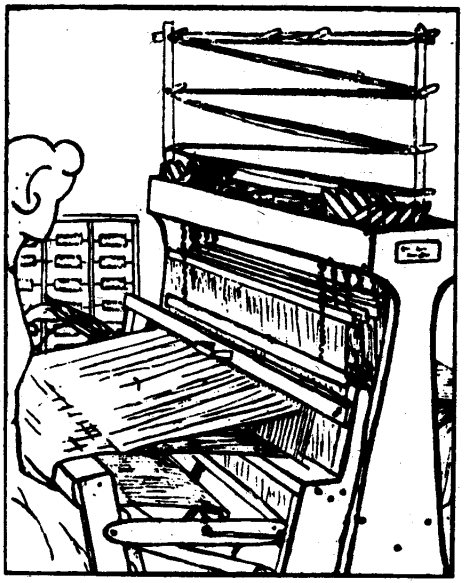
HANDWEAVER'S

INSTRUCTION MANUAL

by

Harriet C Douglas



The Shuttle-Craft Guild
Kelseyville, California

HANDWEAVER'S

INSTRUCTION MANUAL

by

Harriet C Douglas

HTH Publishers
1607-A East Edinger
Santa Ana, Ca. 92705

TABLE OF CONTENTS

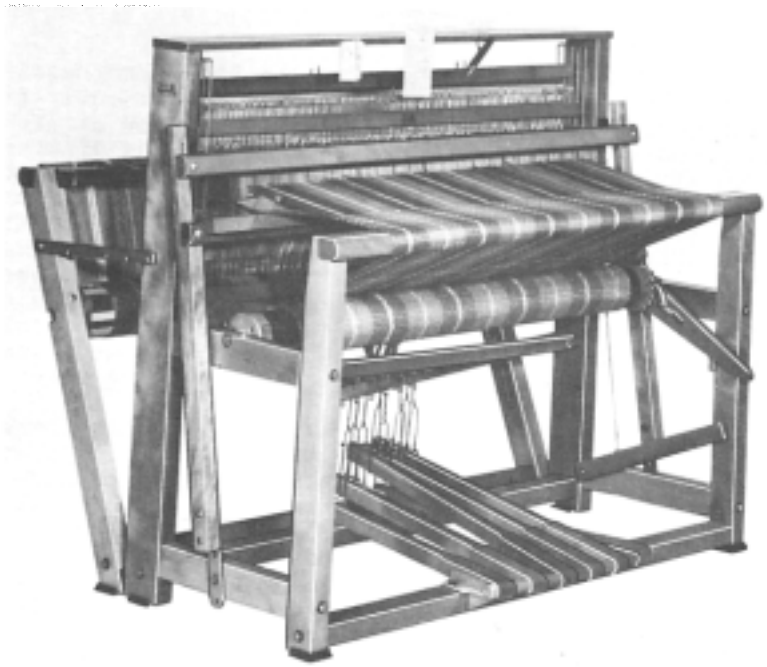
INTRODUCTION

Handweaving, as a creative handcraft, is today progressing toward maturity. During the past thirty years it has been a constantly developing, constantly expanding field, but it has now passed the stage of "revival" of an ancient activity, and has attained the status of a means of creative expression, along with its practical aspect of a means of producing fine, beautiful, and individually designed textiles. Weaving is a handcraft which, with a comparatively small expenditure of money, can give almost limitless outlet to a person's creative urges, and, at the same time, the creation is thoroughly practical since every throw of the shuttle helps produce something both beautiful and useful. It has the advantage over many crafts of appealing to almost countless types of personality and interest. The current enthusiasm for the craft almost proves the lightly made statement that handweaving is a highly contagious disease for which there is no known cure.

It is right, however, that handweavers realize that the status of their craft is a new one, and, while assuming the individual's share in progress, not overlook the contributions of those leaders who have made an ancient, domestic art into a modern, creative activity. There was a day, not many years ago, when power machines in the great textile mills had supplanted the hand-operated loom in the home, and handweaving was considered a dead art. But there were also men and women of vision who saw in this so-called dead art a fulfillment of a need in modern living, each vision as different as is each modern weaver's vision of his craft. The "revival" started at Berea College, Kentucky, where vestiges of the ancient home-craft remained in the far reaches of the Southern Highlands. Many are the contributors to the spreading popularity of the now-modern craft, but without a doubt the most outstanding of these is Mary M. Atwater, who has spent thirty-five years in research, experimentation, and creation in the field, and has made the results of her devotion available to all handweavers through her many publications. We, as all handweavers, are indebted beyond statement to her SHUTTLE-CRAFT BOOK OF AMERICAN HANDWEAVING (Macmillan) which, since its publication date of 1928 has remained the handweaver's "Bible".

The material in this booklet is intended to teach the handweaver the fundamental principles which will make him an independent, creative weaver. No weaver can have creative freedom until he understands the cause and effect of changing threads into textiles. An understanding of Drafts (the arrangement of warp), and Weaving (the arrangement of weft) are as important to a weaver as is the understanding of the multipication tables to a mathematician. All of the techniques given in this MANUAL are basic, traditional weaves. An attempt has been made to give sufficient analytical background for all techniques so that the weaver will have, not only a thorough understanding of the structural basis of each weave, but enough knowledge to make a creative application of it. Here are the basic facts which are the mental tools of the creative weaver. By a direct application of these methods, traditional, classical weaving may be produced. But for the weaver who first masters the tools, then studies and experiments in design, texture, color harmony, as applied to textiles, there opens an unlimited vista of creation. Once mastery of technique is achieved, the weaver must remember that traditional interpretations lead to classical reproductions. It is interpretations of these weaves which lead to originality and creativeness in weaving.

Let the weaver remember that anything which has been done before, any competent weaver can copy. There are no secrets in this craft. Any weaver who wishes to devote himself to sufficient study, may master all techniques. The only exclusiveness, the only truly unfathomed secrets in handweaving, are the subtile nuances of interpretation which every master weaver gives to each piece -- applications and evaluations of techniques, materials, color harmonies, warp settings; and high standards of craftsmanship.



The Nilus Loom
by Nilus Leclerc

A MODERN MULTIPLE-HARNESS JACK-TYPE LOOM

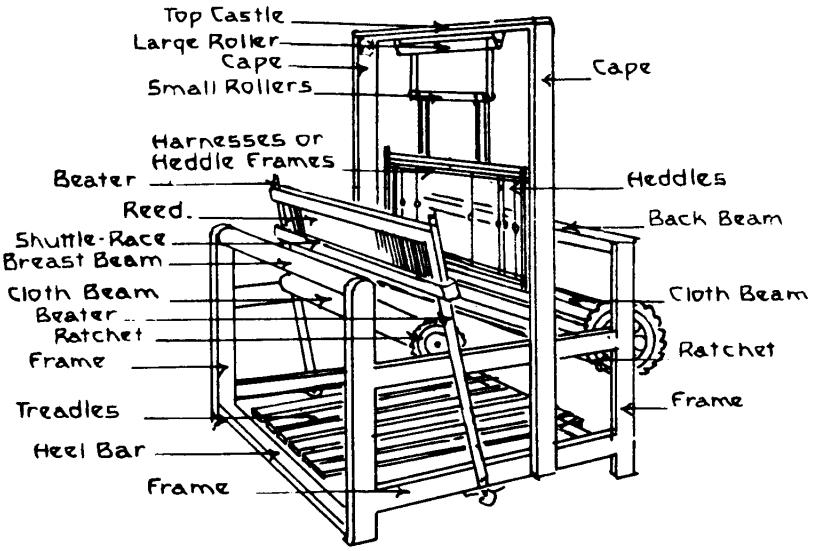
THE LOOM

The loom, in its simplest sense, is nothing more than a frame which will hold parallel threads called warp, at a tension, in such a way that other threads called weft (sometimes filler or woof) can be woven across them to make cloth. Without a doubt the earliest weaving was done on a warp stretched between two sticks, by picking up each alternate warp thread and passing the weft thread through with the fingers. Early ingenuity, however, soon devised a system of dividing the warp into two sheds, each one with every alternate thread up, the remaining threads down, so that a shuttle carrying weft could be thrown through. Weft threads were beaten into place by a flat sword stick inserted into the shed. The Belt Loom used in Guatemala and in other parts of the world where primitive weaving methods are employed, has no frame but consists of two sticks between which the warp threads, with an arrangement of shed sticks in the center, are wound. The tension on the warp is achieved through having one end stick secured to a solid object and the other one to the belt of the weaver, who sits in a position to hold the warp taut. Card, or Tablet, weaving, used by modern weavers for making belts and narrow bands, is done in a similar way. The Navajo loom is an upright frame of logs on which the warp is stretched vertically, with shed sticks in the center. For producing cloth in any quantity, however, these primitive methods are too time consuming and require too much manual dexterity to make them practical.

Modern weavers use a loom of greater complexity, but its principles are exactly the same. The loom consists of a frame for holding warp threads at a tension, a device called harnesses for dividing these threads into at least two sheds, and a beater which forces the weft threads into proper position. Added to these rudimentary features, modern looms have a warp beam at the back of the loom on which long lengths of warp are rolled, a cloth beam in front on which the finished cloth is rolled, a breast beam over this, with a compensating back beam (or slabstock) over the warp beam, for stretching the

the warp. The harnesses are in greater numbers, usually four but as many as sixteen, and they are commonly operated by foot treadles or, in the case of table looms, by hand levers. The harnesses are frames hung parallel to each other and to the beams, in the center of the loom. In each there are bars at the top and bottom to which are strung wires with eyes in the centers, called heddles, through which warp threads are arranged according to a specific pattern, or draft. The beater in a modern loom is a free-moving frame which sets in front of the harnesses, parallel to the beams. Set into the beater is a steel, slotted reed, through which the warp threads pass to hold them equally spaced across the weaving surface.

Most of the looms used by our ancestors, as well as the Swedish looms, are of counter-balanced construction, with harnesses hung in pairs from rollers or horses in the top castle. The harnesses are attached at the bottoms, by cords, to horizontal lamms, which are in turn tied to foot treadles in pairs, so that when a treadle is depressed, the two lamms attached to it pull the two harnesses down, raising the other two simultaneously. This makes what is called a sinking shed. Since the raised and lowered warp threads have compensating angles, the warp threads at rest must lie perfectly flat, through the heddles, from the back to the front beam.



A COLONIAL-TYPE COUNTER-BALANCED LOOM

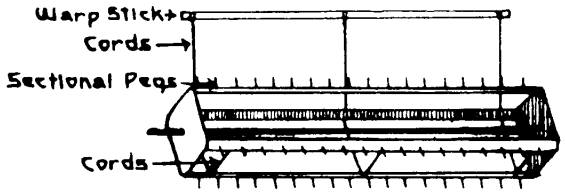
Most modern looms are of the rising shed, jack type. In this type of construction each harness has a jack, to which it is connected either in the center of the top, or at each end. Cords or wires extend from each jack to the lamms which lie under each harness. The lamms are tied, either singly or in combinations, to the treadles. Thus, when a treadle is depressed it brings down the lamm or lamms tied to it, which in turn raise the jacks, which lift the harnesses. As each harness acts independently of all others, a fuller control of the loom and of the weaves is possible than with a counter-balanced construction. Since the lower warp threads of a shed do not move to compensate for the raising of the upper warp threads, the heddle eyes must lie at a compensating distance below the line of the breast and back beams. Thus, in its stationary position, the warp slopes down to an angle in the center.

It may seem platitudinous to repeat that good workmanship requires good tools, but this is as true of handweaving as of any other skill. Since

the loom is the handweaver's most important tool, the weaver's first consideration is having a good loom. There are both good and bad looms on the market so the weaver must have standards by which to judge a loom's adequacy.

A loom, first of all, must be very strong and made of hard wood, as there is great strain on the frame when the warp is stretched, and vibration from the beating process. The wood should be finished very smoothly, particularly the beams, so that threads cannot catch. The frame must be absolutely true, with the breast and back beams, the warp and cloth beams, the harnesses and the beater all setting in perfectly parallel arrangement; a deviation of even a fraction of an inch is fatal here. The shedding mechanism, whether jacks, rollers or horses, should open a wide (minimum 3-inch) and perfect shed, with the tension the same on both the lower and upper sets of warp threads. The beater should be heavy and well balanced, and have a shuttle race for carrying the shuttle, on which the lower threads of any warp shed lie perfectly flatly. There must be a lamm hanging below each harness, and at least two more treadles than there are harnesses, with arrangements whereby each lamm may be attached to each treadle. The treadles should operate lightly and responsively permitting no delayed action in the falling of the harnesses after the treadle is released. If the loom has more than four harnesses, it should be of jack-type construction. There should be ample knee space, so that while treadling, the weaver's knees do not touch the beam or the cloth. The weaving space (that is, the distance of the beater's free play) should be at least ten inches, to obviate frequent warp changes. Heddles should be of wire or flat steel, and the reed of steel and easily removable from the beater frame. The rachets should be made of hard steel, and there should be a mechanism at the front of the loom for releasing the tension on the back beam. Avoid looms with many complicated cords, with permanent tie-ups between treadles and lamms, or which require the depression of two treadles to raise two harnesses. Remember that a strong, absolutely rigid frame and a strong beater are the first considerations.

Some looms are supplied with a solid warp beam, some with a sectional beam, and some with a hexagonal steel rod to hold ready-warped spools, or with a combination of these three. The serious weaver will need both of the former. On a sectional beam, one person can beam a fine warp, forty or more yards long and a yard wide, in two or three hours, while it would take several people several days to make this warp on a solid beam. It is wise, however, for a weaver to have both types of beam available because for short, narrow, or unusual warps it is more practical to warp on the solid beam. A loom with both beams in place and a double back beam is advantageous for many special weaves. If only one beam is possible, make it a sectional one, as chained warps may be beamed on a sectional beam. Sectional beams have a stick for tying the warp, attached by cords to each end of the beam, the cords long enough so that when the stick is carried around the back beam, it will rest parallel to the harnesses, about four inches back of the last harness. A solid beam may have the same kind of arrangement for fastening the warp, or it may have an apron, which is more satisfactory. The apron is a piece of ticking or canvass, tacked to the beam, extending the length of the beam. It has a 3-inch hem at the free end, with two and a half inch slits cut lengthwise, starting one fourth inch from the hem, and evenly spaced every one or two inches. A stiff wire is put through the hem, above the slits. The apron should be long enough to reach around the back beam and to about four inches from the back harness. Aprons attached to the cloth beam are much more efficient than a stick attached by ropes, and one is easily substituted if the loom comes equipped with a stick.



SECTIONAL WARP BEAM
1 or ¾ yard in circumference
2 inches from center to center of pegs

ADDITIONAL EQUIPMENT

Shuttles: In addition to the loom, the weaver needs certain other equipment, some of which may be made easily by anyone handy with tools. First of all are shuttles, both boat shuttles and stick shuttles. Stick shuttles are flat, thin pieces of hard wood, one and a half to two inches wide, with notches at the ends for holding the yarn in place. They should vary in length according to the width of the loom or the width of the warp. They are used with looms which open only a narrow shed, for certain weaves for which only a small shed may be produced, or for very heavy or unusually fragile weft materials which it is not feasible to wind on bobbins.

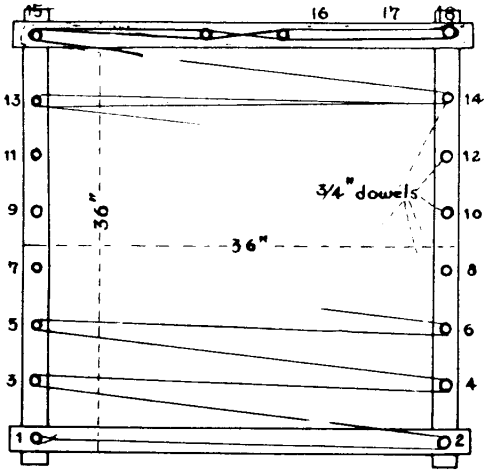
For efficient weaving, boat shuttles holding bobbins of thread are necessary, and at least a pair of these are basic equipment. Shuttle designs vary widely according to the designer, from the delicate, light Swedish ones with rollers underneath, to the heavy, steel-reinforced ones used in mills and by many tweed weavers. For narrow, delicate weaving, the light shuttles are delightful; for efficient production on a wide warp, a heavy, well-balanced shuttle with a large thread capacity is required.

Bobbins: For boat shuttles, the weaving yarn must be wound on bobbins. Tapered, wooden bobbins are required for the commercial-type shuttles, which may be purchased, but for the common boat shuttles, commercial wooden bobbins, heavy paper quills, photographic spools, or home-made paper quills make adequate bobbins. The weaver needs many bobbins, so avoid buying shuttles which require elaborate or expensive ones.

Bobbin Winder: A bobbin winder, either hand or electrically operated, is necessary. It is feasible to devise an electric bobbin winder by putting a straight shank six to eight inches long, into an electric mixer, a sewing machine bobbin winder or motor, or some other small motor. A motor with a rheostat is advantageous but not necessary.

Skein Holder: A skein holder, or swift, to hold skeined yarn, is almost necessary. If warping is to be done from skeined yarn, the light skein holders sold by department stores are inadequate.

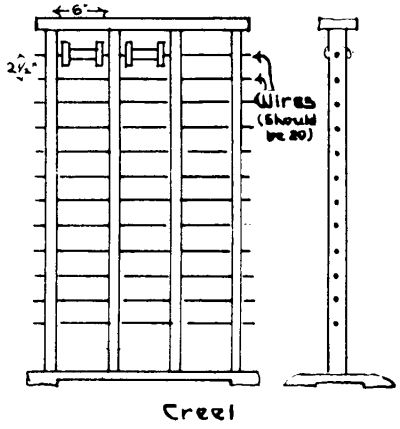
Warping Board: Equipment for warping varys with the warping method used. For chain warping on a solid beam, it is necessary to have a warping board of some kind, the design for one which will make a warp up to fifteen yards, illustrated here. The frame should be of hard wood, with six inch pegs of 3/4 inch dowling. The distance between pegs on each side of the board should be such that one yard is measured off with each turn of the warp. The distance between pegs should be sufficient for the hand to pass comfortably between.



Warping Board

Spool Rack: For sectional warping, the weaver needs a spool rack, or creel, which will hold at least 60 spools, preferably 80. This is merely a solid

frame with wires or small dowels or welding rods to hold spools of warp thread. It may be made to hold from three to eight banks of spools.



