AN ABSTRACT OF THE THESIS OF

__Wilbur Carnes Magness__ for the __M.S.__ in __Industrial Education__

_Name_ (Name)  
_Degree_ (Degree)  
_Major_ (Major)

_Date Thesis presented--__July 24, 1942__

_Title__ A Manual of Handcrafts for the High School Industrial Arts Instructor and the Home Shop Hobbyist__

Abstract Approved:___________________  
(Major Professor)

The purpose of this study is to present a working manual which gives brief historical backgrounds, essential materials and tools, instructional units, typical projects and bibliographies for each craft included.

The supplements contain the teaching outlines and instructional sheets for three handcrafts -- leathercraft, metalcraft and the making of fishing tackle. All are organized on a similar pattern to include the items in the same order as listed in the preceding paragraph. The instructional units are presented in numbered operation steps as is the generally accepted style for industrial arts teaching manuals. Full-page plates of drawings are used to illustrate the tools and projects and to clarify the steps in the instructional units. The projects were chosen to include the operations most used by the beginner in each craft and were selected to be both useful and inexpensive. The designs for the projects are original in most instances. The bibliographies were selected to be of assistance to both instructors and home craftsmen in developing each craft beyond the projects contained in the supplements. The information units, illustrative plates and job sheets are intended for assignments and reference material in classes and for both instruction and appreciation for the home craftsman.

The materials for this manual were obtained from publications on handcrafts and industrial arts teaching, from visits, letters and conferences with craftsmen and hobbyists, and from personal experience in the crafts. The number of crafts included was dictated by the experiences and interests of the writer and by the time available for this study.

It is the intention of the writer to compile a series of handcraft manuals for publication. This study has strengthened his conviction of the importance of handcrafts and increased his respect for well designed and illustrated teaching
manuals and their contribution to education. A manual for publication would employ photographic illustrations of tools, projects and line drawings of operations which would be inserted in the units instead of the full-page plates employed here. A great deal more time would need to be allotted to each craft than was given these supplements and teaching experience will be necessary to warrant publication.

It is hoped that the supplements will make some small contribution as they stand. Most of the material is original and much of it has never, to the writer's knowledge, been presented in teaching manual form before.
SELECTED HANDCRAFTS
FOR THE
HIGH SCHOOL INDUSTRIAL ARTS INSTRUCTOR
AND THE
HOME SHOP HOBBYIST

by
WILBUR CARNES MAGNESS

A THESIS
submitted to the
OREGON STATE COLLEGE

in partial fulfillment of
the requirements for the
degree of

MASTER OF SCIENCE

July 1942
APPROVED:

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ACKNOWLEDGMENT

The writer wishes to acknowledge his gratitude to Professor George B. Cox of Oregon State College for the use of his Industrial Arts Library and for his patient and constructive guidance in the preparation of this manual. Mr. Asa Robley, also of the Industrial Arts Department, was of much assistance in preparing the unit on Metalcraft.

To Mr. H. H. Parker, North Powder, Oregon, Mr. Harry Hobson, Salem, Oregon, Mr. Martin Johnson, Eugene, Oregon, and Mr. Walter Muir, Dallas, Oregon, he is indebted for much information regarding the crafts contained herein. To Mr. Clifford Walmsley of Kent, Washington, he is grateful for the use of many books and manuals and for the loan of tools.

Finally, the writer wishes to express his gratitude to his wife, Gloria Parker Magness, for assistance in the preparation and proof reading of the manuscript for this study.
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The present national emergency brings with it vast, unsettling changes in our economic and social order. Such periods of upheaval inevitably bring to our educators much cause for thought and this one is no exception. The changes must be predicted and evaluated. Methods must often be changed and curricula expanded. Other developments must keep step. This adjustment to changed and changing conditions has come to be one of the most important tasks of education.

Industrial arts is one of the fields of education in which many modifications may come as a result of the very nature of national defense and the performances of the millions now engaged in the defense program. A new upsurge of interest is predicted in machines, science, invention and manual skills which, if true, will result in an expansion of the curriculum and a shift of emphasis to all phases of the practical arts. Educators are also discussing the probability that there will be new stress upon industrial arts in the task of rehabilitation when the emergency is over, as individuals must re-orient
their lives to yet another economic order. And finally there is the probability of increased emphasis upon the recreational and leisure time values of the industrial arts program to provide for the period of reaction which inevitably follows any time of great individual or national crisis.

Whatever the changes which are to come, industrial arts in the minds of educators must retain its broader objectives. Not so long ago it was called "a great integrating force in the development of a new educational program to meet the changing social and economic needs." (6:31)* This will continue to be a valuable concept in the minds of its teachers. It would be a great mistake to be led so far along the path of any one phase of the industrial-arts curriculum as to lose sight of the values of the other phases of industrial arts in the educational scheme; or, for example, to place so much emphasis upon preparation for industry, or otherwise gaining a livelihood, as to leave inadequate time for the development of appreciations or self-expression.

The educational objective of self-realization is one of those listed by a recent publication of the Educational Policies Commission (5:20). The material

* First number refers to the correspondingly numbered item in the bibliography; second number gives the page of the reference.
offered in this study is centered around this objective. From the standpoint of specific aims it falls under the industrial arts objectives of appreciation, leisure time pursuits, self-expression and pride in ability. If the new trends outlined above develop as educators expect, the materials and processes covered by this study are of the kind which can contribute richly toward the purposes of rehabilitation and recreation.

**Needs and Values**

This thesis is the outgrowth of the writer's great interest in handcrafts, his belief in their educational value and the conviction that a manual of this kind, organized about instructional units based upon shop procedures, should be of value to industrial-arts instructors and to hobbyists alike. There is a wealth of material published about hobbies of all types and there is adequate material available for basic shop subjects, but there is need for collections of recreational handcraft instructions which are usable and practical at the high school shop and home shop level and which are organized into the pattern of presentation generally adopted in the industrial arts field.

As noted above, one of the aims of industrial arts is the development of leisure time activities. This is
an aim of education as a whole to which industrial arts, by its very nature, is equipped to contribute a great deal. Handcrafts are especially valuable for the realization of this objective.

Yet another aim of industrial arts is to give appreciations of form, design and workmanship. Handcraft participation, by direct instruction and by individual discovery, widens the appreciations immeasurably.

The desire to create is fundamental to all of us, and industrial arts seeks to direct and satisfy that urge. In handcrafts such as these there is a world of opportunity for individual variation and creation. The material included here is but an introduction to the possibilities of each craft as an outlet for the creative abilities. Pride in personal achievement is an integral part of success in handcrafts and successful handcrafts are easy of attainment for any individual. He has only to follow his interest and the adaptability of the various crafts will account for his success.

Industrial arts offers to its students the possible means of earning a livelihood. Though handcrafts do not rank high among the subjects in the programs which contribute directly to that aim, nevertheless, many a craft begun as a hobby has led to a vocation. Outside
the school, in home shops everywhere, people are finding the worth of handcrafts as an outlet for their creative abilities and are obtaining satisfying recreation in leisure time hobbies. They too can make use of carefully-worked-out projects in their favorite fields.

Statement of the Problem

To compile this manual it was first necessary to decide upon the number of crafts to be included and to select from the wide field of hobbies those which would be the most desirable in a work of this kind. The method of presentation was worked out on the basis of shop procedures. The materials were collected and compiled, and typical projects selected for the formation of the instructional units. Finally these instructional units were set up in the accepted style of a teaching manual.

Purpose of the Study

The purpose of this thesis is to present a working manual which will give enough of the background of each hobby to enrich the teaching and appreciation of it; to present the essential materials and tools needed for each; to present instructional units for each hobby or
handcraft on a plan generally adopted for shop instruction; to present typical projects; and to list a bibliography to assist the teacher or the home shop hobbyist in each unit.

Sources of Materials and Methods Employed in Securing Them

The materials and references used in compiling this manual were obtained from various publications on handicrafts, publications on industrial arts teaching materials, and from the personal experiences of craftsmen and hobbyists. Several public and personal libraries supplied the publications. The craftsmen and hobby enthusiasts were contacted through visits, interviews and letters.

Limitations of the Study

The great number and variety of handicrafts prohibit anything like a complete collection. Selection was based upon the avocational worth, the practicability and the availability of the materials for each craft. In the last analysis, specific selection was influenced by the author's interest in the crafts here presented. This method of selection dictated that a good many handicrafts useful to school and home shops could not be included. Finally, the element of time limited the number
of handcrafts selected for inclusion in this study. Others may be and undoubtedly are as worthy of consideration but they must await the effort of others who may have the interest and the ability to develop them in a suitable manner.
CHAPTER II
THE STUIM AND ITS USE

Organization

Three handcrafts—leathercraft, metalcraft, and the making of fishing tackle—are to be found in separate supplements following Chapter III of this study. Each of these supplements is, in effect, an instructional handbook for the high school shop teacher or the home craftsman. All are organized on the same pattern.

Each supplement offers a brief historical sketch of the craft, pertinent information about the materials used by the craftsman and a list of the tools most commonly employed. The tool lists are accompanied by illustrative plates. In addition to the above, the supplement on metalcraft has a list of terms peculiar to the craft, with their definitions. It has also a list of safety precautions. All these might be called information units. If the supplements were to be further developed into separate manuals they would be so labeled and would be given numbers for convenience in class work.

Each supplement offers instructional units telling, step by step, how to make specific projects. These are original and were developed from the writer's own ex-
perience in the crafts represented. These units might be called job sheets. Each job sheet is accompanied by illustrative plates and reference is made to each figure on the plates where it will serve to clarify the instructional steps for the craftsman or student. The job sheets each list the materials and tools needed for the construction of the project or "job." The instructions follow these lists in numbered steps. These instructions are organized into operation units and each project was planned to contain several craft operations so that the hobbyist would, after making one project, be able to attempt many others using similar operations. Enough job sheets are presented in each supplement to cover the operations most used by the beginner in that craft.

It is the belief of the writer that the learner derives more benefit from constructing a complete project and mastering the various operations as he goes along, than he does from practicing the operations separately. In short, the craftsman's satisfaction comes from making something and he will readily grasp the necessary skills with the goal of the finished project in view. Fortunately handcrafts, by their very nature, allow for satisfactory results by this procedure.

After each instructional unit, with its accompanying plates, there is at least one additional plate
illustrating optional projects. These optional projects involve the same operations covered by the preceding instructional unit. The optional plates give the dimensions and suggest decorations but do not give complete details.

All of the plates are originals. Most of the projects in leathercraft and all of those in metalcraft are original as to design and dimensions. Each project was chosen with an eye to its utility as well as to its adaptability for the beginner in the craft.

Each supplement has its own bibliography. These lists were selected to be of use to the teacher or home craftsman in developing the craft beyond the comparatively few projects contained here.

**Intended Uses**

In the hands of a shop instructor the various information units and job units could be used separately for class assignments. The various operations within the job sheets could be used separately in preparation for the construction of the projects and as reference material for individual students. The information sheets and the references at the end of each make good material for assignments outside of class. The plates of optional articles could be used to offer choice of pro-
jects within a class.

For the home shop hobbyist lacking the help of an instructor, the information units would serve for both instruction and appreciation. The instructional units are designed and worded to guide him to the completion of the projects just as if he were a student in class.
CHAPTER III

SUMMARY AND IMPLICATIONS

It is the intention of the writer, when teaching experience has justified the procedure, to compile a series of handcraft manuals for publication. The experience gained through this study should be a valuable aid in realizing that goal.

One of the conclusions to which this work has already led is that to properly compile an instructional manual for any one of these crafts will require a great deal of time. It was impossible to do justice to the crafts contained in the supplements in the time allotted to them for this study. Again -- the writer's respect for a good teaching manual in his field has been immeasurably increased by his own efforts to produce these handbooks. A teaching manual, carefully constructed and well illustrated, is an outstanding contribution to education. Of all the features of a good craft manual, none commands more respect than useful, original and pleasing designs for projects. To execute a design for a craft article, which is in keeping with the abilities of the amateur craftsman and which will not become outmoded with the passing of a very few years, implies artistic experience and ability beyond the powers of many craft teachers.
Instead of full-page plates such as those in the supplements, two types of illustrations would be employed in a manual designed for publication. Actual photographs would be reproduced to illustrate the tools and the completed projects. The steps in the operation units would be illustrated by lithographic reproductions of line drawings inserted in the job sheets right along with the instructions which they are intended to clarify.

The examination of the many texts and manuals used for this study and the use of manuals in his own craft experience leads the writer to believe that this means of illustration is the most useful to the individual employing the manual.

Conferences with craftsmen, hobbyists and craft instructors have strengthened the conviction, set forth in Chapter I, of the importance of crafts in the tasks of rehabilitation and reorientation which will devolve upon educators as a result of war. Another value of handicrafts has been re-accented since this study was begun; recreation within the home, or within the confines of the community, is the order of the day and handicrafts have their own rich contribution to make to this endeavor.

When this study was begun the materials for crafts were easily obtainable and reasonably priced. Since then the picture has completely changed. The imported
materials such as the Tonkin cane for fishing rods, will be obtainable only so long as pre-war stocks last. Some of the materials for metalcraft, aluminum for example, are now unobtainable. All prices for craft materials have risen considerably. Substitutes will have to be found for the duration. This is not so difficult as it might appear. Domestic cane may be utilized for fishing rods, cotton twine makes an interesting substitute for leather for braiding and thong craft and numberless interesting metalcraft projects have been constructed from tin cans. When the present crisis is passed all the old materials will be stocked again and perhaps there will be new ones, or new uses for old ones, as a result of the present shortage.

Finally the writer hopes that the material in the supplements will make some small contribution as it stands. The greater part of it is original and all the material on fishing tackle and much of the leathercraft has never, to his knowledge, been presented in this way before.


