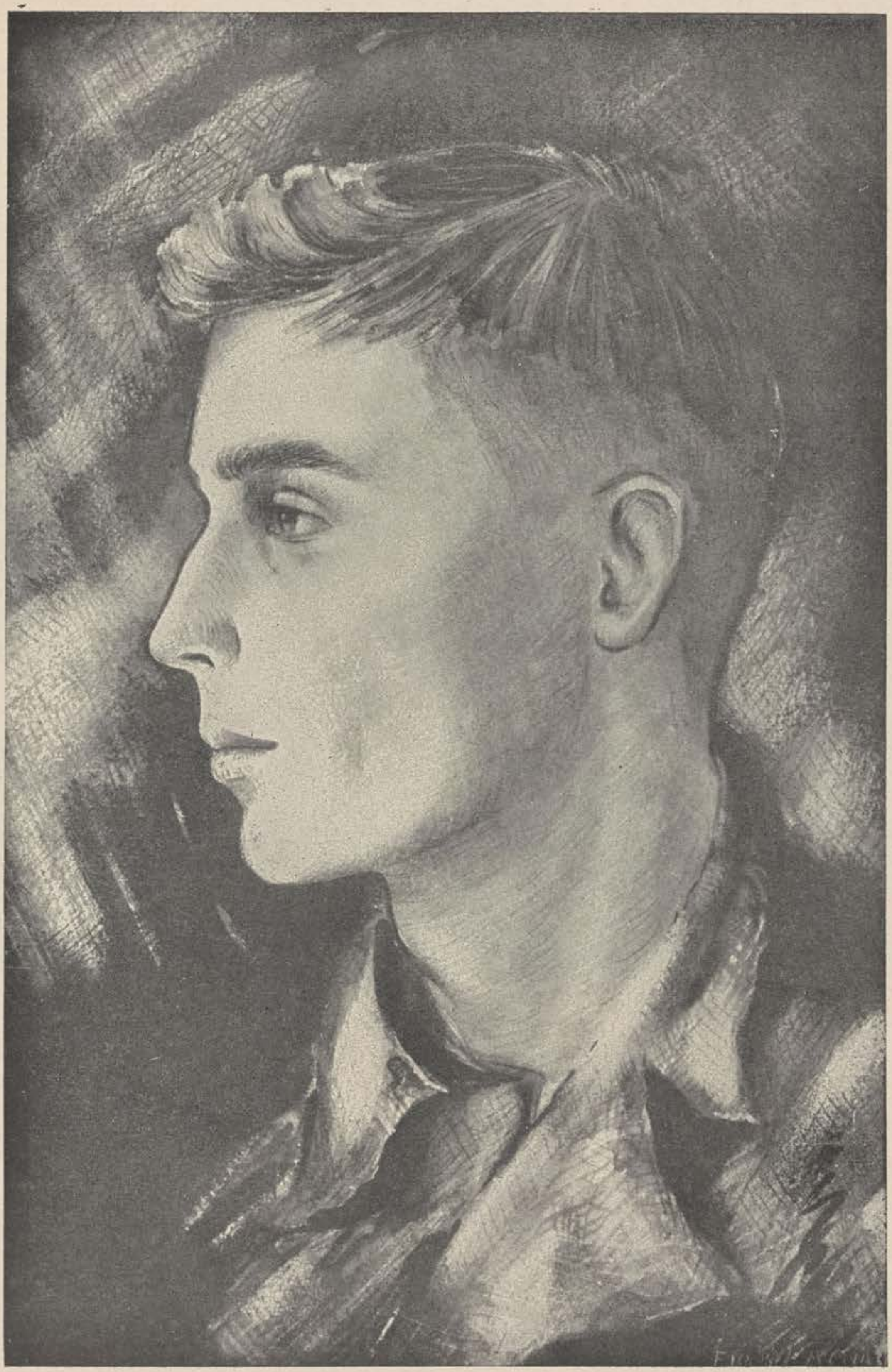
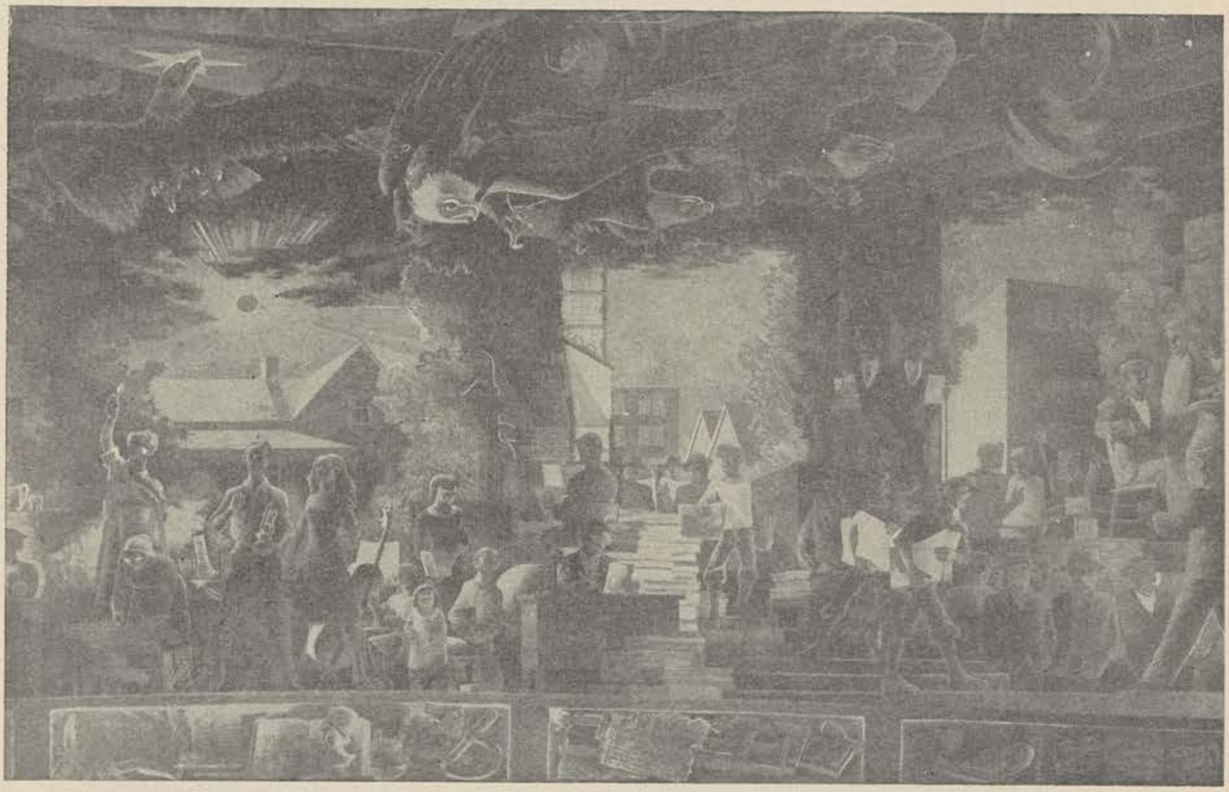


Figure 254.



CHAPTER 24

MURAL PAINTING

221. General

a. Mural painting is something you won't undertake as often as small-scale work. But is is an interesting art that always enjoys considerable demand. Many soldier artists have executed murals for service clubs, chapels, recreation halls, day rooms and other buildings within military installations. The technical requirements for a mural are similar to those for oil and tempera easel pictures. In addition, the following requirements should be kept in mind:

(1) It must be absolutely permanent under the conditions to which it is exposed for the life of the building.

(2) It should present a dead flat (mat) finish so that it may be viewed from all angles without undue glare or reflection such as one gets from an oil or varnish surface.

(3) The design or structure must be laid out with the understanding that the spectator will view the painting from many angles.

(4) The two dimensional feeling of the work should be maintained. Subjects, whether pictorial or decorative, may be presented in full perspective or recession but not to the point of destroying the impression of the wall as a flat plane.

(5) Perhaps the most important thing about a mural is that it be related to the building, in particular to the wall on which it is painted. It should "belong" there and not appear as merely an enlargement of an easel painting.

b. A good example of mural work is that which appears in the new War Department Building, in Washington, D. C. This mural in various stages of construction is illustrated.

c. Before starting your design make a very careful study of the wall on which it is to be placed. Consider the surrounding space, the relationship to doors, windows, and other decoration, and the functional characteristics of the building in that section. As we are considering the lobby of a large building, our mural must not be so large in scale that it will make the room look small. The figures in the mural should not be greater than life size. Architectural designs should be in scale to these figures. Now look at the complete design of the mural as shown (fig. 255). Notice the pattern of subject matter. The elements dealing with war and defense are all kept in the proscenium, or outer ring. The activities depicting the freedoms enjoyed in a democracy form the central part of the mural. The underlying idea is, of course, that the elements of war and defense will achieve and protect the desired freedoms. This is what we mean by grouping or arranging the pattern so the mural will be a well integrated theme carrying out whatever idea you choose to express. At the very outset, then, you will do well to give much thought to subject, scale, color, and medium. These are your important problems. When you are ready to commence work there are definite steps which should be followed.

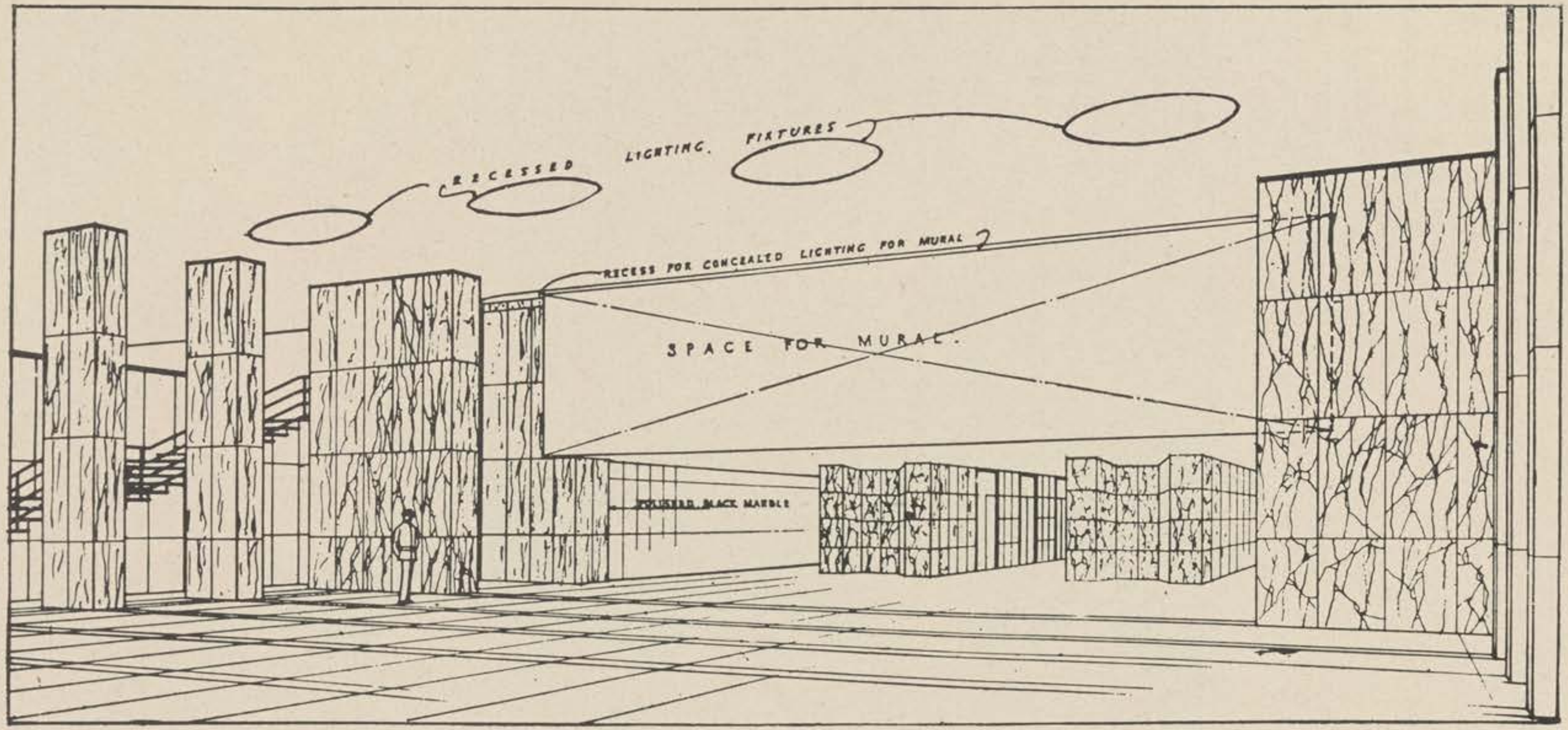
(1) First, make a small drawing of the wall and specific space for the mural. With this drawing go to your studio or workshop and develop what you feel to be the best design for the space.