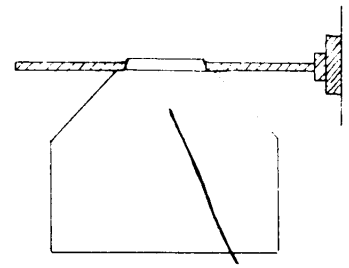
Creel

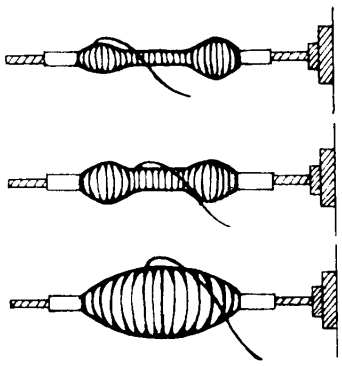
Tensioner: The tensioner is a device for gathering together the warp threads from the spools on the rack, and giving them adequate tension for warping on a sectional beam. The tensioner is a necessity for sectional warping and loom manufacturers who make sectional beams for their looms also make tensioners to fit the looms, so the tensioner should be purchased with the loom. A good tensioner consists of a collecting board with an individual hole for each thread which comes from the creel, a bank of wooden pegs through which the warp is carried to give it the proper tension, and a distributing board which holds the warp threads in the correct order and width for the beaming.

Reeds: It is important, if the weaver cares to do a variety of types of weaving, that he have reeds of several dentages (number of dents per inch). Most looms come equipped with a 15-dent reed, which is proper for warp settings of 15 threads and thirty threads per inch. This reed may also be sleyed 2, 1, alternately, to give 22½ threads per inch, or 3 ends per dent for 45 per inch, or 2, 3, alternately for 37½ ends per inch. Other useful reeds have 10 dents per inch for 10, 20, and 30 ends per inch; or 12 per inch (commonly used for rug weaving), 18 per inch for settings of 9, 18, 27 and 36; 14 dents per inch for 14, 21 and 28 ends per inch, common tweed settings. The usual way to sley a reed is either one or two warp ends per dent, and three to the dent or the irregular settings are considered unconventional. But they weave satisfactorily, and are convenient for many emergencies, as no weaver ever seems to have as many reeds as are desirable.

Small Equipment: Additional useful equipment include a Drawing-In Hook (which most manufacturers supply with looms) though this is not really necessary as a thin bladed table knife is preferred by many for sleying. A Loom Bench which tilts slightly forward is the most comfortable thing to weave on. Two or four hardwood Leash Sticks, the length of the cloth beam, are useful. And it is always handy to have a few quarter and half-inch dowels available for all kinds of purposes. For doing the various pick-up weaves, it is convenient to have a number of different Pick-Up Sticks. These are flat, hardwood, smooth sticks of various lengths, from one-half to two inches wide (according to the purpose and the taste of the weaver) with one or both ends pointed or beveled. They are used for picking up warp threads, and the only length requirement is that any specific one being used should be a few inches longer than the width of the warp which is being woven. A ball of Loom Cord for special tie-ups and for repairs is useful. And one should have extra Heddles.

Winding a Bobbin:


Wind paper quill on shank and insert weft end.



THE YARNS

Our common textile fibers, cotton, wool and linen, are the most used handweaving materials. Early American weaving was restricted to these fibers, but modern weavers are venturing into new fields with other vegetable fibers such as jute, hemp, rami, etc; animal fibers such as silk, mohair, rabbit wool; such synthetics as rayon, nylon, plastics, spun glass, cellophane; various metallic threads, and even informal materials such as grasses and reeds. These are desirable for unusual effects in creative designing, and for special articles, used according to the limitations inherent in the material, and to the trained imagination of the weaver. The beginner must master, first of all, the use of the basic materials.

Each of the three basic fibers is spun according to different specifications, and the thread size is designated by two figures divided by a diagonal line. The first figure tells the arbitrarily set weight of a single strand of the thread, and the second figure shows the number of these strands which are twisted together to form the specific yarn. Thus, a 20/2 cotton is two strands, or plys, of weight 20 cotton, a 50/3 linen is three strands of number 50 fiber. To arrive at the actual weight of the thread, divide the first figure by the second, which indicates that 20/2 cotton has the same weight as a single strand of number 10 cotton; that 50/3 linen has approximately the same weight as number 16 or number 17 singles linen. To the size figures for linen one often sees added the letters "WS" or "DS". These refer to wet spun, or dry spun, in the processing. Wet spun linens are of higher quality and have greater strength and smoothness than dry spun linens.

The thorough weaver familiarizes himself with size and weight standards for each fiber. The arbitrarily set standard for cotton thread sizes is based on the number ten size, which has 8400 yards per pound. Therefore, 10/1, 20/2, 30/3, 40/4 cotton all have 8400 yards to the pound. For linen, number 10 singles has 3000 yards per pound, so 20/2 and 30/3 also have 3000 yards per pound, while 40/2 linen (which is about the size of 24/2 cotton) has 6000 yards per pound. Wool standards are yet different, number 10 having 5600 yards to the pound.

After a suitable warp thread has been selected for any specific woven article, the problem of the correct warp setting must be considered. That is, the weaver must solve the problem of how many threads should be used to the inch to produce a suitable textile. Charts have been devised for warp settings, but these are not satisfactory because the setting for any particular warp material varys according to the type of weave, the use to which the final product is to be put, and the total effect the weaver desires to achieve. The so-called perfect tabby setting is the basis for some charts, which is an absurdity because the perfect tabby varys with the type of textile desired. Therefore, one of the basic ways to judge the ability of a handweaver is by his judgement in selecting the proper warp setting for a particular thread, article, weave, and final effect.

Another important point in the selection of threads, is the suitability of the thread to the weave, or technique. Each type of fiber has definite limitations, so specific techniques have been devised by the weavers of the centuries, to use with each fiber. We have specific cotton weaves, linen weaves, and combination weaves. For instance, the Colonial Overshot weave is a characteristic wool-on-cotton, or wool-on-linen weave. The Bronson weave is primarily a linen technique but it can be used for certain loose woolen fabrics, and, with special interpretations, for some cottons. Twills and Tabby are universal weaves, used with all materials. Although absolute dogmas cannot be applied to the use and the settings of different threads, a guide is useful, if the weaver exercises good taste and high quality standards.

Warp Settings for Cottons:

24/2 (10,000 yards per pound) is a fine, light weight cotton, suitable for light fabrics. Set at 40 ends per inch it makes a firm tabby; at 36 it is good for Overshot, Summer and Winter, and Bronson.

20/2 (8400 yards per pound) is a standard warp, the one most commonly used for two-shuttle and Colonial weaving. For a firm tabby, a setting of 32 to 34 ends per inch is good; for pattern weaving 30 per inch.

24/3 (6720 yards per pound) is another standard warp, particularly good for coverlets. It makes a firm tabby at 30 ends per inch and may be used for pattern weaving at 27 or 28, though 30 is more common.

10/2 (4200 yards per pound) makes an excellent warp for heavy fabrics such as table mats, draperies, coverlets, upholstery. Set at 27½ to the inch the tabby is firm and stiff, but the twill is good; at about 26 the tabby is good; 24 per inch is good for pattern weaving.

10/3 (2800 yards per pound) is an excellent warp for many of the pick-up weaves, for drapery material, sofa pillows and bags. At 22 per inch the tabby is firm, and 20 is good for pattern weaving.

20/6 (2800 yards per pound) has a softer texture than 10/3 and drapes better. It sets the same as 10/3.

5/2 (2100 yards per pound) sets for coarse weaving at 15 ends per inch. This is a good beginner's warp and makes heavy luncheon mats.

Carpet Warp (1600 yards per pound) makes a very stiff fabric suitable for only specialized purposes. For tabby it may be set at 15 ends per inch. For rugs, the common setting is 12 per inch.

Perle (or Pearl) cottons are highly mercerized, softly twisted cottons. #20 is the same weight as 20/2 cotton and will set similarly; #10 is the same weight as 10/2; #5 (2100 yards per pound) is often used for warp set at 15 to 18 ends per inch; #3 at 10 or 12 per inch.

Warp Settings for Linens:

40/2 (6000 yards per pound) is one of the most beautiful of linens for hand-weaving. It makes excellent tabby at 40 ends per inch and a very firm tabby at 44 or 45, this setting being excellent for the twill weaves. Bronson is good set at 36 ends per inch.

50/3 (5000 yards per pound) makes good tabby set at 37½ ends per inch; good twills at 40; Bronson at 34 to 36.

18 singles (5400 yards per pound) is difficult to weave except in the best wet spun quality because it is so delicate, and warp ends break. But it makes beautiful quality napkins and fine table linens at 36.

12 singles (3600 yards per pound) is a strong singles linen which usually warps and weaves with ease. It makes good tabby at 27 or 28 ends per inch, Bronson at 26, twills at 30.

10 singles (3000 yards per pound) is good for heavy table linens. It makes good tabby at 24 to 26 per inch and Bronson at 22 to 24.

20/2 (3000 yards per pound) is the same weight as 10 but it has a different quality, producing a more "finished" piece, and is better if set a little closer: tabby at 28 and Bronson at 26.

Warp Settings for Wools:

Settings for wools can vary so widely that it is impossible to give even a guide. The factor determining the setting must be the type of material desired. For instance, the Bernat Fabri (18/2) can be used for light, open scarves and shawls set at 15 ends per inch; for necktie material, firmer scarves, baby bonnets, at about 20 per inch; for light weight suiting in tabby at 24; 30 per inch makes a firm, high quality twill material; 36 makes a very firm coat material, and 40 to the inch is good for double weave, even closer settings being used for warp-pattern weaves. The best guide for wool settings is to make a short, narrow sample warp and try it at different settings.

ESTIMATING WARP AND WEFT REQUIREMENTS

Before buying weaving materials, the weaver wishes to know how much of any material is needed. There is a simple formula for calculating the warp requirements:

warp-width X ends-per-inch X warp-length = thread-yardage.

Multiply the warp width in inches, by the number of warp ends per inch, to determine the number of warp threads needed; then multiply this by the total planned length of the warp in yards. This gives the total thread yardage, which may be converted to pounds and ounces by using the table on the preceeding page. For example, suppose that one wishes to make place mats, fourteen inches wide, using 24/3 cotton set at 30 ends per inch, a total of 420 warp ends are required. If the mats are to be 20 inches long, with one inch at each end added for hems and shrinkage, and the weaver wishes to make four sets of eight mats each, a total of 32 mats, each 22 inches long, the total weaving warp needed is about 19½ yards. It is wise to add about an inch per yard for take-up in the weaving (this varys with the weave and may be as high as 10%) to give 20 yards; then add one extra yard for waste in the tie-in to warp and cloth beams and cutting waste in the weaving. This gives a total warp length requirement of 21 yards for the proposed project, which, multiplied by 420 warp ends, gives a thread requirement of 8400 yards, or about 1½ pounds of 24/3 cotton. The careful weaver will add another yard to the warp length for experimenting.

Weft requirements vary with the type of weave used. For linen weaves and balanced, two-shuttle weaves and twills, weft like the warp, in an equal quantity is needed, or slightly less because of the inevitable warp wastage. Therefore, if the four sets of mats are to be woven with an all-over pattern, or with a tabby base, decorated with pattern bands, the warp order should be doubled to account for the tabby. Thus 3 pounds of 24/3 are needed. In addition, there is pattern weft, which is usually ordered in colors and with certain freedom, as weavers like to experiment with colors and textures. For a balanced Overshot or Summer and Winter weave, however, the pattern weft will be the same in yardage as the tabby requirement. For instance, a coverlet of traditional size, woven in two strips, would be woven on a 36 inch wide warp of 24/3 cotton set at 30 ends per inch. For two 96 inch long strips, the minimum warp requirement would be 6 yards, 1080 warp ends, with a total warp requirement of about 6480 yards, or approximately one pound. The tabby requirement would almost equal this. Supposing that Fabri (18/2 wool) yarn is used for pattern weft (a yarn which can be woven to give the desired perfect balance) about 6000 yards would be required, or approximately one and one quarter pounds. For the Linen weaves or for balanced wool weaves, no additional pattern weft is required.

Notice that somewhat rough approximations are given for all yarn estimates. The reason for this is that in the weaving yardage of yarns and threads there is always less than in the listed yardages. This is due to threads being wound on tubes or in skeins under tension, and also because the weight of the cardboard tube is sometimes counted as part of the thread weight. So be generous in ordering yarns. Odd bits are always useful, and running short may be disaster.

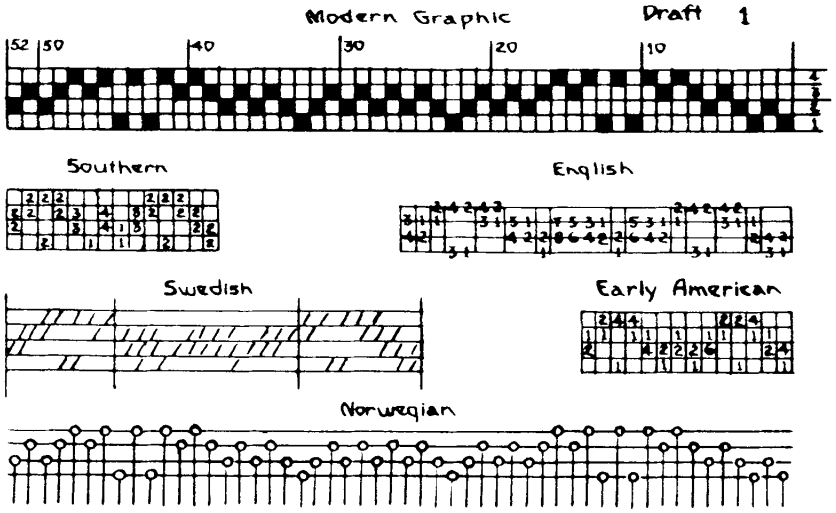
For sectional warping, the best cotton warps are produced from the two-ounce tubes of cotton. It is therefore necessary to order 60 two-ounce tubes to make a 30 to the inch warp. This may seem extravagant at the outset, but with standard materials so many warps may be made from one set of tubes that this is the most economical long-run method of buying. Wools and linens do not come on two-ounce tubes so, if one wishes to warp them sectionally, it is necessary to buy liberally and rewind onto spools or bobbins.

THE DRAFT

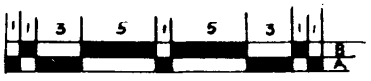
A draft is a diagram or a system of notation which indicates the arrangement of warp threads through the heddles on the several harnesses, to form a specific pattern. A pattern is any organized effect achieved through an integrated arrangement of warp and weft threads; while the draft is the threading guide for securing the effect.

Of the many draft writing methods, one system, the Modern Graphic Draft, is becoming standard. The Modern Graphic Draft is written on squared paper. For a 4-harness draft, four horizontal spaces are required. Each one of these indicates a harness of the loom, harness 1 (toward the front of the loom) represented by space 1 at the bottom, harness 2 by the second space, etc. The vertical divisions of the draft represent the warp threads. The proper harnesses from which to select the heddles for threading, are shown by the black squares, each placed at a point where a specific warp thread intercepts a specific harness. Thus, in the draft given, reading and threading in the conventional manner from right to left, the first warp thread passes through the first heddle on harness 1, the second through the first heddle on harness 2, the third through the second heddle on harness 1, the fourth through the second heddle on harness 2, the fifth through the first heddle on harneas 3, and so on. The mutual associations between threads in a pattern are thus clearly indicated at a glance. Additional clarity for counting, threading and analyzing is given by the vertical lines which indicate each tenth thread.

The other draft writing methods are chiefly of historic interest, though it is often valuable for a handweaver to be able to interpret old drafts or drafts commonly used in other parts of the world. The inaccuracies and difficulties of interpretation are obvious from a brief study of these.



The profile draft is a short form in draft writing which can be used for certain weaving techniques. It is impractical for Overshot, Crackle, Twill, or for any other weaves which have draft irregularities or common threads between pattern blocks. For a few highly stylized weaves such as Summer and Winter, or Bronson, which are built on draft units repeated with unvarying regularity, the Profile is an excellent form of drafting shorthand. As both of these techniques require two background harnesses, only the pattern harnesses are indicated in the profile, harness 3 carrying the pattern threads for block A, and harness 4 carrying the pattern threads for block B.



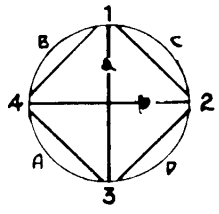
Profile Draft

THE TIE-UP

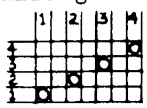
The tie-up of a loom is the connection which is made between lamms and treadles, to control the combinations of harnesses raised or lowered. Tie-ups vary with the type of weave to be produced, and the treadle tie-up for any special weave is indicated by a tie-up draft, somewhat similar to a threading draft. The tie-up draft for a four-harness weave has four horizontal spaces, each one representing a harness, as in a threading draft. The vertical spaces of a tie-up draft indicate the treadles, and each one is separated by a blank space to facilitate interpretation. As tie-ups are read from left to right, the horizontal harness divisions are numbered at the left, and the treadles numbered at the top. The symbols in the squares indicate which harness or harnesses (by connecting the lamms controlling the harnesses) should be tied to the treadle.

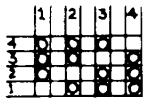
A Standard Tie-Up Draft has come into common use, with either x's or o's representing the tie-up connections. If the tie-up is given for a sinking shed, or counter-balanced loom, the tie-up draft is written with x's at the points where the tie-ups are made; if it is for a rising-shed, jack-type loom, the symbol is o's. The conversion from a sinking-shed to a rising-shed tie-up is made by merely putting o's in the blank spaces of the tie-up draft, and leaving the x's untied, since the rising shed produces the opposite shedding arrangement from the sinking shed.