SUPPLEMENT I

FISHING TACKLE
SUPPLEMENT I

FISHING TACKLE

We are indebted to the fishermen and the fly-makers of Great Britain for the craft of fly-tying. The English fly-tiers made painstaking studies of insect life and wrote volumes on entomology. They reproduced the natural insects faithfully in their artificial flies and wrote profusely about how it was done. The books they compiled on these and the other aspects of trout fishing are classics in the field and delightful reading besides.

Many and staunch are the arguments about the color and form of flies. Which colors do the fish see? Can they see color at all? Must the wings of the flies be folded, sloped down, or tipped up in imitation of the natural insect as it alights? How can you make a fly float on the stream if you tip the wings down? The writer once heard a skillful fly-maker give an answer that will serve until more knowledge comes our way. His statement was that "if you are appealing to the 'land-sucker' with your flies, then by all means make them gay, with lots of feathers and frills; but if you are making them to lure the wise old trout that elude you every season, then make them look as nearly like native trout fare as your ingenuity and powers of re-search will allow!"
Fly-tying is remarkably easy and can be undertaken with very little expense. The only purchases required to begin with are hooks and a fly-tying vise. The remainder of the tools can be made or substitutes secured from tools around the household. Practice materials are to be found in the sewing basket. As the tier develops skill he will find himself collecting useful feathers, wings, scissors, silks and the like wherever he happens upon them. All the materials for fly-tying may be purchased readily and in a wide price range. As in all crafts, the better tools will prove to be the best investment in the long run.

Methods of fly-tying vary and professional tiers often keep their art a secret. The fundamental procedures are all about the same. The method shown here is a good basic one and from it a beginner should be able to develop his own technique. Indeed, he will want to make his own variations. It is the endless possibility for individual skill and for the clever imitations of natural fish lures that makes fly-tying a fascinating hobby.

Modern rod making also is a heritage from English craftsmen. Nearly a hundred years ago a certain rod maker to the King devised a fishing rod of three strips of bamboo. Before then rods were made of cane, plain bamboo and of hardwoods. The obvious advantage of stripped
bamboo for strength came to the attention of rod makers in America and some twenty years later a four-strip rod was produced in Pennsylvania.

Today's best rods are of six glued triangular pieces of Tonkin cane, a kind of bamboo from China. These are split along the grain, never sawed, and are selected from the butt of the cane so that the splits may be made without including any of the pithy part near the center of the stalk. When the six lengthwise triangles are glued together the grain is carefully matched. If the rod is to be a really expensive one what amounts to another rod of six pieces is built on around this original six-piece core. This makes an excellent rod of course, but very serviceable ones can be constructed from the cheaper single sections of six pieces.

The home or school craftsman is advised to begin with a set of fishing rod materials -- glued up rod sections, grip, reel seat, ferrules, guides, etc. -- already designed and proportioned. These materials cost only a fraction of the price of a finished rod and it takes no great amount of skill to assemble and finish them into a rod that will rival the best of the manufactured ones.

References:


Marbury, Mary O., Favorite Flies. See color plates.

Tools and Materials for Fly-Tying

Tools

As pointed out in the introduction to this section, all the beginner really needs to buy to start fly-tying is a vise and some hooks. The rest of the tools and materials are easy to gather as he gains experience. Plate I shows the tools the fly-tier finds most convenient. Below is a list of these, together with their uses and some suggestions about them.

A. Stiletto: used for picking out hackles that have become entangled in the tying and for cleaning the eye of the hook after the fly is finished. Nothing is more annoying to the fisherman than to find the eye of his hook glued shut with shellac or lacquer. A stiletto may be made from a small darning needle inserted in a homemade wooden handle.

B. Hackle pliers: used to hold the hackle feathers clear of the tying silk and to hold the silk in place while the tier is working with other materials. Some tiers like to have several of these. They may be homemade of steel wire. The best commercial pliers are rubber-faced to prevent injury to delicate materials.
C. **Scissors**: used for cutting body and wing materials. They must have sharp points and the cutting edges must be really sharp. Round pointed scissors are of no use to the fly-tier. Really good manicuring scissors will do but if you are buying a pair, regular fly-tying scissors are best.

D. **Thompson vise**: used to hold the hook while the tying is done. There are several types of vises on the market, but this is the recommended one. A jeweler's vise may be used for fly-tying and one tier was seen to be using a snap clothespin rigged to the table for his vise.

E. **Tweezers**: used to pick up fine materials. With rubber bands around the blades they may be used as a substitute for hackle pliers.

**Materials**

Feather materials for fly-tying are easily acquired in any locality where there is hunting. The tail, hackle, breast and wing feathers of game cocks are standard materials for fly-tiers. The Chinese or "ring-neck" pheasant is especially useful. Game ducks, especially the mallard drake, have colorful feathers much used in fly-tying. The tail of the buck deer, with its many-
colored hairs, is used for bucktail and streamer flies. From domestic cocks also come some of the best hackles.

All these feather materials, as well as tying silk, chenille, floss and other wrapping materials used in the craft, are for sale at tackle supply companies at reasonable prices. Materials purchased from reliable dealers are of good quality and may be purchased in large or small quantities. Good fly-tiers are noted for the complete utilization of all their bits of material.

The craftsman's own ingenuity will suggest new materials and new uses for old ones as he develops his skill. That is part of the fascination of the craft.

Below is a list of common fly-tying materials with some of their various uses and some suggestions about their selection.

**Hooks**

Hooks come in sizes designated by numbers. A number 1 hook is about 2" long, while a number 12 hook is about 7/8" long. As the number increases the size of the hook decreases about 1/8" in length. Very small hooks come in "0" sizes and are designated as 1-0, 2-0, and so on.

Number 1 is an extra long-shanked hook recommended for streamer flies; number 2 is a salmon or streamer
hook; number 3 is for salmon dry-flies, sparsely tied streamers or wet-flies; number 4 is recommended for medium length streamers and for large dry-flies; number 5 is a common wet-fly hook; and numbers 6 to 8 are dry-fly hooks. Very small hooks are used for gnats and all the tiny insects.

Hook types are named Sproat, Limerick and Sneck. These differ in shape and in the angle of their barbs and eyes. A "snelled" hook is one which has the leader already attached. The Sproat hook, with a continuous bend from the butt of the shank to the barb, is considered the best by most fly-tiers. Hooks for fly construction have a turned down eye unless they are to be used with spinners. This turned down eye helps the fly-tier because it is easier to trim excess materials away from that end of the hook. It also makes for better action of the fly because it places the pull of the line near the center of the fly.

Body materials

1. Tying silk: used to fasten all the materials to the hook. It is, of course, an absolute necessity to fly-tying and should be of good quality. It comes in a wide range of colors.
2. Wax: used to prepare the tying silk as it is wound. The silk is never used without first being waxed. Beeswax is best but paraffin will do if beeswax is hard to secure.

3. Wool threads: used for fat or fuzzy bodies. Wool is good for this purpose because it dries out readily, does not change color when wet and wears well. It can be purchased in many colors. It usually is of four strands wound together. For fly-tying these are separated and only two used in the winding.

4. Chenille: used for fat bodies. It looks very realistic but it soaks up readily and changes color when wet.

5. Silk floss: used for colorful, water-resistant bodies on both wet and dry flies. Like wool it is unwound and used in smaller strands than as purchased.

6. Raffia: used for various kinds of bodies. It is easy to handle when wet, is almost waterproof and comes in a wide range of colors.

7. Quill: used for body padding for fat-bodied and taper-bodied flies. Quill is what remains when the fibres have been stripped from the feather and it makes particu-
larly good filler because it is light and waterproof -- a quality especially important for dry-fly material. The glazed covering of a peacock quill will strip off readily. These strips are easily wound.

8. **Herls**: used for bodies and tails and sometimes for wings. A herl is a single strand off a peacock or ostrich quill. Because of their varying lengths they serve many uses. Peacock herls are especially fine because of their sheen which so much resembles that of insects. Ostrich feather herls make excellent fat-bodied flies.

9. **Bucktails**: used for streamer flies and for the tails of many types of insects. Bucktail gives the tier many colors and shades to choose from for his imitations, though other furs such as rabbit, fox and muskrat are sometimes used to get the specific colors and textures he wants.

10. **Furs**: used for tails, wings and bodies. Wound or rolled into the waxed tying silk, fur makes very life-like material for fat bodies.

11. **Tinsel**: used to imitate the body segments of insects. It can be purchased on spools in many colors or may be stripped from Christmas or corsage decorations.
12. **Hackles**: used for bodies, tails and wings. Hackles are necessary to most types of flies. Grey hackles from the neck of the pure-bred Plymouth Rock cock, jersey hackles from pure-bred Buff Orphington cocks and the hackles from game cocks are the most used. When we speak of crown hackles we mean the feathers from the back of the neck. The feathers that run far up toward the beak are the smallest and are useful for making tiny flies. Body hackles are used for making wet flies and those from the backs of wild fowl are used for wings in certain patterns.

13. **Sterilastic**: used to construct the tapered bodies. Adhesive tape will do if it is treated to make it waterproof after it has been wound.

14. **Pheasant tippits**: used for the tails of many patterns. A tippet is the fibre from the tail feather.

15. **Collodion or shellac**: used for doping flies to make them waterproof for streamer fly heads, and for covering the tied-down silk to lock it securely. Finger nail polish does nicely because it comes in colors and in handy bottles with applicators. Lacquer, in colors or "clear", can also be used.
Wing materials

1. **Quills**: used for many kinds of fly wings. Fly wings are curved and so must be made with both the right and left quills from the right and left wings in order to construct them properly. Mandarin duck wings are much used and are valued for their white quills. Domestic fowls and game birds both supply quills for fly wings.

2. **Tail feathers**: used for pointed wings; their fibres are also used for delicate small wings.

3. **Breast feathers**: used for fan-wing insects. Those from mandarin duck are excellent.

4. **Hackle feathers**: used for spent-wing flies and for some upright varieties. Good neck hackles are wiry and strong so that they stand up well for erect wings, and wear well.

Feather and fur materials may be protected from moths by placing them in glass containers. Silks and other winding materials should be kept on spools and protected from dust. Shellac or collodian must be kept corked when not in immediate use or it will become gum-like. Hooks may be strung on safety pins or wire, or they can be stuck into cork. Every bit of fly-tying material can be utilized in one way or another so it
should all be neatly kept and readily available.

References


Hyndman, James H. *Modern Fly Craft,* pp. 11-29.

Knots for Fly-Tying

Before attempting to tie a fly the beginner will benefit by first practicing the knots he will use. Good knots are smooth and not bulky. They insure a neat and durable fly.

In all winding and tying remember that the tying silk, and all other materials which may be wound around the shank of the hook, must be carried always in the same direction.

Plate II illustrates the knots commonly used. Figure A shows the single half hitch. Figure B. shows the double half hitch. These are used for the process of "tying in" materials. By "tying in" is meant securing the materials of a fly to the hook shank with waxed tying silk. By "tying off" is meant securing the tying silk after all the other materials have been "tied in" and the fly is nearly complete.

Figure C shows the tying silk as it is carried over
HALF HITCH KNOTS

FIGURE 8 KNOT

WHIP KNOT

PLATE II. KNOTS FOR FLY TYING
and under the wings of a dry fly to make them stand upright. Figure D shows the completed loops just before they are tightened. When this knot is tightened be sure to set the wings in the exact position desired and then slowly set the knot with the help of the stiletto.

The four diagrams at the bottom of Plate II show the sequence of steps in tying the whip knot, which is the tying-off knot. When tying this one it is important to hold taut the thread which has just been wrapped on the shank, while the whips are made. Use not less than three nor more than six whips unless the thread is to be built up to make a head on the fly. In that case use as many whips as required to build the head.

References

Hyndman, James H. Modern Fly Craft, pp. 30-35.

How to Tie a Dry Fly

The Royal Coachman is the most popular of all the dry flies. For that reason, and because it illustrates the basic procedures of fly-tying, it was chosen for the instructions given here. It is always easy to select the materials for a particular fly because every fly-tying book has fly patterns giving you the exact materials and colors. One of these has as many as six hundred patterns.
Materials and tools

the tools illustrated in Plate I

a number 6 hook
red tying silk about 24" long
wax
several golden-pheasant tippets
split quill pieces about 1/2" long
four long peacock herls
red silk floss 6" long
a pair of grey duck quills
two grey hackles
red collodian

Procedure

1. Lay out all the tools and materials.

2. Set up the vise.

3. Put the hook in the vise and test. Replace if necessary.
   (To test a hook put the index finger underneath the eye when the hook is in the vise. Push upward and release. If it snaps back into place it is a good hook.)

4. Wax the tying silk.

5. Tie the silk to the hook, with a slip knot, at a spot just where the hook begins to bend downward.

6. Take several even turns of the silk along the hook shank and suspend with the pliers.

7. Pick up the pheasant tippets and match and trim them.
8. Place the tippets on top the wound silk and bind them to the shank with two or three turns of the thread. Tie them in with a half hitch.

9. Pick up two peacock herls and tie in as shown in Plate III, Figure A.

10. Wind first one and then the other of the herls around the shank just in front of the tail. Wind in the same direction as the tying silk is wound. Tie in each one with a couple of turns and a half hitch.

11. Pick up the piece of stripped quill and the red floss and tie in just in front of the herls.

12. Place the quill along the shank and wrap with four or five fast turns to a point on the shank about one-third the distance from the eye. Plate III, Figure B. Follow with the tying thread. Tie in with a half hitch.

13. Pick up the floss and, beginning close to the herls, wind it with tight, closely-spaced turns up to the one-third point. Tie in with six or eight turns and several half hitches one on top of the other. Trim off extra floss. Plate III, Figure C.

14. Tie in and wrap the other two peacock herls just in front of the floss and on top of the tying silk hitches. Tie in. Plate III, D and E.