(2) Next make a color study of this design and render it in the same surface technique desired in the final work.

d. After your design is thoroughly studied you are ready to make studies for the details and figures. This is best done in the following manner: make actual size drawings in crayon, chalk or pencil of the details and figures of your work. The drawings should be as simple as possible but contain all the principle elements necessary to your design. These final drawings are called cartoons (fig. 256). You are now ready to transfer your cartoons to the wall itself. There are two satisfactory ways of doing this.

e. Trace the reverse side of the drawing with a soft pencil or chalk. Then tack or tape the drawing to the wall. Trace over the original side, thus leaving the desired impression on the wall.

f. The second method is to put pin pricks along the outlines of your drawing. Place the drawing on the wall and transfer the design by "pouncing," that is, by taking a soft, dry rag or blackboard


RECESSED LIGHTING. FIXTURES
RECESS FOR CONCEALED LIGHTING FOR MURAL
SPACE FOR MURAL.
POLISHED BLACK MARBLE

A

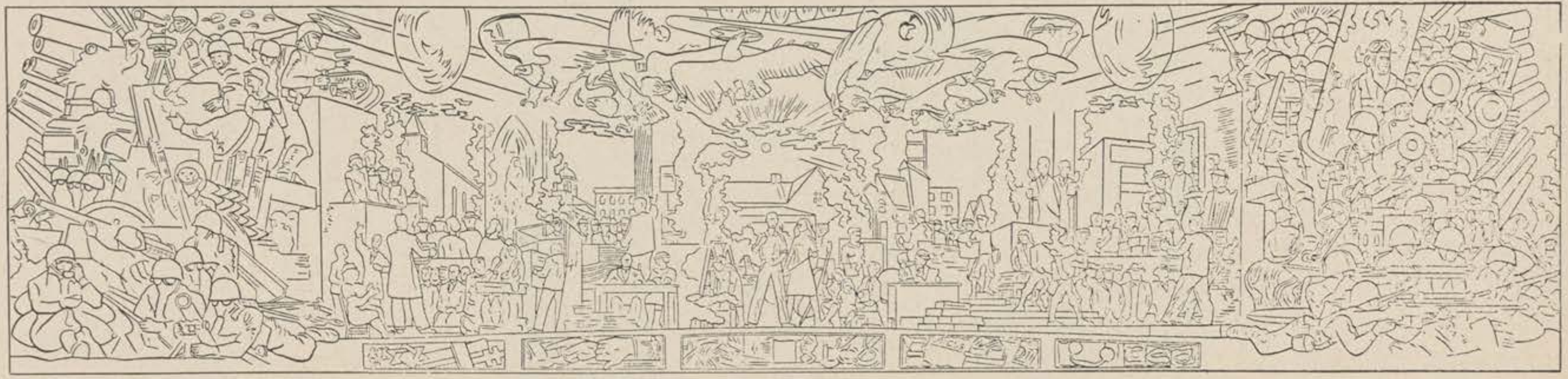


Figure 255.

eraser and patting powdered pastel or charcoal dust over the drawing. The colored dust will penetrate the pin holes and leave desired outline on the wall.

g. The most satisfactory medium for mural work is tempera on gesso. (See ch. 22.) It is low in cost, easy to handle and has good lasting quality. Do not try to cover too much ground in one cartoon. Divide your material in such a way as to facilitate handling. You can't paint more than one thing at a time anyway and it is difficult to transfer very large cartoons to the wall (fig. 257).

h. This chapter merely attempts to point out a few practical things to be considered. Bear in mind that each mural presents problems of its own. Correct analysis of these factors in advance is a vital part of your work. It is a challenge to your imagination and judgment.

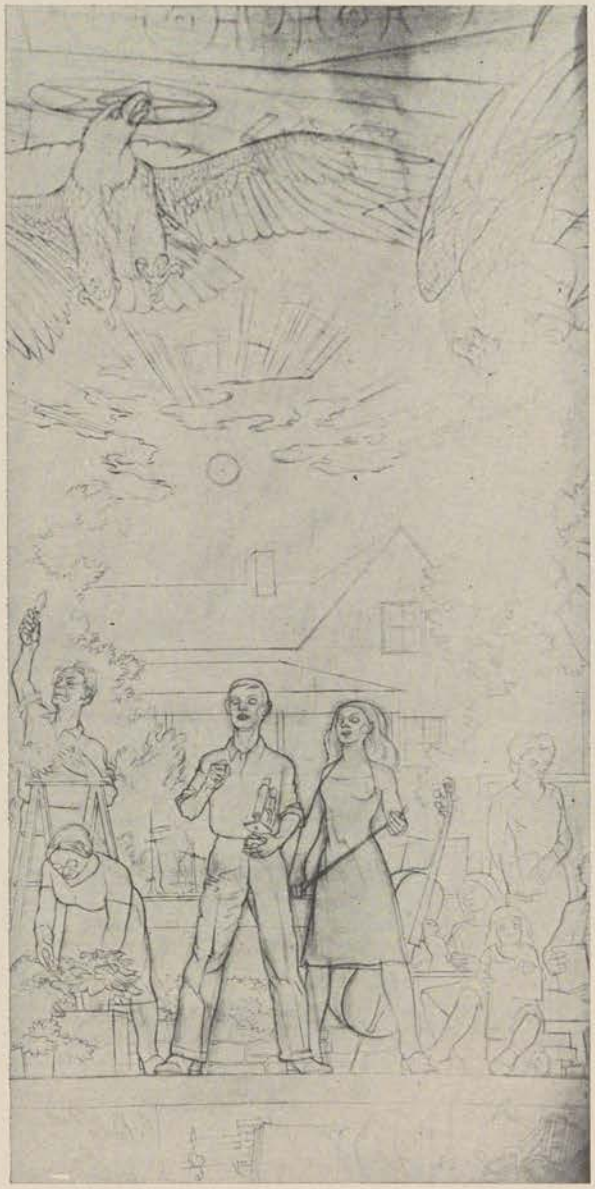


Figure 256.

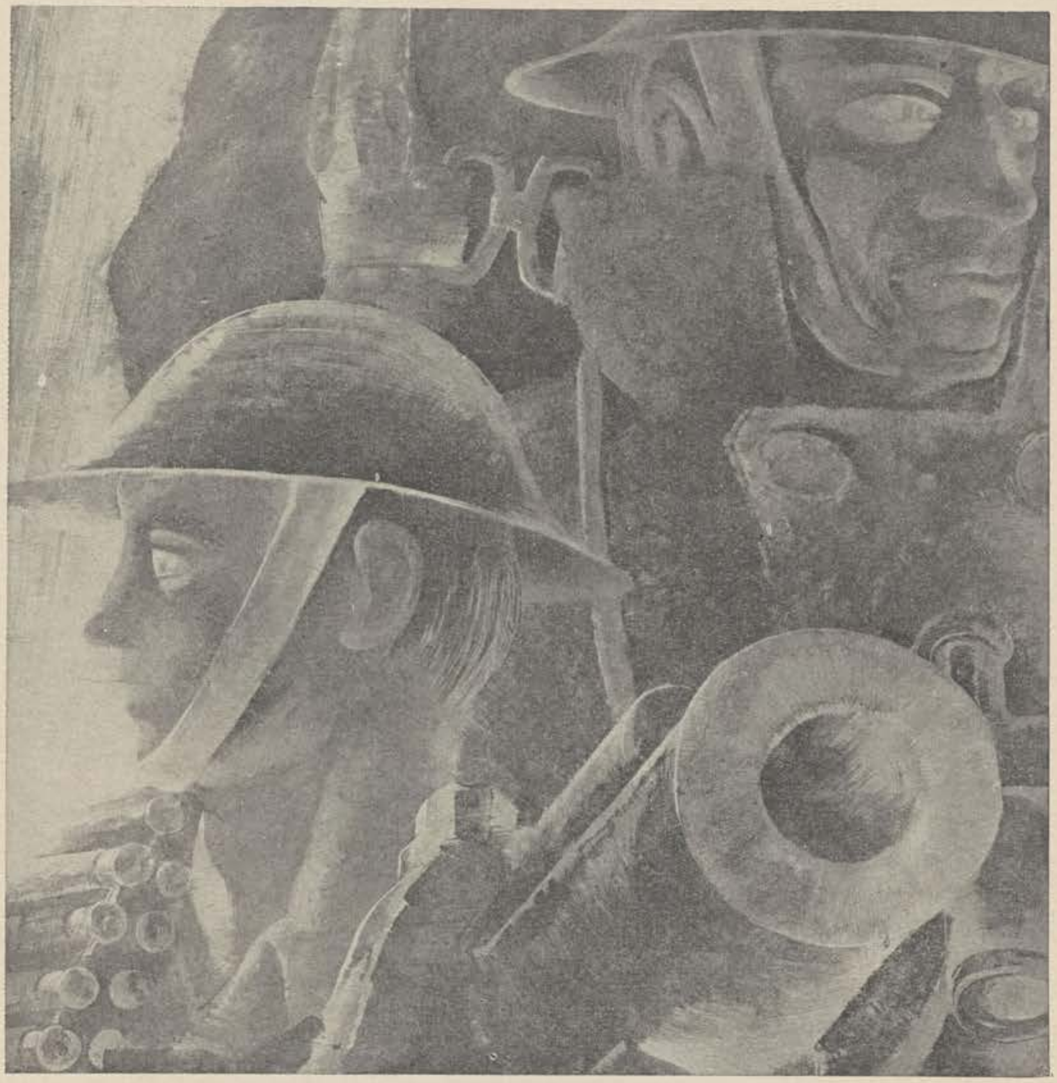


Figure 257.

CHAPTER 25

PAINTING RECIPES AND EQUIPMENT

222. Grinding Oil Colors

a. The dry powdered pigments which may be purchased at any art supply store are generally so finely ground that they will not require further treatment. If they should, however, a mortar and pestle may be used or a sheet of glass and a milk bottle. Grind until pigment is reduced to a fine powder. Add linseed oil to the powder, mixing thoroughly with a palette knife until it reaches the proper consistency, about that of soft butter. It is then ready to use and may be stored in jars or tubes which have been well coated inside with oil.

b. Many pigments tend to separate from the oil in time. To prevent this dissolve ½ ounce of pure, unbleached beeswax in ½ ounce rectified turpentine by heating them together in a double boiler. Care must be taken to heat slowly and at a low temperature, as turpentine is highly combustible. Add this wax solution to 25 ounces of linseed oil and combine with the dry pigments as above.

223. Sizing the Canvas

When the raw canvas has been stretched or mounted on a panel, it should be painted with a simple solution of glue water (2 ounces glue to 1 quart water). The best glues are those made of hide, rabbit skin or gelatin. All come in thin sheets and should be soaked in a little water overnight, then heated slightly to dissolve them. Add the remaining water after the glue is dissolved.

224. Priming the Canvas

a. There are many ways of priming a canvas. A simple gesso ground which can be used on either linen or panel may be made as follows:

1 quart glue water (made as above).
1 pound whiting powder.
1 pound zinc powder (or 2 ounces titanium dioxide).

b. Mix thoroughly and paint very thinly on canvas with a brush or smooth on with a knife. Several coats may be applied, but each must be given time to dry. The titanium has more covering power than the zinc white, but does not give as white a surface. This ground is suitable for tempera; if it is to be used for an oil painting it is advisable to add up to 8 ounces of open kettle boiled linseed oil or thickened linseed oil, stirring it drop by drop into the gesso when the latter is cool. The above quantities will make enough gesso to prime about six 25- by 30-inch canvases.

225. Varnish

a. An excellent picture varnish may be made by dissolving one part of either mastic or damar resin in two to four parts of rectified turpentine (by weight). The resin comes in small lumps. Select those with the fewest impurities, grind to a powder, place in a bag of linen or cheese cloth, and suspend freely in a jar three-quarters full of rectified turpentine. Cap the jar to prevent evaporation.

b. Damar will dissolve in a few days, while mastic may require several weeks. The process can be hastened by melting the resin *with the greatest care* in a double boiler over a low flame and adding the turpentine in small quantities. However, the cold method provides better varnish and avoids the very great danger of combustion. If the varnish is muddy, add a few drops of methyl alcohol, which will clarify it immediately.

226. Egg and Oil Tempera

a. A simple and entirely satisfactory oil tempera may be made by mixing one egg (yolk and white) with an equal measure of thickened oil or of oil damar varnish in equal parts. To this is added 1 to 1½ measures of water. The oil used should be either stand oil or sun-thickened oil.

b. It is important that the ingredients be mixed in the following order. Beat the egg to a froth, then combine with the oil, or oil and varnish mixture. Shake vigorously. Add the water and shake again until an emulsion is achieved. Your ground colors may then be added to this medium after being worked into a stiff paste with a very little water. If only oil is used in the above mixture, the medium will be heavy and slow-drying; the addition of varnish makes it thinner and accelerates the drying. The proportions may be altered to suit the taste of the individual.

227. Painting Equipment

Many kits containing a selection of paints and other equipment may be purchased at art supply stores, but these often fail to provide certain indispensable tools. Also, they are generally more expensive than the same items purchased separately. For the assistance of the beginner, the following lists of equipment have been drawn up.

228. Oil Paints

a. The majority of oil paints may be bought in either student quality or finest artist quality. The former are quite satisfactory for most purposes and should be bought, for economy, in the studio-size tubes (except zinc white, which it is advisable to buy in 1-pound tubes). A simple selection of colors for the beginner should include the following:

cadmium yellow (light)
earth red
cadmium red
permanent blue
raw umber
burnt sienna
yellow ochre
alizarin crimson
viridian green
ivory black
white (titanium or zinc)

b. For a more complete palette, the following additions are recommended:

cadmium yellow (medium)
yellow ochre deep
cobalt green
cobalt blue
French ultramarine
cerulean blue
cobalt violet
verte emeraude
terre verte
burnt umber

229. Brushes for Oil or Tempera

Taste in brushes varies greatly, but the following selection will cover the needs of the beginner.

a. Flats (white bristle brushes) one each of the following sizes: Nos. 2, 4, 6, 8, 10. A wider range can be achieved by adding one each of the following:

b. Brights (white bristle brushes) Nos. 2, 4, 6, 8, 10.

c. Rounds (white bristle brushes) Nos. 4, 6, 8.

d. Flats (sable oil and tempera brushes) Nos. 6, 12, 20.

e. Rounds (sable oil and tempera brushes) Nos. 8, 10, 12.

230. Other Tools for Oil or Tempera

a. The following are recommended as invaluable aids to the artist:

(1) Palette knife of the general shape illustrated (fig. 259). It has a flexible steel blade set in a wood handle.

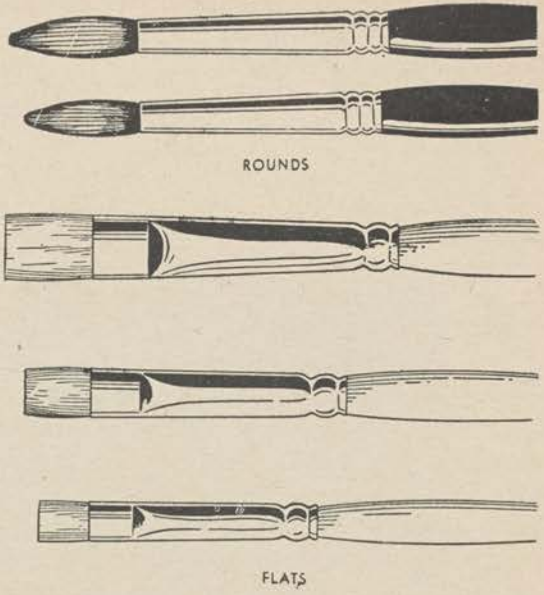


Figure 258.

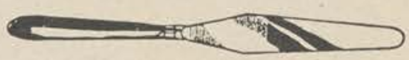


Figure 259.

(2) Single palette cup for oil or turpentine (fig. 260).

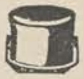


Figure 260.

(3) Bottle rectified turpentine.

(4) Bottle pure or sun-thickened linseed oil.