The simplest tie-up arrangement, by which one treadle raises one harness, cannot be made on the sinking-shed loom because of its counter-balanced action. Therefore, a single tie-up, and also the triple tie-up which raises three harnesses, are indicated with o's for the rising-shed loom. For simple Twill weaving and for the four-harness Overshot and Crackle Weave techniques, the harnesses are always operated in pairs, so these are the weaves most commonly produced on counter-balanced looms. For these weaves the Standard Tie-Up is used. The Standard Tie-Up requires six treadles for four harnesses, two of the treadles being tied to give plain weave, or tabby, and four for pattern combinations. To facilitate understanding the Standard Tie-Up system, think of the harnesses as lying around a circle instead of parallel. The Circle Diagram shows the harnesses on the periphery of the circle. The four pattern combinations are chords between the four harnesses in pairs, and the tabby combinations each bisect the circle. This shows that in the structure of the weave, harnesses 1 and 4 have the same mutual association as harnesses 1 and 2, 2 and 3, 3 and 4. For the maximum weaving convenience, the four pattern harnesses are always tied at the left of the loom and the tabbys at the right. Treadle 1 sinks harnesses 1 and 2 (or raises 3 and 4); treadle two sinks 2 and 3 (or raises 4 and 1); treadle 3 sinks 3 and 4 (or raises 1 and 2); treadle 4 sinks harnesses 4 and 1 (or raises 2 and 3). The tabbys are always indicated by the letters "a" and "b", tabby a sinking the even numbered harnesses (or raising the odd numbered ones), and tabby b sinking the odd numbered harnesses (or raising the even numbered ones).

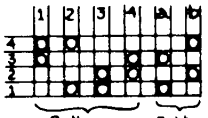


Circle Diagram


Single Tie-Up


Triple Tie-Up

Sinking Shed



Rising Shed

Tie-ups cannot be made on a hand-operated, table loom, as each harness is controlled by a separate lever. Therefore, in following treadling directions, the tie-up combinations must be substituted for the treadle numbers. If the tie-up is for a sinking shed, the rising-shed conversion must be made.

PATTERN ARRANGEMENT

Drafts which produce definite patterns must be arranged for threading so that the patterns are balanced and well spaced in the finished piece of weaving. The first problem in arrangement is adding a selvage, which, if the weave is Overshot,will be twill repeats. The method is explained under "Drafting Border". Next is the problem of balancing the pattern so that the left hand edge is identical to the right hand edge. This means adding a thread, a pattern block, or a pattern unit, following the final full pattern repeat, according to the nature of the draft. If one is threading Rosepath, or any of the hybrid drafts which start with a twill and end with a reverse twill, only one thread is required to balance the pattern. If one is threading a one-unit Overshot draft, such as any of the Diamonds, one block (the first block of the draft) is required for pattern balance. But most Overshot drafts are composed of two units. Suppose that the draft for threading is a Star, followed by a Diamond. The weaver must analyze the draft to determine the exact point where the Star ends and the Diamond begins. The Star, then, is the unit which must be repeated after the final complete pattern repeat, to balance the pattern. (To find the last thread of the Star, first find the turning point or center block of the figure, then balance the blocks on either side until the first block is matched, and the first two threads of the figure is matched by two at the end.) Or, the weaver may wish to have the Diamond of the pattern lie at the edges of the warp, which involves balancing the pattern at the beginning rather than at the end. Start the threading with the first thread of the Diamond figure, thread to the end of the draft, then repeat the entire draft as many times as desired. If a border is threaded at either side of the warp, this must be taken into consideration in figuring the number of repeats of the draft, and border allowances made at each side of the balanced pattern. Considerable arithmetic is usually involved in planning pattern repeats, pattern balance, two borders, and two selvages. The selvage is a device for using the extra threads left from the pattern and borders, as each selvage may be from two to sixteen threads wide.

Suppose one wishes to thread Draft (19) for table mats on a 14-inch wide warp, 30 ends to the inch, a total of 420 threads. The pattern consists of Tables separated by a double Diamond, and part of the Diamond weaves as a border around the Table. The first problem is to select a suitable place in the pattern for a good edge. This could be either the Table figure, the Double Diamond figure, or a spot on the Diamond which would make one of the strong lines between Tables fall at the edge. The exact starting and ending points must be determined by the balance of the pattern and by the relationship between the number of threads in the draft and the number of threads in the warp. Since the draft has 64 threads, it will allow 6 complete repeats with 36 threads left over for pattern balance and a selvage. However, the Table (with its border) is made by threads 1 through 41, so there are not enough remaining threads for the complete Table repeat. The complete Double Diamond figure is threads 36 to the end, plus threads 1 through 8, a total of 44 threads, again too many. It becomes plain that we can use only five complete draft repeats, with long balancing units on either side. Therefore, we choose to start the threading at the center of the Double Diamond, thread 49, and make a compensating pattern balance at the other side. The Threading Schedule will be as follows:

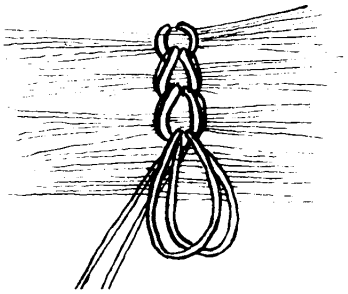
Right selvage (4,1,2,3,4,1,2,3,4,1,2,3,4)	13	warp ends
Threads 49 to 64	16	" "
5 Repeats of the complete draft	320	" "
Pattern Balance (threads 1 - 57)	57	" "
Left Selvage (4,3,2,1,4,3,2,1,4,3,2,1,4,3)	14	" "
Total	420	Warp Ends.

A threading schedule of this type should be made before any warp is threaded to a pattern. (Weaving requires a good bit of arithmetic.) For simple twill threadings, the threading may be started and ended at any point.

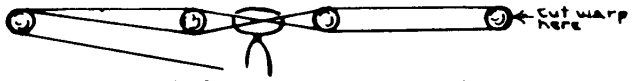
DRESSING THE LOOM

The weaver's first task must necessarily be the preparation of the warp and stretching it on the loom. This process, known as setting up, or dressing, the loom, consists of preparing the warp; winding the warp on the warp beam; threading, or drawing in, the heddles; sleying the warp through the reed; tying-in the warp to the cloth beam. Warping is done by two main methods: chain warping and sectional warping. A third method, chain warping with a drum or mill, is commonly used by commercial handweavers, but because of the great skill it requires the method will not be considered here. The new weaver's first warp is usually advisably made on a warping board, warped by the chain method. A suggested material for the first warp.(which should be coarse, not more than 20 inches wide or 10 yards long) is 5/2 cotton or #5 Perle cotton, set at 15 ends per inch, or 10/3 cotton set at 20 per inch. Step by step directions for chain warping and threading are given below.

1. Plan the project. (Warp material, length of warp, width of warp, number of warp ends per inch, or total warp ends.)
2. Tie the warp thread around the upper right hand peg of the warping board. Carry the thread over the first of the center pegs, under the second, and around the left end peg. Continue around pegs on alternate sides of the board until the desired yardage is measured off. (See the diagram of the Warping Board) Then retrace exactly, to the top of the board. Make a cross between the two center top pegs by carrying the warp over the first peg and under the second. The cross will always be perfect if, regardless of the direction, the warp is carried over the first peg, under the second, and around the end one. The cross should occur at from 18 to 24 inches from the end of the warp. Continue measuring off the warp, making the cross, until the desired number of threads are around the pegs. To facilitate counting as one winds the warp, separate each ten threads with a chain made of a long double strand of heavy thread. Hold the center loop around the first ten threads and pull a double loop through it. let the ends hang down, the loop up, until another ten threads have been wound; then make a second chain around them. This counter chain may be placed at any convenient spot on the warp and should be removed before the warp is chained off the board. Do not think it necessary to make an entire warp in one chain. It is usually easier to make several small chains of 100 to 150 ends. In winding on the pegs, be sure the tension is uniform throughout. Winding too tightly will strain the pegs, pull them out of position, ruining the warp tension, as well as the board.



3. Tie a piece of heavy twine loosely through the cross between the two center pegs, to hold the cross in place. Tie a piece of cord tightly through the loop at the last peg, to mark the exact end of the warp.

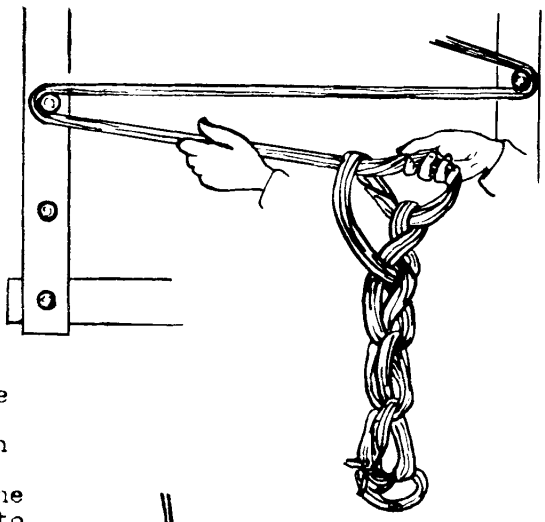


Method for making the leash tie

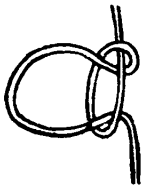
4. With the left hand, grasp the warp firmly, near the end, and slip the loop off the end peg (or remove the peg). Place the right hand through the loop and grasp the entire warp, pulling it through to form a new loop. Put right hand through the new loop, and pull through another, continuing thus to make a chain of the entire warp, until the upper left hand peg is reached. Always hold the unchained portion of the warp firmly so it will not slip over the pegs. In chaining back and

forth across the board, always face the direction of the chaining.

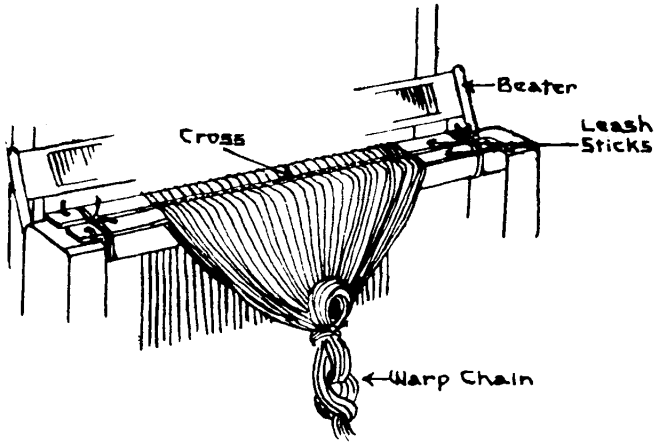
5. Cut the loop around the peg at the upper right hand corner, the first peg of the warp.
6. Insert a leash stick or a dowel on either side of the cross as it is held by the cord. Tie both ends of the two sticks firmly to the breast beam of the loom. Cut the cord holding the cross and spread the warp ends. Anchor the chain so the warp ends will not slip.
7. Sley the warp ends through the reed, from front to back, in the order in which the cross holds them. Be sure to measure the length of the reed and start sleying at the point which will exactly center the warp in the reed. Draw the warp ends through the reed in pairs or singly, according to the pre-arranged plan.
8. Thread the heddles, working and reading the draft from right to left. Push the heddles to the left hand side of the harnesses (be sure first that there are enough heddles on each harness for the complete threading) and select a heddle at a time, pulling it toward you to thread. Thread ten warp ends, check them against the draft for accuracy, tie the group behind the heddles with a loop knot, and push the heddles to the right side of the loom before proceeding to the next group of ten threads. Before tying the loop, be sure the ends are all of equal length.
9. Tie the ends of the warp to the stick or apron attached to the warp beam, in groups of about one inch. Use the tie-in cross around the stick but tie in a simple knot rather than a bow. Be sure in tying that the apron or stick is carried around the back beam.



Chaining from the Board



Loop Knot

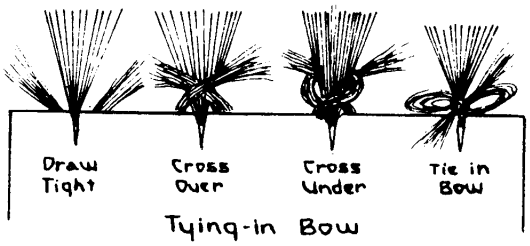


The Cross Tied in Position

10. Untie the two leash sticks from the breast beam, but leave them in the warp, tying the ends together so they cannot slip out of the warp. Unchain as much of the warp as possible (five yards is a good length to handle at one time), grasp the warp firmly at the far end from the loom, and pull it out with both hands until the tension is even throughout and all the threads are lying in order. The use of a comb in the pulling-out process is not advisable, but if it is necessary, pull a very coarse toothed comb gently through the warp only when the warp chain is held under tension.

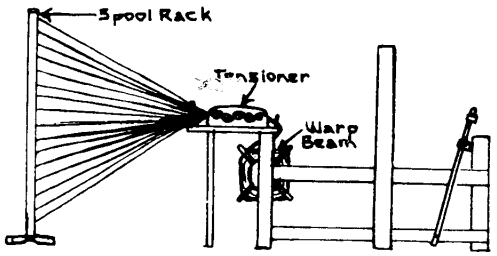
11. Beam the warp by turning the warp beam and rolling corrugated cardboard, newspaper, or heavy brown paper along with the warp to separate each layer. A second person should hold the unchained warp at a tension and another helper is useful to keep the warp from knotting in front of the leash sticks. The leash sticks will lie directly in front of the reed, helping maintain the order of the warp and giving it even tension on the beam. It is possible for one person to do the beaming alone if additional leash sticks (dowels are even better) are inserted giving the hanging warp the proper beaming tension. To insert sticks, after the warp has been tied to the back beam, hold the chain at a tension in front and raise a tabby shed, inserting a dowel in the shed directly in front of the reed. Release the shed and push the stick back. Make the other tabby shed and insert a second stick. Four or six sticks may be inserted this way into tabby sheds, so that a cross lies between each stick. The sticks should be tied in pairs at both ends to prevent their falling. Allow two or four sticks to ride directly in front of the reed to give the tension, and pull one pair back the length of the unchained warp to facilitate the thread straightening, letting them ride to the reed as the warp is beamed. The type of warp will determine the number of sticks necessary to give the proper tension so the weaver must experiment. The lonely beamer can straighten a few feet of warp in front of the loom, let the warp, weighted by the leash stick, hang in front of the loom, and go to the back to turn the beam crank and insert the beaming paper, repeating this process over and over. Beam the warp until the shortest warp ends hang just over the breast beam, then trim the ragged ends.

12. The tie-in knot is made according to the illustration. Bring the warp in bunches, from one to two inches, over the stick attached to the cloth beam. First tie a group at each end of the warp. Tighten the tension one notch on the ratchet. Tie a group of warp ends at the center of the warp. Then tie groups on the left and right, working from center to edges. Pull the beater forward and gently pass the hand over the warp, back of the reed. If any parts of the warp are looser or tighter than the total warp, pull out the tie-in bow and retie to the proper tension.



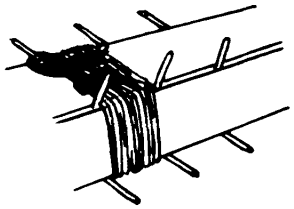
Tying-in Bow

Sectional Warping: This method, in addition to its time saving advantage, requires only one person for the entire operation. The first step is to place on the creel the exact number of spools of warp as there are warp ends in two inches of the warp. For instance, if the warp setting is to be 30 ends to the inch, 60 spools of warp thread are required. Be sure that all spools will turn in the same direction. In an orderly manner, carry each warp end, in turn, from the spool, through the collecting board of the tensioner, alternately over and under the tensioner pegs so that a cross is formed between pegs, and thread it through the separating reed or comb. When all



Equipment in Position for Sectional Warping

the spools have been threaded in this manner, tie the entire group of threads to the center of the warp beam stick, and arrange the tensioner so that the ribbon of warp coming over the beam lies exactly between the two pegs dividing the center section. Turn the warp beam the correct number of times to measure off the desired length of warp, usually one turn per yard. A cross is not necessary to insure the proper order of warp threads, since the threads roll onto the beam in orderly fashion. It is convenient to place a strip of gummed paper on either side of the warp ribbon while it is stretched under tension, to insure the thread order after the ribbon is cut. Cut the warp a few inches above the tape, and twist the group of threads around a peg to hold it. Move the tensioner along to an adjacent section and repeat this process until the desired width of warp has been beamed. Be sure to count the beam turns accurately so each section will have the same yardage.



To thread from a sectional beam, loosen the first (right hand) bout and carry the entire ribbon of warp around the beam and over the back beam. The warp ends should extend about to the breast beam so adjust the length by turning the warp beam. The threader works from right to left, his position while threading determined by the type of loom. Hold the warp ribbon at a tension with the left hand, and with the right hand pick off the threads in order and thread the heddles. It is a great convenience and time saver if two people cooperate on the threading process, one person to hold the warp ribbon and pick the threads in order, the other person to select and thread the heddles. With only one person threading, a good bit of ingenuity is required to devise a suitable and efficient system for holding warp, and selecting and threading heddles. One system is to carry the ribbon of warp over the top castle or over the harnesses, and secure it with a thumb tack through the gummed tape. Follow the same threading system as for chain warping, checking each ten threads and tying them off with a loop knot.