15. Split sections from the duck quills as shown in Plate IV, E and F. They should match as in H.

16. Trim these sections to the shape shown in Plate IV, G.

17. Place the wings on top of the shank, just in front of the front herls and tie in with two turns and a half hitch. Plate III, F.

18. Tie the wings upright with a figure eight knot. Trim off the protruding wing quills in front of the tie-in.
PLATE IV. PREPARATION OF FEATHERS
19. Strip two grey hackles as shown in Plate IV, B.

20. Flex the fibres toward the butt of the hackles so that the fibres will stand apart. Do this by pulling the thumb and forefinger down along the hackle close to the quill.

21. Tie in the hackles just in front of the wings. Tie at the spot where the fibres begin. Use two turns and a half hitch. Trim off protruding hackle butts.

22. Pick up one hackle with hackle pliers and wind around the shank just in front of the wings. Tie in the tip with two turns and a half hitch.

23. Wind the second hackle in the same way. Tie in. Plate III, H.

24. Tie off the tying silk with a whip knot. See Plate II.

25. Apply collodian to the knot and trim off excess thread.

26. Check to see that the eye is clear of collodian.

References

Hyndman, James H., Modern Fly Craft, pp. 35-42.
Rhead, Louis, American Trout Stream Insects, pp. 104-123.

How to Tie a Wet Fly

A wet fly, designed to sink beneath the surface of the water, has heavier body materials than does the dry fly and has a somewhat different construction. It often has "spent" or down-turned wings, or, as in the bucktail streamer, no wings at all.
Materials and tools

the tools listed in Plate I
a number 5 hook
orange tying silk about 24" long
wax
several black hairs from a bucktail
stripped peacock quill pieces
orange wool thread 6" long
three-inch piece of gold tinsel
two pieces (tippets) trimmed from a pheasant tail feather
two jersey hackles
clear collodion

Procedure

1. Assemble all tools and materials.
2. Set up the vise.
3. Put the hook in the vise and test. Replace if necessary.
4. Wax the tying silk.
5. Tie on the silk with a slip knot at a spot just where the hook begins to bend downward.
6. Pick up the bucktail hairs and roll them between the thumb and forefinger to pack them tightly together.
7. Place the hairs on top of the hook shank where silk is tied. Tie in with four or five tight turns and several half hitches. Plate V, Figure A.
8. Pick up the two pieces of quill, the wool, and the tinsel and tie in just in front of the tail as in Plate V, B. Tie these with the butts facing the eye so that they will be covered by the body wrappings. Use four or five turns and a half hitch.

9. Pick up the wool and tinsel with hackle pliers and fasten them back of the vise out of the way.

10. Pick up one strand of quill and wrap it with even, tight turns to a point on the shank about one-third the distance from the eye. Follow with the tying thread and tie in with a half hitch.

11. Pick up the second piece of quill and wrap it up the shank so as to make the body thicker in the middle. Plate V, C. Tie in with several hard fast turns and two half hitches.

12. Trim off the excess quill at the front of the body.

13. Pick up the wool and wrap it with even, tight turns up over the quill filler. Be sure to cover the filler carefully. Tie in with several turns and a half hitch.

14. Pick up the tinsel and with spaced turns wrap it up to the same point so as to make the body appear segmented. Plate V, C. Tie in.

15. Trim off excess wool and tinsel.

16. Pick up the tippets and trim them to wing shape as in Plate V, D.

17. Place them on top of the shank, just in front of the body so that they lie back as in Plate V, D. Tie in with three turns and a half hitch.

18. Trim off the protruding ends of these wing feathers in front of the tie in.

19. Pick up the jersey hackles. Trim and flex as in Plate IV, B.

20. Tie in the hackles by their tips, just in front of the wings. Plate V, D.
21. Suspend one hackle with hackle pliers and pick up the other with another pair. Wrap tightly around the shank with even turns so that none of the hackle fibres are wrapped in.

22. Pick up the second hackle and repeat. Trim off hackle butts.

23. Tie off the tying silk with a whip knot. See Plate II.

24. Apply collodion to the knot and trim off excess thread.

25. Check to see that the eye is clear of collodion.

References

Hyndman, James H., Modern Fly Craft, pp. 43-45.

Rhead, Louis, American Trout Stream Insects, pp. 104-123.

How to Tie a Detached-Body Fly

An interesting fly to construct is the detached body fly in imitation of May flies, dragon flies, and the like. This type of fly is very easy to build and offers quite a challenge to the tier's ingenuity.

Materials and tools

- the tools listed in Plate I
- a number 6 hook
- red tying silk about 12" long
- wax
- several black bucktail hairs
- piece of sterilastic 7/8" square
two matched pheasant breast-feathers
two grey crown hackles
clear collodion

Procedure
1. Assemble all the tools and materials.
2. Set up the vise.
3. Put the hook in the vise and test. Replace if necessary.
4. Wax the tying silk.
5. Pick up the sterilastic and hold it like a cigarette paper.
6. Place the bucktail hairs in the trough thus made so that they protrude as in Plate V, Figure E.
7. Press the sterilastic tightly together. Trim with scissors to the dotted lines shown in Plate V, E.
8. Roll the body firmly into shape as shown in Plate V, F.
9. Tie on the tying silk with a slip knot at a point on the shank of the hook about one-third the distance from the eye.
10. Place the body on top of the tying silk as in Plate V, G. Tie in with two turns and a half hitch.
11. Pick up the breast feathers and trim to wing shape as shown in Plate V, H.
12. Tie in the wings on top of the end of the body, with the figure eight knot. This knot is shown in Plate II.
13. Pick up the grey hackles and trim and flex as in Plate II, B.
PLATE VI. SUGGESTED FLIES
14. Tie in the hackles just in front of the wings. Tie at the spot where the fibres begin. Use two turns and a half hitch. Plate V, I.

15. Trim off the protruding wing-quill butts.

16. Pick up the tip of one hackle with the hackle pliers and wind tightly around the shank with even turns and in such manner that none of the hackle fibres are wrapped in.

17. Pick up the second hackle and repeat.

18. Trim off the protruding hackle tips.

19. Tie off the tying silk with a whip knot. See Plate II.

20. Apply collodion to the knot and trim off excess thread.

21. Check to see that the eye is clear of collodion.

References

Hyndman, James H., Modern Fly Craft, pp. 50-54.

Rhead, Louis, American Trout Stream Insects, pp. 104-123.

Tools and Materials for Fitting and Mounting Fishing Rods

The tools and materials necessary for rod making are really very few and can be very inexpensive. Most of them are essential to other crafts. The only large item is a table or bench which is slightly longer than the longest joint of the rod to be assembled. This is a necessity. In this, as in most crafts, good lighting is important.
Tools -- Plate VI

A. **Pocket knife**: used to scribe and cut the joints, or rod sections, for fitting. The blade must be very sharp to cut across the strong fibre grain of bamboo. A different blade of the same knife may be used as a scraper to clean and finish off the surfaces of the joints.

B. **Mill file**: used to take down the joint end to fit the male and female ferrules, top, reel seat and handle grip. This file should be six to eight inches long.

C. **Pencil**: used for scribing distances on the joints for the fittings.

D. **Three-square file**: used interchangeably with the mill file to get the square shoulders off the cane in fitting the ferrules and top. This can be a three to four inch file.

E. **Scraper**: used to dress the entire surface of the joints. The knife blade may be used for this purpose but the scraper does a much more satisfactory job. A good substitute is a hack saw blade so sharpened as to have the same cutting burr on the back edge as the scraper. The saw blade fits the curves of the joints better even than does the scraper.

F. **Hack saw**: used in cutting off the joints to the designated lengths.
PLATE VII. ROD CONSTRUCTION TOOLS
G. Yard stick: used to measure joint lengths.

A screw driver, used to fasten on the screw butt plate; a light hammer, to tap the serrated ends of the ferrules down over the joints; and a caliper for accurate measurements. These are all handy but not essential. Winding outfits for the silk wrapping of poles may be purchased to make this process easier. Many other handy and time-saving devices suggest themselves to the pole maker as he develops his craft. Some of them he will develop for himself by his own ingenuity.

Materials

The glued-up Tonkin cane, recommended in the introduction to this section, can be purchased separately, as can the fittings for fishing rods. Many dealers have both made up into kits of various types and these are generally a bit cheaper and more satisfactory for the beginner. Since the beginner must rely largely upon the dealer for the quality of these materials, it is best to go to those who sell the products of the old, dependable tackle companies.

The beginner may doubt his own ability to assemble and finish a rod and so resort to cheap materials. Cheaper materials will make a useable rod but not a very sat-
isfactory one. It takes only a little natural mechanical ability and some patience to build a rod; and no more labor and time goes into a good rod than into a cheap one.

A rod kit should include the following:
2 or 3 joints, depending upon the kind of rod
a butt plate and screw
reel seat
grip, usually of cork
ferrule set and waterproof plug
guides, agate and metal
top (sometimes called tip) of metal and agate
In addition there are some accessory materials used in finishing a rod. The necessary ones are listed here:
o and oo sandpaper
different colored winding silks
waterproof casein or "Cascamite" glue
ferrule cement
winding silk preservative
rod varnish
beeswax

References
Frazer, Amateur Rodmaking, pp. 30-74.
Willmarth, Rod Making for the Beginner, pp. 2-4.
How to Assemble and Finish a Two-Piece Bait Casting Rod

A two-piece casting rod involves all the processes used in making any rod. Properly designed, a two-piece rod may be used with reasonable success for both fly casting and bait casting. Finally, the materials for such a rod are in the comparatively low price range, which makes it desirable for the beginner in the craft. For all these reasons it was the rod selected for this job sheet.

Materials and tools

- Kit for a two-piece casting rod
- Winding silks of two or more colors
- One sheet each of 0 and 00 sandpaper
- Ferrule cement
- Casein glue
- Winding silk preservative
- Rod varnish
- Beeswax
- Small, flat varnish brush
- Jack knife
- Mill file
- 3 square saw file
- Pencil
- Scraper
- Hack saw
- Yard stick
- Light hammer
- Screwdriver

Procedure

A. Fitting the reel seat and grip:
1. Sight the joints for straightness. If out of line, heat with a hot damp cloth or very careful application of direct heat, and gently press the cane straight with the hands. Place under weight until cool.

2. Scrape and sand the entire surface of both joints. Finish with 00 sandpaper.

3. Mark on the butt joint the total length of the grip and reel seat as shown in Plate VIII, Figure A. Mark completely around the joint.

4. With the jack knife, starting from the mark, shave off the corners of the butt joint where the reel seat and grip will fit. Be careful not to cut away too much. Test frequently the diameter of the rod ends in relation to the reel seat and grip. These must fit tightly. Use the mill file for the final working down and for the last trial assembly.

5. Place a ring of glue four inches down from the mark.

6. Force the reel seat over the butt joint through the glue, and up to the mark as shown in Plate VIII, Figure B. Be sure that the flat spot on the reel seat, where the reel rests, is in line with one of the flat sides of the cane where the guides will be placed later.

7. Dip the remainder of the butt, below the reel seat, into the glue about one inch.

8. Force the grip on and partly off several times to spread the glue and finally push it up to the reel seat.

9. With the knife point make a slight mark in the exact center of the base of the butt joint to serve as a guide for the butt-plate screws.

10. Screw the butt plate over the end of the joint as shown in Plate VIII, Figure C.
B. Mounting the ferrules:

1. Mark the upper end of the butt joint at 1 as shown in Plate IX, Figure D. When the rod is assembled the end of G, the male ferrule, must just touch the waterproof plug which will be inserted in E over the end of D. If this will make the butt joint too long cut off a piece, the length of the plug of the male ferrule, with the hack saw.

2. With the jack knife, starting at the mark, shave the end of the butt joint down slightly to fit into the female ferrule. Use the files for the final fittings and trial assembly. These ferrules must be force fitted.

3. Heat a piece of the ferrule cement over direct heat and apply to the dowel. Put it over the end as well as around the joint.

4. Heat the ferrule as hot as can be handled easily. It should not be heated enough to remove the temper.

5. Push the ferrule quickly into place. If it fits as tightly as it should it will not go all the way on but will need to be reheated and forced up to the mark.

6. Insert the waterproof plug into the female ferrule and reheat the cement on the end of the butt joint until the plug adheres.

7. Make a mark on the lower end of the top joint at 2 as shown in Plate IX, Figure F. This point is where the base of the male ferrule will come.

8. Shave down and fit the joint until it will insert in the male ferrule to the shoulder. It must be a force fit.

9. Make a second mark at 3, Figure F, where the shoulder of the male ferrule will come.

10. Shave down and fit into the extreme end of the ferrule.

11. Cement and assemble as for the female ferrule.
12. Remove any cement from the cane or metal by scraping.

13. Tap the split edges of the ferrules gently with the hammer.

C. Mounting the top:

1. Mark the tip of the top joint the distance the top will fit over. Plate IX, Figure K.

2. Shave down and fit as for the ferrules. This too must be a force fit.

3. Glue and assemble with heat as for the ferrules.

D. Mounting the guides:

1. Lay out the location of the guides on the pole. The agate guide is placed on the butt joint just back of the female ferrule. The other two are placed so that the top joint, including the top, is equally divided into thirds.

2. Test the setting of the guides. If necessary file the bases so that they will rest flat on the flat surface of the pole.

3. Fit the guides on the flat surface of the pole in line with the reel seat and tie in each one temporarily as shown in Plate IX, Figure 1.

4. Cut the winding silk in two-foot strips and wax them.

5. Wind and tie down the silk strips over the feet of the guides as shown in Plate IX, Figure J, 1, 2, and 3 or J, 4, 5, and 6. These illustrate two different ways of securing the threads to prevent slipping. Trim carefully.