(5) Palette. This may be purchased, but a sheet of glass or a square of masonite or other wall board which has been rendered non-absorbent will prove satisfactory.

b. For a more complete painting kit, or for the special purposes indicated, the following items may be added:

(1) Trowel type painting knife with flexible steel blade in wood handle (fig. 261).

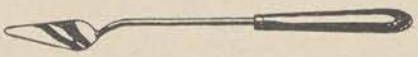
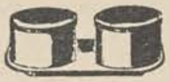


Figure 261.

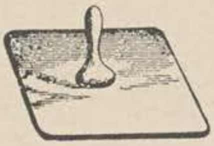
(2) Double palette cup for oil and turpentine (fig. 262).



DOUBLE PALETTE CUP

Figure 262.

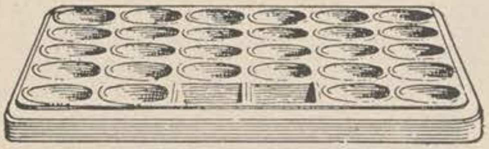
(3) Glass muller and slab for grinding colors (fig. 263).



GLASS MULLER

Figure 263.

(4) China mixing palette for tempera with rows of round and slanting wells (fig. 264). An ordinary muffin tin also makes a satisfactory container.



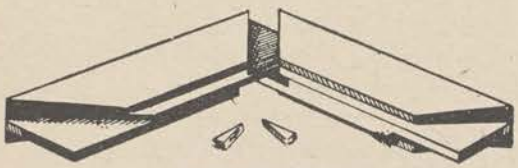
CHINA MIXING PALETTE

Figure 264.

231. Supports for Oil or Tempera

Convenient prepared supports are the panels listed below in their most practical sizes:

a. CANVAS PANELS. Sizes in inches: 8 by 10, 12 by 16, 20 by 24. For more advanced work painters generally prefer to stretch their own canvases. Wooden stretchers for this purpose may be purchased in a wide variety of sizes (fig. 265). Linen is the best support, but other materials may be used for certain purposes. A few of the many textures and qualities available are illustrated below:



STRETCHER STRIPS

Figure 265.

b. Linen with a finely woven, smooth texture for portraits and illustrations (fig. 266).

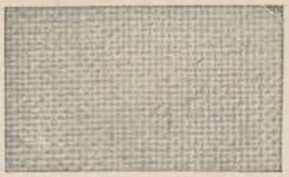


Figure 266.

c. A heavy weight canvas with a medium texture for general sketching (fig. 267).

Figure 267.

d. Decorator's canvas of light-weight cotton with a medium texture. Practical for large paintings which are not intended to be permanent (fig. 268).

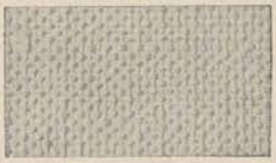


Figure 268.

232. Water-color Paints

a. Tube colors are generally considered the most satisfactory. A simple palette should include:

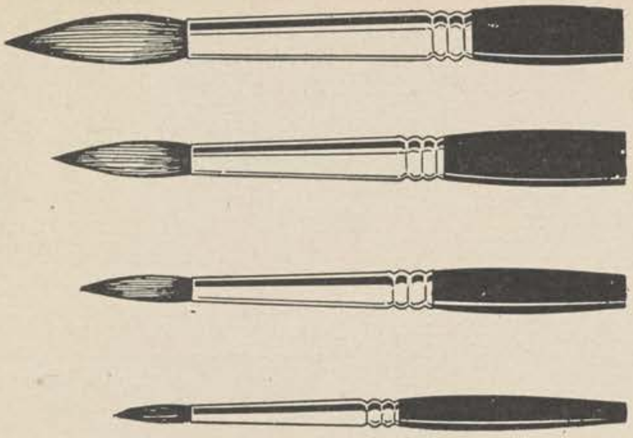
orange vermilion
cadmium yellow (medium)
burnt sienna
yellow green (No. 11)
Sepia
Antwerp blue
French blue
alizarin crimson
ivory black

b. The following may be added as the artist needs them:

vermilion
cadmium red
brilliant orange
cadmium orange
aureolin
lemon yellow
viridian
cerulean blue
cobalt blue
turquoise (No. II)
mineral violet
Indian red
Prussian blue
raw umber
Davy's gray
Payne's gray
lamp black

233. Water-color Brushes (fig. 269)

a. The best quality are made of sable. If these are too expensive, brushes of camel's hair are a good substitute.



WATER COLOR BRUSHES

Figure 269.

b. A practical kit for the beginner consists of one each of the following sizes of water color brushes: Nos. 4, 6, 8.

234. Water-color Paper

For student work, blocks of paper are generally satisfactory. Any of the following sizes and textures are recommended.

a. Water color blocks, 24 sheets in smooth, medium or rough surfaces; sizes in inches: 9 by 12, 12 by 16, 16 by 20.

b. Professional work is generally done on loose sheets mounted on a stretcher or drawing board. There are many fine papers, both imported and domestic; generally these come in three surfaces: smooth, medium, rough; sizes in inches: 19 by 24, 22 by 30.

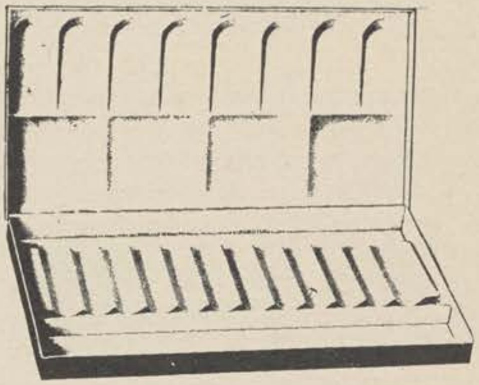
235. Other Equipment for Water-color Painting

The items listed below are all advisable for the water-color painter to own and in most cases are inexpensive.

a. Small soft sponge.

b. Sharp knife.

c. Japanned tin water color box with lid compartmented as a palette (fig. 270). If the box is not needed, a white porcelain plate makes a satisfactory substitute for a palette.



JAPANNED TIN WATER COLOR BOX

Figure 270.

CHAPTER 26

PHOTOGRAPHY

236. General

a. Photography, as a hobby, brings pleasure to people of many different inclinations. The scientific-minded person will want to concentrate on the optical and chemical side of picture taking and making. The artistically inclined person will be interested in the careful composing of all the lights and shadows so that a pleasing picture results. A mechanically minded person will enjoy putting together gadgets and inventing useful devices to make his work simpler or more efficient. This discussion is limited to the basic processes involved, starting with the idea for the picture and going straight through to the print. Specialization or a more thorough mastery of any one phase will come with time and study.

b. No particular makes or brands of cameras, film, or paper are discussed. A general type is considered in each case. The discussion is divided into three main sections: first, taking the picture; second, developing the negative; third, making the print. At the end of each section there is a listing of all essential equipment and a listing of desirable accessories.

237. Planning Pictures

a. If simple snapshots are being made, little planning will be necessary, since the main object is to get pictures of people or their surroundings in a natural pose or mood. Several things should be considered, however. Watch out for messy backgrounds. Try to have the main subject against a plain background of contrasting shade. If the subject is dark, use a light background, such as a white wall, or plain sky. If the subject is light, use a dark wall or shrubbery. This precaution is not necessary, but it produces a more interesting picture in most cases.

b. Vary the angle or position in which you place the camera. If your subject is a standing figure, kneel down and see if that point of view improves the background or is more flattering to the subject. Have the person turn three-quarters away so that he does not look directly into the camera or into the sun. If there are several people, try to get them into an unposed group instead of standing everyone up in a straight line and all level. If possible, take the picture when people are not aware of the camera. Then the groups will be completely natural.

c. Get in close enough, but not so close that you blur the subject. All cameras are limited as to how close to the subject they can be used. If there are figures showing the range printed on the lens, the smallest represents the closest possible distance. For folding cameras, it is usually 4 to 6 feet. If the camera is of the box type, with no printed range, experiment. Take pictures from varying distances of some black and white object, with sharp outlines, such as a white signboard with black letters. Start at a distance of 14 feet, and take 7 pictures, moving in 2 feet each time. Compare the prints. You can tell at what distance each was taken, because the closer you are the less signboard appears in the picture. The last sharp picture shows the closest camera-to-subject distance possible with that particular camera.

d. Too many trick shots, such as the perennial greatly enlarged feet, become monotonous. They seldom succeed and are almost never as funny as they look at the time. If you see something unusual which looks very funny or strange, go ahead and take it. Your own experience will soon tell you what is funny from the camera's point of view.

e. If you are controlling the angles, the groupings, and the light, study all possibilities and then take several shots. Again, your own eye will soon tell you what you did wrong. Remember that a lot of small objects seldom make a good picture unless they are arranged in a definite pattern. Large, broad flat surfaces of contrasting brightness make better subjects to start out on. Varying textures, shapes, and brightness (or tone) result in more interesting pictures.

f. Work with strong diagonals, circles, or spirals to achieve interesting compositions. Contrast a large dark object with a small bright one for emphasis. As soon as you become aware of all the elements that make up a photograph, your pictures will be more interesting even to the untrained eye.

238. Loading the Camera

a. You will probably start out with roll film, since this type is most common and very practical under all conditions. All film comes in several speeds. This means that some films are better suited to bright light, while others are better suited to dim light. The films to be used in daylight or other bright light are called "slow" films, while those suitable for dim light are called "fast" films.

b. Load the camera in subdued light. Most film is protected by a paper backing, so loading in direct sunlight would probably do no harm, but the fast films are very highly sensitive to light so be careful with them. Take off or open the back of the camera and examine the path through which the film travels. After exposing and removing a roll of film from the camera, an empty spool will be left in the camera. Remember that the function of this spool is to take up the film after each picture. Place the empty spool in such a position that it turns when you turn the take-up knob or handle.

c. Put the new roll of film into the empty position. Pull out enough leader (the paper end of the roll) to reach to the take-up spool. Thread the leader into the slit in the spool and give the spool a few turns. See that the film is winding straight onto the take-up spool.

d. Replace or close the back of the camera. Be sure it snaps into position firmly and locks tightly. When opening or closing a camera, never pry it open or force a knob to turn. You will certainly damage the camera and probably cause light leaks, which will make the edges of your picture streaky.

e. Advance the film forward by turning the winding knob. On roll film a warning arrow or hand will appear to indicate that the first film is coming into position. Turn slowly until the number 1 appears in the window on the back of the camera. The film is now ready for the first picture.

239. Taking the Picture

a. Bear in mind all the advice given earlier about planning the picture. With the box type camera, no further adjustments are necessary. Move the camera forward or backward or up or down until you see in the viewfinder exactly what you want to see in the picture. Press the lever which takes the picture.

b. If the camera is of the folding type, there are other adjustments which must be made. Since the picture is made by means of light, most of the devices put on the front of the camera are simply means of controlling the light. A box camera which has none of these devices will work anyway, since the film allows a wide variation in light. The final picture will, however, be better, if control is exercised over the light which enters the camera. This admitting of light to the film is called exposure.

c. There are two ways of controlling the exposure. First, you may let more or less light in; second, you may let the light in for a shorter or longer time.

(1) The first control is achieved by means of a diaphragm or opening of variable diameter. It is variously called *f/* stop, lens aperture, or just opening. There are many systems for numbering the different openings, but they all have one thing in common. The smallest opening has the largest number. If your camera has openings varying from *f*/6.3 to *f*/22, the *f*/22 opening is the smallest, that is, it lets in the least light. The *f/* is not actually engraved on the camera. Another system uses numbers from 1 to 4, in which case 4 is the smallest opening. Roll film has an exposure guide included in the package. This guide suggests the opening to be used under varying light conditions.

(2) The second control is achieved by means of the shutter, which allows the light to enter for a predetermined length of time. These times usually vary from 1/25 second to 1/100 second. In bright light, use the shortest time, 1/100 second. Exposures within the 1/25- to 1/100-second range are called instantaneous. Time exposures may be used when the light is very dim. The light is then allowed to enter the camera for 1 or more seconds, depending on the amount of light and the type of film. During a time exposure the camera must be propped up on a chair, or put on a tripod.

d. With film of the Super-XX, Superpan Supreme, or fastest type, less light is necessary. If this film is used during very bright daylight, it will probably be necessary to use the smallest opening (such as *f*/22) and the shortest time (1/100 second). Light subjects and certain areas, such as a beach or snow scene, reflect more light. Consequently, when taking pictures at the beach or in the snow, use a smaller opening or less time than usual.

e. After taking the first picture wind the film until the number 2 appears in the window. It may be necessary to reset the exposure controls if the light changes or if the subject moves into the shade. Continue through the roll until the last picture is taken. It is wise to form the habit of winding the film on to the next number immediately after taking the picture, thus avoiding double exposures.

240. Unloading

After the last picture has been taken wind all the remaining film onto the spool. (This is not actually film, but simply a paper covering which protects the film from light when the camera is open). Take off or open the back of the camera and remove the exposed roll of film. Moisten the sticker and seal the roll immediately so that there is no danger of it unrolling. Close the camera after reloading, if more pictures are to be taken.

241. Accessories

The essential materials for taking pictures are only the film and a camera. Many extra gadgets help, but none are necessary. Among the most useful ones are an exposure meter, a tripod, and light filters.

242. Exposure Meters

An exposure meter provides a means of measuring the amount of light or the brightness of an object. There are many types of meters, varying from the simple extinction type to the more complex photoelectric cell type. The extinction meter has a series of translucent numbers or spots of varying thickness. When held up to the light the last visible number or spot indicates the relative brightness. The photoelectric type of meter makes use of the fact that electric current is generated when light strikes a photoelectric cell. This current is used to move a pointer. When a bright light strikes the cell, the pointer moves far along the scale. When the pointer comes to rest, it indicates the numerical value of light, which is then used to calculate the size of the lens opening and the time of the exposure. The photoelectric type meter is much more expensive, but is a valuable asset, since it leaves nothing to guesswork.

243. Tripod

A tripod provides a steady base for the making of time exposures and allows the photographer to take his time about framing or composing the picture in the viewfinder. For most photography the very light, collapsible tripod will be completely satisfactory.

244. Filters

Light filters are used over the lens of the camera when special effects are desired. A pale yellow filter will be most generally useful. It emphasizes clouds by darkening the blue sky, but it has no visible effect on skin coloring or objects in the main portion of the picture. All filters cut out some light, so it is necessary to compensate by using a larger opening or leaving the shutter open for a longer time. A guide in how much of a change should be made is given in a system of filter factors. If the factor for a particular filter is 2, it will be necessary to double the amount of light. This may be done by opening the lens to the next larger opening (smaller number) or by doubling the length of time, that is, changing from 1/50th to 1/25th second. There are various shades of yellow, red, and green filters. They have different use, and are for very specialized work. They should not be used until technique is completely mastered.