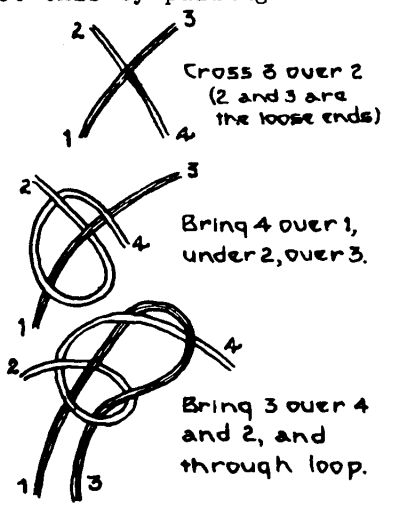
Correcting Errors: With the warp beamed, threaded, sleyed, and tied-in, supposedly the weaver is ready to start producing a textile. Unfortunately this is frequently not the case. After a few shots have been woven, it often becomes apparent that errors have been made in either the threading or the sleying. It is absolutely imperative that these two steps be accomplished with perfect accuracy. Therefore, any errors must be corrected at the outset. Sleying errors consist of missed dents in the reed, or too many threads in one dent. If either of these occur there is no solution but to remove the warp threads from the point of the error to the nearest warp edge and re-sley them. Sometimes a cross in the shed will appear between the heddles and the reed, which prevents the proper tabbying and beating. This is due to threads having been selected in improper order from the heddles. To correct this error, loosen the tie-in bow which holds the incorrect threads, pull the offending threads from the reed, re-sley them correctly, and retie the bow. An error in the actual threading is more complicated to correct. The most common type of threading error, which may easily pass the check unnoticed, is the selecting of the wrong harness for one warp thread. For instance, a failure to tabby correctly may mean that two adjacent threads may lie on harness 3, when one of them should be through a heddle on harness 2. The problem is solved by loosening the tie-in bow and drawing out the incorrectly thread warp end. But since there is no heddle available for it on the correct harness, a string heddle

Granny Knot

Square Knot

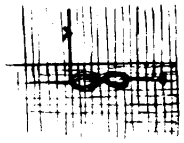
String Heddle

must be added. Make the heddle of carpet warp or a strong linen thread, according to the illustration, tying Granny knots to make the top and bottom of the heddle eye. The Granny holds well enough, and can be adjusted more easily than a Square knot to make the heddle eye match the others exactly. Thread the warp through the string heddle, sley, and tie it in. Another common threading error is due to correctly threaded warp ends becoming twisted in front of the harnesses. Correct this by pulling out the reversed threads and rethreading them in the right order. Occasionally errors in threading are due to a pair or more of threads being added to or omitted from the draft. If such an error involves only one or two warp ends a correction may be made by adding the needed threads, with warp hung in balls at the back of the loom, threading them through string heddles, and resleying from the point of error. If there are extra threads, these may merely be removed, hung at the back of the loom, and the warp resleyed from the error. Loose warp threads, or hanging spools, are a great nuisance, but they can be coped with. If a greater number of threads, or an entire unit, have been omitted, the only solution is to pull out the warp from the error to the closest edge, rethread, and resley.



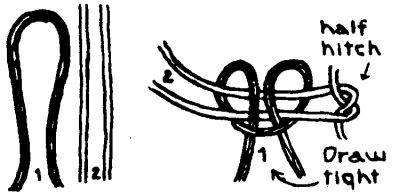
Weaver's Knot

Another source of occasional error which requires correction as the weaving progresses, is broken warp ends. With a correctly beamed warp of good quality thread, and good weaving technique, there is ordinarily no excuse for broken warp threads. But accidents do happen, and the weaver must be prepared. To repair broken warp end, tie a suitable length of warp thread with a Weaver's Knot, to the broken warp end. Be sure it is drawn through the proper heddle and reed dent. Fasten the loose end at the proper tension, by winding it criss-cross around a common pin inserted in the edge of the weaving. When the weaving is cut from the loom, fasten the loose end by darning it inconspicuously into the cloth.



Mending Broken Warp End

Loom Adjustments: The last step before starting the weaving is checking the loom adjustments. With a counter-balanced loom having harnesses hung by cords, this is a serious and ever-present problem. Adjustments other than treadle tie-ups are seldom necessary on a jack-type loom. Be sure that every harness hangs perfectly even and straight, and that they make the maximum shed. See that the warp of each bottom shed lies flat on the shuttle-race. Be sure that the treadle cords are of the proper length to produce the maximum harness lift. The tie-up between treadles and lamms, and also any ties in the harness suspension cords, are made with Snitch Knots. These facilitate quick adjustments, as the knot needs merely to be loosened and the half-hitch pulled up or loosened. A loom should never have a hard knot at an adjustment point. Some modern looms have patented systems for harness suspension and treadle tie-ups, which never require adjustment. The more cords a loom has, the less efficient it is for weaving.



Snitch Knot

WEAVING

The mechanical process of weaving is soon mastered and becomes an almost instinctive body motion. The first step, when the loom is in perfect adjustment and has been accurately dressed, is to spread the warp so the threads lie perfectly parallel. One way of doing this is to depress treadle a and insert a leash stick into the shed. Press the stick into place with the beater, release treadle a and step on treadle b and beat again. Insert a second stick in the b shed and beat as before. If the warp is not perfectly even, insert two more leash sticks in sheds a and b. A better method for spreading the warp, because it takes up any unevenness in tension due to the warp threads sloping in to the knots, is to use rags which have been cut about an inch wide. Six to eight rows of rags, hanging loose at the ends or with large loops, are required to spread the warp perfectly.

The loom is now ready for the actual weaving. A tabby heading is usually woven first. Open shed a, beat, throw shuttle through the shed from left to right, beat, release a and open shed b, beat, throw shuttle from right to left, beat, repeat the entire operation. These are the simple, rhythmic movements which are repeated over and over.

The Beat: Beating is tricky. In the perfection of the beat lies the fundamental perfection of a textile. Each type of material and each different effect requires a different beating pressure. Therefore it is important that a weaver achieve flexibility in his beat. Do not develop the tendency to be a hard beater, or a light beater; since the uniformity of a textile is determined by the consistency of the beat, be a smooth beater. A beat into which a great deal of muscle or weight is put is apt to be hard on both the weaver and the loom. To achieve a strong beat, it is usually better to give two short, sharp taps than one hard one. Closely set warps which are to be balanced, weft faced fabrics, and heavy textiles such as rugs, all require a strong beat. Light or fairly open fabrics, and wools in general, require a light beat, sometimes so light that a mere pressure of the reed against the weaving surface is sufficient. In weaving plain tabby material, the beat should always be adjusted so that exactly as many weft threads as warp threads per inch result in the final textile. To achieve this perfect balance it is usually necessary to weave slightly fewer threads per inch than there are warp ends, because there is some warp take-up when the tension is released. It is advisable for the weaver to release the tension on the front beam when examining the balance of the weave. The warp tension must be kept uniform if there are to be no uneven streaks in the weaving, so it may be necessary to loosen the cloth beam one notch as the weaving surface approaches the reed.

Throwing the Shuttle: A shuttle should always be thrown when the beater is at rest against the capes, and it should always travel along the shuttle race at the front of the reed. It should be removed from the shed close to the reed, never allowing the hands to touch the warp threads, so that the weft lies in a diagonal line from the weaving on one side, to near the reed on the other side, with the attached end drawn tightly enough so there is no loop, but not so tightly that the edge of the weaving is drawn in. The first beat should be made with the weft lying loosely in the shed, on the diagonal. It is this loose lying weft which gives a handwoven textile its distinctive texture, as distinguished from a machine woven texture made when the shuttle carries the thread close to the weaving surface and at a slight tension. The loose lying weft prevents the material from narrowing-in and also obviates much weft-wise shrinkage.

Two-Shuttle Weaving: For pattern weaving with two shuttles carrying two types of thread, the weaving process is more complicated. The basis of pattern weaving is tabby, so one shuttle carries a tabby thread similar to the warp, while the other shuttle carries a heavier pattern thread. The pattern treadles

are operated with the left foot and the tabby treadles with the right, in a walking rhythm. First, depress treadle a and throw the tabby weft from left to right, beat, change the shed, and beat again. The second shed will be a pattern shed, treadle 1, for instance. Through this shed throw the pattern shuttle, always following the tabby, in the same direction; then beat, change to treadle b, beat. Change to the second pattern shed which may be treadle 1 again, or may be 2 or 4; follow the tabby with the pattern shuttle, beat, change to treadle a, beat; and continue thus. With the complication of two shuttles and two sets of treadles, tabby errors will occur unless a weaver establishes the habit of always treadling a when when the shuttle passes from left to right, and treadling b when it travels from right to left. Tabby and pattern wefts are locked at each edge by always keeping the two shuttles in the same geographic relationship to each other. That is, after removing the tabby shuttle from the shed, lay it on the weaving near the weaving surface, and on removing the pattern shuttle, lay it toward the weaver. This arrangement may be reversed, but which ever order is used, always be consistent. In conventional pattern weaving, the beat should be so adjusted that the final textile has a balanced tabby background.

Fastening Weft Ends: New weft threads must be secured inconspicuously. To fasten a new weft end, throw the shuttle carrying the loose weft and beat the weft into place, leaving a couple of inches of thread hanging at the edge. Without changing the shed, carry the loose end over one or two edge warp threads and then under three or four warps, in the shed, bringing the end out on top. The loose end is thus securely, but inconspicuously, held, and the end is trimmed when the piece is finished. A discontinued thread is secured in the same manner. Insert all new, and end all old, weft ends in the selvage area, never in the body of the weaving. If the change is merely the starting of a new bobbin of identical material, it is sufficient to cross the old and new weft ends in the new shed, under four to six warp ends at the edge. But this method is unsightly when a change of color or thread type is being made.

Selvages: The generalization may be made that only after much experience and concentration can a weaver make good selvages. A selvage should be straight and firm, with no weft loops at the edge. A very slight narrowing-in at the edges is permissible, just enough to allow the edge four or five warp threads to lie a little closer together. One of the greatest problems of the beginner is the tendency to narrow-in too much, a fault which should be corrected as soon as it appears. Narrowing-in is usually caused by tension on the weft. If the weft lies in the shed on a loose diagonal, narrowing-in is negligible. Never permit any tension on the weft while beating. Make the weft-turn from one shed to the next smooth. A strong tendency to loop at the weft-turn may be caused by too much tension on the warp. Slight looping may be corrected by putting a slight tension on the weft just before the shuttle is thrown. A narrowing-in of about a quarter of an inch on each side is quite correct, but if the woven width of the piece is more than one inch narrower than the warp width, there is something in the weaving technique to be corrected. Almost all weavers, even with the strictest concentration on selvages, make one selvage better than the other. Don't worry about this.

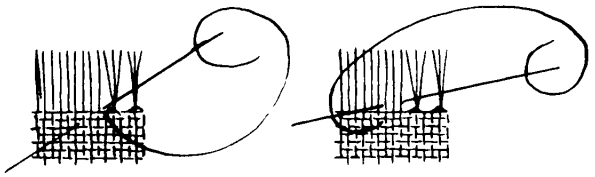
Some types of selvages are much easier to control than others. When the weaving is uniform, selvages are uniform. When pattern bands and weft materials of differing weights are introduced, selvages have a tendency to scallop or pull in irregularly, and require severe concentration to keep them straight. There are no rules for doing this, as this is part of the "feel for materials" which the weaver develops with experience. In weaving yardages, or articles which are to be hemmed at the selvages, one need not concentrate on making perfect selvages.

Some weaves make better selvages than others. In Overshot weaving, the Twill threading at the edges makes good selvages. In the Bronson and Spot weaves, tabby selvages may be threaded. Some of the Linen weaves will

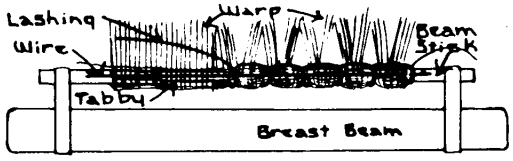
not make a threaded selvage, so the weaver must just do the best he can to produce a good edge. On some weaves, Summer and Winter for instance, the selvage can be made only by threading it to two extra harnesses, a proceedure never used by four-harness weavers. However, in two-shuttle weaving the edges can always be controlled by the proper weft interlocking at the edges. Twills present a particular selvage problem when they are woven with one shuttle and no tabby. There may be a warp thread at one or the other, or both edges, which is not caught by the weft. In straight twill weaving, these uncaught threads may be disregarded or removed from the warp. However, if the twill treadling is reversed, the loose thread will move from one edge to the other. In weaving textiles which will be hemmed or cut, the loose thread at the edge may be overlooked. However, in an article which should have a good selvage, the only way to control the loose warp thread is to carry the shuttle around it. The most efficient way to do this is to hold the offending thread down or up with the fingers, as the shuttle is thrown. Carrying the shuttle around the thread is apt to stretch it. Another system for controlling loose edge threads is to weave with two shuttles carrying identical material, so the wefts may be locked at the edges.

There are several very poor practices in making selvages. One of these is threading the edge threads double in the heddles. This gives a heavy cord-like, unpleasant edge. Another is threading the edge half-dozen threads closer in the reed, which increases the tendency for weft loops. It is also undesirable to warp the edge threads of a heavier material, as this makes an unpleasantly conspicuous edge. Avoid all these make-shifts.

End Finishes: End finishes for handwoven articles are the handweaver's eternal problem. Common finishes are hems, or tied or whipped fringes, the choice determined by the nature of the article, the material used, the current fashion and the inclination of the weaver. Where possible, hems are usually in better taste than fringes. Hems should harmonize with the design of the article. Hems are usually made of tabby and, if the article has bands of pattern work as in towels and table mats, the hem should be made to the border. If the article is of all-over pattern weaving with which a wide tabby hem would not harmonize (often true of Crackle Weave patterns), a narrow, turned under, tabby hem may be used. Such devices as hemstitching are not particularly suitable on hand-woven articles as they mix techniques. If one wishes to hem to an open-work border, a row of pick-up leno, woven into the piece, is much more suitable, and saves time. A simple whipped edge for an article may be made directly on the loom. To make this edge, thread a needle with a bit of warp or tabby thread. Raise all the harnesses so the warp slopes toward the weaver. Start at the right selvage with a tiny knot in the thread. Insert needle to left, under three warp threads and two tabby threads. Put needle under same three warp threads, looping thread under needle. Pull thread tight. This may be put in very rapidly when the piece is still held under tension on the loom. To hemstitch the beginning end of a piece, insert a stick in a tabby shed, and weave a few rows of tabby. Remove the stick and put in the row of stitches upside down.



Cutting the Warp: It is possible to cut the weaving from the loom without having to make a new tie-in. Weave half an inch to an inch of tabby, insert a wire, leash stick, or dowel in a tabby shed and weave two more tabby shots. Cut the weaving at the end of the article and lash the wire to the cloth beam stick. The tabby edge may be "fixed" by painting it with colorless nail polish or duco cement dissolved in acetone.



TWO-HARNESS WEAVING

Weaving in its simplest form is produced with two harnesses. The most common textile weave is Tabby weave, which may be woven on two harnesses, by threading 1, 2, 1, 2, in regular succession, and weaving by raising the odd numbered threads and the even numbered threads alternately, throwing a shot of weft through each shed. By definition, tabby is a perfectly balanced weave with warp and weft of identical weight thread, and exactly as many weft shots per inch as there are warp ends. This weave is the basis of all weaves, and because of its closely interwoven nature and its perfect warp and weft balance, it is the strongest weave there is. Tabby weave has no possible texture variation. Designs in tabby weave are made by the introduction of colors into the weft to form stripes, and by balancing warp color stripes in the weft, to make plaids. Tartan plaids may be woven in tabby, though they are traditionally twills. Shepherd's Check is an interesting color arrangement with two threads of dark thread alternating with two of light, in both the warp and weft.

In the plain weave, a one up, one down weave in which the warp and weft do not balance, endless texture variations may be made through emphasizing either warp or weft, or through combining different weights, textures and types of thread in warp and weft. Most primitive weaves are warp-faced plain weaves, with a very close-set warp and a relatively few weft shots. There was a reason for this, as it was so difficult to make sheds on the primitive looms that weavers concentrated on the warp to minimize the amount of shedding required. Modern weavers with poor looms sometimes use this device. A weft-faced weave may be produced by weaving many shots of fine material over a coarse, wide set warp. These two weaves are called reps, or warp-faced cord and weft-faced cord.

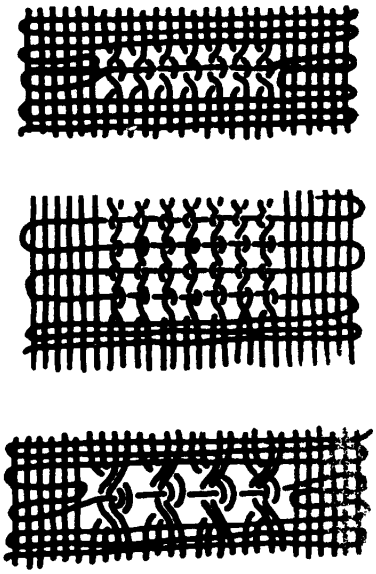
Color patterns are made in warp-faced rep through introducing colors into the warp. If the colors are solid, strong stripes will result. A method for making two-block color patterns is to thread dark threads on harness 1 and light threads on harness 2, for the desired width, then reverse the order and thread dark threads on harness 2 and light threads on harness 1, which makes two dark or two light threads lie together at the point of change. Weave with two shuttles, one carrying a fine thread and one carrying a heavy thread, throwing them alternately. When the fine thread is thrown through the first shed and the heavy one through shed 2, the light threads on harness 2 will be dominant, and the dark threads on harness 1. Repetition of this order of shuttles will make blocks or stripes. Reversing the order of shuttles will make the opposite color effect. Pleasant effects may be gained from this technique even if the warp is not set to cover the weft completely. One can make heavy table mats in this manner with carpet warp set at 15 or 20 ends per inch, and heavy cotton yarn and carpet warp for weft materials. Any of the two-block Profiles given with the drafts may be used as a threading guide.

Color patterns in weft-rep may be made by throwing two shuttles carrying two colors of thread, on a coarse, wide set, warp. Such material should be beaten until the warp is completely covered. Many beautiful color and pattern arrangements may be devised by the weaver. A good warp for this weave is carpet warp set at seven to twelve ends to the inch, as this will take a variety of weft materials. For a strong and more delicate weft-faced rep, use 20/2 or 24/3 cotton, set at 30 per inch but threaded double (1, 1, 2, 2, etc) and weave with fine wool or cotton. This makes lovely material for bags, chair seats, footstool covers.

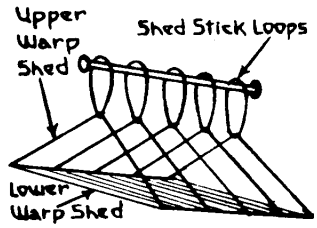
Another variation of the plain weave is the Basket Weave. This is a balanced weave in which the warp ends and weft shots are grouped: 1, 1, 2, 2; or 1, 1, 1, 2, 2, 2; or 1, 1, 1, 1, 2, 2, 2, 2. In weaving, the weft must balance the warp, and the correct number of strands cannot be wound on a single shuttle, any more than an entire group of warp may be threaded through

a single heddle. Separate shuttles carrying identical weft may be used for each thread in a group, each shuttle being thrown through each shed, and beaten individually. Or one weft strand may be carried back and forth through the shed the correct number of times, each time carrying the shuttle around an edge warp thread. This weave is used for draperies, occasionally in linen for table mats, and is excellent in wool for baby blankets.