6. Wind the silk over the split ends of the ferrules in the same way. See Plate IX, Figure H.
7. Apply any decorative windings that taste dictates. (Fly casting rods should be free of these but some experts feel that they strengthen a bait casting rod).

8. Dress the wound silk with the preservative. Allow to dry.

E. Finishing the pole:

1. Clean the rod thoroughly.

2. Heat the varnish over water until it is quite hot.

3. Hold one end of a joint with the left hand and place the other end on the table. With a moderate brushload of varnish stroke down from the metal edges about 4\" at a time. Turn the pole slowly.

4. Apply the whole first coat in this way to both joints. Keep the varnish off the metal parts.

5. Hang each joint up by one end and allow to dry for at least 24 hours, longer if necessary.

6. Go over the rod with the coarse sandpaper and wipe clean. Keep the work away from all dust.

7. Apply a second coat of varnish exactly as the first.

8. Smooth down again and apply the final coat when the second is thoroughly dry.

References

Frazer, Amateur Rodmaking, pp. 200-220.

Willmarth, Rod Making for the Beginner, pp. 4-13.
BIBLIOGRAPHY


SUPPLEMENT II

LEATHERCRAFT
Leather, in the form of crude, sun-dried pelts, was first used by the most ancient of the cave tribes. No one knows how far back in the dim past the first tanning processes may have been developed but there are references to leather articles and to tanning methods on the ancient Egyptian stone tablets. Pieces of leather more than thirty-three centuries old, from the early Egyptian tombs, are on display in the British Museum.

The Hebrew tribes are credited with the discovery of oak bark tanning, a process that was not much improved upon until modern tanning methods began to be developed in England and America as late as the eighteen hundreds.

The ancients valued leather as we do precious metals. They used it as a medium of exchange and for tribute to their rulers and gods.

The Egyptians dyed leather and ornamented it with studs of enamel and bits of burnished bronze, and later with gold and silver thread and embroidery. The Egyptians, Greeks, and Romans all used decorated leather for their sandals, shields, chariots and harnesses. Some of the designs they tooled on leather show remarkable
artistic development, both in skill and in creative ability.

The Middle Ages saw no great development in leather work but some of the loveliest of all leathercraft is in the early bookbindings and articles used in the churches at the time of the Renaissance. All the processes known to the leathercraftsmen of our day, dyeing, tooling, enameling, stamping and so on, were employed by the artists of that period.

Leather has always offered a satisfactory medium for creative expression because of its comparative durability and its pliability, and because the articles created from it are useful as well as decorative. There is a kind of satisfaction in the "feel" of good leather that is seldom equalled in the experience of the craftsman. Leathercraft requires a minimum amount of tools and equipment and the cost of the materials is very little in comparison with the value of the articles turned out. It is the kind of craft in which even the novice can turn out beautiful and satisfying projects. And, finally, leathercraft is limitless in its opportunities for the development of skill, ingenuity and creative design.

Leather lacings and simple knots appear on the earliest sandals and other garments, and on the trappings
of horses and chariots, but no one can say just when people learned to braid strands of leather together to increase its strength and durability. Some credit the early Arabians with the origin of this craft.

In our own country the Indians before us were well versed in the art of braiding and thonging. Their clothing, their lodges and their wampum all bore testimony to their skill. Some contend they learned it from the braided articles which Columbus' sailors traded them, some that they learned it from the Conquistadores who came up from the south, and still others that they developed the art themselves. It is known that it has been a craft of sailors and of horsemen the world over.

The use of hair, rope, cord and leather for all sorts of articles requiring lightness, flexibility and strength has been taken for granted among us for so long that many of us have overlooked the inventiveness that led to the development of the craft and the skill which goes into it. Few crafts require so little in materials and tools and yield such quick and satisfying results. The manipulation of leather strips or lacings into knots, flat braids and round thongs can be reduced to a few simple procedures and yet gives a peculiar fascination all its own. Braiding and thonging as a craft are especi-
ally adapted to camps, hospitals and the like because they require so little space and equipment and because they are so satisfying.

References

Bruce, Marjory, The Book of Craftsmen, pp. 223-248.


Tools for Leathercraft

The tools needed to start leathercraft are really very few. Many of them are easily made. Some, like the mallet, may be borrowed from among the tools of other crafts. A beginning set may include a square, a piece of marble or glass for a backplate, a soft pine cutting board, a modeler, a thonging chisel, a punch, a snap-fastener set, a mallet, a skiving knife and a tracer. The cost of such a set should be under $3.00. Beginner's kits may be purchased from any of the leathercraft companies and the tools are usually less expensive when purchased that way.

Good tools will prove to be the most satisfactory over a period of time. The most important thing to remember about leather tools is that they must at all times be scrupulously clean to avoid marring the leather.
As skill in the craft is developed, the beginner will want to add to his equipment by either making or buying additional tools. The more important tools used in leathercraft, together with their uses and some suggestions about them, are illustrated in Plates X, XI, XII and XIII.

Construction Tools - Plate X and XI

A. Thong cutter: used to cut strips up to ¼" wide. Thongs may be cut with a knife or scissors, or one may construct a cutter with a razor blade. Thongs and lacings can be purchased ready-made.

B. Spacing awl: used to lay out round punch holes of equal spacing.

C. Drive punch: used for punching holes in places which cannot be reached with a spring punch. These come in various sizes. Number 0 is a good one for most projects. Hard steel tubing with one end ground to a sharp edge toward the center of the tube makes a good drive punch.

D. Four-pronged lacing awl: used to make slits for lacing, rather than round holes. Generally used with a 3/32" lace. There is a single pronged lacing awl which is advantageous for corners and these two work well to-
gether. The single space punch is best if only one is to be purchased. This can be made of $1/4"$ strap iron hacksawed to dimension and ground sharp. Nut picks also make passable awls.

E. **Spring punch:** used for punching round holes in leather. Punches are from $3/64"$ to $7/32"$. This six-tube punch is quite useful. They may also be had with one or four tubes. The drive punch is a slow but efficient substitute.

F. **Skiving knife:** used for tapering or thinning leather and for cutting.

G. **Skiving gouge:** used for skiving leather where a fold is to be made. A small wood carving chisel with a fast curve or a linoleum block cutter number 5 may be substituted for this tool.

H. **Scissors:** used for thongs, trimming and the like. Be sure they are of heavy construction with short blades. They must have a tight pin and be sharp.

I. **Mallet:** used for striking the thonging awl and the drive punch, and for setting the laced edge of a project. The one pictured here is a cobbler's hammer which provides a peening surface for decoration. Wooden mallets can be made from a square block, turned block, or even from old baseball bats, with a handle set in.
J. **Ruler:** used for pattern and design making and for guiding other tools. Some leather workers recommend a steel square as essential. If a steel square is used it must be polished so as not to mar the leather.

K. **C-clamp:** used for holding leather to the back-plate, Plate XI. When this tool is used, the face side of the project must be protected with a piece of scrap leather where the clamp would contact the leather.

L. **Compass dividers:** used for laying out arcs, dimensions and hole marks. Points should be dull to prevent marking the leather.

M. **Celluloid 45-degree triangle:** used for layout of patterns and designs and for marking lace holes. Celluloid will not mar leather surfaces.

N. **Snap-button outfit:** used for inserting large and small snap buttons in leather projects. Plate XI. A snap button is made up of four separate parts: the cap "a", the eyelet "b", the spring "c", and the post "d". The manner "e" fits over the cap. The eyelet fits on the pin of the anvil "f". In assembly the leather goes between ab and cd. The corresponding hammer and anvil for the spring and post are illustrated by "g" and "h".
PLATE XI. LEATHER CONSTRUCTION TOOLS
Leather stamping tools - Plate XII

A. Stamping tools: used for many border decorations and to enrich other designs. Sometimes employed for all-over designs. They can be homemade of screws or nail heads as illustrated in "a" and "b". These are marked into patterns with a saw-file and punch. Round, square or hexagonal rods may be used to make stampers such as "c", "d", and "e".

B. Embossing wheel: used to make continuous designs such as those shown at the left for borders. A variety of wheels fit into a single carriage or handle. Metal discs, filed and shaped, or even alarm clock gears, may be used for embossing wheels.

Leather decorating tools - Plate XIII

A. Tracer: used for tracing patterns on leather and for deepening lines. Two sizes are shown here.

B. Flat spoon modeler--two sizes: used for modeling designs on leather. Hardwood sticks, such as orange-wood, may be substituted. A round rod, hammered to shape and finished with a fibre-wrapped handle makes an excellent modeler.

C. Ball modeler: used in making repousse (raised designs). With a straight-edge and this tool varied border effects may be worked out. Different sized ball
PLATE XII. LEATHER STAMPING TOOLS
PLATE XIII. LEATHER DECORATING TOOLS
bearings spot welded to a welding rod makes a passable substitute for this tool.

D. Deer-foot modeler: used for fine modeling. This tool can be constructed as the one above but with grinding and finishing to get the deer foot shape.

E. Diamond point modeler (two views): used for getting at small corners on the design.

F. Tracer and single point stippler: used to trace borders and for stippling. Combination tools like this are very useful. This stippler may be used for an awl.

G. Embossing wheel and lacing awl.

H. Beveler and fid: used for pressing and shaping the edges of leather and for lacing. This tool should be purchased though it can be made of rods filed to shape. The fid is used primarily for lacing, thonging, and to construct knots. It may be used for stippling.

Additional tools or materials not illustrated

In addition to such leathercraft tools as you may select you will need the following to make your outfit complete.

1. Oilstones to keep tools sharp.

2. A piece of plate glass or marble for a backplate. A piece of hardwood will do but the others prove more satisfactory.

3. A soft pine board for cutting and trimming.

4. A sponge and dish for dampening leather for tooling.
5. Paper, cardboard and pencils for patterns, and tracing paper for designs.

6. Leather cement for splicing laces and to cement linings in place.

References

Cherry, Raymond, General Leathercraft, pp. 13-38.
Snyder, W. E., The Leathercraftsman, pp. 41-56.
Steri, Emanuele, Indoor Hobbies, pp. 231-250.

Craft Leathers

Good leathercraft depends a great deal upon the selection of leather of the correct kind and finish for the project to be constructed. For example: leather to be tooled or embossed must be bark-tanned or it cannot be dampened, and it is only upon dampened leather that tooling will leave a permanent impression.

The most economical way to buy leather is by the whole, half or quarter skin. It may be bought by the even square foot or "by the piece," cut to order. These latter ways are more expensive than by the whole or half skin but they do eliminate waste. Many supply companies have kits prepared with all the materials necessary for a single project. These are useful for small classes and for the beginning home craftsman.
The term "hides" refers to pelts of the heavier type, such as those from cattle. Those of the smaller animals are called skins. The grain side of leather is the hair side. Heavier hides are split for most purposes and the flesh side of the two pieces is termed "split leather." Leather is often finished or "grained" to resemble the markings of other types of skins and though this leather is not too stable it is often very attractive and inexpensive for craft purposes.

The following chart lists the more commonly used craft leathers together with suggested uses and some facts about them which are of interest to craftsmen.
# Craft Leathers