245. Developing the Film

a. The next step is to develop the film. There are two general processes which can be used. The more efficient is based on the time and temperature theory. The temperature of the solution determines the length of time the film is to be left in it. This method requires a lightproof tank, and is commonly called the tank method. The solutions may be changed without removing the cover.

b. A less efficient method is tray development. Simpler equipment is required, but practice is necessary before control can be achieved. The same developer that will be used later for developing the print may be used when developing the film in a tray.

246. Tank Development

a. Either a stainless steel or bakelite adjustable tank may be used (fig. 271). The loading of the tank must be done in complete darkness for panchromatic film. Orthochromatic film (Verichrome or Plenachrome) may be exposed to a dark red safelight, such as one with a Wratten Series 2 filter. Read the instructions in the film package concerning the proper safelight. These instructions will also mention that total darkness is necessary, if that is true. To be absolutely sure, ask at the photographic supply store when you buy film. Practice loading the tank in bright light with a roll of waste or developed film. Read the instructions supplied with the tank and follow them very carefully. The commonest tank has matched spiral grooves at the top and bottom of the reel. Hold the film between thumb and forefinger of the right hand and the reel in the left hand. Thread the beginning of the film into the groove and push gently. If the grooves are wet the film will stick. Feed the film into the reel until it is completely threaded. When you become practiced at loading with the dummy film in bright light, try a roll in the darkroom. Before starting

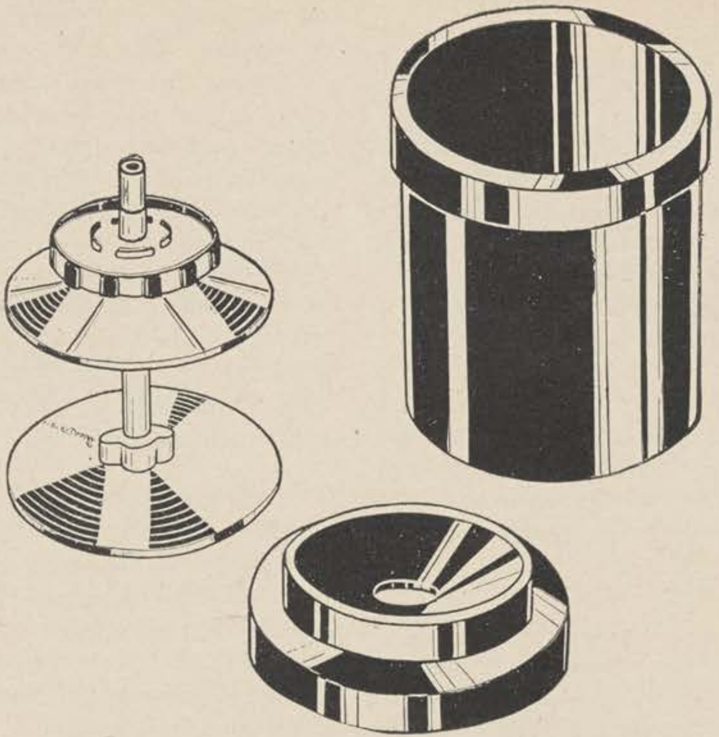


Figure 271.

be sure to place the tank, the cover, and the reel in a convenient position for locating in the dark. When the film is loaded, replace the cover, making sure that it is secure. The white light may now be turned on.

b. The standard chemical formula for tank development is Eastman Kodak's D-76. The prepared developer, in powder form, is sold in any photographic supply store. The 1-quart size will be sufficient for most tanks. Mix according to the directions on the package.

c. If the prepared developer is not available, the formula may be mixed from the basic chemicals. Doing so wastes a great deal of time and saves no money, unless quantities of 5 gallons or more are mixed. If mixing from the basic chemicals is necessary, mix the following chemicals in the order given:

	Avoirdupois	*Metric*
Water (about 125°F. or 52°C.)...	24 ounces	185 cc
Elon	29 grains	0.5 gram
Sodium sulfite, desiccated........	3⅓ ounces	25.0 grams
Hydroquinone	72.5 grains	1.25 grams
Borax, granular	29 grains	0.5 gram
Cold water to make.............	1 quart	250 cc

d. Elon is Eastman's name for a solution also known commercially as metol. The two are identical for all ordinary uses.

(1) Pour the completely mixed developer into a 32-ounce graduate and check the temperature. It may be used at any temperature from 65° F. to 75° F. If it is above 75° F., cool it for immediate use. Set the graduate in a sink of cold water and stir the developer slowly. When the proper temperature is reached, pour as much developer as your tank will hold into the closed tank through the opening provided in the top. Make a note of the time at this moment. Agitate the film by rotating the knob on top of the tank or by the use of whatever device is provided. Do not agitate violently and do not turn constantly in one direction.

(2) The time of development at 65° F. is about 20 minutes. As the temperature increases, the time decreases, until, at 75° F., only about 12 minutes are required. These times are approximate. If the film has been taken under very poor light conditions, increase the time 2 or 3 minutes.

(3) When sufficient time has elapsed, pour the developer back into the graduate. After completing the next two processes, pour the developer back into the bottle and stopper it tightly for future use. It may be used for 15 or 20 rolls of film. Increase the time 2 minutes for each roll after the tenth.

(4) The next solution needed is the short stop. It must be prepared before starting development. The purpose of this solution is to stop development immediately. The solution is made by adding 30 drops of 28 percent acetic acid to 32 ounces of water. Do not necessarily mix 32 ounces. Mix only as much as

your tank will hold. It must be at the same temperature as the developer. Use this solution only once. Pour the correct quantity into the tank the moment the developer has been poured off. Agitate gently for 5 minutes. Pour off the short stop.

(5) The third and final solution is the acid fixing bath, or hypo, which should also be prepared before developing starts. It should be about the same temperature as the other solutions, but may be some 5° cooler. Once again the prepared formula is available wherever photographic supplies are sold, but it may be mixed from basic chemicals. Mix the following chemicals in the order given:

	Avoirdupois	*Metric*
Water (125°F.)	20 ounces	600 cc
Hypo	8 ounces	240.0 grams
Soldium sulfite, desiccated	½ ounce	15.0 grams
Acetic acid, 28 percent	1½ fluid ounces.	48.0 cc
Boric acid, crystals	¼ ounce	7.5 grams
Potassium alum	½ ounce	15.0 grams
Cold water to make	32 ounces	1.0 liter

(6) Crystalline boric acid should always be used, as powdered boric acid is very hard to dissolve. Pour the hypo into the tank and agitate for 2 minutes. Leave the tank closed for 8 more minutes. Remove the lid and pour the hypo back into the bottle or graduate. This hypo may be used for another roll of film if used within the next day or so. Otherwise it should not be used for film again but should be saved for fixing prints. Place the film, still in the tank, under running water of about the same temperature as the other solutions. If the water is lower than 60° F. or higher than 75° F., it may not be used directly from the tap. Cool or heat a large vessel of water to the proper temperature, and use it for washing the film. Pour the tank full of water of the correct temperature, and let it stand for about 5 minutes. Pour it off and pour the tank full again. Let the second bath stand for about 5 minutes. Continue this until the bath has been changed 7 or 8 times, letting the film soak in each bath for about 5 minutes.

(7) Remove the film from the reel and hang it up to dry. Use film-hanging clips or clothes pins of the clamp type. Hang the film with one clip and attach another to the bottom. When the film has been hung up, wipe it clean with a wet chamois cloth, a sponge (of a special photographic type), or a wet piece of absorbent cotton (fig. 272). Wipe both surfaces free of excess moisture. Do this gently to avoid scratching the film. Handle the film by the edges only during this entire process. Let the film hang, in as dust-free a spot as possible, until it is completely dry, about 1 hour in normal humidity. Prints may then be made. The materials necessary for tank development are:

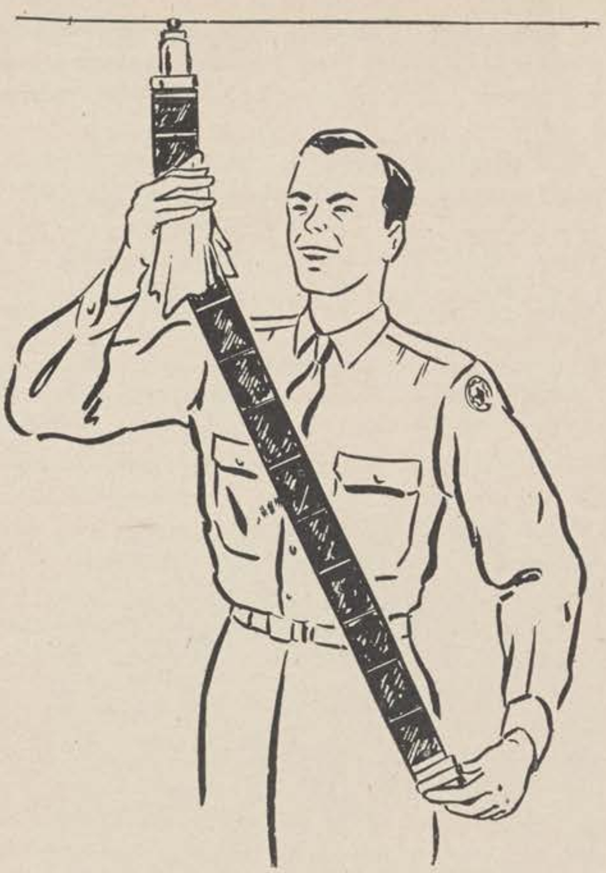


Figure 272.

Tank, bakelite or steel.
Thermometer.
Developer, D-76, or equal.
Short stop, acetic acid.
Hypo, acid hardening and fixing bath.
Film clips or clothes pins.
Chamois cloth, sponge, or absorbent cotton.
Graduate, 32-ounce.
Safelight (for orthochromatic film).
Timer (not necessary).

247. Tank Development

a. Panchromatic film should never be developed in a tray because it requires absolute darkness. The tray solutions are difficult to manage in total darkness. Orthochromatic film may be handled in a red safelight (Wratten series 2) which makes the tray process easier. For tray development a faster developer is needed than for tank development. Kodak D-72, the same developer to be used for prints, is suggested.

b. Arrange three trays and mix all three solutions (developer, short stop, and hypo) before turning off the white light. The short stop and hypo are prepared exactly as they were for tank developing, and are poured into the second and third tray respectively.

c. Prepared developer is simpler, but developer may be mixed from the basic chemicals, as follows:

	Avoirdupois	*Metric*
Water (about 125°F)	16 ounces	500.0 cc
Elon (metol)	45 grains	3.1 grams
Sodium sulphite, desiccated	1½ ounces	45.0 grams
Hydroquinone	175 grains	12.0 grams
Sodium carbonate, desiccated	2¼ ounces	67.5 grams
Potassium bromide	27 grains	1.9 grams
Water to make	32 ounces	1.0 liter

d. For an 8- by 10-inch tray make about 15 ounces of diluted solution by adding 5 ounces of the above stock solution to 10 ounces of water. Stir this solution thoroughly and pour it into the first of three trays. Check the temperature.

e. Tray-developing times are much shorter than those in a tank. Average time for the above developer when diluted is about 4 minutes at 65° F., or 3 minutes at 70° F. It is best not to use the developer above 70° F. because it is difficult to control the developing in such a short time.

f. Before starting to develop the film, presoak it in plain water at the same temperature as the developer. Prepare the film for developing by unrolling it (in the dark or by the light of the proper safelight) and tearing off the paper leader and backing. Be careful not to turn loose one end of the film suddenly since it will reroll very quickly and will be scratched. Put a film clip on either end of the film and bend the film into a **U**-shape, being careful not to coil it. Lower bottom of the **U** into a tray of plain water, and pass the film back and forth until the entire length is wet (fig. 273). Lift it out and drain it.

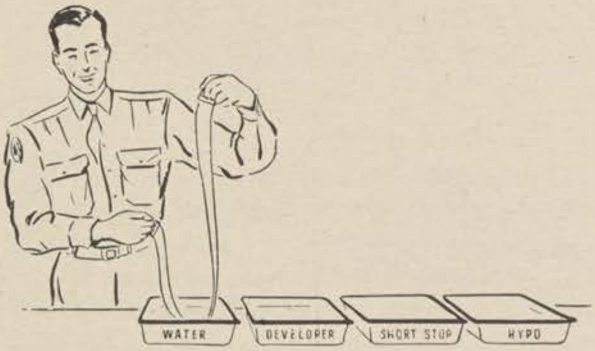


Figure 273.

g. Lower the bottom of the **U** into the developer and notice the time. Move the ends up and down slowly; be sure that the entire length of the film is immersed during each up-and-down motion. Lift the film up, drain it, and lower it into the short stop. Lift the ends up and down again. Continue this motion for about 2 minutes. Lift the film, drain it, and lower it into the hypo. Start the up-and-down motion again and continue for 10 minutes. The white light may be turned on after about 3 minutes. After 10 minutes, drain the film thoroughly and wash it for about 30 minutes in running water or in 7 or 8 successive baths of 5 minutes each. The procedure for hanging, wiping, and drying the film is the same as that in tank developing.

h. The materials needed for tray development (fig. 274) are:

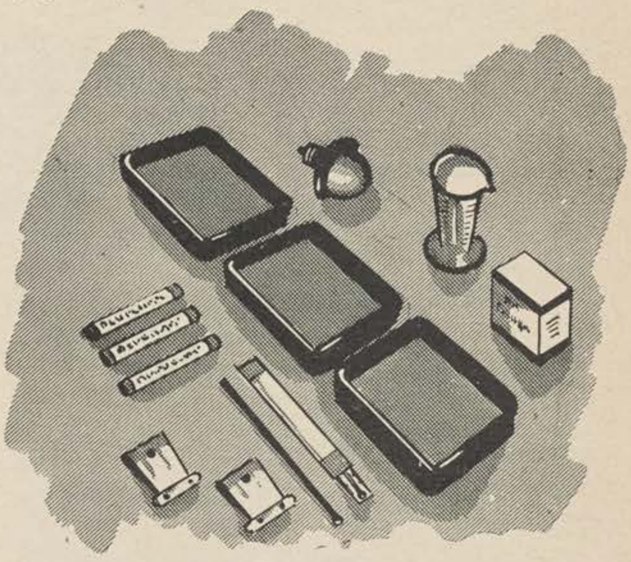


Figure 274.