Many of the pick-up weaves, the tapestries, brocades, open work and pile weaves are produced on a two-harness set-up. These, however, are outside the scope of this Manual and are taken up in special Bulletins. The simple Leno twist, however, is given here because of its usefulness as an end finish for table linens and towels. It makes a stripe of open work which seems much more appropriate for hand-woven linens than hem-stitching. To make one row of pick-up leno across the entire warp, make the tabby shed which puts the right hand warp thread on the top of the shed. With the fingers of the left hand, reach around the top edge thread and pull up the bottom edge warp thread, pulling it to the right and up, and holding it on top of the shed by placing a pick-up stick under it. The pick-up stick rests on top of the top warp. Then reach between the first and second warps of the top shed and pick up the second lower thread, pulling it to the right and up and holding it with the stick. Proceed across the entire warp in this manner, picking up each one of the warps from the lower shed and bringing it to the upper shed, with a twist, until the entire lower warp lies on top of the upper warp, secured by the pick-up stick. Release the shed, turn the pick-up stick on edge (a rather wide pick-up stick should be used) and throw the shuttle through the shed made. Remove the stick and beat the twist into place. Then proceed with normal weaving. If the weaver wishes to make several rows of open work, merely throw the shuttle from left to right through the second shed and repeat the pick-up process, always working from right to left. If a firm tabby selvage is desired, throw two extra tabby shots the width of the selvage and then start the pick-up, continuing it to a balancing point on the other side, and build up the left edge with two extra shots. A more open effect may be achieved by picking up two or three threads on the lower warp, and carrying them in a group around the same number on the upper shed.



THREE-HARNESS WEAVING



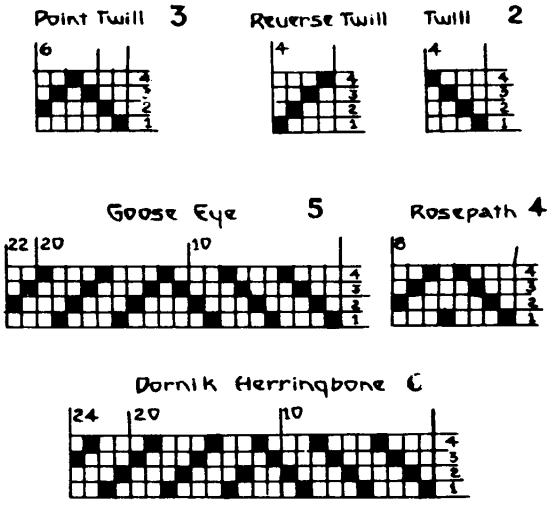
Method for making extra harness with shed stick carrying loops

The three-harness weaves are a rather obscure field, but they are useful to the weaver who has only a two-harness loom to which a primitive shed stick may be added to give an extra harness. Set the shed-stick in front of, or in back of the harnesses, and thread the loops, or half-heddles, as though they were heddles on a harness. The common three-harness weave is the Jeans Twill, or 2-1 twill. The harnesses are raised singly to make the warp dominant, and in pairs to make the weft dominant. It should be woven with a warp-weft balance. A pleasant 3-harness open or "lace" weave for linens or wool scarves or baby blankets is given at draft (12). The treadling for this is 1, b, 1, b, a, b, repeated. The two little Swedish three-harness weaves are given at (11) and (13). These are commonly woven as a weft-faced fabric, treadled 1, 2, 3, pattern effects in color made by using different colors in different sheds.

TWILL WEAVING

Twill weaving is a large field in textile production, and can be touched upon only briefly here. Twill is a balanced weave, with warp and weft of identical material, though they may differ in color, its most common form being the simple 4-harness, 2-2 twill. The warp threads of each of the four successive twill sheds rise in pairs, two up and two down, with pairs progressing one thread to the left with each change of shed. This produces a diagonal texture line of 45 degree angle. There are countless variations of the simple twill, produced by different tie-up and treadling arrangements, some of which are shown on the draft diagrams with accompanying tie-ups. The imaginative weaver will think of many more.

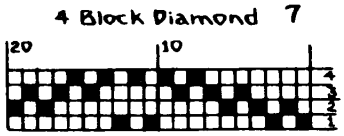
Like tabby, twill is a simple weave which is adaptable to any kind of material. It is used either alone, or in combination with other weaves, and is the structural basis of many techniques. Twill, and the twill variations such as Point Twill, Goose Eye, and Rosepath, are excellent linen weaves and are commonly used for woolens. The plain twill is the common weave for tweed yardages, with twill variations and color stripes and plaids used for the more individual tweeds. Although the tweed-weaving field cannot be treated here, a few words on the subject are not amiss. The reed setting for tweeds must be determined by the weight of the yarn, and the most satisfactory way to determine the proper setting is to make a short sample warp of about a hundred threads, and weave samples with different reeds and settings. Wash, dry and steam press the samples to illustrate the final textures. Select the setting which gives the desired weight and texture to the fabric. Since tailors can cut yardages most economically if the final width is about 28 inches, a good width in the reed is 32 or 34 inches, allowing four to six inches for take-up and shrinkage. A correctly set warp will shrink less than one which is set too wide. Many woolen yarns are spun in the grease to facilitate the weaving. Therefore, a tweed or wollen material looks very disappointing on the loom, and requires a thhorough but gentle washing in mild soap (sude,) a quick, cool drying preferably in an extractor, and steam pressing.



The first variation of the simple twill is the Point Twill (twill and reverse), a 6-thread draft, sometimes known as Bird Eye. An extension of the Point Twill is the Swedish Rosepath, an 8-thread draft. Rosepath is woven in many ways, either with a tabby or without, and countless small pattern and color variations are possible. The no-tabby method is the common Swedish system, treadling 1, 2, 3, 4 throughout, weaving each shed with a different color of fine wool, and making pattern variations by shifting color relationships. The effect is a handsome weft-faced fabric similar to the two and three harness weft reps, but more elaborate in pattern. The Point Twill is enlarged by adding more threads, to make the Herringbone, sometimes called the Goose Eye. In weaving Point Twills on the customary Standard Tie-Up, the perfect 2-2 balance of the straight twill is lost at the points where the direction of the draft changes. Weft skips of three threads are quite permissible for linen weaves or for blankets, but they reduce the wearing quality of suiting material. Therefore, for suitings, one thread is omitted at each turning point, to give the Dornik draft, the common tweed herringbone.

THE OVERSHOT WEAVE

The next derivative of the Point Twill draft is the Overshot pattern draft. In the Overshot technique, the basic twill combinations of 1-2, 2-3, 3-4, 4-1 are retained, but each of these is enlarged to make a "block" rather than a 2-thread twill skip. Thus 1, 2, is enlarged to 1, 2, 1, 2, or even more threads are added, up to about twelve. Enlarging the Rosepath draft by making each twill combination a block, gives the simplest of all Overshot patterns, the four-block Diamond. From this point, many arrangements of blocks of different proportions may be developed to produce different patterns.



Overshot drafts are composed of various traditional pattern units which have been known since the "Coverlet Days" by specific names. There are:

Twill Succession: blocks arranged in regular, progressive order;
Diamonds: blocks arranged in progressive order, with a return;
Stars: five or seven block alternations between two blocks, in different proportions;
Roses: drafted the same as Stars, but woven differently;
Tables: long alternations between two blocks, or a single block with regular tie-down threads on a second block;
Wheels: twill successions of blocks which lie in opposite directions on either side of a Star or Table;
Bow Knots (or Blooming Leaf): a long twill succession which has blocks of increasing, then decreasing size, leading to a center or turning block, with a reverse;
Sunflowers: large Stars with small Stars drafted on the opposite pair of harnesses, at each corner, surrounded by a twill or a wheel;
Sunrise: long twill succession which starts with large blocks that gradually grow smaller, toward a large turning block.

Combinations of these figures in varying interpretations and with different sized blocks, make endless possible pattern configurations. Pattern balance is an Overshot design characteristic. The intricacy of design and beauty of proportion and mass and line arrangements in many of the old patterns, make them an eternal joy.

Between the Twill weaves and the Overshot weave lies a group of hybrid patterns which combine twills with Overshot blocks. Honeysuckle, one of the drafts most commonly used by beginners, is such a hybrid weave. Because of the simple appearance of the drafts, these weaves are mistakenly used by the beginner, when they are actually much more difficult to weave than the true Overshot patterns, though they give small, delicate designs which are attractive for small borders. Twills are used to produce the selvages for all Overshot weaves.

Overshot, in its characteristic interpretation, is a balanced weave with a 50-50 tabby background, interwoven with an added pattern thread. The pattern threads skip over and under and interweave with the tabby, producing three separate textures to the weave: pattern areas, background areas, and half-tone areas which separate the two through an interweaving of pattern and background. The pattern wefts which lie on the surface are variously called floats, skips, overshots, or, if they are repeated several times, blocks. Overshot weaving is properly done with exactly as many tabby shots per inch as there are warp ends, the pattern weft being an added weft which follows each tabby shot, making a total of twice as many weft shots per inch as there are warp ends. In order to produce this balance, a very soft pattern weft which will beat into place taking no preceptible space between tabby threads, is required. It is obvious why this is traditionally a wool-on-cotton, or a wool-on-linen weave,

as a fine wool will beat up properly. An ideal combination of materials for Overshot weaving is 20/2 cotton warp and tabby, set at 30 ends to the inch, and Bernat Fabri for pattern weft. If an all-cotton fabric is desired, a soft, stranded cotton such as the Lily 20/6 (Art 914) is suitable if it is beaten very strongly, though this makes a rather stiff fabric. Stranded Perle may be used if one wishes the shiny effect in pattern thread. Linen in any form should never be used as pattern weft as it is stiff and stringy, producing sleazy loops at the pattern areas, which do not adequately cover the blocks. Linen, however, may be used for warp or tabby.

Drafts for Overshot patterns are easily come by. Most weaving books give many such drafts, and the best collection of authentic Early American drafts, taken from original Colonial sources, is in The Shuttle-Craft Book of American Handweaving by Mary M Atwater. Since the Overshot technique was used in Colonial days primarily for coverlets, most of the authentic Colonial drafts are for large patterns which require several hundred threads. Modern handweavers who use the Overshot weave for table mats, towels, and many other small articles, usually wish small drafts which weave into attractive borders. Therefore, the Overshot drafts given in this Manual are all short drafts, none of them authentic Colonial. The clever weaver, who understands the technique, can easily create his own drafts.

Weaving As-Drawn-In: Each Overshot draft has a characteristic pattern configuration. In most cases, many pattern variations may be made from a single threading, but there is always a basic pattern which the good weaver must be able to produce without written directions. It is a symmetrical design which is identical when viewed from each of the four sides of a woven piece. Since the horizontally viewed figure is identical to the vertically viewed figure, obviously the weaving must exactly follow the threading. This is called "woven as-drawn-in". Mastery of this method of weaving is fundamental as it gives the weaver control over any Overshot (and many other types) draft. A weaver may sit at a strange loom and, without knowledge of the threading, produce the basic pattern. To the uninitiated this is deep mystery.

To weave as-drawn-in, the weaver must understand the basic principles of the Overshot technique. Overshot patterns are produced through arrangements of four pattern blocks. A "block" in weaving is an area of three or more warp threads, over which the pattern weft skips. The pattern blocks appear as warp skips on the top shed, when two harnesses are raised. For convenience, the blocks are indicated: A (harnesses 1 and 2 down), B (harnesses 2 and 3 down), C (harnesses 3 and 4 down), D (harnesses 4 and 1 down). Weaving as-drawn-in is a problem in selecting these four blocks in the correct order and weaving each block in its proper proportion.

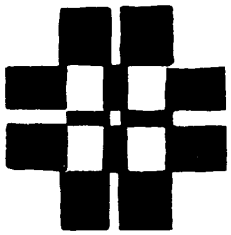
First, depress a pattern treadle (any treadle) and examine the right hand edge of the warp to see if a warp skip occurs just inside the selvage. Unless the pattern is one which contains twills, this will be at least a four thread skip. If the warp skip does not occur exactly inside the selvage, try another pattern treadle, and another, until the first block at the right appears. Weave this shed, alternating the pattern and tabby, until the first block appears square. Then the second block must be found, the block which lies just to the left of the first block. Because of the intrinsic nature of the Overshot draft, this will be produced on an adjacent treadle, and it will have one thread in common with block one. If the first block of the pattern was block A (commonly true),then the next pattern block will be either B or D (treadles 2 or 4). It will lie just to the left of the first block and the thread under its right hand side will lie under the left hand side of block one. Weave this block until it is square. Then find the third pattern block in the same way. It will soon become apparent that a diagonal line of pattern blocks is developing, starting at the lower right hand corner of the weaving, and progressing at an exact 45 degree angle toward the left hand side. In weaving the pattern, be guided only by this diagonal; the rest of the pattern will take care of itself. The selection of the proper block to weave soon

becomes a simple matter; the skill of the weaver is indicated by the exactness of the 45 degree diagonal. If the warp and tabby are exactly balanced, and the pattern weft is exactly suitable, each squared block will have one less pattern shots than there are warp threads under the block. The "less one" compensates for the common thread between blocks. The treadling progression is always from odd to even, or from even to odd, in the treadle numbers.

All draft blocks, except turning blocks on which the direction of the draft reverses, are composed of an even number of warp threads. Turning blocks always involve an odd number. These turning blocks, particularly in small patterns, should always be woven with an even number of weft shots. The acute weaver will discover that when an odd number of threads are woven on a turning block, there is a slight difference in the way the warp comes up which makes the two sides of the pattern slightly different and gives a wavy appearance to the weaving. On large patterns, with long overshots, this effect is negligible, but in small patterns, particularly those which contain twills, it is very strong and disfiguring.

Rose-Fashion Weaving: Weaving as-drawn-in is sometimes known as star-fashion weaving. Another standard method of weaving Overshot symmetrical patterns is known as rose-fashion. Rose-fashion weaving is rather complicated. It can be done by the expert directly from the loom, but the beginner will find it simpler to work out the treadling from the draft, before weaving. The method involves switching the order and the proportion of adjacent pairs of blocks. It is usually used with drafts which contain star figures, which can be converted into roses. A Star, being a balanced alternation between two pattern blocks, might be written A,B,A,B,A. This figure produces a Rose, if the original (drafted) proportions are retained, but the order of weaving is reversed to B,A,B,A,B. Thus,

Block A - 5 shots	Block B - 5 shots
" B - 4 "	" A - 4 "
" A - 2 "	" B - 2 "
" B - 4 "	" A - 4 "
" A - 5 "	" B - 5 "

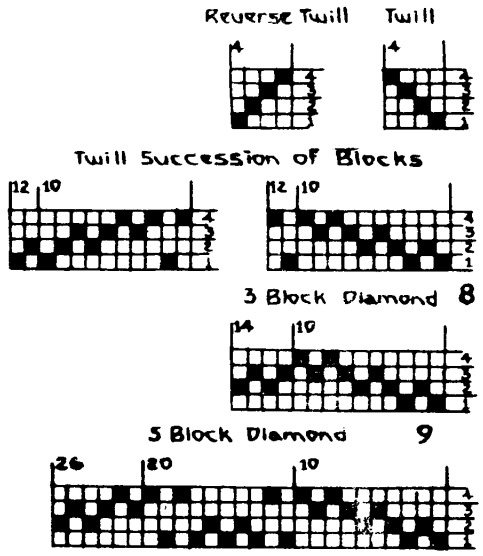


A Typical Rose

makes a Star by the first order, a Rose by the second. To complete the pattern development, the conversions must be made throughout the entire draft, and the order of weaving Blocks C and D must be likewise reversed, while maintaining the proportions of the Star-fashion development. It might be that the Star is drafted on blocks B and C. In this case B and C are the conversion pair, and A and D are likewise exchanged. In some cases, drafts have combinations of Stars and Roses in the same pattern. If this is true, it is simpler to weave Star-fashion, as the Roses will develop independently.

Weaving Pattern Borders: Beyond these two conventional methods, the production of Overshot patterns is dependent upon the imagination of the weaver. The treadles may be operated in countless orders to produce all-over patterns, or balanced border arrangements. It is desirable, when any new threading is put on a loom, to make a sampler to determine the pattern's design potentialities. Certain standard arrangements are valuable here to give a comparative basis. Here are some standard treadlings which may be tried with all patterns: Twilling, which is simply treadling 1, 2, 3, 4, over and over; Twilling and Reverse which reverses the treadle order after the twill succession; Sunburst which is weaving blocks in twill order, reducing the number of shots per block with each succession until four twill shots are made, then reversing the entire thing; Diamonds which are blocks A,B,C,D,C,B,A, or B,C,D,A,D,C,B, etc, a different pattern resulting with each different pattern block; Beadings made with one or two shots on two harnesses, A,B,A, or B,C,B, etc, or A,B,C,B,A, etc. Vary proportions by throwing different numbers of shots in blocks, and then go farther into other arrangements and combinations. Remember that turning blocks should have even numbers of shots. The possibilities are limited only by the imagination of the weaver. A good weaver is an experimenter.

Drafting Borders: Articles which are woven with all-over Overshot patterns are often more attractive with a threaded border which will weave symmetrically all the way around a piece. Most Colonial coverlets were woven thus. The simplest border is merely a wide selvage made of a number of repeats of the Twill. If the border is to harmonize with the pattern, the direction of the twill must be the same as the direction of the first pattern blocks. If the pattern starts on Block A, then progresses to B and C, the twills are threaded 1,2,3,4 for the right border, 4,3,2,1 for the left. If emphasis rather than harmony is desired, reverse the direction of the twill. Sometimes patterns start on other harnesses than 1, and in this case the border must be carried to the first thread of the draft. Nor does a twill need to start on harnesses 1 or four, but may be drafted 2,3,4,1, or 3,4,1,2, etc, the same being true of the reverse twill. These rules apply also to the threading of selvages. The next simple border, one which is a little stronger than the twill, is a twill succession of blocks. Instead of threading 1,2,3,4 thread repeats of blocks A,B,C,D, for the right hand border, blocks D,C,B,A for the left hand one. A commonly used border is the simple Diamond, either 3-block, 4-block, or 5-block. If the Diamond border is to harmonize with the pattern, the main turning block or blocks of the pattern should be used for the turning blocks of the Border. For instance, if the pattern makes all its turns on block A, then the border should be the 5-block Diamond, drafted A,B,C,D,A,D,C,B. If the pattern reverses on C and D, then use the 4-block Diamond drafted D,A,B,C,B,A. Another effective border arrangement is the reproducing of any small figure or unit from the pattern draft, repeated over and over for a border. Twills may be set between border and pattern, to set off the border.