<table>
<thead>
<tr>
<th>Type of leather</th>
<th>Craft uses</th>
<th>Skin size</th>
<th>Color range</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Calfskin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Tooling calf-</td>
<td>Billfolds, book covers, purses, key cases, card covers.</td>
<td>10-14 sq. ft.</td>
<td>Wide variety. Natural color,</td>
<td>Natural color, finishes to</td>
</tr>
<tr>
<td>skin (Russia</td>
<td></td>
<td>app.</td>
<td>Will take stains, dyes rich brown</td>
<td>stains, dyes rich brown</td>
</tr>
<tr>
<td>calf)</td>
<td></td>
<td>3/64&quot; thick</td>
<td>and enamels. shades</td>
<td>and enamels. shades</td>
</tr>
<tr>
<td>2. Lining calf-</td>
<td>Linings and inside sections. Can be tooled but not deeply.</td>
<td>10-12 sq. ft.</td>
<td>Usually in natural.</td>
<td>A split leather sometimes called</td>
</tr>
<tr>
<td>skin</td>
<td></td>
<td>app.</td>
<td></td>
<td>dyed.</td>
</tr>
<tr>
<td>3. Suede calf-</td>
<td>Fine velvety linings. Not tooled.</td>
<td>4-6 sq. ft.</td>
<td>Wide variety</td>
<td></td>
</tr>
<tr>
<td>skin</td>
<td></td>
<td>app.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cowhide</strong></td>
<td></td>
<td>1/32&quot; thick</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Tooling</td>
<td>Same as calf and camera cases, brief cases, sheaths, wastebaskets.</td>
<td>24-26 sq. ft.</td>
<td>Natural color Produced especially</td>
<td>Produced especially for leather-</td>
</tr>
<tr>
<td>cowhide</td>
<td></td>
<td>3/64&quot;, 4/64, 7/64 in.</td>
<td>for leathercraft. Good for</td>
<td>craft. Good for tooling, carving,</td>
</tr>
<tr>
<td>(Alhambra</td>
<td></td>
<td>all available</td>
<td>tooling, carving, incising and</td>
<td>incising and stamping</td>
</tr>
<tr>
<td>leather)</td>
<td></td>
<td></td>
<td>stamping</td>
<td></td>
</tr>
<tr>
<td>Type of leather</td>
<td>Craft uses</td>
<td>Skin size</td>
<td>Color range</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------------</td>
<td>-----------</td>
<td>---------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>2. Cowhide belt</td>
<td>Plain or braided belts, cases,</td>
<td>18-22 sq. ft. 3/32&quot; thick</td>
<td>In several colors</td>
<td>Can be stamped</td>
</tr>
<tr>
<td>or case leather</td>
<td>sheaths</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Ooze cowhide</td>
<td>Where heavy leather with a</td>
<td>22-28 sq. ft. 3/16&quot; thick</td>
<td>Natural. Takes colors well</td>
<td>Toolable, good when tooled and then waxed</td>
</tr>
<tr>
<td></td>
<td>suede finish is desired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. White cowhide</td>
<td>Plain or braided belts, banners,</td>
<td>14-18 sq. ft.</td>
<td></td>
<td>Heavy. Not</td>
</tr>
<tr>
<td></td>
<td>quivers</td>
<td></td>
<td></td>
<td>toolable.</td>
</tr>
<tr>
<td>5. Cowhide moccasin</td>
<td>Outdoor wear.</td>
<td>10-12 sq. ft. 1/32&quot;</td>
<td>Dark brown</td>
<td>Well oiled. Practically</td>
</tr>
<tr>
<td>(Spartan)</td>
<td></td>
<td></td>
<td></td>
<td>waterproof and heatproof</td>
</tr>
<tr>
<td></td>
<td>billfolds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Morocco cowhide</td>
<td>Linings</td>
<td>20-26 sq. ft. 1/32&quot; thick</td>
<td>Brown or black</td>
<td>Pinseal grain.</td>
</tr>
<tr>
<td>Type of leather</td>
<td>Craft uses</td>
<td>Skin size</td>
<td>Color range</td>
<td>Remarks</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------------------------</td>
<td>---------------</td>
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<td>--------------------------------</td>
</tr>
<tr>
<td><strong>Steerhide</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Natural steerhide</td>
<td>Handbags, brief cases, book</td>
<td>24-30 sq. ft.</td>
<td>Russet</td>
<td>Natural finish and pebbled.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3/64&quot; and 4/64&quot; thick</td>
<td></td>
<td>Grain good.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Takes colors and enamel well.</td>
</tr>
<tr>
<td>2. Mottled steerhide</td>
<td>Same as above</td>
<td>24-30 sq. ft.</td>
<td>Combination of colors in mottled thick effect.</td>
<td>Needs no decoration.</td>
</tr>
<tr>
<td><strong>Sheepskin</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Tooling sheepskin</td>
<td>Same as calf. Does not tool</td>
<td>7-10 sq. ft.</td>
<td>Natural</td>
<td>Sheepskin is not as strong as many others.</td>
</tr>
<tr>
<td></td>
<td>as well but is about half as expensive.</td>
<td>3/64&quot; thick</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Suede sheepskin.</td>
<td>Linings, cut-out and applique.</td>
<td>6-8 sq. ft.</td>
<td>Wide variety</td>
<td>Soft, velvety finish. Fliable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3/64&quot; thick</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1/64&quot; thick</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of leather</td>
<td>Craft uses</td>
<td>Skin size</td>
<td>Color range</td>
<td>Remarks</td>
</tr>
<tr>
<td>-----------------</td>
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<td>-----------------</td>
<td>-----------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Pigskin</td>
<td>Purses, bags, cigarette and card cases.</td>
<td>12-22 sq. ft. 1/32&quot; and 3/64&quot; thick</td>
<td>Natural or black</td>
<td>Toolable only in straight line or stipple. Very strong.</td>
</tr>
<tr>
<td>Elkskin</td>
<td>Moccasins, vests, coats, archery equipment, Indian craft.</td>
<td>14-16 sq. ft. 5/64&quot; thick</td>
<td>Natural and brown</td>
<td></td>
</tr>
<tr>
<td>Lacings</td>
<td>Joining.</td>
<td>By the yard</td>
<td>Many colors</td>
<td>Made of thin calf or goat skin. Can be bought in different thicknesses.</td>
</tr>
</tbody>
</table>

References:
Cherry, Raymond, General Leathercraft, pp. 9-10.
Snyder, W. E., The Leathercraftsman, pp. 27-32.
Tanner's Council of America, The Romance of Leather, pp. 21-33.
How to Make a Pencil Case

This project involves a good many of the processes used in making leathercraft articles but does not take a very large piece of material. The design is simple and the article is one which students like and can use. The lacing is the simplest kind also. For these reasons it was selected for the instructions given here.

Materials

a piece of tooling calf or tooling sheep 8 1/2" x 8 1/4", dark in color
one snap fastener to match
matching or contrasting goat lacing 30 inches long
paper, cardboard and tracing paper

Tools

pencil, ruler and scissors skiving knife
backplate of glass skiving gouge
pine cutting board spring punch
pencil compass drive punch
cobbler's hammer beveler
tracer snap button set
modeling tool celluloid triangle
spoon modeler large paper clips
sponge and dish
Procedure

A. Making the pattern:

1. Make a full size paper pattern from Plate XIV, Figure A. Draw all specifications.

2. Mark for lace holes as shown in Plate XIV, A. Place marks 1/4" apart and 1/8" from the edge. Start holes equidistant from the bottom fold "a". Lay out lacing guide holes with the triangle.

3. Lay out and mark hole "b" to fit the size of the post of the snap fastener.

4. Lay out and mark eyelet hole "c" to fit the eyelet of the snap fastener.

5. Fold and check the pattern. Be sure to allow 1/8" for the folds.

6. Paste the pattern on cardboard and cut around the outline with scissors. Cut just to the line. Allow to dry.

B. Getting the design on the leather:

1. Lay out 1" squares on a piece of tracing paper with a hard lead pencil. Mark one of the vertical lines as a center line.

2. Trace the outline of the pattern on this tracing paper. Be sure the center lines match.

3. Lay out the design borders. These are 1/4" wide. Be sure to allow the additional 1/8" between the borders at the two points where the project will be folded.

4. Plot the center of the designs on Plate XIV, Figure B, and draw a faint line through these on your tracing paper.

5. Set the pencil compass at 7/8" and draw the large circle. Set again at 5/8" and draw the large circle.
PLATE XIV  PENCIL CASE
6. Sketch the rest of the design from Plate XIV, B, on the tracing paper.

7. Check the placement of the design on the pattern.

8. Dampen the flesh side of the leather. Be sure that it is damp, not wet.

9. Place the leather on the glass backplate tooling side up.

10. Locate the design on the tracing paper so that the outlines match. Secure with scotch tape.

11. Trace over all the lines, including the border, with a firm, steady pressure of the tracer. Do not rush. Be careful not to trace over the same line twice. This tracing must all be done at one session.

12. Lift one edge of the paper and check the design. Any lines which have been omitted must be traced on while the leather is still damp.

C. Tooling:

1. Moisten the leather on the flesh side. Be careful not to get it so moist that dark spots appear on the face side.

2. Place the leather on the glass backplate in a good light.

3. Place the spoon modeler against the outside edge of the lines and, holding it at a 45-degree angle, follow all the object lines. Every time the tool is pressed down be sure to overlap the last impression.

4. Outline the smaller lines, such as the radiating ones, with the point modeler. Use a firm steady pressure.

5. Go over the border lines with the point modeler. The ruler may be used as a guide when tracing these lines. Be sure that it is polished and clean.
6. Allow the leather to dry thoroughly.

D. Assembling the project:

1. Place the tooled leather face side down on the cutting board and lay the cardboard pattern over it. Match the two and trace the outline of the flap on the leather.

2. Remove the pattern and cut the flap with the skiving knife. Hold the knife blade at a 90-degree angle to the leather and cut firmly to the line. Be sure to cut clear through on the first stroke.

3. Punch holes in the cardboard pattern in punch marks. Use a spring punch. Be sure the punch tube fits the size of the lacing to be used. Remember that the holes for the fasteners will be of different sizes.

4. Secure the pattern firmly to the leather with paper clips and punch the holes in the leather, using the holes in the pattern as guides. Be very sure the pattern does not slip out of place.

5. Place the eyelet of the fastener through the leather from the under side of the flap; and place the cap on top of the flap over the shank of the eyelet. Secure with the hammer and anvil.

6. Place the post of the fastener through the leather from the under side of the front piece and put the spring over the shank of the post. Secure with the spring and post hammer and anvil.

7. Test the fastener.

8. Turn the leather face side down on the wooden backplate and lay out the 1/8" folding lines with the fid and straight edge.

9. Skive within the 1/8" lines with the skiving gouge, to not more than one third the thickness of the leather.
10. Fold against the straight edge.

11. Test the edges of the project for squareness. See that the lace holes match. Test the fastenings in relation to the folds.

12. Tap the corrected folds gently with the cobblers hammer.

13. Place the leather face side down on the wooden backplate, and with the skiving knife, taper the underside of the flap and the sides. Taper to about one third the thickness of the leather. Stick the knife into the wood at a 15-degree angle and pull the leather with both hands past the blade.

14. Place leather face side up and bevel around the outline edge with the beveler.

15. Fold the leather ready for the lacing.

16. Start the lacing at one lower corner as in Plate XV, Figure A. Tie on as shown in Plate XV, B.

17. Lace with the over-and-over stitch clear around the flap and down the other side. Tie off as in Plate XV, C. Place the case on the wooden backplate with the flap open. Gently tap the lacing all the way around with the cobbler's hammer.

References:

Cherry, Raymond, General Leathercraft, pp. 19-38.

Snyder, W. E., The Leathercraftsman, pp. 57-74.

Steri, Emanuele, Indoor Hobbies, pp. 239-245 and 260-266.
WHIP STITCH
CROSS STITCH
BUTTONHOLE STITCH
WHIP LOOP STITCH
RUNNING STITCHES
NOVELTY LOOP STITCH
FLORENTINE STITCH
FOUR ROUND STITCH

PLATE XVI. LEATHER LACINGS
PLATE XVII. MIRROR CASE
PLATE XVIII. JEWEL BOX
How to Make a Six-Strand Braided Belt

Craftsmen and teachers most often purchase belt kits with the strands already prepared for braiding and the buckle ends cut and ready to assemble. In this unit all the steps are offered, from cutting out the parts to the completed project, in the hope that the different steps will prove useful in constructing other articles.

Materials

- Strip of cowhide belt or case leather 1 1/2" wide and 5 1/4" long for the belt proper (This makes a 36" belt. Allow 1/3 of the waist measurement for braiding and add 6" for the strap end.)
- Strip of the same leather 6" long for the buckle end
- A matching strip 3/4" wide and 3 1/4" long for the loop strap
- Small matching lacings in one-yard lengths
- Metal belt buckle with two tongues for 1 1/2" belt
- Leather cement
- Pieces of scrap leather

Tools

- Spring punch
- C-clamps
- Skiving knife
- Edge creaser
- Lacing awl
- Tracer
- Straight edge
- Leather compass dividers
- Smooth pine cutting board one yard long
- Sponge and dish
Procedure

A. Splitting the leather:

1. Divide the width of the belt strap into six equal portions and lay out five pilot marks for the punch six inches from the strap end. See Plate XX, Figure A.

2. Lay out similar pilot marks on the buckle end.

3. Punch these pilot holes with the smallest tube of the spring punch.

4. Place the strap grain side up on the table and mark the lines between the holes with the straight edge and tracer.

5. Place the strap on the cutting board grain side up with the straight edge on top and along line "a". Clamp the board, strap and straight edge to the table edge.

6. Cut line "a" from the pilot hole at the strap end clear through the buckle end. Hold the knife directly against the straight edge. The knife will need to be very sharp. Cut through to the board with a firm stroke.

7. Lift strand away and test for a clean cut. If it is not cut clear through it will not come away.

8. Re-clamp and cut lines "b" and "c" in the same way.

9. Reverse the strap and reclamp over the cut strands to give sufficient grip while cutting "d" and "e". (If you have a thong cutter, do the cutting with it. Clamp the buckle end to the table and cut from it to the pilot holes at the strap end.)

B. Finishing the strap end:

1. Measure 1/2 the belt width at the end and make a slight mark with the tracer on the face side of the leather. Plate XX, Figure A, X.
PLATE XX. BRAIDED BELT
2. Set the compass at the width of the belt and place the one compass point on the mark "x".

3. Set the other point of the compass at the edge of the belt at "y" and make this point stationary.

4. Trace an arc from this point, with the tracer, from "x" to "z".

5. Trace a similar arc from "x" to "y" with "z" as a center.

6. Place the belt grain side up on the cutting board and cut arcs xy and xz with the knife. Be sure it is sharp.

7. Lay out holes on the face side of the strap for the buckle tongues. See Plate XX, Figure A. The first hole is 3" from the tip of the strap. Holes are spaced 3/4" apart.

8. Select a tube in the spring punch which will make a hole to fit tightly over the buckle tongues. Punch the holes with this tube.

9. Moisten the flesh side of the strap from the tip to the beginning of the cut strands. Be sure all tools and surfaces are clean so as not to mar the leather.

10. Place the strap grain side up on the cutting board and trace a light mark with the edge creaser, along the edge, from the point where the strands begin, to the tip. Stop before reaching "x" and lift the tool.

11. Trace a similar line along the other edge.

12. Repeat this tracing along both edges three or four times until the groove is clear-cut.

13. Allow to dry.

C. Preparing the buckle end:

1. Cut both ends of the 6" strip as you did the tip of the strap end. See Plate XX, Figure B.
2. Find the center and lay out two eyelets for the buckle tongues. These fit tightly over the base of the tongues so they must be planned accordingly. Be sure they are not too large.

3. Punch holes the size of the tongue base along line ab in B. Trim out with the knife.

4. Repeat for line cd.

5. Mark faint lines with the tracer 5/8" from the center, from "e" to "f" and from "g" to "h". See Plate XX, Figure B.

6. Mark eleven pilot marks for the punch along these lines. Use the tracer for marking.

7. Repeat this at 1 3/8" from the center for lines "i" to "j" and "k" to "l".

8. Lay out pilot marks for the holes around the two ends of the strip. Use the same spacing as for the marks along the straight lines. They must be so placed that when the piece is folded the holes in the two sides will match for lacing.