Developer, D-72, or equal.
Short stop, acetic acid.
Hypo, acid hardening and fixing bath.
Two metal clips.
Chamois cloth, sponge, or absorbent cotton.
Graduate, 32-ounce.
Safelight, for orthochromatic film.
Timer (not necessary, but helpful).
Thermometer.
Stirring Rod.

248. Printing

Before discussing the actual procedure for making prints, it is necessary to explain several other points, such as the types of printing and the choice of paper.

249. Types of Printing

There are two general types of printing: contact printing and projection printing. In contact printing the paper and the negative are in direct contact. A picture of the same size as the negative results. This picture is then called a contact print. In projection printing the negative is placed between a light source and a lens. The light rays are then projected down onto a piece of printing paper. By varying the distance from the negative to the paper, a print of any size can be made. The usual print made this way is larger than the negative and is called an enlargement. The equipment for projection printing is much more complex than that for contact printing. Contact prints will suffice for any practical purpose unless the negative is very small.

250. Choice of Paper

a. The choice of paper depends on the type of negative. The two main kinds of paper are glossy and matte, each of which comes in single or double weight. The glossy paper brings out details very sharply but it also shows up faults or blemishes. The matte paper has a dull finish and, consequently, a slight diffusing quality. It is fine for portraits and snapshots in general. The single weight paper is better for mounting in albums, but the double weight paper is more durable. There are also contact and projection papers. The contact paper is slower and can be used with a brighter light.

b. All printing papers come in varying degrees of contrast, numbered from 0 to 5. The most common are from 1 through 4. The lower numbers are for use when a soft print is desired and should be used for printing very contrasty negatives which have definite blacks and whites. The higher numbers are for hard prints with definite blacks and whites and less graduation between the two. They should be used for negatives which tend to be an even over-all gray. It is wise to limit your printing papers to numbers 2 and 3 until you are familiar with the characteristics of them and with other phases of printing.

c. Within the above general groups there are many variations of surface and tone from deep buff to a clear white paper and from regular glossy to an almost velvetlike surface. The use of these papers depends upon personal preference.

251. Chemical Solutions

The chemical solutions for contact printing are the same as those for projection printing. They are also the same as those for tray development. The developer (D-72) should be diluted 1 part of stock solution to 2 parts of water. It should be used at about 70° F. The short stop and hypo are made in the same manner as for all other processes. Arrange the three trays to the right of the printing lamp and in this order from left to right: developer, short stop, hypo. A large tray with clear water may be put after the hypo tray if running water is not available.

252. Contact Printing

a. The printing light should be about a 60-watt bulb in a lamp with an easily-operated switch. A mask slightly smaller than your negative size is necessary if white borders are desired.

b. The printing frame may be any simple wooden one with a glass, or it may even be two pieces of glass pressed together. One sheet of glass and a completely flat surface may be used. The best type is made like a picture frame with the back held in by springs and a felt layer over the back which avoids scratching the negative (fig. 275). Clean the glass of the printing frame and the negative thoroughly with a soft brush or lintless cloth. Turn off the white light.

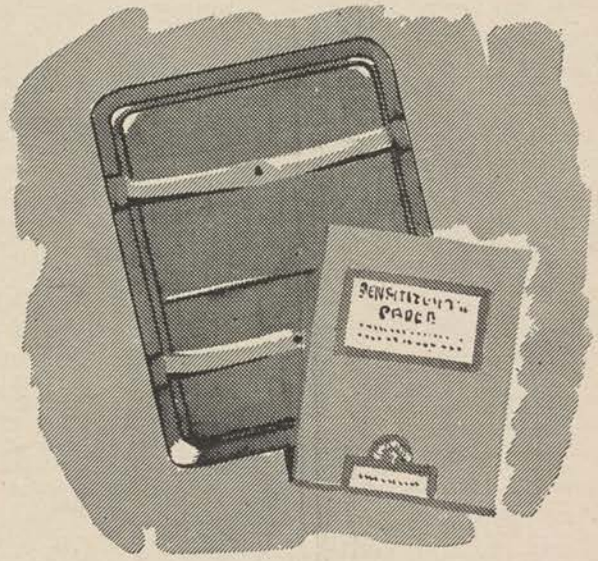


Figure 275.

(1) Remove the back of the frame and lay the cut-out mask on the glass. Then place the negative, shiny side down on the mask. Select the proper paper and determine which is the emulsion side. The emulsion side can best be determined by the fact that it feels smoother than the paper side. It will also show a slight sheen when held under the safelight. Lay the paper on top of the negative with the emulsion side in contact with the negative.

(2) Replace the back and close the frame. Place the frame, glass side up, under the white light, at a distance of about 3 to 5 feet. Turn on the white light for about 10 to 15 seconds.

(3) Open the frame, remove the paper, and put it face down, into the developer. Wet the entire sur-

face of the paper at once. Turn the paper over so that the emulsion side is up. Leave the paper in the developer for at least 1 minute, while rocking the tray back and forth, or rubbing *gently* on the surface of the paper. Watch the tone of the print carefully. If it goes very dark, remove it, drain it, and immerse it in the short stop for about 30 seconds. Drain it and drop it into the hypo. Be careful not to take the print out of the developer too soon. The safelight causes the print to look darker than it is.

(4) Do not allow any of the short stop or hypo to drip into the developer at any time. It is best to have a bowl of rinse water handy and rinse off the hands after each print to avoid getting hypo into the developer.

(5) If the print is much too dark, make another under the same conditions, being sure to get the printing frame exactly the same distance from the light as before. Cut in half the time of exposure to the white light. If this print is too dark, cut the time still further. To make a lighter print, decrease the time; to make a darker print, increase the time. A little practice will enable you to look at a negative and judge the length of time the print should be exposed for best results.

(6) The time of development for each print will vary somewhat. Since printing is done with a fairly bright safelight (Wratten OA filter and a 10-watt bulb), you may watch the development of the print and stop it at any time. It is best to arrange printing times so that the print stays in the developer at least 1½ minutes. It cannot stay longer than 4 minutes without developing a yellow fog. Be careful not to take the print out of the developer too soon. A general caution to be observed is to be sure that the white light is never turned on while the package of paper is open, or before the negative and paper are completely set in the frame.

(7) Allow the prints to remain in the hypo tray about 10 minutes. They may be left in a little longer, but it is best to transfer them to a tray of clean water or to running water after about 10 minutes. In running water allow the prints to wash at least 45 minutes. If running water is not available, change the water in the tray every 5 minutes until the prints have had about 10 baths.

(8) When the prints have been washed, put them to dry between photographic blotters, or on ferrotype tins, if the surface is glossy. When using a ferrotype tin, place the print face down and roll it flat with a rubber roller. Leave it on the ferrotype tin until it is completely free and dry. Any attempt to lift a print off before it is completely dry will end in disaster.

253. Enlarging

a. The developing, fixing, and washing of enlarged prints made by projection are the same as those processes for contract prints. The difference between the two lies entirely in the method of making the exposure. A typical enlarger is shown (fig. 276).

b. The negative is inserted between the light and the lens, and the paper is placed in a frame or easel on the table. The size of the print depends on the distance from the negative to the paper. In enlarging, special enlarging paper must be used, because contact paper takes too long an exposure.

c. Place the negative, emulsion or dull side down, in the negative carrier and turn on the enlarger. Place in the printing easel a piece of plain white paper (not photographic) the same size as the print desired. Move the borders of the easel (if they are adjustable) until the margins are equal. Move the enlarger head up and down until the image thrown on the paper is the size desired. Notice that you do not have to use the entire area of the projected image. A small portion may be used and a better composition will be achieved.

d. Move the focusing lever or knob until the image is at its sharpest. This focusing should be done when the lens of the enlarger is wide open. When the focus is sharp and the composition is determined, close down the lens one or two stops. Turn off the enlarger. Place a sheet of photographic paper, emulsion side up, in the easel, being careful not to move the easel from its predetermined position.

e. Turn on the enlarger. Make an exposure of about 15 seconds. Develop the print in the same manner as a contact print. If it is too dark, shorten the exposure.

f. If, after development, it is noticed that a certain small area of the picture is too dark and the rest is correctly printed, hold the light back from this area during part of the exposure by shading it with a small piece of irregularly-shaped cardboard on a wire. Keep the wire and cardboard moving up and down so that the sharp outline does not show. If a small area is too light in the final print, reverse the procedure. Cut a small hole with irregular edges in a piece of cardboard. Make the exposure for the majority of the print and then move the cardboard in and allow the light area to have a longer exposure. Once again, do not hold the cardboard still. Move it up and down.

254. Summary

The above suggestions are purely an outline for the basic procedures in photography. Many ideas for

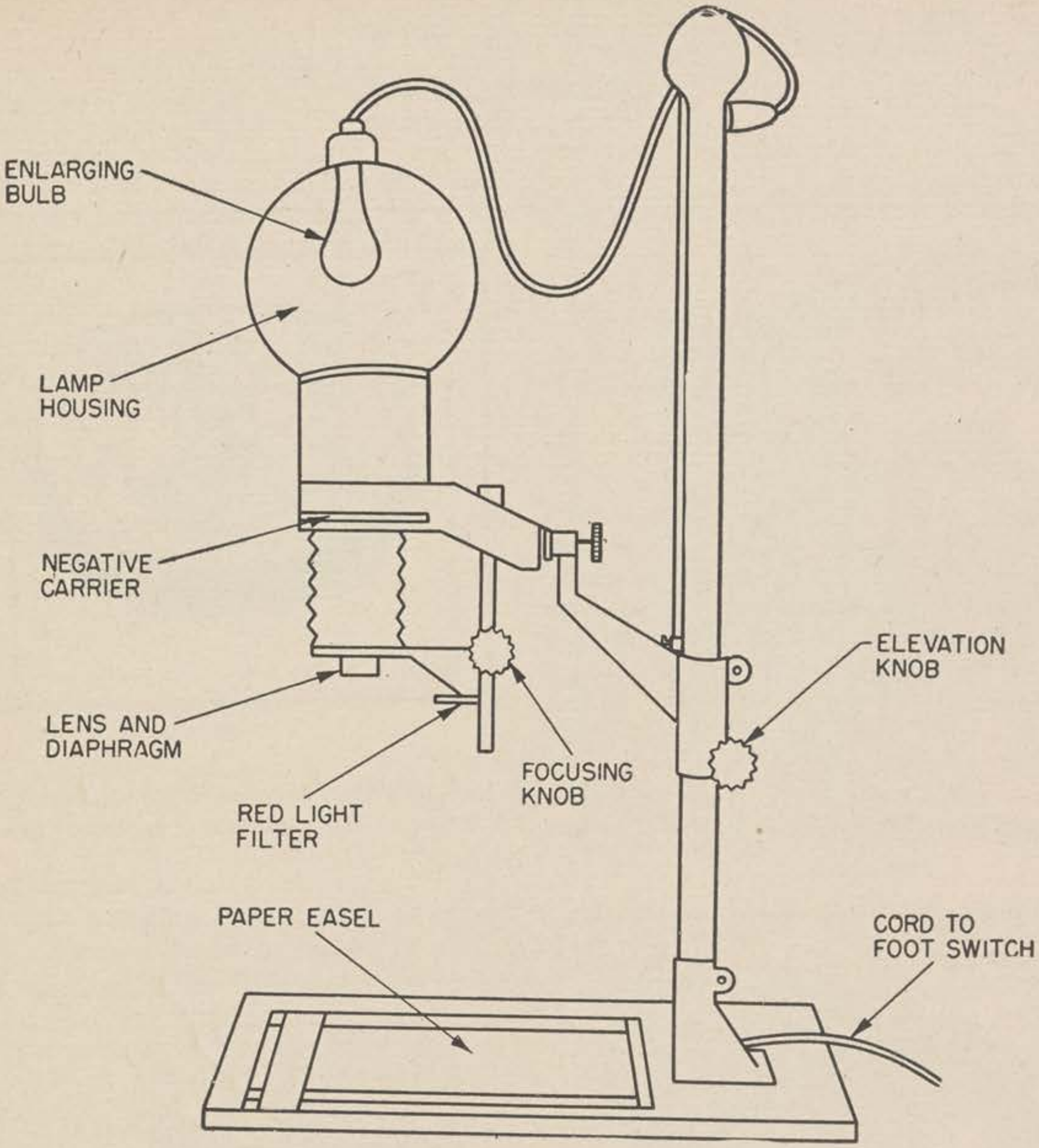

ENLARGING BULB
LAMP HOUSING
NEGATIVE CARRIER
LENS AND DIAPHRAGM
RED LIGHT FILTER
FOCUSING KNOB
ELEVATION KNOB
PAPER EASEL
CORD TO FOOT SWITCH

Figure 276.

varying or extending these processes will occur to the photographer after he has learned the basic procedures. There are many excellent books which can speed up the learning processes. The Army has published a complete series of Technical Manuals covering photographic equipment, as well as general theory, and many commercial publications are also helpful. (See bibliography.)

CHAPTER 27

ADDITIONAL CRAFTS

255. General

There are many forms of craft work not covered in this manual. It is impossible to list them all, but a few of the more popular are described briefly below.

256. Shells

Shells found on any beach can be used to make figurines. They should be cleaned first with soap and water. Heads are made by painting the mouth, nose and eyes on the outside with the hinge end down. Another shell forms the body. The two can be cemented together with the edge of one overlapping the outer surface of the other. Rubber cement or a quick setting glue can be used. Pipe cleaners provide arms and legs with small shells attached for hands and feet. A variety of fantastic animals and birds can also be made in this manner (fig. 277).

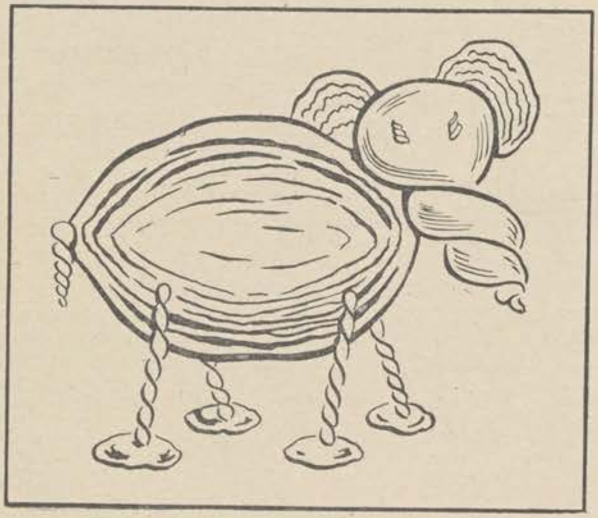


Figure 277.