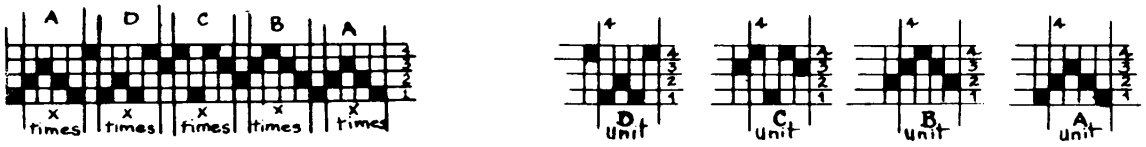


Borders will weave to give identical patterns on all four sides of a piece if the piece is woven as-drawn-in, or woven Rose-fashion. The diagonal (or Rose-fashion) development starts at the right hand edge and continues to the left edge. Symmetrical borders may not be woven with pattern variations.

Weaving "Opposite" Drafts: The Overshot drafts taken up thus far have all been drafted on the principle of a straight succession of blocks, with reverses. That is, after block A, comes either block B, or block D; blocks A or C follow block B. There is another type of draft known as the "opposite" draft in which a block is skipped in the succession. Thus, after block A (1-2) comes block C (3-4), the opposite combination; after block D (4-1) comes B (2-3); after block C, block A; and after block B, block D. It is evident that if this system is followed consistently, the result is a 2-block pattern written on only A and C, or on B and D. Drafts of this type may be developed from the 2-block Profile drafts (those not using more than 6 blocks together), by substituting 1,2 for A, and 3,4 for B. These patterns are stronger in effect than Overshot patterns, being two-tone: pattern and background, without half-tones. Opposite drafts with four blocks are a distortion of true drafts, in which two of the pairs of blocks are on opposites, the others being regular. The twill succession is A,C,B,D, or the reverse of this. This gives a strengthened pattern effect by placing the pattern and background areas for the main figures directly adjacent, removing the half-tones from their customary positions. The irregularity of these drafts is indicated by "accidentals" or two-thread skips, in the half-tone areas. Opposite drafts are used when additional sparkle is desired in the pattern. The 2-block patterns are good for articles such as aprons or dirndels in which a "Peasant" character with many colors is desired.

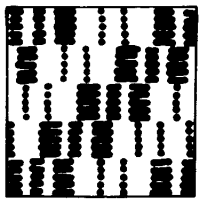
CRACKLE WEAVE

The so-called Crackle Weave is a four-harness, four-block, pattern weave of Scandinavian origin. It is woven, like Overshot, with a tabby, on the Standard Tie-Up. It differs from this technique in that it is not necessarily a balanced weave, the draft unit contains four threads instead of two, each fourth warp thread ties down the pattern weft, the overlap is of full blocks rather than of a single thread, and it has a two-tone rather than a three-tone pattern texture. The two tones are pattern and background, and each of these is a three-quarter tone, in that every fourth warp thread ties down the pattern area, and the pattern thread covers every fourth thread of the background. Because there is no full tabby background to harmonize with plain tabby weaving, this weave is not effective for pattern borders, but is most commonly used for all-over pattern. It makes an admirable textile for draperies, rugs and upholstery, sofa pillows, any purpose which requires a firmly interwoven texture with no long, catching weft skips. A wide range of materials may be used for both warp and weft, very heavy or very fine, because balance of weave need not be considered. It's three-quarter tone values give a toned-down pattern which is so often desirable. Its four-thread block units lend themselves to long repititions in large geometric designs, rather than small, intricate patterns. The overlapping of entire blocks gives a pattern harmony and continuous movement of line and blocks. The Scandinavian use of this technique is almost altogether for producing symmetrical, geometric patterns. Modern interpretations of the weave use simple block arrangements with emphasis on movement of areas and interesting texture variations. The treatment may be very informal.



The Crackle Weave is developed from four pattern blocks, each composed of repeats of specific four-thread units. Each of these pattern units is a three-harness Point Twill and may be understood more clearly by reference to the Circle Diagram. The Point twill for block A starts on harness 1, for block B on harness 2, for block C on harness 3, and for block D on harness 4. As many repeats as desired may be made of the four-thread unit, to give blocks of any size. A peculiarity of the draft is that between each pattern block, an extra thread called an "incidental" must be added, to carry the shift from one block to the next. The incidental thread is the balancing thread for the point twill,which means that for block A, harness 1 carries the incidental thread, harness 2 for block B, etc. Because of this draft irregularity, the drafts are written in full, or with unit repeats as illustrated above; profiles are impractical.

Weave the Crackle exactly like Overshot, alternating tabby and pattern shots on the Standard tie-up. Symmetrical pattern developments may be woven, but freedom of interpretation is more interesting. Materials such as are used for Overshot patterns are suitable, but also one may use very heavy pattern weft combined with very fine tabby, or any off-balance combination, since the balance of weave is not fundamental. A smooth pattern effect is achieved by throwing two tabby shots of fine material between each pattern shot. Two pattern blocks always combine in the weaving so that block D always weaves incidentally when block A is treadled, block A weaves with block B, block B with C, and block C with D. Patterns are often drafted on opposites to eliminate part of this overlap, when straight lines are desired. In drafting thus, the incidental thread for the omitted block must be added, so two incidentals occur between opposite blocks.



THE SUMMER AND WINTER WEAVE

The opposites Method (Summer/Winter weave)

The Summer and Winter is a Colonial American coverlet technique, produced on from four to ten harnesses according to the intricacy of the pattern. In its classical interpretation it is a perfectly balanced, two-shuttle weave, which has as many tabby shots per inch as there are warp ends. It is built on a basis of perfectly regular four-thread pattern units, with two harnesses of the draft carrying tie-down threads, each remaining harness controlling one pattern block. Thus, one pattern block requires three harnesses, two-block patterns may be threaded on four harnesses, six-block patterns on eight harnesses, etc. There are no irregularities in the pattern unit. Each fourth warp thread ties down a pattern weft and each fourth thread of the background warp is covered by a pattern weft, giving a two-tone weave, each having a three-quarter value. It is thus adaptable for all-over patterns rather than for pattern borders. Pattern blocks may be drafted as long or as small as desired, and in this technique each pattern block weaves completely independently of all other blocks, though in using more than four-harness patterns, pattern blocks may be combined in any desired way, by the treadle tie-up. The patterns are clear cut, though the effect is softened by the three-quarter tone values of the weave. The texture, when Summer and Winter is woven in the classical manner, is one of the most beautiful of weaving textures.

The draft unit for block A is 1, 3, 2, 3, harnesses 1 and 2 carrying the tie-down threads, harness 3 the pattern control threads. For block B the draft unit is 1, 4, 2, 4. Thus, each draft unit carries two tie-down threads, alternating with two pattern threads. The units may be repeated as many times as desired in the draft blocks, as indicated by the profile draft above. It will be seen that, with perfect regularity, every fourth warp thread is carried by harness 1, and harness 2 also carries a fourth warp thread, harnesses 1 and 2 combining to make one tabby. Since every alternate thread of a draft is carried by a pattern harness, the pattern harnesses combine to make the other tabby. Because of the absolute regularity of the weave, drafts are commonly written in profile, each profile square representing a 4-thread draft unit. The classical Summer and Winter tie-up requires two treadles for each pattern block, one tied to the pattern harness with the harness 1 tie-down, the other combining the pattern harness with the harness 2 tie-down. Therefore, block A requires treadle 1 (2-4), and treadle 2 (4-1); block B requires treadle 3 (2-3), and treadle 4 (1-3); tabby a is 3-4, and tabby b is 1-2. This may be considered the Standard Tie-up for four-harness Summer and Winter. In multiple-harness weaves the pattern harness tie-up varies for each draft (according to the block combinations desired) but the arrangement of the tie-down harnesses is always the same.

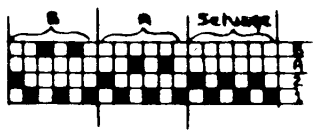
Summer and Winter is perhaps the most flexible technique there is for weaving. Many different methods may be employed to give different texture effects. The simplest way to weave is by using a single tie-down harness and weaving exactly as in Overshot, alternating a pattern treadle with tabby to the desired extent of a pattern block; thus, treadle 1 is used to produce Block A and treadle 3 for block B, treadles 2 and 4 not being used at all. A more interesting texture is produced by alternating the tie-down harnesses by throwing pattern shots alternately on treadles 1 and 2 for block A, alternating 3 and 4 for block B. The Colonial method is more complex as it is built on a weaving unit of four pattern shots, alternating with four tabby shots, making the complete weaving unit 8 shots, and these 8 weft shots must square exactly with four warp ends. The classical weaving unit for block A is: b, 1, a, 2, b, 2, a, 1, repeated to square the pattern block. (For block B 3 is substituted for 1, and 4 for 2.) The texture on the under side will be different from that on the top, but the under texture may be woven on the top

by following the treadling order: a, 1, b, 2, a, 2, b, 1. This series of eight shots gives the beautiful, characteristic Summer and Winter texture. Another interesting method for weaving this technique is known as the Polychrome method, in which pattern wefts of two different colors are used. In four-harness Summer and Winter this gives an all-over pattern of two colors, with no background areas. In multiple-harness Summer and Winter this may be more interesting, as two (or three) patterns in different colors may be woven simultaneously, with background areas between them. This is a three-shuttle weave which uses two separate background wefts of two colors, both pattern wefts being thrown between each tabby shot. It is usually woven in the single tie-down method as it is not a classical weave and the more complex treadlings are difficult to follow. To weave block A, follow the tabby with one shot of pattern color on treadle 1, and then one shot of the second pattern color on treadle 3 -- repeat. Block B is produced by reversing the color order.

Although Summer and Winter is classically, like Overshot, a wool-on-cotton, or a wool-on-linen technique (and for traditional weaving it should remain so) it is also adaptable to a wide range of materials. It is little used in all-wool fabrics, as none of the two-shuttle weaves are good for this purpose. It may, however, be used for linen if a heavy texture is desired. Damask-like linens may be woven on four harnesses (the damask technique requires a minimum of eight harnesses) though never make the mistake of calling this damask, or even semi- or false-damask. This is an excellent technique for close-woven fabrics such as upholstery, and very modern interpretations may be made for coverlets, and it is also good for many small articles for which an all-over pattern or pattern-texture is desired.

THE BRONSON WEAVE

The Bronson Lace weave is a balanced, one-shuttle weave. The draft is built up similarly to the Summer and Winter draft, in stylized units, patterns requiring two more harnesses than there are pattern blocks, so that two-block patterns are possible on four harnesses, six-block on eight harnesses, etc. The characteristic of the weave is that every alternate thread of the draft is threaded on harness 1 (making this a tabby harness), every sixth thread is on harness 2 (the tie-down harness), the remaining warp ends threaded on pattern harnesses. The draft unit is six threads, block A threaded 1, 3, 1, 3, 1, 2, and block B threaded 1, 4, 1, 4, 1, 2. These units are repeated to any desired size to give the classical Lace Bronson effect, but in this case the minimum repeat of the unit is two. A plain tabby is produced when harnesses 1 and 2 are alternated in the threading, so this may be used for selvages, borders, or tabby areas between patterns. The profile drafts may be used for threading, each block of the profile representing a 6-thread draft unit, but the profiles cannot indicate tabby proportions, so a full draft is often used for this technique.



The treadle tie-up for patterns is made to raise the pattern harness, plus the tie-down harness, so block A is tied to harnesses 2 and 4, and block B is made by harnesses 2 and 3 raised. Tabby a is produced on all the harnesses except 1, tied to raise together; tabby b is produced by raising harness 1 alone. (As in Summer and Winter, for multiple-harness weaves, pattern blocks may be combined by tying several pattern harnesses to the same treadle.) Harness 2 may be tied alone to a treadle to produce the lace texture all across the weaving. In four-harness Bronson, both pattern harnesses (plus the tie-down harness, of course) tied to one treadle give tabby all across, identical to tabby b.

The classical method for weaving Bronson is to treadle: a, b, 1, b, 1, b, for block A, the six shots exactly balancing the six-thread unit of the threading. Block B is woven, treadle: a, b, 2, b, 2, b. It is very important that this technique is woven to give an exact balance between warp and weft. The patterns produced are in texture rather than in color; the characteristic texture being five threads grouped together, separated by open-work "windows" bisected by the tie-down threads in both directions. Weft material identical in weight and color to the warp is used.

Bronson may also be used to produce weft-pattern in a two-shuttle weave. The tabby should be identical to the warp and the pattern weft quite heavy, preferably wool. Both tabbys must be thrown between each pattern shot. This makes an excellent upholstery material. Though basically a linen weave, the Bronson is also excellent for light-weight, soft, woolen articles such as scarves, baby blankets and shawls. For both wools and linens the warp may be set a little wider in the reed than is customary for tabby weaving in the same material. If it is used for cotton, the closer, tabby setting is best.

FOUR-HARNESS LINEN WEAVES

The traditional linen weaves are all balanced weaves, produced with a weft identical in size and type to the warp. The patterns in these weaves are made by shifts of texture, and they are not ordinarily as effective if woven with weft of a contrasting color. In the past, when well spun linen was difficult to secure, linen weaving was considered an advanced art because of the special handling, treatment and dressing which the warp required. Modern, wet-spun linens are of such quality that the warps present no different problems from cotton warps. Warp and weft linens are often listed separately, the warp linens being two or three ply, and the wefts, singles; but any warp linen is suitable for weft and many weft linens make good warps. Number 10, 12 and 14 wet-spun singles usually make excellent warps, though finer singles linens are delicate and difficult to handle. (Spinning and pre-spinning processes are constantly being improved to give greater tensile strength.) Although some weavers still prefer to work on a wet linen warp, this is seldom necessary. Many of our domestic linens are now as good as imported ones.

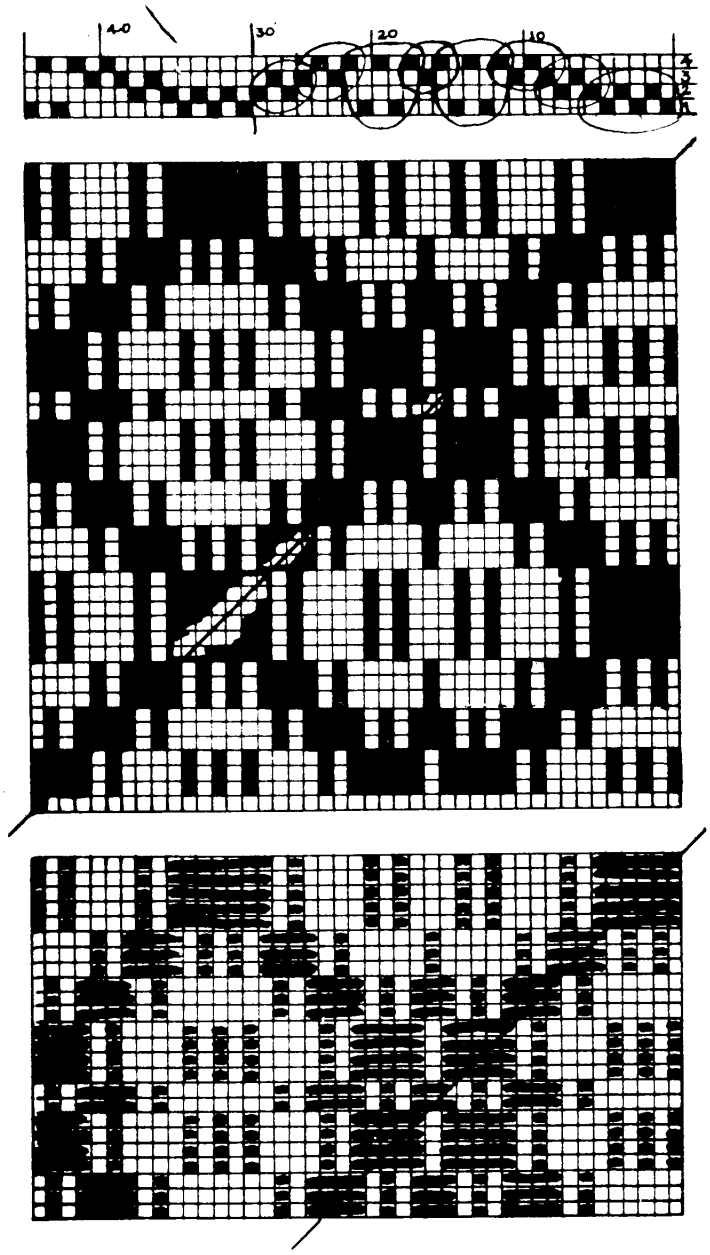
The small linen weaves give textures rather than true patterns. They are delightful for table linens, towels, and are also good in wool for soft articles such as baby blankets, afghans, scarves. Some of the linen weaves have tabby selvages, but with most of them it is impossible to thread a selvage, so they of necessity look a bit uneven at the edges. All are woven with warp and weft identical, and are beaten to balance.

Huck is given at Draft (47), with the tie-up. Treadle this: a, 1, a, 1, a; b, 2, b, 2, b. A tabby selvage may be threaded on harnesses 1 and 4. Tabby is woven a, b, alternately, as usual. Treadles 3 and 4 give an edging which is particularly pleasant if several shots are thrown in one shed.

Spot Weave (sometimes called Spot Bronson) is given at Draft (48). This has three pattern spots, each woven with four shots: b, 1, b, 1; b, 2, b, 2; b, 3, b, 3. The draft units may be threaded with six threads each rather than four (and woven with six shots) but never more than six.

M's and O's, Drafts (53) to (56), are somewhat different in that the threadings will not weave a true tabby. Also, a good bit of variation may be made in two-block pattern arrangements because large blocks may be used. Block A is woven by alternating treadles 1 and 2 as many times as desired, Block B is made by alternating treadles 3 and 4 as desired. A semi-tabby for headings is woven on treadles 5 and 6.