9. Select the spring punch tube that will make a hole to fit the lacings and punch all these holes. Center the tube accurately on the pilot mark.

10. Place the strip grain side down on the cutting board and skive along the center line to about one third the thickness of the leather.

11. Fold the strip and test for folding and lacing.

12. Skive off edges that do not match exactly.

13. Lay out two holes at either end of the loop strap for lacing it together. See Plate XXI, Figure C.

14. Punch holes to fit the lacings.

15. Place the belt over the loop strap and trace a mark where the loop will bend over the strap. Lines "a", "b", "c", and "d", Figure C.
16. Skive along these on the flesh side until the loops will bend easily.

17. Moisten the flesh side of the loop strap and place it on the board grain side up.

18. Trace a line along each edge of the loop strap with the edge creaser. Repeat until the groove is clear-cut.

19. Allow to dry.

20. Bend the loop strap around one end of the 6" strip. Remove and lace as in Plate XXI, Figure C.

21. Cement the lacings and put under pressure to dry.

22. Place the buckle on the buckle end as in Plate XXI, A.

23. Fold the strip and test to be sure the buckle is not in backwards.

D. Braiding the belt:

1. C-clamp the strap end of the belt to the table with a protective piece of scrap leather between belt and clamp. Place the clamp close to the cut strands.

2. Weave strand 6, Plate XX, Figure C, over 5, under 4, over 3, under 2, over 1 and turn down.

3. Weave strand 5 over 4, under 3, over 2, under 1, over 6 and turn down.

4. Weave strand 4 over 3, under 2, over 1, under 6, over 5 and turn down.

5. Weave strand 3 over 2, under 1, over 6, under 5, over 4 and turn down.

6. Weave strand 2 over 1, under 6, over 5, under 4, over 3, and turn down.

7. Weave strand 1 over 6, under 5, over 4, under 3, over 2 and turn down.
8. Start again with strand 6 and repeat to 2" from the end of the strands. Braid tightly by holding the strands firmly and pushing them together.

9. Clamp the braid at this point between two small pieces of soft wood and arrange the protruding ends in a straight line for a flat surface.

E. **Joining the buckle end to the belt:**

1. Skive off the flesh side of the strands to a gradual taper from the clamp to the ends.

2. Remove the clamp and make a trial assembly. See Plate XXI, A.


4. Apply a second coat of cement and place the strand ends carefully on the buckle strip so that they lie flat as in Plate XXI, A. Be sure they are grain side up.

5. Press the strand ends firmly into the cement.

6. Put the two small boards over the glued area and secure with the clamp. Allow to dry 20 to 30 minutes.

7. Remove the C-clamp. Punch the strand ends through the lace holes in the strap end.

8. Apply cement to the upper side of the strand ends and another coat to the flesh side of the buckle strip end which is to fit over them.

9. Fold the upper half of the buckle strip down over the strand ends and firmly into the cement. Be sure that the lace holes match.

10. Put the two small boards over the glued area and secure with a C-clamp. Allow to dry 20 to 30 minutes.

11. Remove the C-clamp. Check lace holes for alignment and cleanliness.
THREE STRAND BRAID—DOUBLE FIVE STRAND BRAID—FIVE STRAND BRAID

PLATE XXII. OPTIONAL FLAT BRAIDS
PLATE XXIII. BRAIDED SUSPENDERS
12. Lace with the over and under stitch as in Plate XXI, B.

13. Fasten the ends of the lace on the underside of the belt and cement firmly.

14. Slide the loop over the strap end up to the buckle end. See Figure B.

References

Cherry, Raymond, General Leathercraft, pp. 45-46.
Griswold, Lester, Handicraft, pp. 85-112.

How to Make a Braided Dog Leash

This project is made with a four-strand round braid and two types of knots; a sliding knot and a terminal turkshead knot. The forming of these serves as a foundation for six and eight-strand round braids and for other very similar knots. The finished leash is illustrated on Plate XXIV, Figure A.

Materials

two 9-yard strands of 1/4" lacing
one swivel dog leash snap
one 12" piece of matching lacing
piece of string
Tools

fid, awl, or marlinspike
skiving knife

Procedure

A. Braiding the leash:

1. Secure the swivel snap over a hook or nail as in Plate XXIV, Figure B.

2. String the two long strands through the eye of the snap as in Figure B.

3. Pull the strands so that the ends are all even.

4. Cross the nearest strand over itself as in Figure B. This is called a crow's-foot.

5. Hold the crow's-foot tightly with the thumb and forefinger and pick up strand 4. Bring this strand behind the crow's-foot and between 1 and 3, over 3. See Plate XXIV, Figure C.

6. Pick up strand 1 and bring it behind the new crow's-foot between 2 and 4, over 4.

7. Pick up strand 2 and bring it behind the crow's-foot between 3 and 1, over 1.

8. Continue picking up the back strands, first on one side and then the other, and braiding as in Figure D. Braid to within six inches of the ends of the strands.

9. Check the braid to see that all the strands are straight.

B. Making the terminal turkshead knot:

1. Turn the braid upside down as shown in Plate XXV, Figure A.

2. Hold the end of the braid tightly and arrange the strands as in Figure A.
PLATE XXV TERMINAL TURK'S HEAD KNOT
3. Pick up strand 1 and cross it over 2. Let the end drop down between 2 and 3. See Figure E.

4. Pick up strand 2 and cross it over 1. Let the end drop down between 3 and 4. Figure C.

5. Pick up strand 3 and cross it over 2. Let the end drop down between 4 and 1. Figure D.

6. Pick up strand 4 and cross it over 3. Stick it through the loop made by 1. Figure E.

7. Pick up each strand in turn and gently tighten as in F.

8. Pick up strand 2 and put it through the loop of 4, underneath 3 and up through the center. See Figure G.

9. Pick up strand 3 and put it through the loop of 1, underneath 4 and up through the center. Figure H.

10. Pick up strand 4 and put it through the loop of 2, underneath 1 and up through the center. Figure I.

11. Pick up strand 1 and put it through the loop of 3, underneath 2 and up through the center. Figure J.

12. Take a tight grip on the end of the braid and pull each strand in turn until the knot is firm as in Figure K. Be sure the strands in the knot are not linked.

13. Skive the tips of the protruding ends of the strands.

C. Making the handle of the leash:

1. Roll the braid under a board to smooth out any unevenness and to "set" the braid. Be sure the surface upon which it is rolled is clean.

2. Bend the knotted end of the braid into a loop about 7" long as in Plate XXIV, Figure A. Tie temporarily with a piece of string, at the base of the turkshead.
3. Pick up the 12" piece of lacing and loop it around the two sections of the braid as shown on Plate XXVI, Figure A. (the sliding knot illustrated at the left)

4. Make a double wrap as on Plate XXVI, Figure B.

5. Weave as in Figures C and D. The course of the strand is indicated by the arrows.

6. Tighten the knot with the fid by following the course of the strand and taking up the slack throughout.

7. Pull both ends of the strand very tight.

8. Skive off these ends to about 1/2" butts.

9. Tuck the ends into the knot with the aid of the fid as shown by the arrows in Figure E.

10. Roll the completed knot. The finished knot is illustrated by Figure F.

References

Griswold, Lester, Handicraft, pp. 85-123.

Snyder, W. E., The Leathercraftsman, pp. 132-140.
CROWN TERMINAL (SQUARE)

SIX ROUND BRAID

CROWN TERMINAL (SPIRAL)

PLATE XXVII. OPTIONAL KNOTS


4. Cherry, Raymond, General Leathercraft, Bloomington, Illinois: McKnight and McKnight, 1940.


13. Leland, C., Leatherwork, New York: Pitman and Sons, Ltd.


Anyone who sets out to be a metalcraftsman joins a procession of workers so old that its origin is almost lost in the backward reaches of history. The Bible tells us that Tubal-Cain was an instructor in the craft of metalwork. The Egyptians are known to have been mining and working copper 3000 years before the beginning of Christianity.

It is generally believed that copper was the first metal to be discovered by man and that tin was next. Then, perhaps quite by accident, the ancient craftsmen blended the two and so discovered the alloy known as bronze. The uses of this alloy spread to all the civilizations around the Mediterranean and from there to Northern Europe and so affected the cultures of these peoples that historians have named the period the Age of Bronze. Of the many utensils, tools, weapons and images made of bronze the most striking example was the Colossus of Rhodes, which is listed as one of the seven wonders of the world. It was the figure of a man, 110 feet high, standing across the harbor entrance to the ancient city of Rhodes.
Gold and silver came into use almost as soon as copper and gold early became the most precious of the metals. It came to have a royal and sacred character and it is thought that this was so because its color was like the sun's rays. To the ancients the Sun was the giver of Life. The kings of Egypt, Babylonia and Assyria decked themselves with gold and their faithful subjects buried them in all the splendor of their royal treasures. The Greeks, Romans and Etruscans prized silver as well and their tombs have yielded quantities of gold and silver utensils, ornaments and trinkets. Some of these are of incredible grace and thinness because they believed they needed to be light to be lifted by ghostly fingers. The early civilizations of the Americas did not set this same high value upon gold and silver and durn-founded the Spanish explorers by their willingness to part with them.

In Biblical times men knew how to alloy tin and lead into pewter and used it for utensils. Iron was worked in India as early as 1500 B.C. The Egyptians called iron the Stone of Heaven so it is thought that they first knew meteoric iron. Iron came into widespread use much later than bronze because it can be reduced from its ore only by intense heat. Fewer objects have been preserved from the early Iron Age than from
the Age of Bronze because iron is destroyed by rust.

The rise of Christianity lent impetus to the metal crafts for then the craftsmen added candlesticks, lamps, sacred vessels and shrines to the long list of weapons, utensils and jewelry which they were already skilled at making. Indeed the churches and monasteries became treasure houses of precious metal objects and in due time the stories of them reached the ears of the Vikings and prompted them to set out over unknown seas to collect this shining plunder.

Many of the beautiful and enduring objects of metal which have survived through the ages and which are now to be seen in museums challenge the craftsmen of today. There is, for example, the Ardagh Chalice, a sacred vessel of Celtic times, which is composed of gold, silver, bronze, brass, copper and lead. It is of an endlessly pleasing shape and is handsomely ornamented with filigree work and chasing, and with amber and blue enamel!

The methods of working and decorating metals have all been known to craftsmen for centuries. Beating, engraving, chasing and piercing all were used by the Egyptians. Spinning came later and was originated by the Chinese some ten centuries ago. The tools these craftsmen used have been much improved upon, as have the quali-
ties of some of the metals, but they still remain comparatively few and simple. Metalcraft is within the grasp of all of us and it still retains its ageless fascination. Objects of metal have the advantage of lasting beauty and utility and offer an endless range of possibility for creative effort.

The few projects offered here are intended merely to initiate the learner into the craft, with the hope that he may carry on from these simple beginnings.

References

Bruce, Marjory, *The Book of Craftsmen*, pp. 36-65.


Smith, Robert, *Units in Etching, Spinning, Raising and Tooling Metal*, pp. 24-27.

Tools for Metalwork - Plates XXVII--XXX

Tools for metalwork are a little more extensive than those for some of the other crafts and are not so easily hand-made. They should always be good tools, purchased from reliable companies. Poor ones make for very unsatisfactory work. Tool steel, properly tempered, is essential to metalworking tools and it is important to have the right tool for the particular job. Piercing, for example, can be accomplished only with the proper piercing tools.
There are various appliances used in metal work; forms, pitch blocks, sandbags, blow torches, alcohol lamps and the like, which are not tools in the strictest sense but which have been so classified in this discussion. There are, of course, additional tools which are not essential to the beginner. These last are not listed here but the metal worker will want to add some of them to his equipment as he progresses in the craft. They are listed by the reliable tool companies and, when they can be afforded, they do add to the satisfaction and perfection of metalwork.

Metal working kits for beginners may be purchased from the better companies in many different combinations, for specific operations and so on. Tools purchased in this way are always cheaper than those purchased singly.

Following is a list of the tools most used in metal craft, with illustrations of each:

Plate XXVIII shows a table such as is necessary to metalworking. This table will need to be very strong and well constructed and have the kind of surface which will allow for heavy work. It will support vises, stakes, sawing boards, back plates, burners and all the other appliances of the craft. The placement of these appliances on the table must be so planned as to allow for free working areas around each one, sufficient light on each
PLATE XXVIII. TOOLS FOR METALCRAFT
for close work, and for the frequency of use of each. The vise, for example, is much used so it will need to be placed where it is easily available.

A. Screw clamp: used for securing saw frames, for holding work together for soldering, drilling and other operations. There are many types of these but the most useful ones have a ball and socket swivel jaw on the threaded shaft and an adjustable jaw on the clamp frame.

B. Saw frame; used for piercing and filing operations. This appliance may be of wood or of metal and is one of the few which may be made easily by the beginner.

C. Sandbag: used for raising. A sandbag conforms readily to the changing shape of a metal object under construction. It may be made of leather or canvass and can be purchased or home-made. It should be of a size to fit the work attempted.

D. Steel bench block: used for the cutting, hammering, and bending of metals. This may be purchased with machined and polished surfaces and with or without shaped or rounded edges. A useful one is one which has a combination of shaped edges with a polished surface on one side and a machined surface on the other. It should be at least $3/4$" thick.
E. **Stake holder and mushroom stake**: used for shaping. This is only one of the many shapes of stakes used in metal shaping. A holder such as this one has various openings to fit the various sizes and shapes of stake shanks. These stakes are not essential if the craftsman can make his own forms for shaping, out of end-grain hardwood. The wooden ones, of course, are not as durable as those of metal.

F. **Bench vise**: used for holding metal for sawing, filing, bending and the like. These come in various sizes and are purchased according to the work to be done. Heavy work calls for a heavy vise while fine work, such as jewelry making, calls for a very small vise. The jaws of these vises are often covered with soft metal shields to protect the work.