257. Nuts

a. Cross sections of walnuts make decorative buttons or may be laced together with thin strips of leather to make a belt (fig. 278).

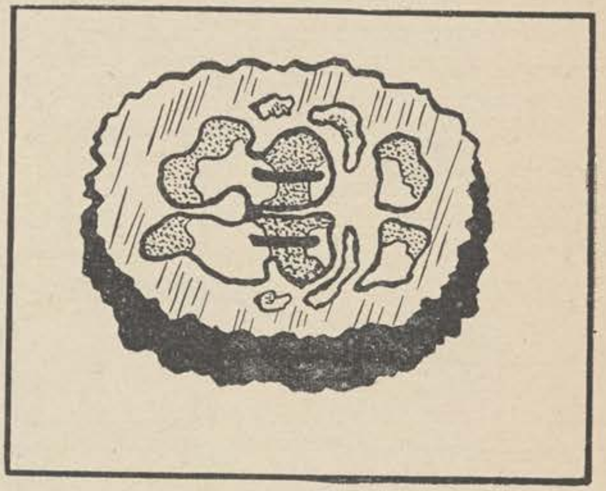


Figure 278.

They should be cut across the grain of the nut with a coping saw and shellacked or waxed after the kernels have been removed.

b. Peach pits and the stones of other fruits can be carved with an ordinary pocket knife into a variety of human and animal shapes. They should be washed and dried before carving (fig. 279).

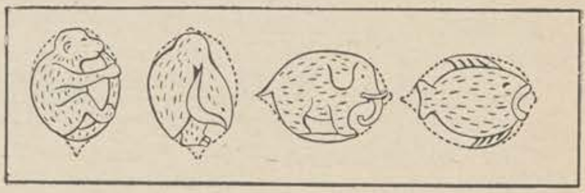


Figure 279.

c. Cocoanut shells may be made into cups, small lamp shades, or holders for balls of twine. Faces or designs can be either painted or carved on the outside. Peanuts and the shells of other small nuts can be glued with pipe cleaners to form many amusing figurines.

258. Coins

a. Antique coins make attractive jewelry. Some countries have no laws against defacing coins, but this should be investigated before starting. Drilled coins can be strung together to make bracelets or necklaces. Rings are formed by tapping the rim of a coin, turning it frequently, until it is compressed to the right diameter. The hammering will also make it thicker. The center is then drilled out and the ring filed and polished.

b. Semiprecious stones or pebbles with unusual markings can be found in some localities. A thin coin about the size of a dime will make a setting for one of these if its center is cut out in a clover leaf pattern and the stone wedged firmly between the prongs thus formed (fig. 280). The cutting is done by drilling a round hole in the coin and filing out the indentations. The mounted stone may then be soldered to a ring of the type described above.

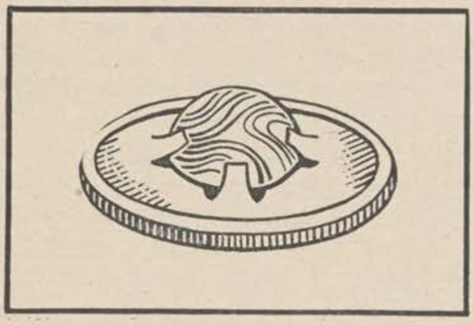


Figure 280.

259. Cork

Cork from bottle caps provides materials for mats, coasters and similar articles. The small discs inside the caps are glued to a piece of canvas or other cloth until they cover it completely. They may be cut into squares, triangles or other geometrical shapes and fitted together to form a variety of patterns.

260. Woodburning

There are several methods of burning designs and monograms in wood. An electric needle, made for this purpose, is the best. A nail or heavy wire set in a wood handle and heated in an open flame will also do. Focusing the sun's rays by means of a magnifying glass will burn wood, but the action of the glass is difficult to control.

261. Bookbinding

a. Magazines and paper bound books will be more attractive and durable if they are bound in stiff cloth covers. A good quality of paste, a piece of linen or other cloth for the cover, a strip of buckram, some paper and a sheet of cardboard about 1/16 inch thick are the materials needed.

b. First, the old cover of the book is cut off with a razor blade, care being taken not to remove the threads that stitch the pages together. Cut a strip of buckram the exact length of the book and about 1½ inches wider than the book's thickness. Cover the back of the book with paste and set it on the center of the strip of buckram (fig. 281). The buckram will be flush at top and bottom, and will extend about ¾ inch beyond the book at each side.

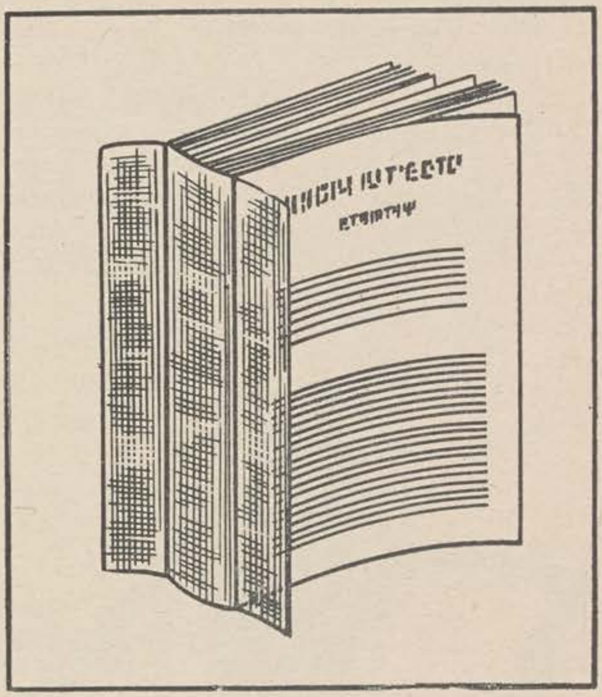


Figure 281.

c. Now prepare the new binder in the manner shown (fig. 282). The cardboard for front and back covers should be about ⅛ inch longer and wider than the book itself. The strip of paper between them is the same width as the back of the

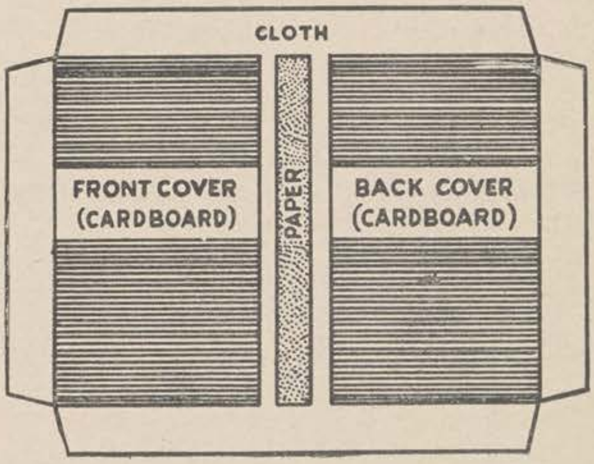


Figure 282.

book. A space of ¼ inch is allowed between its edges and the cardboard panels to insure easy opening and closing

d. Paste the cardboards and paper to the cloth which has been selected for the binding. Leave a 1 inch margin of cloth on all four sides and cut out the corners as shown. Fold over the flaps and paste them down. Place the binder under weights until the paste is dry.

e. The book is now fastened in the binder. Spread paste on the buckram flaps which extend beyond the back of the book. Do not paste the back itself. Place the book in the exact center of the paper strip which marks the middle of the binding. Press down the buckram flaps and hold them with weights until the paste is dry (fig. 283).

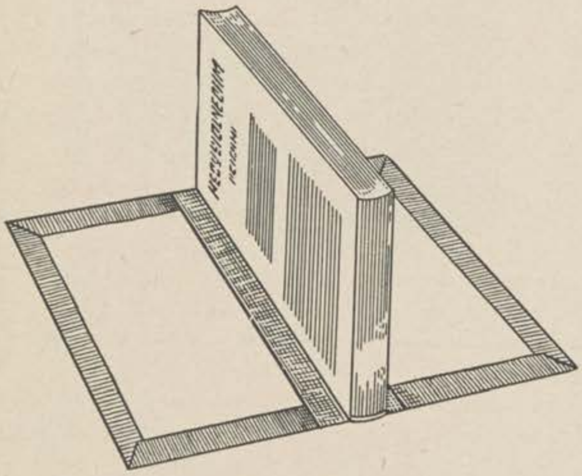


Figure 283.

f. The final step is to paste end papers on the inside of each cover to conceal the buckram and the edges of the cloth. Cut two pieces of paper the same length as the book and twice its width. Take one of these, fold it and paste one half of it over the inside of the front cover. The other half is left free and forms the first page of the book. It is advisable, however, to run a narrow band of paste down the inside edge of the free leaf next to the first page of the book itself. This will fasten them together and will conceal the buckram hinge.

g. Insert the back end paper in the same way and press the book under a heavy weight until the paste is dry. The spine will be neater if a pair of knitting needles or similar objects is placed as illustrated during the pressing (fig. 284). It is also advisable to put several sheets of scrap paper between the covers and the book during pressing to prevent the dampness of the paste from wrinkling the pages.

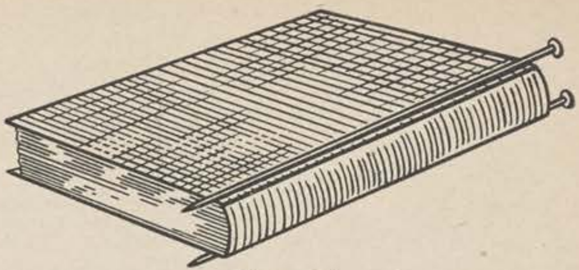


Figure 284.

262. Soap Carving

a. Any fresh cake of soap with a reasonably fine, even texture can be carved into reliefs or three dimensional figures. The only tool needed is a kitchen knife with a three inch pointed blade. Any lettering on the soap should be scraped off first. The design is then outlined lightly on the surface.

b. Next comes the cutting. Rough out the general shape of the figure before doing fine details. It is best to draw the knife toward you as in paring vegetables; the blade can be more easily controlled in a cut of this kind. A smooth, almost marblelike finish can be obtained by scraping the soap with the knife blade held at right angles to its surface.

263. Other Crafts

a. The following crafts may be mentioned briefly. Fly-tying is a popular and profitable pursuit for the fisherman; local feathers and fur can be used extensively. Fans can also be made from feathers by drilling the quills and lacing them together.

b. Paper is the only material required for lamp shades, decorations, and many ingenious small objects made simply by cutting, folding and gluing. Oiled paper stencils used with paint or crayons provide an easy means of decorating wood and cloth or producing greeting cards.

c. Glass can now be etched by means of a prepared compound which is harmless to skin or clothing. The glass is covered with a stencil and the etching cream spread on the exposed surface for 2 minutes. When washed off, the monogram or design will be found engraved on the glass.

d. The wings of butterflies can be used to decorate plastic covers of compacts or cigarette boxes. They should be dried and mounted with a very little liquid glue on a stiff base, which is then cemented to the under side of the plastic.

e. Basket weaving will produce not only baskets, but chair seats, mats, screens, and a variety of other objects. It requires no special equipment, and many improvised materials can be used such as roots, stems, bark, wood splints, and rushes.

SELECTED BIBLIOGRAPHY

CRAFTS

GENERAL.

ARTS AND CRAFTS
Marguerite Ickis

General directions for several crafts and some of the graphic arts. Simple projects for each subject.

A. S. Barnes & Co., 1943, $2.50.

BOOK OF DESIGNS AND SILHOUETTES

Contains many designs which can be used in working leather, wood, metal, plastics. Can either be copied or pasted directly to work for cutting. No directions.

American Handicrafts Co., n. d., $1.25.

GREEN BOOK OF DESIGNS

Very useful designs in forming metal objects or making small pieces of jewelry. Without plans.

American Handicrafts, n. d., $1.25.

HANDICRAFT
Lester Griswold

General directions for various crafts, such as leather, metal, plastics, woodwork. Projects for each craft. Illustrated.

Lester Griswold, 1942, $3.00.

LET'S MAKE SOMETHING
H. Zarchy

Directions for many different gifts to be made from wood, clay, paper, metal. All directions illustrated.

Knopf, 1941, $1.50.

WHAT TO MAKE

Five-year books, each containing many projects and useful ideas in many crafts. Detailed instructions.

Popular Mechanics Press, 1941 through 1945, $0.50 ea.

BASKETRY.

BASKETRY WEAVING AND DESIGN
N. Lang

A book written for the advanced student on weaving baskets with different materials. Numerous designs.

Scribners, $3.50.

CANEWORK
Chas. Crompton

Instructions on how to weave trays, baskets. etc., in different forms.

Manual Arts Press, $2.25.

INEXPENSIVE BASKETRY
W. S. Marten

Clearly written directions for the beginner on how to make different types of coil baskets. Lists all equipment necessary.

Manual Arts Press, n. d., $0.65.

BOOKBINDING.

BOOKBINDING NO. 3378

General directions for binding books and magazines. Illustrated.

Boy Scouts of America, n. d., $0.25.

BRAIDING, KNOTTING AND WEAVING.

BRAIDING AND KNOTTING FOR AMATEURS — C. A. Belash

Clear and concise directions on how to work with different types of material. Excellent for the beginner. Illustrated.

Beacon Press, 1943, $1.00.

CRAFTSTRIP BRAIDING PROJECTS NO. 3169

Illustrated instructions on how to braid a lanyard and bracelet.

Boy Scouts of America, n. d., $0.25.

FUN WITH STRING — Joseph Leeming

How to make a variety of objects from string. Interesting projects. Directions for simple string tricks. Illustrated.

Lippincott, 1940, $2.25.

SQUARE KNOT BOOK NO. 3 — P. C. Herwig

Complete instructions on square knotting. Easily understood. Many different projects.

P. C. Herwig, 1926, $1.00.

SQUARE KNOTTING, TATTING, FRINGE AND NEEDLE WORK — R. Graumont and J. Hensel

Clear directions and illustrations on various useful items which are easy to make. Very good for the beginner.

Cornell Maritime Press, 1943, $1.50.

WEAVING FOR AMATEURS — Helen Coates

Step-by-step instructions for the layman on weaving on small and large looms. Illustrated.

Studio Publications, n. d., $3.50.

CLAY MODELING AND POTTERY.

FUN WITH CLAY — Joseph Leeming

Describes many objects which can be made with self-hardening or fired clay. Instructions on how to build simple molds.

Lippincott, 1944, $2.00.