DEVELOPING DRAFTS ON PAPER



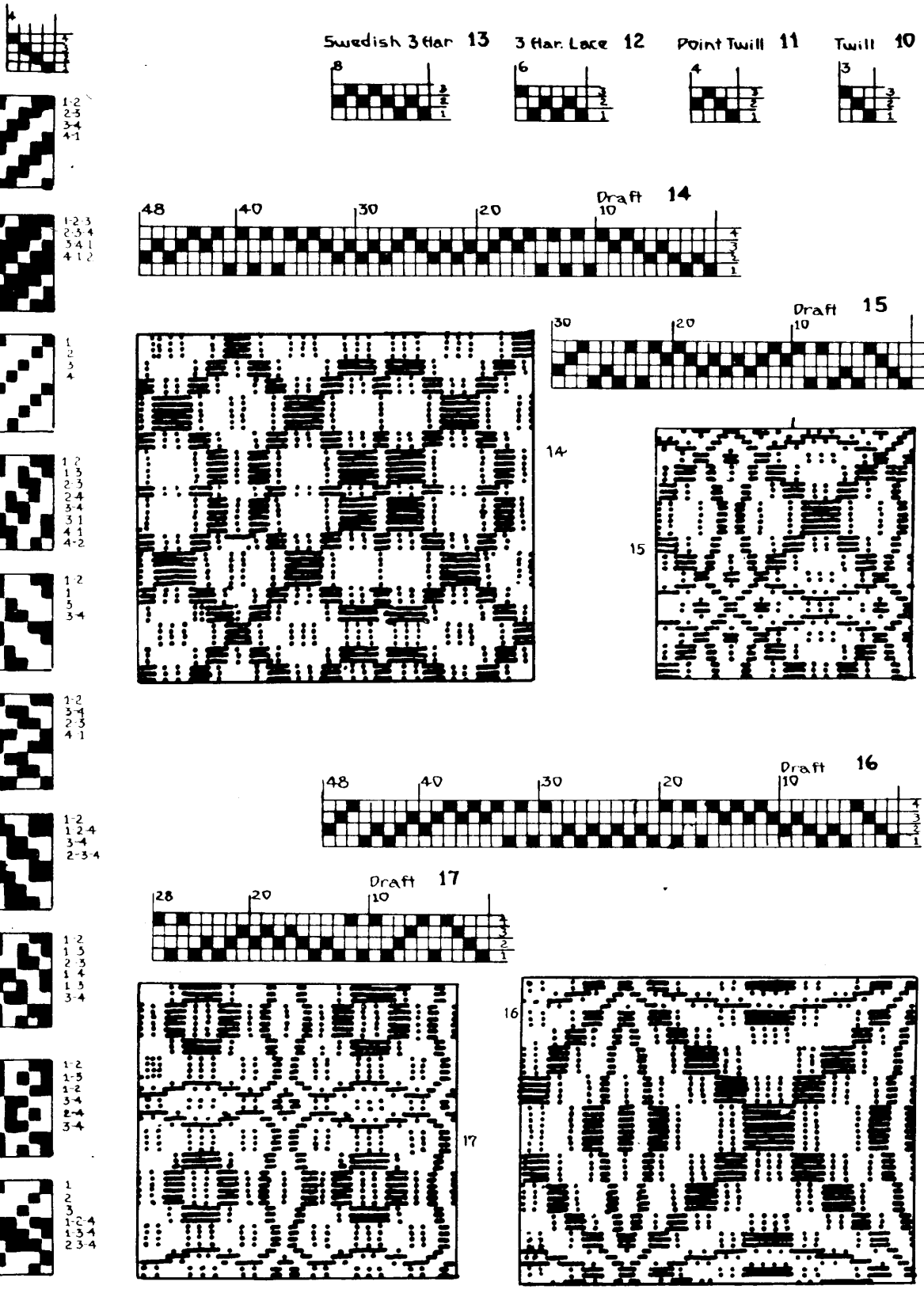
Draft developing is the process of weaving a draft on paper. It is useful in learning the nature of a pattern, seeing if the draft is correct, and in making original drafts. It is particularly important in designing a border, to determine if the border and pattern are harmonious, and in arranging patterns for the loom, to see good starting and ending points, and balancing points.

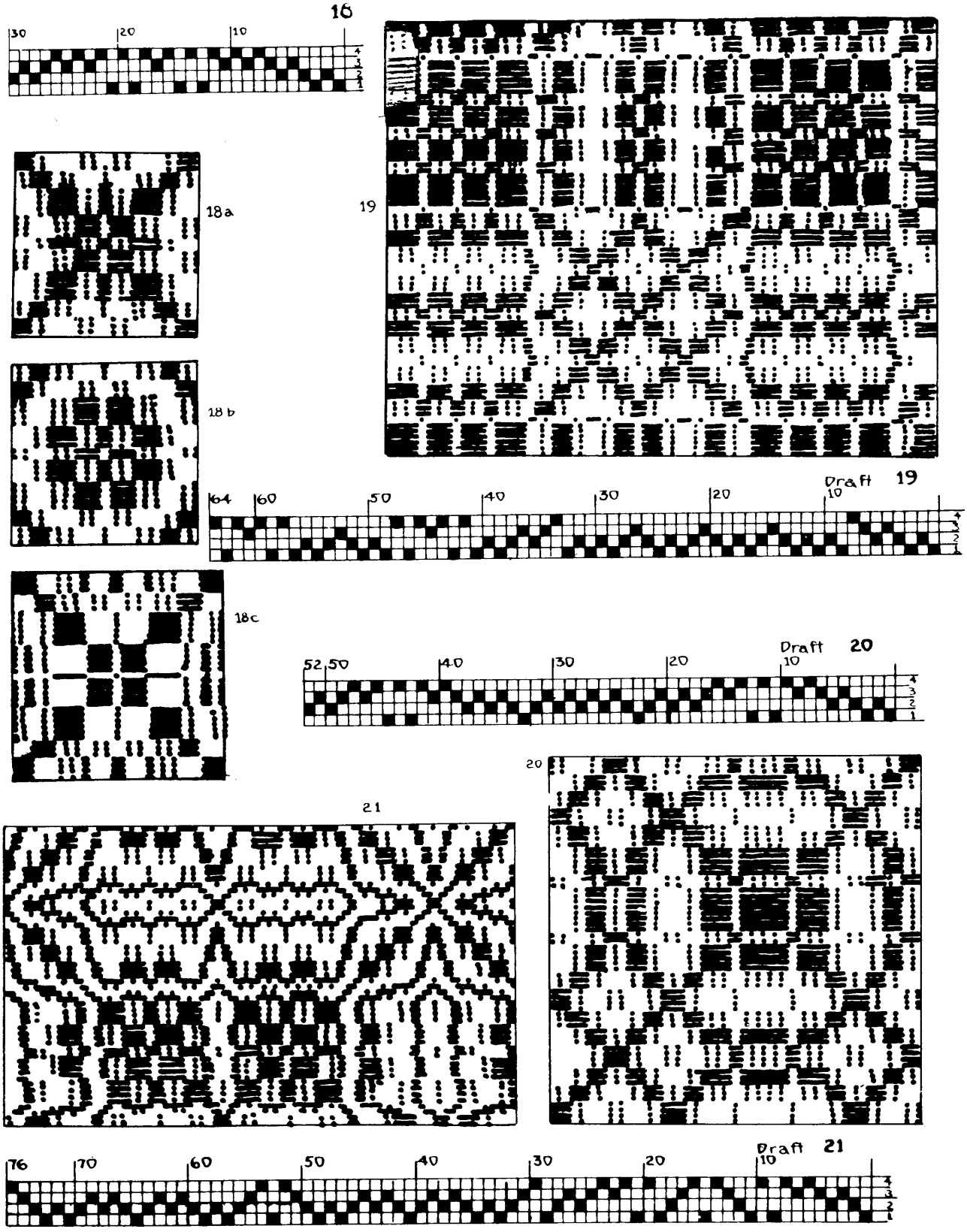
Materials for draft developing are 10 to the inch squared paper (16, if your eyes are exceptional) a straight lettering pen a 10th of an inch wide, India ink, a crow quill pen, a steel edged ruler or a triangle, and a lining pen is useful. There are two methods for developing drafts, the speedier one shown at the top fills the blocks solidly; the second one shows individual "shots" and requires a ball-point pen. Only the pattern is drawn in developments, the tabby assumed.

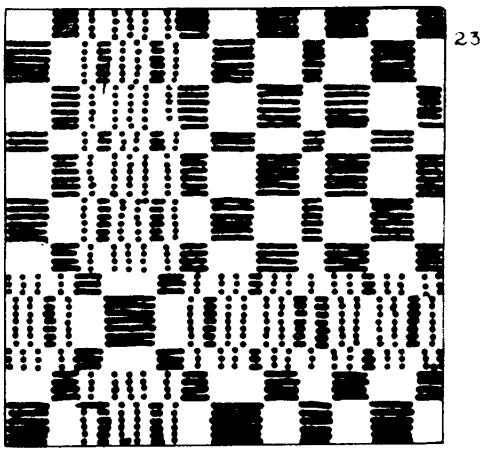
First set down one-plus repeats of the draft at the top of the page. Skip two lines and draw an exact diagonal line from the upper right corner, to make a square from the draft. Than "weave" each block along the diagonal, exactly as it would be woven as-drawn-in on the loom, by drawing lines (or filling the squares) under each thread of the draft on the shed being woven. Count the number of threads in the block which lies above the diagonal at the development point, subtract one, and "weave" that many lines all the way across. For instance, in the diagram, the first block is on harnesses 1-2 and has six threads. Therefore fill in, for five lines down, all the squares lying under 1 and 2 threads in the draft. The diagonal line emerges one square to the right of the lower left corner. The square just below the lower left corner (which the diagonal bisects) is the "significant square" which indicates the first thread of the next block. This, on the diagram, is a 4-thread 2-3 block, so all of the 2's and 3's across the draft are brought down three "shots" which places the "significant square" under the lower left corner of the block, on harness 3, the first thread of a 4-thread 3-4 block. Notice that the next (4-1) is a turning block with five threads and is developed with four shots. All turning blocks have odd numbers of threads and are developed with even numbers of shots, the opposite being true of straight succession blocks. "Opposite" drafts are developed with actual squares and the block being developed is brought to the diagonal line, at the point, This is because opposite blocks have no common threads.

INDEX OF DRAFTS

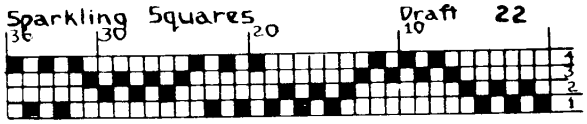
Let no one think that these Drafts or this MANUAL cover the field of handweaving. Textile creation is a field without horizons, one might almost say, a limitless field which a lifetime of devotion cannot cover. Here is merely the foundation for the weaver who will make a solid structure of his craft. Beyond these simple weaves are the endless multiple-harness weaves, the pick-up, laid-in, brocade, lace and tapestry techniques, the open-work, gauze, pile and shag weaves, the weaves for special materials and special purposes, as well as the expansions of these basic weaves. The Shuttle-Craft Guild aims, through its monthly Bulletin and special pamphlets, to constantly push out horizons for the handweaver, and instill high standards of craftsmanship. The Guild also maintains a correspondence service to help its members, as far as possible, with their personal handweaving problems. If you are not now a Guild member, you may write to the Shuttle-Craft Guild, Basin, Montana.

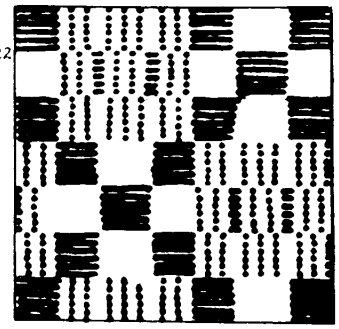

Swedish 3 Har 13
3 Har. Lace 12
Point Twill 11
Twill 10
Draft 14
Draft 15
Draft 16
Draft 17
14
15
16
17

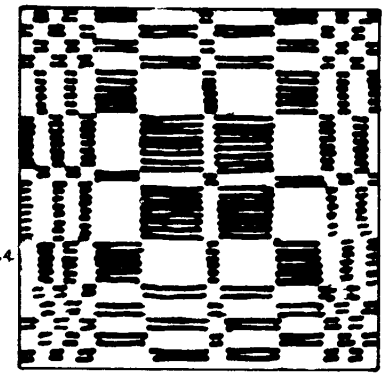

16
30
20
10
18a
18b
18c
19
Draft 19
64
60
50
40
30
20
10
Draft 20
52
50
40
30
20
10
20
21
Draft 21
76
70
60
50
40
30
20
10