G. **Scratch awl**: used for making layouts and for scribing.

H. **Center punch**: used for making small reference marks in metal and for securing accurate starting points for drilling.

I. **Jeweler's saw**: used for piercing and sawing. There are many types of blades for these, designed to fit into one frame and adapted to the type of work to be done. Sixteen and eighteen gauge metals call for medium
to coarse blades. Blades must be sharp and should be of metal which will not break readily when following curves or angles in the work. Coping saws are a possible substitute when working with light-weight soft metals.

J. Tin snips: used for cutting. This is only one of the many types of tin shears employed in metal working. They come with curved blades, straight blades and bent blades. The craftsman will add different types to his equipment as his work progresses.

K. Spring dividers: used for laying out and spacing.

L. Chasing tools (Plate XXIX): used for making patterns on the surfaces of metals in chasing and repousse. The last four are examples of matting tools designed for filling in the decorative backgrounds on larger pieces of work. These tools can be made by the clever craftsman, working with good tool steel.

M. Hammers: used for planishing, peening, doming, chasing, embossing and shaping. The first is a ball and peen hammer, universally used for driving other tools and for doming. These are available in many sizes. The second is a French chasing hammer for hammering the chasing tools. The four to the right are silversmith hammers. They are used for planishing, peening, smoothing, embossing and shaping, while the work is held on stakes, backplates, sandbags, and wooden forms.
N. Mallets: used for forming and embossing. The first is a dogwood round-end forming mallet used for raising. These come in various sizes and are much used. The second is a rawhide mallet. These are used on soft or highly polished metals to avoid marking them. Others are also made of buckskin and of rubber. The third is another type of round end forming mallet of wood. These are useful for turning out the edges of cylindrical pieces and in beating-down operations. The next is an example of the horn mallet, used for softer metals and smaller work. Horn leaves no mark on metals yet holds its own shape well. The last is another type of dogwood mallet. This mallet is one of the most adaptable for general use. Leather over the face transforms it for the finer work. The craftsman who has access to a lathe can turn out his own mallets and can re-surface and reshape old ones.

Too much emphasis cannot be placed upon keeping all these tools clean, and free from marks, scratches and metal chips.

O. Swiss files (Plate XXX): used after piercing for fine finishing, particularly for fine contours. These are available in various shapes to fit into the different contours of pierced designs. They may be purchased in kits of assorted shapes and sizes. Care must be exercised
PLATE XXX. TOOLS FOR METALCRAFT
in using them to avoid breakage and marring or pinning the file surfaces.

P. **Blow pipe and Bunsen burner**: used for soldering operations. The blowpipe is to direct the flame and the burner supplies the heat. Other types of burners, such as alcohol lamps and metal-working torches, may be used. For annealing a gasoline blowtorch is highly satisfactory. A Bunsen burner will not produce enough heat for annealing.

Q. **Forming block**: used for doming. Similar blocks, called raising and start-forming blocks, are obtainable for different designs. These can be made easily, of wood, if cut into the end grain.

R. **Wooden forming plate**: used for beating down. These are sometimes of wood and sometimes of metal and come in many shapes and sizes for various types of bowls and trays. They may be home-made if a lathe is available. Seasoned maple is recommended for the wooden ones.

S. **Hand drill and bit**: used for making holes in metal when electric drills are not obtainable. The bits come in assorted sizes.

**References**


Osborne and Wilber, Pewter, Spun, Wrought and Cast, pp. 27, 38, 58, and 65.
Materials for Metalwork

The common art metals are copper, pewter, brass, bronze, aluminum, German silver, sterling silver and monel metal. Lately tin has become popular as a craft medium, but will be unavailable "for the duration."

Metals are judged for craft purposes on their beauty, malleability, reaction to foods, comparative cost and availability. Yet another consideration is whether they must be annealed or not. Pewter is the most malleable, with sterling silver next and copper, aluminum and German silver slightly less so. Bronze, brass and monel metal are comparatively hard and stiff. Copper and silver tarnish readily and copper is unsafe as a moist food container. Pewter and aluminum are the only ones which do not have to be annealed for spinning.

Art metals may be purchased in strips, rolls, sheets and circular discs, all of varying sizes. They are gauged for thickness with the standard Brown and Sharpe (B & S) Wire Gauge, with stocks usually running from #36 (paper thin) and in copper weighing 4 ounces per square
foot, to #12, nearly an eighth inch thick and weighing 56 ounces per square foot in copper. Most of the reliable companies will cut the rolls and sheets to the sizes desired by the craftsman.

Wire of copper, brass or silver is purchased in coils or on spools, according to gauged sizes. For some purposes it is rolled to ribbon form. Short lengths can be ribboned by hammering on a flat anvil.

Rivets, pins, tacks and riveting wire of the various metals, for fittings and finishing, are sold by the pound. The catches, chains, swivels, clasps and other fittings used in jewelry making are called jeweler's findings. They are on sale by the better metal craft supply companies, either separately or in lots.

In addition to the metals the craftsman will employ solders, various abrasives and polishes, acids, sulphates and lubricants for the many decorating and finishing processes. Some of these are listed on the job sheets later on in this section as the need for them arises. The craftsman will do well to become acquainted with them gradually, just as with his metals, so that he doesn't buy unnecessary materials to begin with. Much of the charm of a craft is in the element of discovery and development.
There are numerous terms peculiar to metal craft which will be used repeatedly in the discussions and job sheets to follow. Brief definitions of them follow.

1. **Annealing**: softening metal by treating it with heat.

2. **Beating down**: hammering metal into shape with the use of wooden or metal forms, mallets and hammers.

3. **Burnishing**: polishing metals with a mirror-smooth, hard, curved tool.

4. **Buffing**: polishing metal with cloth, felt, leather or brush together with rouge or other abrasives.

5. **Chasing**: modeling or depressing metal according to a design. Done with chasing tools of various shapes and sizes.

6. **Doming**: Forming metal into a circular design by raising it from the back.

7. **Forming**: shaping metal by pounding it over blocks or other molds.
8. **Matting:** decorating the backgrounds of metal designs with special tools which produce varying effects.

9. **Peening:** decorating metal surfaces with indentations made with various types of hammers.

10. **Piercing:** removing parts of a design by drilling and sawing through the sheet on which the design is placed.

11. **Planishing:** smoothing and stiffening metal by striking it with a smooth-faced planishing hammer.

12. **Raising:** forming a bowl or other circular object by striking blows with a hammer so as to elevate the outer part of a sheet of metal to form the sides. Raising is also done by pressing or pounding metal into hollow forms.

13. **Repousse:** raising metal from the back as in doming, but forming other designs than circular ones.

14. **Spinning:** forming shapes of circular section on a lathe, by means of pressure applied with a tool against a revolving disc of sheet metal, forcing the sheet against a form or "chuck".

**References**


Smith, *Units in Etching, Spinning, Raising and Tooling Metal*, pp. 6-23.
Safety Measures in Metalcraft

In metalcraft, more than in some of the other crafts, there is danger of injury if the worker does not know how to protect himself. It is very easy to prevent injury if a few simple precautions are observed. Below are listed some safety measures which, if followed faithfully, will serve to keep the home craftsman from injury and which could be the basis for safety instructions for school shop classes in metalwork.

1. Do not use a file unless it has a handle. The pointed tang may cause an injury to the hand.

2. Be careful when picking up metals. Sharp edges and pieces of hot metal are dangerous.

3. Smooth the edges of metal with a file before working further on them. Burrs or slivers may cause serious harm.

4. Use a brush or thin piece of wood to remove metal chips and splinters from any surface. Never use bare hands for this.

5. When a lighted torch is laid down it should be so placed that it cannot be accidentally bumped or jarred into a position to burn you or your clothes, or to ignite flammable materials.

6. Use tongs to handle hot pieces of metal and pieces in acid solutions.

7. When adulterating acid, always pour the acid into the water carefully; never pour water into acid!

8. When lowering metal into a solution, hold it firmly and lower it slowly so as to prevent splashing.
9. Rinse both your hands and the metal which has been in contact with any of the working solutions.

10. Do not breathe the fumes from acid solutions.

11. In spinning, never insert a disc while the lathe is running.

12. Do not stand opposite the disc when starting the lathe.

13. Keep your hands away from the sharp edge of the disc.

14. Do not stand in line with the disc when trimming. Flying pieces are dangerous.

15. Do not wear long loose sleeves or a dangling tie when working with machinery or acid solutions.

16. Remember that careful planning, unhurried working, and uncrowded work spaces do much to prevent injury.

References

Regan and Smith, Metal Spinning, pp. 75-76.

Smith, Units in Etching, Spinning, Raising, and Tooling Metal, pp. 3-4.

How to Make a Napkin Clip

This project is simple enough for the beginner, yet it involves two of the popular ways of decorating art metal, namely: piercing and peening. The clips are small, inexpensive, and useful.
**Materials and tools**

piece of 16 oz. art metal, 1 5/8" x 5 1/2"

layout materials: tracing paper, carbon paper, hard lead pencil, scissors, whiting and brush, scotch tape

emery cloth, 1/2 and FF, and felt buffing cloth

crocus cloth, steel wool, tripoli brick buffing compound and rouge polishing compound

scriber

tin snips

hand drill and 1/8" bit

peening hammer which makes rather small marks

back plate

center punch and chasing hammer

metal saw frame and number 3 blade

jeweler's files, flat and round

saw board

2 C-clamps

burnisher

2 wooden blocks, one with a rounded 1/8" edge

**Procedure**

A. Cutting out the project:

1. Transfer the project pattern as in Plate XXXI, Figures A and B, to tracing paper. Mark all details. Sketch in the desired initial.

2. Clean both sides of the selected metal with emery and steel wool.
PLATE XXXI. NAPKIN CLIP
3. Determine the face side of the metal.

4. Trace the outline of the project on the metal with the scriber. See Plate XXXI, Figure A.

5. Cut around the outline with tin snips. Cut just to the line.

6. Surface the cut edges with file, emery paper and burnisher.

B. Piercing:

1. Rub the back side of the metal lightly with steel wool so it will hold whiting.

2. Apply whiting to back surface with the brush. Allow to dry.

3. Place the carbon and then the traced design over the whiting surface.

4. Scotch tape rigidly to table or board and check for accurate placement of the papers.

5. Trace the piercing design on the metal with the lead pencil.

6. Remove the papers and place the metal on a back-plate.

7. Center punch and drill the holes for the saw blade insert. See Plate XXXI, Figure B. Place the holes exactly as illustrated.

8. Place the metal over the V in the saw board which has been C-clamped to the table with the V protruding beyond the edge.

9. Hold the metal firmly with one hand. Saw, through the saw board opening, around the pieces to be removed. Saw only to the line on the inside.

10. File all the edges of the interior design with the jeweler's files. Select files to fit the straight lines and curves. File just to the line.
11. Burnish all the interior edges. Be careful that the burnisher does not slip and mar the project.

C. Peening the surface:
1. Re-check the face side for mars or scratches. Correct with the emery and then the crocus cloth.
2. Practice on a piece of scrap metal to get the peening stroke which will give the desired effect. Change hammers if necessary.
3. Place the metal, face up, on the back plate. Be sure the plate is absolutely clean.
4. Hold the metal in place with one hand and peen with the other. Start at one end of the clip and work to the other. Examine at intervals to check the effect. See Plate XXXI, Figure C.

D. Finishing:
1. Place the metal on a clean working surface.
2. Rub the face and back surfaces with steel wool. Rub in all directions.
3. Buff the surfaces with the felt cloth and tripoli compound.
4. Buff again with another piece of felt and the rouge compound.
5. Wash the surfaces with soap and water to remove the compounds completely.

E. Bending the clip:
1. Lay out the line, with a colored pencil on the back side, where the clip is to be folded over.
2. Place the metal, back side up, between the two clean wooden blocks as shown in Plate XXXI, Figures D and E.
PLATE XXXIII.

LENGTH -- 7"
WIDTH -- 2"
JELLY -- SERVER

LENGTH -- 7½"
WIDTH -- 1"
BUTTER -- KNIFE

OPTIONAL DECORATION
3. Clamp the blocks and clip to the table edge with the C-clamps as shown in Figure E. Check the line very carefully to insure a straight bend.

4. Grasp the free end of the clip close to the blocks and bend gently upward through 180 degrees.

5. Remove the clip from the blocks and check.

References

Payne, Art Metalwork With Inexpensive Equipment, pp. 61-72.

Smith, Units in Etching, Spinning, Raising and Tooling Metal, pp. 6 and 23.

How to Make a Mint Dish

This project involves the process of beating metal down into a form. The form is illustrated on Plate XXXIV, Figure C. To construct such a form in wood, a recess of the desired shape and depth is cut and smoothed in the one panel and it is then glued over the second.

Copper was chosen for this project so that the process of annealing would be included in the operations. Chasing and matting are also used in the decoration of the border. See Plate XXXIV, Figure A. A small object such as this one is always advisable to start with.

Materials and tools

- A square of 24 B & S gauge copper 4 1/2" x 4 1/2"
- Layout materials: tracing paper, carbon paper, hard lead pencil, scissors, whiting and brush, scotch tape
MINT DISH

PLATE XXXIV
Emery cloth, felt buffing cloth, crocus cloth
steel wool, tripoli and rouge buffing compounds
small nails or brads
a wooden forming block
tin snips and mill file
tongs, blow torch, asbestos mat
5 per cent sulphuric acid solution in a lead container
round-faced dogwood mallet with leather covering
tracer chasing tool
matting tool with a fine design
chasing hammer

Procedure

A. Beating down the metal:

1. Center the square of metal over the recess in the form. The original metal is larger than the project to allow for the shrinkage when it is beaten down.