KEENE CEMENT CRAFT — O. A. Radtke

Directions for casting from simple molds. Step-by-step instructions cover making the mold, casting, removing the mold and polishing. Illustrated.

Bruce Publishing Co., $2.00.

POTTERY FINGER BUILT METHODS — H. and D. Wren

Directions for making small vases, platters, pitchers, etc. Step-by-step instructions easily understood. Illustrated.

Pitman, 1932, $2.00.

POTTERY MADE EASY — J. W. Dougherty

Clear directions on different ways to work in clay. Full descriptions of how to make simple molds. Instructions for decorating the finished product. Fully illustrated.

Bruce Publishing Co., $2.25.

LEATHER.

APPLIED LEATHERCRAFT — C. H. Groneman

Detailed explanation of how to work in leather. Clear drawings of designs.

Manual Arts Press, 1942, $2.50.

GENERAL LEATHERCRAFT Raymond Cherry

Full directions for making articles. Good working drawings and designs for tooling.

McKnight & McKnight, 1940, $1.00.

LEATHERCRAFT NO. 3167

General directions for working with leather.

Boy Scouts of America, n. d., $0.25.

LEATHERCRAFT AS A HOBBY Clifford Pyle

Manual for the different leather processes. Few selected projects.

Harper, 1940, $1.75.

THE LEATHERCRAFTSMAN W. E. Snyder

All operations in leather described in detail. Very good for the beginner. Explains the use of the different tools.

American Handicrafts Co., 1936, $2.00.

METAL.

ART METALWORK Arthur F. Payne

Directions for working in copper, brass, pewter and similar metals. Discusses tools and finishing. Each step thoroughly illustrated.

Manual Arts Press, 1929, $3.00.

BEATEN METAL WORK A. C. Horth

All steps in this craft fully described. Each step clearly illustrated. Helpful to beginner or advanced student.

Pitman Press, 1940, $1.00.

55 NEW TIN CAN PROJECTS Joseph J. Lukowitz

Contains many interesting objects that can be made from discarded cans with a few tools. Simple instructions. Illustrated.

Bruce Publishing Co., 1936, $1.00.

INTERESTING ART METALWORK J. J. Lukowitz

Clear and concise directions for making many metal objects in scrolled form. Plenty of illustrations.

Bruce Publishing Co., 1938, $1.00.

METALCRAFT AND JEWELRY Emil F. Kranquist

Covers all operations for working in metal and making jewelry. Has a few projects. Fully illustrated.

Manual Arts Press, 1926, $2.50.

PLASTICS.

GENERAL PLASTICS Raymond Cherry

Introduces the beginner to the newest of crafts. Lists and explains the use of all hand tools necessary. Contains many easy projects.

McKnight & McKnight, 1941, $1.00.

PLASTICS IN THE SCHOOL AND HOME WORKSHOP A. J. Lockrey

General text on plastics explaining all machine and hand operations. Contains some objects that can be made by hand.

D. Van Nostrand Co., 1940, $2.50.

PUPPETS.

HAND PUPPETS AND STRING PUPPETS W. S. Lanchester

General text on the making of glove puppets and small string puppets. General illustrations.

Manual Arts Press, 1943, $1.25.

MARIONETTES FOR ALL AGES P. P. Goerdeler
Fully illustrated directions on how to make marionettes and puppets from various materials such as wood, clay, paper.
Universal School of Handicrafts, 1941, $1.25.

MARIONETTES, MASKS, AND SHADOWS W. H. Mills & L. M. Dunn
Thorough directions on how to make puppets and produce plays. Illustrated.
Doubleday, 1939, $2.50.

MASKS AND PUPPETS D. S. Green
Explains how to make all types of puppets and masks from wood, wool and rags. Illustrated.
Studio Publications, n. d., $3.50.

WOODCARVING AND WHITTLING.

CHIP CARVING Harris W. Moore
General directions on how to carve intricate geometric designs. Numerous projects. Clearly illustrated.
Manual Arts Press, 1942, $1.00.

WHITTLING AND WOODCARVING
General information and illustrations on a few selected projects.
Popular Mechanics Press, n. d., $0.25.

WHITTLING AND WOODCARVING E. J. Tangerman
Detailed instructions and illustrations on carving several types of materials. Very good for the beginner.
McGraw Hill Book Co., 1936, $3.75.

WHITTLING BOOK Ben Hunt
Very fine text, illustrations and plans for this craft. Helpful to the beginner as well as the expert.
Bruce Publishing Co., 1944, $2.50.

WOODCARVING AND DESIGN Lynn Miller
Step-by-step instructions on how to get different effects in wood with different tools.
Pitman Press, 1936, $3.00.

YOU CAN WHITTLE AND CARVE Hellum and Gottshall
Full directions for whittling with only a pocket knife. Contains step-by-step instructions.
Bruce Publishing Co., 1942, $2.25.

WOODWORK.

BASIC WOODWORKING PROCESSES Herman Hjorth
Detailed instructions on all the processes used in wood. Excellent illustrations.
Bruce Publishing Co., 1935, $1.80.

CREATIVE CRATE CRAFT Paul V. Champion
Numerous suggestions and drawings on what to make from scrap materials. Easy plans for the beginner.
Bruce Publishing Co., 1942, $1.50.

GENERAL SHOP WOODWORKING V. C. Fryklund & A. J. LaBerge
Describes what tools to use in different operations and how to use them. Fully illustrated.
McKnight & McKnight, 1940, $0.80.

OPERATIONS OF COMMON WOODWORKING MACHINES Herman Hjorth
Describes in detailed illustrations how to use all the different power tools for wood.
Bruce Publishing Co., 1942, $2.50.

POPULAR MECHANICS LITTLE LIBRARY

Detailed plans and instructions for various projects in a selected field.

No. 32, WOOD TURNING. General directions for using the lathe.
No. 40, WOOD FINISHING. How and what paint to apply.
No. 47, WORKBENCHES AND TOOL CABINETS. Plans and directions for building.
No. 49, MAGAZINE RACKS. Ten attractive racks.
No. 52, BOOK ENDS. Ten designs to choose from.
No. 56, SMOKING STANDS. Seven different types.
No. 57, JIGSAWED NOVELTIES. Many easy projects.
No. 62, NOVELTIES TURNED ON LATHE. Small objects a beginner can make.
No. 64, SHELVES YOU CAN MAKE. 25 Plans to choose from.
No. 66, ACTION TOYS. 21 Easy to make toys.

Popular Mechanics Press, $0.25 each; 5 for $1.00.

SMALL CREATIONS FOR YOUR TOOLS — H. Showalter

Plenty of objects the beginner can build with a few simple tools. Many mechanical toys included. All projects illustrated.

Bruce Publishing Co., 1942, $2.75.

STANLEY TOOL GUIDE

Large illustrated sheets, 11 by 12 inches, showing the care and use of hand tools. Very good for hanging on the wall of the workshop for reference.

Stanley Tools, n. d., $0.25.

MISCELLANEOUS CRAFTS.

FUN WITH PAPER — Joseph Leeming

Contains hundreds of different projects for work with paper. Illustrated.

Frederick A. Stokes, 1939, $2.25.

SOAP CARVING — Lester Gaba

Full instructions on how to carve different forms in soap. Lists necessary tools.

Studio Publishing Co., n. d., $1.00.

ARTS

BLOCK PRINTING.

BLOCK PRINTING WITH LINOLEUM — Henry Frankenfield

A small booklet covering the general technique with illustrations showing a wide variety of styles, background cuttings, etc.

C. Howard Hunt Pen Co., 1940.

ESSENTIALS OF LINOLEUM-BLOCK PRINTING — Ralph W. Polk

A well illustrated text on procedure and equipment with a chapter on commercial uses of block printing.

The Manual Arts Press, 1927, $2.00.

HOW TO MAKE LINOLEUM BLOCKS — Curtiss Sprague

A brief and rather general text with numerous illustrations of linoleum cuts used for portraits, greeting cards, advertisements, illustrations, etc.

Bridgman Publishers, 1928, $1.00.

LINO-CUTS, A HANDBOOK OF LINOLEUM-CUT COLOUR PRINTING — Claude Flight

A stimulating treatise on the use of linoleum to produce fine prints in color. Several color plates of work by the author.

John Lane, 1927.

LINOLEUM BLOCK PRINTING FOR AMATEURS
Charlotte D. Bone
A detailed, clear and usable text on all aspects of the subject.
The Beacon Press Inc., 1936, $1.00.

LINOLEUM BLOCK PRINTING FOR THE AMATEUR
Lyle B. Yeaton
A small volume covering the essentials of the technique with a chapter on color printing.
The Yeaton Press, 1931, $2.00.

WOOD ENGRAVING AND WOODCUTS
Clare Leighton
A brief demonstration of tools and methods as well as several examples of fine prints in these techniques.
Studio Publications Inc., 1932, $3.50.

CARTOONING.

CARTOONING IS A FUNNY BUSINESS
S. B. Faier
A number of easy formulas for producing comic figures.
The House of Little Books, 1944, $1.00.

CARTOONING PLUS GOOD DRAWING
Harriett "Petey" Weaver
A picture-and-caption course on how to create various types of cartoons.
The Davis Press Inc., 1939, $2.50.

COMICS AND THEIR CREATORS
Martin Sheridan
Biographies of cartoonists and samples of their work. Shorter sections on creating and selling cartoons.
Hale, Cushman & Flint, 1942, $2.75.

FUN WITH A PENCIL
Andrew Loomis
An easy and concise method for the beginner. Devoted chiefly to comic heads and figures; also a short section on perspective and light and shade.
The Viking Press, 1942, $3.00.

HOW TO CREATE CARTOONS
Frank F. Greene
Detailed and fully illustrated discussion of the art of cartooning.
Harper Brothers, 1941, $3.50.

HOW TO DRAW FUNNY PICTURES
E. C. Matthews
A series of exercises graded from simple to complex cartoon compositions.
Drake Publishing Co., 1944, $2.00.

COMMERCIAL ART.

CARTOONING AND COMMERCIAL ART
E. C. Matthews and Phillip Albaum
An omnibus picture book of cartoons, drawings, lettering, fashion and advertising art. Uneven, with little on technique, but useful for its many illustrations.
Illustrated Editions Co., 1941

DRAWING FOR MONEY
Chuck Thorndike
A brief text with numerous illustrations of all types of commercial art. Includes posters, lettering, magazine illustration, fashion art, etc.
House of Little Books, n. d., $1.00.

HOW TO ILLUSTRATE FOR MONEY
Sid Hydeman
An entertaining, autobiographical account of illustrators, their methods of work, and general problems of commercial illustration by the art editor of Redbook Magazine. Not a manual on techniques.
Harper & Brothers, 1936, $2.50.

IT'S FUN TO DRAW
Alan D. Bogorad
Treats briefly illustrating, figure drawing, cartooning, lettering, advertising, and similar subjects. Emphasis is on commercial art. Well illustrated.
Knickerbocker Pub. Co., 1944, $1.00.

LINE DRAWING FOR REPRODUCTION — Ashley Havinden

A general discussion of working for modern methods of reproduction with numerous examples of various linear styles from Beardsley to Picasso.

The Studio Publications Inc., 1933, $3.50.

TECHNICAL DRAWING — F. E. Giesecke, Alva Mitchel and H. C. Spencer

A thorough reference book on many phases of technical drawing, including lettering, projections, perspective, shop methods, etc.

Macmillan Co., 1940, $3.00.

DRAWING (See Also *Cartooning, Commercial Art*).

ANIMAL DRAWING — Frank Medworth

A useful reference book with numerous drawings of a variety of animals and birds, their skeletons and proportions.

Faber and Faber Ltd., 1935, 12s.

ANIMAL DRAWING — John Skeaping

A series of schematic drawings analyzing the proportions and gaits of the horse with 15 plates of other animal drawings from prehistoric to modern times.

The Studio Publications Inc., 1936, $3.50.

THE ART AND CRAFT OF DRAWING — Vernon Blake

Devoted chiefly to the esthetics of drawing with little on technique.

Oxford University Press, 1927, $6.50.

ANYONE CAN DRAW — Arthur Zaidenberg

A simple system for the beginner. Largely illustrations.

World Publishing Co., 1942, $2.49.

BLACK AND WHITE — Paul Brown

How to sketch by the over-lay method of correcting the original with a series of tracings. Many illustrations of figures and animals in action.

Chas. Scribner's Sons, 1939, $1.50.

CONSTRUCTIVE ANATOMY — George B. Bridgman

A detailed text on drawing the human figure by one of the best-known teachers of the subject. Over 400 illustrations.

E. C. Bridgman, 1925, $6.50.

DESIGN AND CONSTRUCTION IN TREE DRAWING — Frank M. Rines

Full page illustrations of different kinds of trees with brief notes on their distinctive characteristics. Helpful for the advanced student.

Bridgman Publishers Inc., 1936, $2.50.

FIGURE DRAWING — Iain McNab

A short analysis of esthetic problems for the advanced student and professional. Also 15 plates of master drawings from Rubens to Dali.

The Studio Publications Inc., 1936, $3.50.

FIGURE DRAWING FOR ALL IT'S WORTH — Andrew Loomis

A brief text with many illustrations of varied poses, anatomy, proportions, different methods of rendering. Emphasis on drawing for commercial purposes.

The Viking Press, 1943, $3.95.

HOW TO DRAW CHILDREN — Priscilla Pointer

Lively illustrations of children of different ages with diagrams of proportions and a few anatomical details. Little text.

The Studio, 1942, $1.00.

HOW TO DRAW HORSES — Walter J. Foster

A useful picture book with no text, showing anatomy and proportions of horses, also simple methods of blocking in. (One of a series in Walter J. Foster "How to Draw" Library. Other titles cover figure drawing, cartooning, lettering, commercial art, etc.).

Walter J. Foster, n. d., $1.00.

HOW TO DRAW WHAT YOU SEE — Norman Moore

The mechanics of perspective and exact representation rather than free sketching.

Hillman Curl Inc., 1932

THE HUMAN FIGURE — John H. Vanderpoel

Several hundred excellent illustrations of details of human anatomy. The text is academic and rather technical. For the advanced student.

Bridgman, 1936, $2.50.

I WISH I COULD DRAW — Percy V. Bradshaw

A general course of instruction for the beginner starting with stippled shading and proceeding to line. Covers still life, landscape, figure, and architectural drawing.

The Studio, 1941, $3.50.

A MANUAL ON DRAWING TREES AND FOLIAGE — L. A. Doust

Takes the student from a simple representation of general masses to details of leaf and branch structure. Well illustrated.