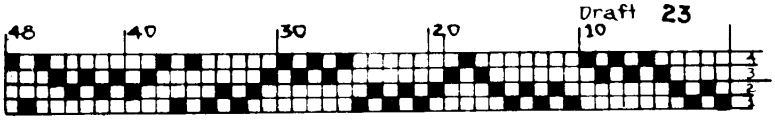
Sparkling Squares Draft 22



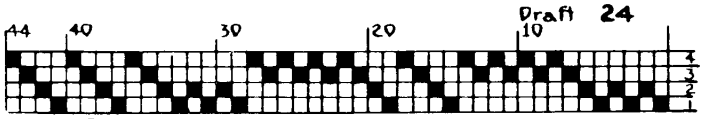




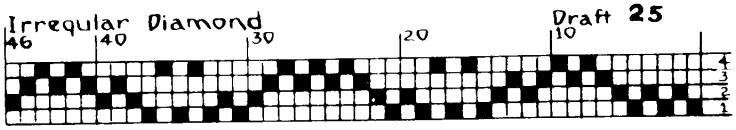
Draft 23

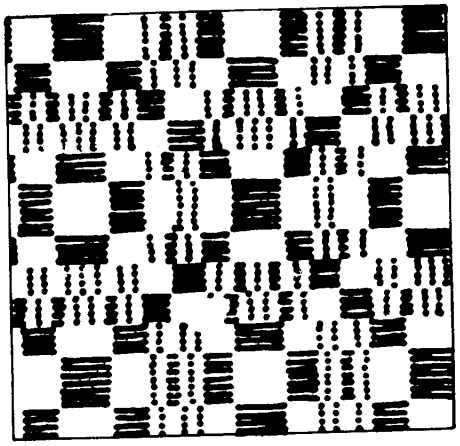


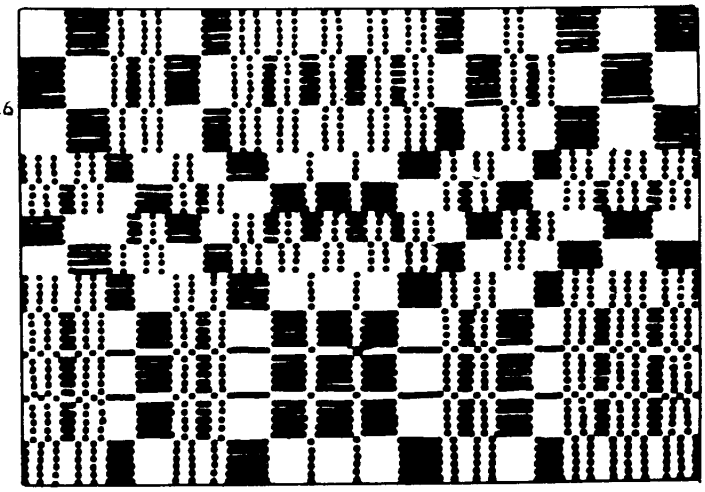
Draft 24



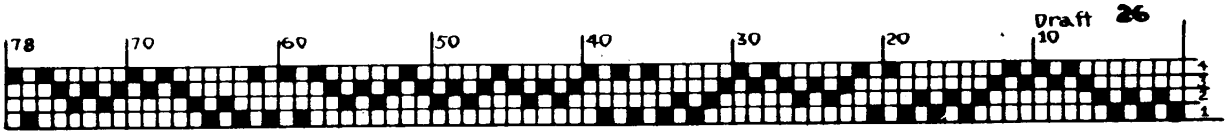
Irregular Diamond Draft 25

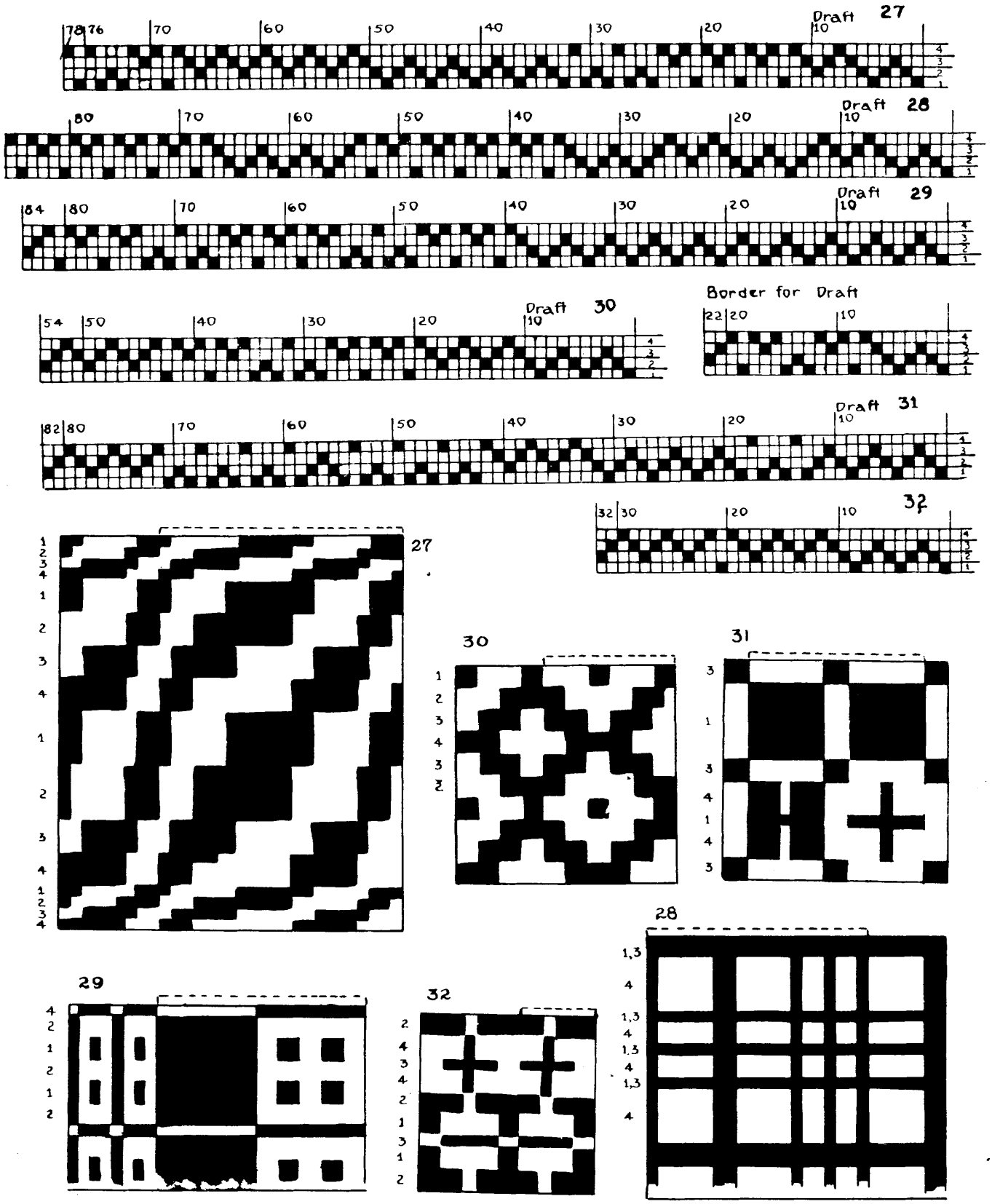


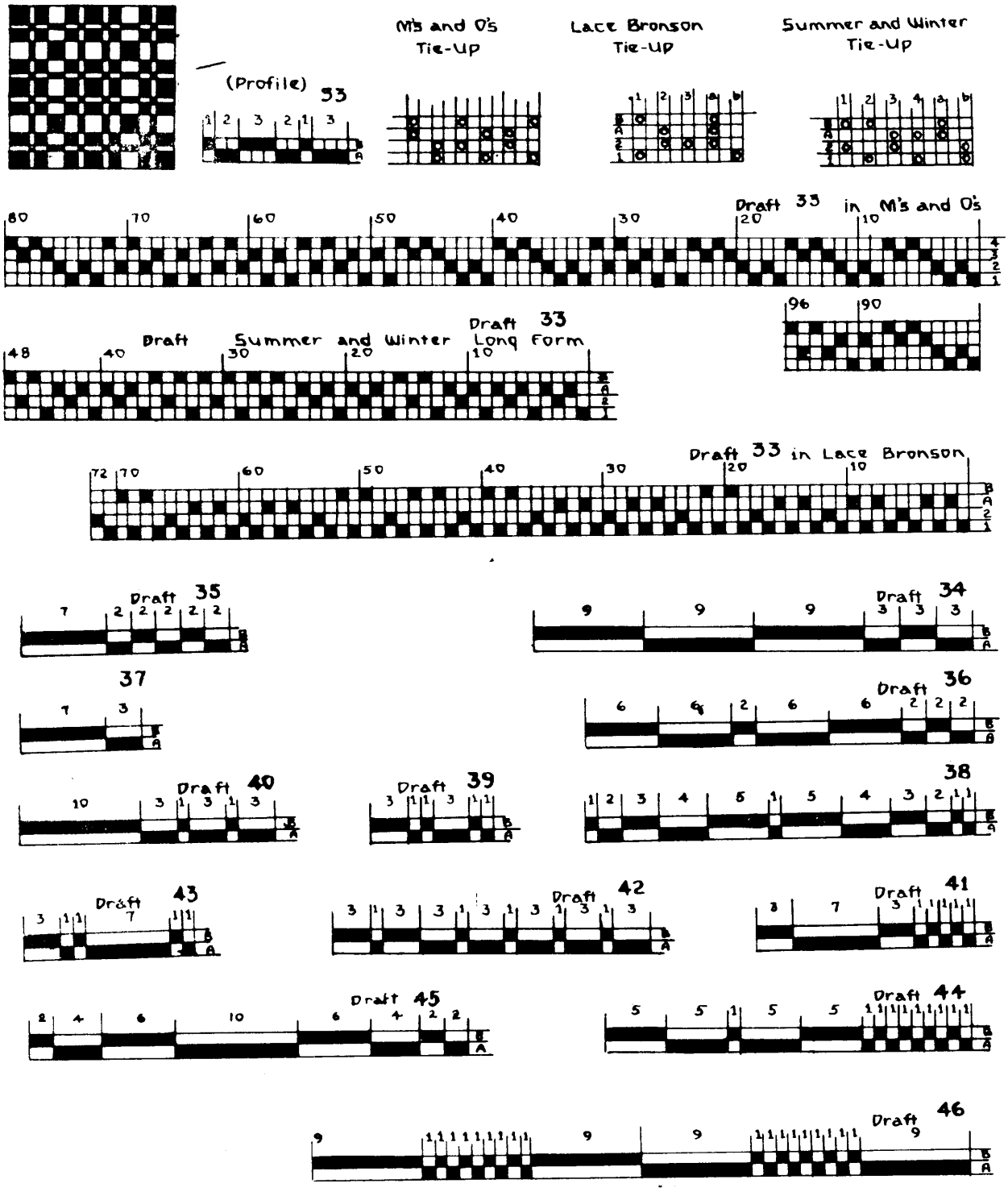


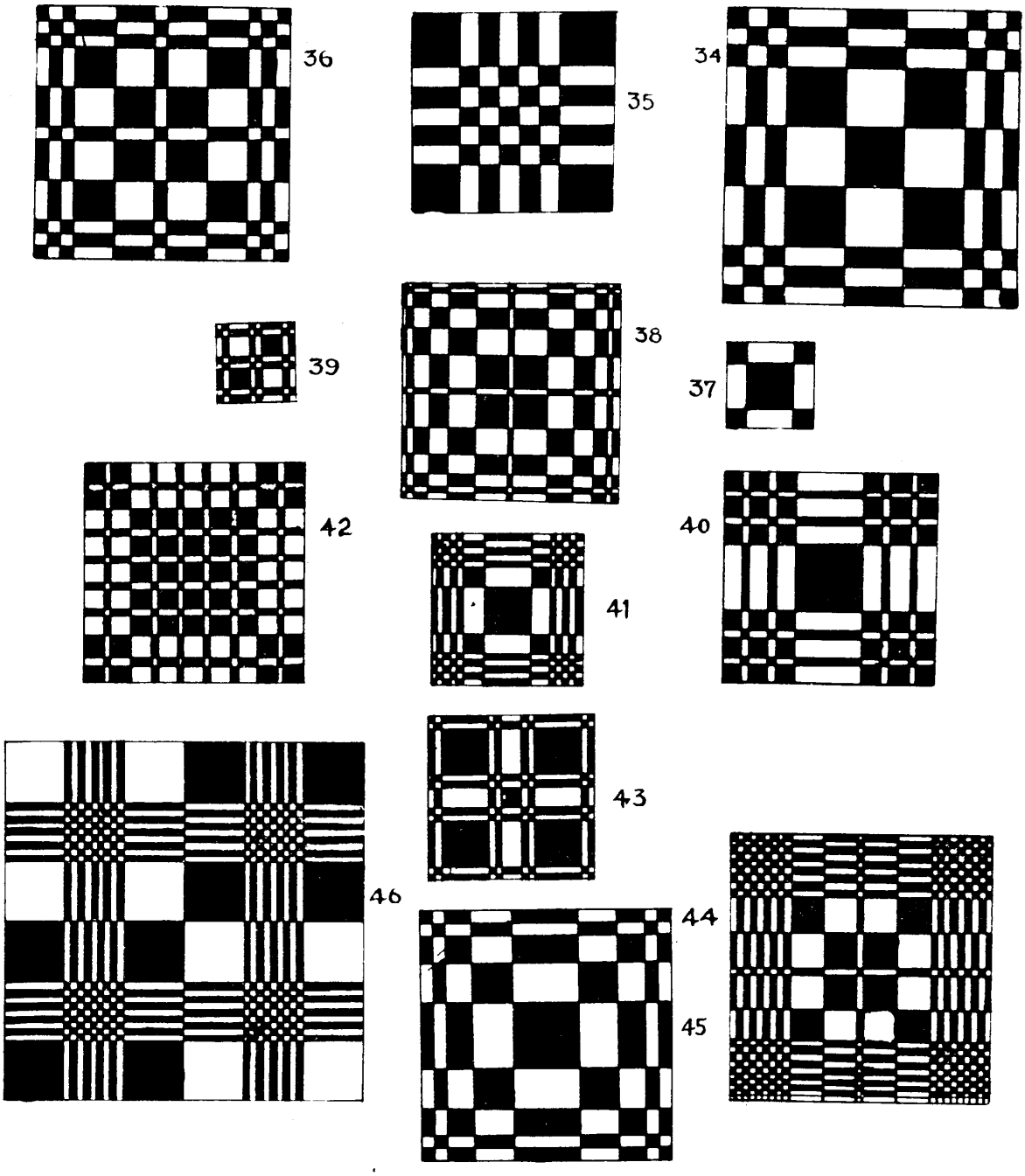


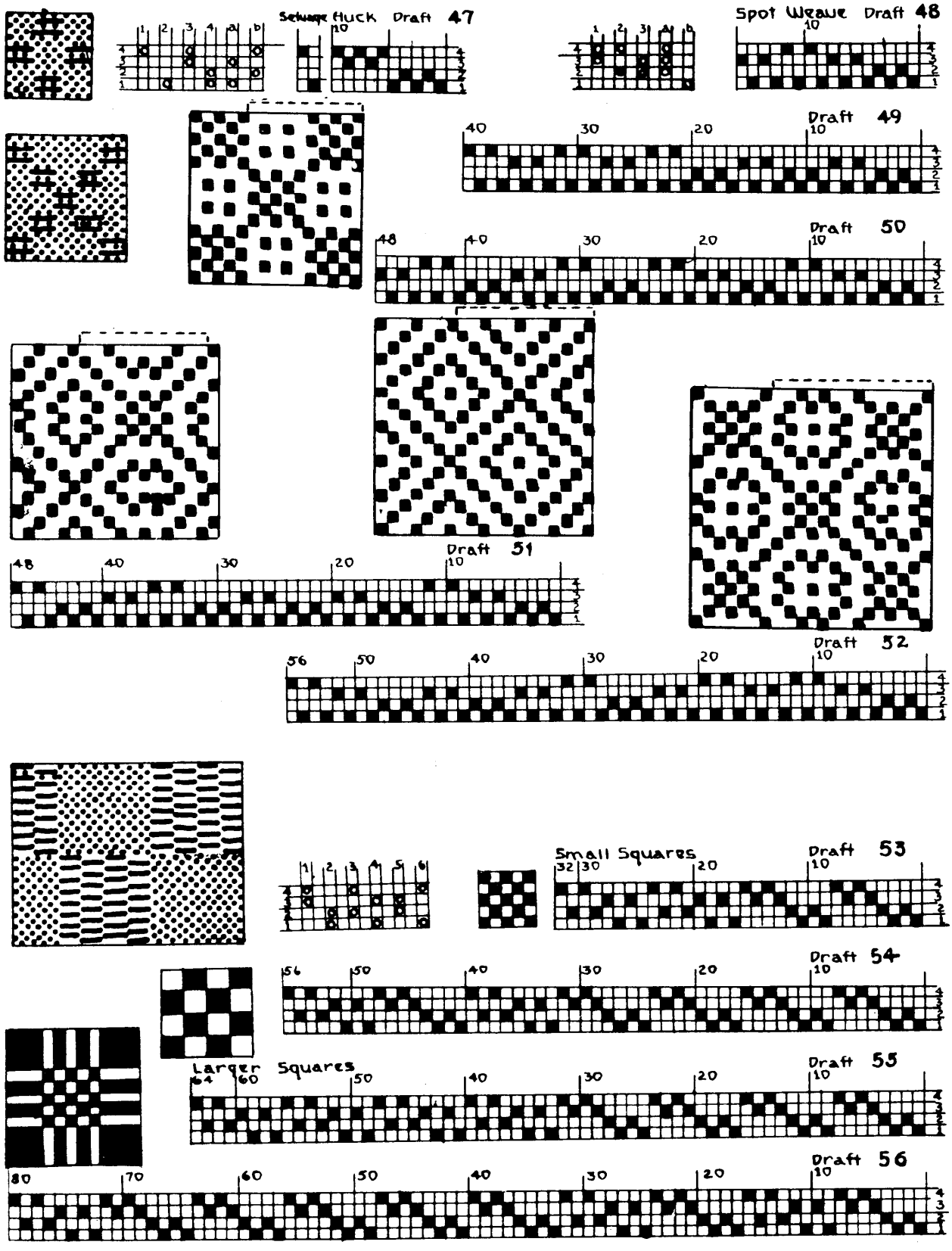
Draft 26



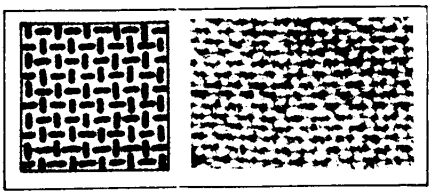

Draft 27
78 76 70 60 50 40 30 20 10
Draft 28
80 70 60 50 40 30 20 10
Draft 29
84 80 70 60 50 40 30 20 10
Draft 30
54 50 40 30 20 10
Border for Draft
22 20 10
Draft 31
82 80 70 60 50 40 30 20 10
32
32 30 20 10
27
30
31
28
29
32


(Profile) 33
M's and O's Tie-Up
Lace Bronson Tie-Up
Summer and Winter Tie-Up
Draft 33 in M's and O's
Draft Summer and Winter Long Form 33
Draft 33 in Lace Bronson
Draft 35
Draft 34
37
Draft 36
Draft 40
Draft 39
38
Draft 43
Draft 42
Draft 41
Draft 45
Draft 44
Draft 46


36
35
34
39
38
37
42
40
41
43
46
44
45

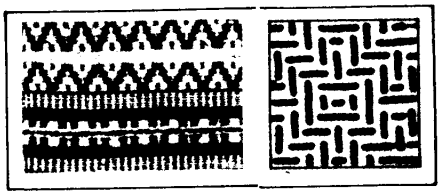

Seluage Huck Draft 47
Spot Weave Draft 48
Draft 49
Draft 50
Draft 51
Draft 52
Small Squares
Draft 53
Draft 54
Larger Squares
Draft 55
Draft 56

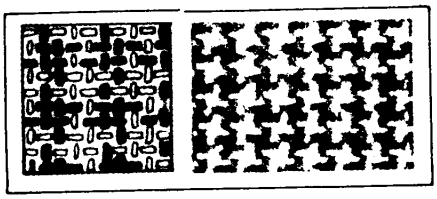
TECHNIQUE ANALYSES



Tabby

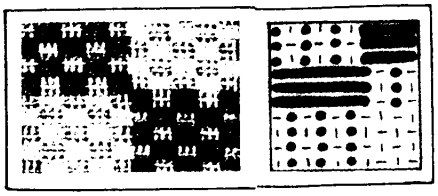
Rosepath

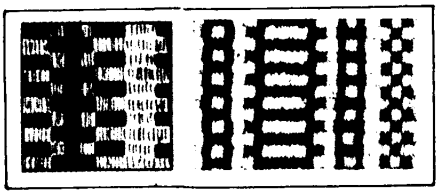




Shepherd's Check

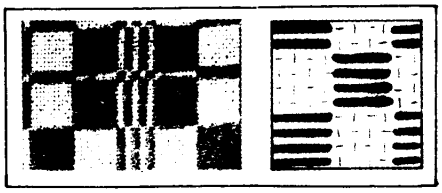
Overshot

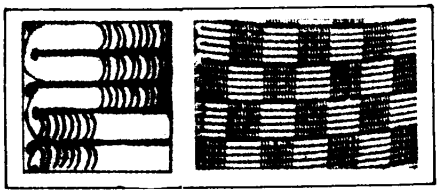




Warp Pattern

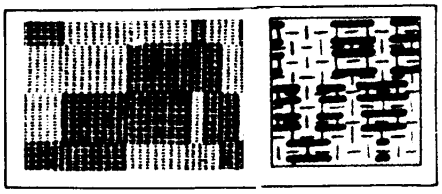
Overshot
(on Opposites)

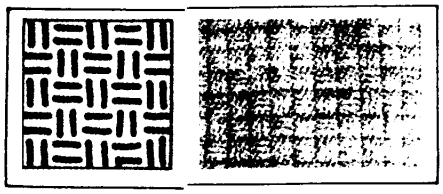




Warp Pattern
(Weft Cord)

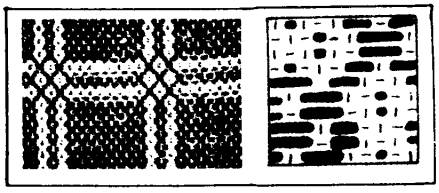
Crackle Weave

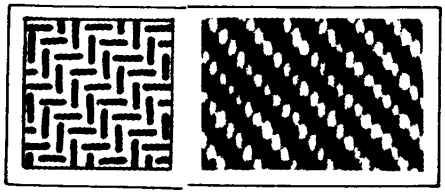




Basket Weave

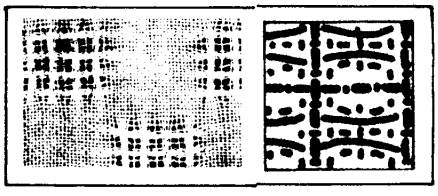
Summer and Winter

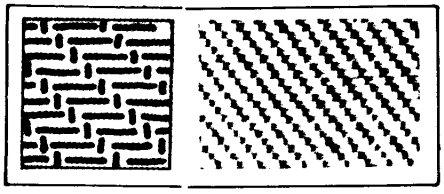




Twill (2-2)

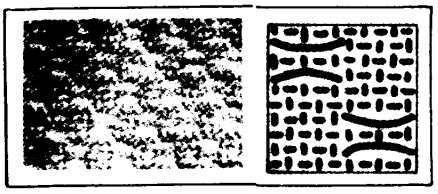
Lace Bronson

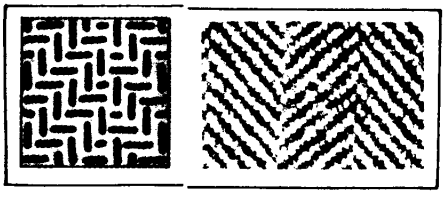




Twill (3-1)

Spot Weave





Dornik
Herringbone

M's and O's