2. Fasten the metal to the form by driving the nails through the metal and into the wood at the four corners. Place the nails out well toward the edges.

3. Beginning at the center, strike the metal with overlapping blows with the round-faced mallet. Make the blows light and square to the metal. Work in circles out toward the edges.

4. Start at the center again and repeat. Continue until the metal assumes the shape of the form.
5. Strike glancing blows against the sides of the form to draw the metal firmly against them. If the edges start to raise put pressure on the center of the metal and hammer them down.

6. When the metal begins to harden, remove it from the form and anneal it.

7. To anneal, heat the copper with the blow torch to a dull red and place it on the asbestos mat to cool. Be sure the mat is entirely clean.

8. Remove the discoloration from the annealed copper by dipping it in the sulphuric acid solution.

9. Wash all acid from the metal.

10. Place the project in the form again and continue beating down until the metal is completely shaped.

11. Leave the metal in the form for the next operations. If it seems hard to the hammer, anneal it again and replace. It must be malleable for the chasing and matting.

B. Finishing the borders:

1. Rub the surface of the borders in all directions with the steel wool.

2. Buff the borders with the crocus cloth.

3. Buff again with the felt cloth and tripoli compound.

4. Buff again with the second piece of felt and the rouge compound.

5. Sponge the surface to remove the compounds completely.

C. Laying out the design:

1. Transfer the border design from Plate XXXIV, Figure A.
2. Apply whiting to the borders with the brush. Allow to dry.

3. Place the carbon and the traced design over the metal.

4. Fasten the papers down with scotch tape. Check the placement carefully.

5. Trace the design onto the metal with the lead pencil.

6. Remove the papers carefully.

**D. Chasing the design:**

1. Set the tracer on one of the outlines of the design. Tip it slightly rearward and strike it lightly with the chasing hammer.

2. Move the tool forward, toward the operator, about half the length of the mark just made and strike again.

3. Continue around all the rectangles of the design. The tool is always moved toward the operator.

4. Shorten the overlapping stroke when working around a curve and incline the tool further rearward.

5. If the lines do not appear deep enough chase them a second time.

6. Place the matting tool at a right angle with the surface of the metal at one corner of a rectangle in the design.

7. Strike the tool a light, firm blow with the hammer. Check for the force of the blow required to properly mark the metal.

8. Practice with both the tracer and the matting tool on scrap metal may be desirable for the beginner.

9. Continue the application of the matting tool to fill out the design in every other rectangle.
10. Check the chased design against the pattern to see that it is complete.

E. **Trimming and finishing the project:**

1. Remove the metal from the form and trim the outline with the tin snips.
2. Finish the cut edges with the mill file.
3. Turn the dish upside down and place it on a clean surface.
4. Tap the center of the bottom two or three light blows with the dogwood hammer to "dish" it slightly.
5. Remove any remaining whiting.
6. Polish the bottom and the inside of the dish as the borders were done.
7. Polish the plain surfaces of the design if they have become marred.
8. If the copper cannot be polished satisfactorily treat it again with the acid.

**References**


Smith, *Units in Etching, Spinning, Raising and Tooling Metal*, pp. 16-18 and 19.

**Metal Spinning**

The art of metal spinning is not as difficult as the beginner may have been led to believe and it offers almost unlimited opportunity for projects from the most utilitarian of kitchen articles to the most exclusive of
decorative pieces. It opens up a field of industry to the student or hobbyist, too. Airplane factories, automobile factories, manufacturers of electric fixtures, and home decorative industries are examples of concerns employing metal spinners.

The softer metals are best adapted to spinning and the beginner will want to start with them. Pewter, copper, and aluminum are the most popular of these. Copper must be annealed in spinning. All three take a high polish.

The first requirement for metal spinning is a lathe with heavy thrust bearings. The wood-turning lathe, provided with a thrust bearing, will be found satisfactory, or a spinning lathe can be made over from an engine lathe. It must have variable speeds. A beginning craftsman need not have a speed greater than 1800 r.p.m. for metal spinning.

An all-important accessory to the lathe is a special revolving dead center. A good one is a simple hardwood block drilled and mounted to the tail stock, lubricated with soap or grease. A tool rest with an adjustable pin is a necessity. The pin acts as a fulcrum for the tools. The chucks over which the metal discs are spun are described later in this section.

To reduce the heat, to keep the tools from marking or cutting the metals, and to prevent injury to the tools,
spinners employ lubricants on the surface of the metal while it is being spun. Sheep's tallow, tallow candles, and a mixture of soap and engine oil are popular lubricants. They are applied with a swab or dauber. Their selection depends upon the room conditions while spinning and upon the preferences of the craftsman.

The tools which are employed in metal spinning are illustrated and discussed in the section following this one.

References

Regan and Smith, *Metal Spinning*, pp. 11-23.

**Metal Spinning Tools - Plate XXXVI**

Plate XXXVI shows the tools most commonly used in metal spinning. The ones shown are sufficient for a beginning set.

A. **Flat tool**: used for a finishing tool to remove all the marks made by other tools. Also used to make small grooves, coves, and shoulders in designs and shapes.

B. **Diamond point tool**: used for trimming the lip of a metal disc to exact size and shape prior to finishing the edge.
PLATE XXXVI. METAL SPINNING TOOLS
C. Round nosed tool: used with a back stick for breaking down a metal disc to conform to the outlines of the chuck. Also used to square up corners and to smooth out the part of a disc which is yet unspun.

D. Knob tool: used for forming and finishing.

E. Beading wheel: used for putting a bead finish on a spun article.

F and G. Back sticks: used to apply pressure behind the metal disc in the breaking down process. This prevents wrinkles, which develop into cracks, in the drawing of the metal. These are necessary tools. They may be home-made of hardwood.

H. Beading pliers: used to start the bend in the metal disc when making a bead finish.

I. Tool rest and pin: used to make a fulcrum point for applying the pressure to the spinning disc with the tools. The pin is adjustable so that the tool may follow the position of the work.

References

Art Metalcraft tools and Supplies, Catalogue of the William Dixon Co., pp. 159-164.

Johnson, 32 Metal Spinning Designs, pp. 13 and 14.

Reagan and Smith, Metal Spinning, pp. 23-28.
Plate XXXVII illustrates some of the types of chucks used for forming metal by spinning. In spinning, the metal disc is forced to the contour of the chuck by the pressure of the tool.

The craftsman's chuck is usually made of eastern maple turned on a wood lathe. Wood chucks can be mounted on the regular face plate which fits the line center spindle. To save purchasing face plates, when many shapes of chucks are to be used, the chucks may be threaded to fit directly to the spindle. A wood wrench may be purchased with which to cut threads in a wooden chuck. A threaded core of cast lead is sometimes used.

Chucks are also made of metal, turned out on a metal lathe, and commercial workers use plastic chucks. Either of these may be purchased from the tool companies. The wooden chucks, however, give the craftsmen the opportunity of designing his own forms. In school shops their turning gives additional experience and knowledge of the craft to the students.

The following block, also generally made of hard wood, is a fixture for holding the metal disc against the chuck. It is about one inch thick. It is never larger than the diameter of the base of the project to be spun, but should be about 1/16" smaller. It is placed
on the revolving dead center of the lathe. The chuck and the follow block work together and both are, of course, a necessity.

The surface of all chucks must be kept free of all dirt and marks to avoid marking the metals. Those made of wood need to be refinished after each project.

A. Low form chucks: used for forming plates, bowls, coasters, and dishes. These form the simplest type of projects.

B. Break down chucks: used for spinning high form, or deep projects such as beaker and vases. This figure shows, from left to right, how the disc is placed on the base of the chuck and held by the follow block and the gradual breakdown of the metal over the form.

C. Air chucks: used for high form spinning over air. The back stick is used inside the project to give the pressure against the tool, while the chuck merely holds the vessel in place.

D. Collapsible chuck: used to form metal projects, such as tea pots, which cannot be pulled from the chuck when completed. It has a core and a number of segments which can be pulled off the base when the core is removed. The metal ring holds the segments in place at the base of the chuck when the core is in.
References

Johnson, Metal Spinning Designs, pp. 16-17.

Osburn and Wilber, Pewter, Spun, Wrought and Cast, pp. 131-137.

Reagan and Smith, Metal Spinning, pp. 29-36.

Smith, Units in Etching, Spinning, Raising, and Tooling Metal, pp. 30-32.

How to Spin a Metal Coaster

A coaster is a low form project and simple enough for any beginner. It doesn't require a very large piece of metal so that if the beginner ruins a piece in his first attempts at spinning no great loss is involved. The project involves most of the fundamentals of metal spinning, however, and is useful when completed.

Materials and tools:

To estimate the diameter of a disc to be used for such a project, calculate the diameter of the base of the chuck to be used plus twice the length of a straight line drawn from the base to the top of the project as planned.

- a pewter disc ¾" in diameter
- a lubricant of engine oil and tallow (1 pt. oil to 2 lbs. of tallow)
- a swab for applying lubricant
crocus cloth, felt buffing cloth, steel wool, tripoli and rouge buffing compounds

a metal spinning lathe

the tools shown in Plate XXXVIII.

a coaster chuck for a 3 1/2" coaster

a follow block

a piece of hardwood board

Procedure

A. Spinning the project:

1. Check the chuck for a clean, finished surface.

2. Place the follow block on the dead center.

3. Mount the chuck on the spindle.

4. Center the pewter disc by sight between the base of the chuck and the follow block.

5. Advance the follow block until it presses firmly against the metal.

6. Regulate the tool rest until the top is slightly below the revolving center and about 2" in front of the disc.

7. Revolve the set-up by hand to see that it clears the tool rest.

8. Start the lathe at a low speed. Remember never to stand in front of the disc.

9. Place the piece of hardwood board on the tool rest and in contact with the edge of the disc. Hold this board with the left hand and with the right gently release the tailstock so that the board will center the disc.
10. Draw the follow block up firmly against the disc.

11. Stop the lathe and check to see that the disc is held firmly but not so tightly that the chuck cannot turn with ease.

12. Start the lathe and apply the lubricant to the outer surface of the disc with the swab. This process must be repeated frequently throughout the spinning.

13. Place the pin in the tool rest so that the round-nosed tool, when inserted between the pin and the disc, will meet the point where the metal will be bent. The tool point should rest slightly below the revolving center. The end of the tool should be under the spinner's armpit and held along the arm in such a way that he may use his whole body in the strokes and thus avoid fatigue.

14. Increase the speed of the lathe to about 1200 r.p.m.

15. Exert a steady pressure against the base of the project until the metal starts to turn forward over the chuck. See Plate XXXVIII, Figure B. The disc will begin to turn backward toward the tool.

16. Insert the back stick between the metal and the chuck at the point of contact of the round nose and the metal. See Figure B.

17. Pull the tool and the back stick together outward and downward along the length of the disc to the edge. Use the greater pressure on the tool rather than on the back stick.

18. Repeat the above operation, until the metal appears as in Plate XXXVIII, Figure C. The stroke of the tools should be even. The metal may crinkle and in this case it must be worked until it is smooth again or it will eventually crack.

19. Place the diamond point tool on the rest and cut the outer edge of the disc to keep it uniform. Use light cuts.
20. Advance the pin in the tool rest one notch. If necessary, adjust the rest to get the proper angle for the tool so that the metal can be forced against the chuck.

21. Check the round nose and the back stick for smoothness and cleanliness.

22. Insert the round nose at the base of the chuck where the spinning is to continue. With the aid of the back stick to support the metal, spin the metal until it turns out as in Plate XXXVIII, Figure D. If the metal turns too soon, repeat operation 17. This may have to be done two or three times.

23. Stop the lathe frequently to check for shaping and for lubrication. If there is any tendency toward cracking, trim the edge again with the diamond point.

24. Adjust any slight ridges or thin places in the metal by reversing the direction of the tool stroke toward the base of the chuck. A planishing tool may be used in this operation.

B. Forming the bead:

1. True the edge of the disc with diamond point tool. Hold in at an angle to the metal as in Plate XXXVIII, Figure D.

2. Advance the pin and adjust the round nose to force the metal firmly against the chuck at the point where the metal will turn back to start the bead.

3. Trim the edge of the metal with the diamond point tool, leaving just enough metal to turn under for the bead. Cut from well to the right so that the metal, when rolled under, will fit tightly next to the side of the project.

4. Check the beading pliers for cleanliness and a highly polished surface.

5. Rest the pliers on top of the tool rest and grasp the outer edge of the disc. Do not grasp the metal so tightly as to tear it.
6. Bend the metal back toward the chuck as far as the pliers will allow.

7. Rest the beading wheel on the tool rest and exert leverage pressure against the turned down metal. Move the tool back and forth to shape the bead. See Plate XXXVIII, Figure E.

8. Check the surface of the bead. Do any final smoothing which may be necessary with the planisher.

C. Polishing the project:

1. Release the tailstock and reverse the project on the chuck. This leaves both inner and outer surface exposed.

2. Remove the tool rest.

3. Remove any remaining lubricant from the metal with gasoline.

4. Start the lathe at 1800 r.p.m. and polish both surfaces of the coaster with steel wool.

5. Remove the project from the lathe.

6. Buff all the surfaces, in all directions, with the crocus cloth.

7. Polish all surfaces with a piece of the felt cloth and the tripoli compound.

8. Repeat with a second piece of felt and the rouge compound.

9. Wash the compounds off with soap and water. Polish further if necessary.

References

Johnson, 32 Metal Spinning Designs, pp. 21-29.

Osburn and Wilber, Pewter, Spun, Wrought, and Cast, pp. 115-125.
Reagan and Smith, Metal Spinning, pp. 43-53.

Smith, Units in Etching, Spinning, Raising, and Tooling Metal, pp. 32-36.
PLATE XXXIX. METAL PORRINGER
BIBLIOGRAPHY