Frederick Warne & Co., 1936, $1.00.

THE NATURAL WAY TO DRAW — Kimon Nicolaides

Explains a free technique for the beginner based on drawing contours and masses rather than on "block" construction of figures. Many illustrations.

Houghton, Mifflin Co., 1941, $3.00.

SIMPLIFIED DRAWING — Charles Carlson

A picture and caption book demonstrating a simple, schematic method of drawing a number of common objects from locomotives to the human figure.

House of Little Books, 1942, $2.00.

THE SIMPLIFIED HUMAN FIGURE — A. Best-Maugard

A clever, highly schematic and rather mannered formula for drawing the human figure. Many step-by-step illustrations.

Alfred A. Knopf, 1936, $2.50.

SKETCHING AND RENDERING IN PENCIL — Arthur L. Guptill

Technical data of use to the advanced student, particularly in rendering architectural details.

The Pencil Points Press, 1941, $5.00.

STILL LIFE TO LANDSCAPE DRAWING — Allan Smith

Many diagrams and a thorough text on perspective, architectural rendering, shadows, reflections, etc. A conservative, realistic approach.

Sir Isaac Pitman & Sons, 1937, $1.75.

THE THEORY OF PICTORIAL ART — H. W. Harrison

A brief study of perspective, light and shade, composition and movement. A useful text poorly illustrated.

Sir Isaac Pitman & Sons, 1931, $1.75.

YOU CAN DRAW — Frances O'Brien Garfield

A scribble method of learning figure drawing. Freer than the usual cube and block systems. Thoroughly explained and illustrated.

D. Appleton-Century Co., 1936, $3.00.

ETCHING AND DRYPOINT.

THE ART OF ETCHING
E. S. Lumsden

A complete reference book on the various techniques used in etching and other intaglio print processes. Includes technical notes by several modern etchers. For the advanced student and professional.

J. B. Lippincott Co. ca. 1924, $6.00.

CELLULOID ETCHING, A MANUAL FOR BEGINNERS

A small pamphlet describing tools and methods of printing.

Universal School of Handicrafts, 1944, $0.35.

ETCHING AND DRYPOINT
E. G. Porter

A good work for the beginner with a particularly useful chapter on home-made apparatus.

Sir Isaac Pitman & Sons, 1933, $1.00.

ETCHING METHODS AND MATERIALS
Wilson Silsby

Technical notes covering many unorthodox experiments such as etching on tin cans, simulated aquatint, use of galvanized iron, aluminum, etc.

Dodd, Mead & Co., 1943, $2.50.

ETCHING PRINCIPLES AND METHODS
Clifford Pyle

A well illustrated treatise on etching, drypoint, aquatint, mezzo-tint and monotype.

Harper & Brothers, 1941, $3.00.

GIANT HOME WORKSHOP MANUAL, pp. 125-132

A series of articles on celluloid etching with a list of necessary equipment. Includes instructions for building a press from a clothes wringer.

Popular Science Press, 1941, $1.95.

MANUAL OF ETCHING
George T. Plowman

Outline of a simple method for the beginner. Many illustrations of finished etchings, but few of procedures or equipment.

Dodd, Mead & Co., 1924, $3.50.

LITHOGRAPHY.

CREATIVE LITHOGRAPHY AND HOW TO DO IT
Grant Arnold

A discussion of the technique and special problems of lithography for the advanced student and serious artist.

Harper and Brothers, 1941, $3.00.

LITHOGRAPHY FOR ARTISTS
Bolton Brown

An authoritative text with a useful appendix of materials and recipes.

University of Chicago Press, 1930, $4.00.

METAL PLATE LITHOGRAPHY
C. A. Seward

One of the simplest forms of lithography clearly explained for the beginner.

The Pencil Points Press Inc., 1931, $2.00.

OIL PAINTING (See also *Commercial Art, Painting Materials and Techniques*).

ANYONE CAN PAINT
Arthur Zaidenberg

Instructions for the beginner given largely through illustrations of the author's own rather mannered work. Devoted chiefly to oil, but covers also drawing, water color, murals, print making, and pastels.

Crown Publishers, 1942, $2.75.

PAINTING AS A HOBBY
Stephen D. Thach

Many helpful suggestions for the beginner, though not a complete course of instruction. Devoted chiefly to oil with chapters on drawing and water color. Inadequately illustrated.

Harper & Brothers, 1937, $1.75.

PAINTING FOR PLEASURE — Morris Davidson

An excellent method for the beginner with emphasis on composition and abstract design. A long text with a few good color plates.

Hale, Cushman & Flint, 1938, $2.50.

PAINTING IN OILS — Bertram Nicolls

A brief discussion of the indirect method of painting with numerous references to work of past masters. For the advanced student.

The Studio Publications Inc., 1938, $3.50.

THE SCIENCE AND PRACTICE OF OIL PAINTING — Harold Speed

Several practical chapters of step-by-step instruction in painting various subjects. Also a general discussion of color, composition and esthetic problems.

Chapman and Hall, 1924, 21s.

THE TECHNIQUE OF OIL PAINTING — Frederick Taubes

A compact, nontechnical work on the painter's materials, their preparation and use. Covers such subjects as sizing and priming, grinding colors, glazing, varnishing, etc.

Dodd, Mead & Co., 1944, $2.75.

THE TECHNIQUE OF OIL PAINTING — Leonard Richmond

A series of color plates with text showing scumbling, brushwork, glazing, palette knife painting, etc., with several good step-by-step demonstrations for the beginner on how to paint various subjects.

Sir Isaac Pitman & Sons, 1940, $6.50.

PAINTING MATERIALS AND TECHNIQUES.

ARTIST'S HANDBOOK OF MATERIALS AND TECHNIQUES — Ralph Mayer

A technical reference book of the artist's materials and their use. For the serious student.

The Viking Press, 1940, $3.95.

THE MATERIALS OF THE ARTIST AND THEIR USE IN PAINTING — Max Doerner

An exhaustive reference book on all aspects of the painter's craft. Highly technical, but extremely useful for the advanced student.

Harcourt, Brace and Co., 1934, $3.75.

THE PAINTER'S POCKET BOOK OF METHODS AND MATERIALS — A. P. Laurie

A highly technical reference book for the advanced student. Covers chiefly oil, tempera, and fresco techniques.

J. B. Lippincott Co., 1926, $7.50.

PASTEL.

COLOUR SKETCHING IN CHALK — Donald Maxwell

An anecdotal, informative booklet on use of colored chalks, toned papers, aerial perspective and working for reproduction. Good color plates of rather conventional drawings by the author.

Pitman Publishing Co., 1934, $3.00.

THE TECHNIQUE OF PASTEL PAINTING — L. Richmond and J. Littlejohns

An authoritative work, profusely illustrated in color. Step-by-step instruction for the beginner; also useful for the advanced student.

Sir Isaac Pitman & Sons, 1931, $4.00.

POSTERS AND LETTERING (See also *Commercial Art*).

LETTERS AND LETTERING — Paul Carlyle and Guy Oring

Several hundred modern alphabets and samples of special lettering effects. A useful reference book.

McGraw-Hill Book Co., Inc., 1938, $4.00.

MAKING A POSTER — Austin Cooper
A brief text on technical procedures with many color illustrations of good modern posters.
Studio Publications Inc., 1938, $4.50.

PLANNING AND PRODUCING POSTERS — John de Lemos
A well illustrated work on design, lettering, values, and various techniques for producing posters.
The Davis Press Inc., 1943, $2.75.

POSTER PROGRESS — F. A. Mercer and W. Gaunt [ed.]
A stimulating collection of several hundred modern posters with critical captions.
The Studio Publications Inc., 1939, $4.50.

PRACTICAL SIGNS AND POSTERWORK FOR BEGINNERS — H. P. Harshbarger
Written for high school use, but technical information has wide application.
McKnight & McKnight, 1939, $1.00.

THE SCULPTOR'S WAY — Brenda Putnam
Treats fully all aspects of modeling, casting and carving with numerous illustrations. A long section is devoted to anatomy.
Farrar & Rhinehart Inc., 1939, $7.50.

SCULPTURE INSIDE AND OUT — Malvina Hoffman
Covers modeling, casting, carving, use of the pointing machine and similar technical problems. Well illustrated.
W. W. Norton & Co., 1939, $3.75.

SILK SCREEN PRINTING.

HANDBOOK OF THE SILK SCREEN PRINTING PROCESS — Harry Summer and Ralph M. Audrieth
A good general text on equipment and processes. Covers blocking out, paper stencil, tusche, and photographic methods.
Arthur Brown and Bro. 1941, $1.00.

SILK SCREEN COLOR PRINTING — Harry Sternberg
A detailed demonstration, profusely illustrated. Devoted chiefly to the tusche method, favored by artists, with a brief outline of five others.
McGraw-Hill Book Co. Inc., 1942, $2.50.

SILK SCREEN METHODS OF REPRODUCTION — Bert Zahn
A standard reference book on all aspects of the process.
F. J. Drake, 1935, $3.00.

SIXTY ALPHABETS — W. Ben Hunt and Ed C. Hunt
Very brief text with sixty rather conservative alphabets.
The Bruce Publishing Co., 1931-35, $1.50.

SCULPTURE (See also *Clay Modeling and Pottery* under CRAFTS).

MODELING AND SCULPTURING IN THE MAKING — Sargeant Jagger
A general outline of the subject for the advanced student.
The Studio Publications Inc., 1933, $3.50.

MODELING FOR AMATEURS — Clifford and Rosemary Ellis
Several easy clay modeling projects for beginners. Also sections on glue and paper figures and puppets.
The Studio Publications Inc., n. d., $3.50.

MODELING AND SCULPTURE — F. J. Glass
A useful reference book on techniques of modeling and casting. Many, but not very clear illustrations.
Charles Scribner's Sons, 1929, $6.00.

A PRIMER OF SCULPTURE — Suzanne Silvercruys

A useful introduction to clay modeling for the beginner.

G. P. Putnam Sons, 1942, $2.75.

SILK SCREEN PROCESS IN THE WAR EFFORT

A booklet on the work done by the Sherwin-Williams Silk Screen Process School for Servicemen. Also, useful picture charts of eight methods of printing.

The Sherwin-Williams Co., n. d.

SILK SCREEN STENCILING AS A FINE ART — J. I. Biegeleisen and Max Arthur Cohn

A thorough and well illustrated treatment of four popular methods, the paper stencil, film stencil, tusche, and photographic.

McGraw-Hill, 1942, $2.50.

TEMPERA AND MURAL PAINTING (See also *Painting Materials and Techniques*).

CANVAS ADHESIVES — Raphael Doktor

A mimeographed treatise on how to attach murals to the wall with various adhesives.

Federal Art Project, W. P. A., n. d.

EGG TEMPERA PAINTING, TEMPERA UNDERPAINTING, OIL EMULSION PAINTING — V. Vytlacil and R. D. Turnbull

Modern variations of the early tempera technique with notes on their use.

Oxford University Press, 1935, $1.75.

HOW TO PAINT IN EGG TEMPERA — Viola and Rosamund Borradaile

A technical treatise on the preparation and use of the medium.

Yale University Press, 1936, $3.00.

WATER COLOR PAINTING (See also *Oil Painting, Painting Materials and Techniques*).

ON THE MASTERY OF WATER-COLOUR PAINTING — Adrian Hill

A general discussion of composition, moods, skies, etc., for the advanced student. Good color plates.

Sir Isaac Pitman & Sons, 1939, $4.00.

MAKING A WATER-COLOUR — George Pearse Ennis

The artist demonstrates his method of painting a picture from start to finish. Also 12 illustrations of finished work by others.

The Studio Publications, n. d., $3.50.

MAKING WATER COLOR BEHAVE — Eliot O'Hara

How to paint in a simple, free technique particularly well suited to the needs of the beginner.

Milton, Balch & Co., 1932, $2.75.

THE TECHNIQUE OF WATER-COLOUR PAINTING — J. Richmond and L. Littlejohns

A variety of technical processes and tricks illustrated entirely in color plates.

Sir Isaac Pitman & Sons, 1929, $6.00.

WATER COLOR PAINTING — Alfred W. Rich

A good text for the student with some experience. Many helpful illustrations.

J. B. Lippincott, n. d., $3.50.

PHOTOGRAPHY.

THE AMATEUR PHOTOGRAPHERS HANDBOOK — A. F. Collins

A reference book for the amateur photographer on how to make pictures.

T. Y. Crowell, 1941, $2.50

BASIC PHOTOGRAPHY

A Technical Manual on all steps in this graphic art. Clearly illustrated.

TM 1-219, 1 July 1941.

ELEMENTARY PHOTOGRAPHY FOR CLUB AND HOME USE C. B. Neblette

A handbook of instruction on the basic principles of taking pictures.

MacMillan Co., 1944, $1.00.

EVERYBODY'S PHOTO COURSE

A guide book for the beginner and amateur photographer with illustrations.

U. S. Camera Publishing Co., $0.75.

A GUIDE TO BETTER PHOTOGRAPHY Berenice Abbott

A basic manual on how to take pictures, processing and planning a dark room. Many illustrations.

Crown Publishers, 1941, $2.00.

HANDBOOK OF PHOTOGRAPHY Keith Henney & Miles Martin

A reference work by experts in various aspects of photography dealing with the technical and scientific applications in making pictures.

Whittlesey House, 1939, $7.50.

HOW TO MAKE GOOD PICTURES

A text book for the beginner and amateur photographer.

Eastman Kodak Co., 1940, $0.50.

KODAK REFERENCE HANDBOOK

Lists and explains use of different types of lenses, films, filters, darkroom equipment, etc. Very good for reference work.

Eastman Kodak Co., 1941, $2.75.

LOOTENS ON PHOTOGRAPHIC ENLARGING AND PRINT QUALITY J. G. Lootens

An illustrated book on the principles of darkroom developing and printing of photographs.

Camera, 1944, $3.50.

MAKING A PHOTOGRAPH Ansel Adams

Discusses the fundamentals of operative techniques, necessary apparatus, etc. Illustrated. No. 8 of "How to do it Series."

Studio Publication, 1939, $3.50.

THE PHOTOGRAPHIC PROCESS

A technical work on pictorial photography, color photography, positive printing, etc.

McGraw-Hill Book Co., 1939, $5.00.

PHOTOGRAPHY—ITS PRINCIPLES AND PRACTICE C. B. Neblette

A manual for the advanced photographer and studio technician. Basic knowledge of chemistry and physics required to use this book.

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A guide to the principles of making pictures and developing.

Camera, 1943.

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