PETER COLLINGWOOD

The Techniques of Rug Weaving

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I.
Weft-face rug in wool
and horsehair on linen warp,
using the shaft shifting
principle applied to a
Four-Shaft Block Weave,

see page 327

(designed by the author)
and woven by Jill Maguire.

THE TECHNIQUES OF RUG WEAVING

Peter Collingwood

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To the late Alastair Morton

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Preface

This book is written from the point of view of a professional, not a hobby, weaver. Most readers will fall into the latter category, more through lack of time and opportunity than through any lack of ability. But it is hoped they will agree that the one-rug-per-year weaver should aim as high, both in design and technique, as the weaver who makes one or two a week. Many ideas, methods and attitudes only occur to the weaver who lives with his work. Complete control over and insight into a technique often comes only after it has been repeated many times. It is one of the purposes of this book to pass on this sort of knowledge.

The possibilities in rugweaving are immense. It may seem at first to have very obvious boundaries; but greater familiarity forces these to recede and eventually disappear, until finally the field of possibilities is seen to be so vast that the difficulty becomes one of selection. To describe these techniques in an orderly way, I have had to adopt an arbitrary sequence. It moves mainly from the simple to the complex, from few shafts to many shafts, from one weft to many wefts, but this does not mean that the techniques occurring early in the book are necessarily the easiest, or vice versa. Often a weave of complex construction, using many shafts, is simple in the actual weaving.

Because some of these techniques are original and others have no names, I have had to christen many of them for ease of reference. I have endeavoured to use descriptive rather than fanciful names, being grateful to the clear-headed lead given in this direction by Irene Emery in *The Primary Structure of Fabrics*, and to helpful advice from Harriet Tidball.

Most of the samples photographed have been especially woven in contrasting colours in order to illustrate their structure. Some are the work of students to whom I am very grateful.

The diagrams have been drawn solely to convey information. To this end various aspects have had to be distorted, such as relative size of warp and weft. It is hoped that this will be thought justified by the resulting clarity.

Once or twice in the course of writing this book, I have wondered whether by being too explicit I was not perhaps robbing the readers of the pleasure of personal discovery. But the thought has been banished when I realized its implicit arrogance—that the book contained all there was to discover. There is of course a great deal more. The information contained in this book can serve as a foundation on which I hope readers will continue to build for some time to come.

The majority of the photographs are by A. J. A. M. van Helfteren, except for
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All the diagrams are by the author.

1 · Equipment for Rug Weaving

1. THE LOOM

A. Rug looms in use today

INTRODUCTION

Weaving is the interlacing of two sets of threads, the active weft crossing the passive warp at right angles. For the easy manipulation of the warp and the easy beating down of the weft, it is essential that the warp threads be kept under tension. Basically, a loom is nothing but a device to produce this necessary warp tension; indeed some simple rug looms do very little else. All the complexities that have been added to the loom are only to save time or effort or to make intricate weave structures possible. They do not alter the fundamental function of a loom as a warp-stretcher.

At least four different ways are still used to achieve this tension:
the horizontal ground loom, in which the warp is stretched between two beams, fastened to pegs in the ground.
the warp-weighted loom, in which weights are attached to a vertically-hanging warp.
the horizontal and vertical frame looms, in which the warp is stretched between two beams, which are themselves part of a rigid horizontal or vertical framework.
the back-strap loom, in which the warp is stretched between the weaver's body and some fixed point.

All except the last method are used for rug weaving and will be described in detail.

(i) THE HORIZONTAL GROUND LOOM

The very earliest portrayal of any loom shows a horizontal ground loom. It is a drawing inside a shallow dish from the Badarian civilization in Egypt, and is dated about 4400 B.C. Many details can be plainly seen, including the four pegs at the corners, three picks of weft and some cross sticks, presumed to be a shedding mechanism.

The earliest representation of this loom being used to weave a floor-covering is more recent and is found in one of the famous Beni Hassan tomb paintings, dated about 1900 B.C. A stiff weft, possibly rush, is being woven and is seen protruding at

the selvages. The weaver squats on the part already woven. Of about the same date is a small wooden model of a weaver's workshop, found at Thebes in Egypt, which includes a loom of this type, at which two weavers sit.

Today the horizontal ground loom is used by nomads, such as the Bedouin in Jordan and the Kashkai in Persia, as its portability makes it ideal for their way of life. At any point in the weaving of a rug, the pegs can be uprooted, the completed section of the rug, plus the warp, rolled up on one of the beams and the whole loaded onto a camel. Such nomads weave kilims, flidjs (strips of goathair material for tent making), warp-face rugs, the decorative saha and even knotted rugs. But the simplicity and cheapness of the loom commend it to more static weavers, such as the weavers of durries (cotton kilims) in India and many others.

The warp is wound in a continuous figure-of-eight between the two beams, see Fig. 1. Its tension can be adjusted by altering the lashings between the two beams and

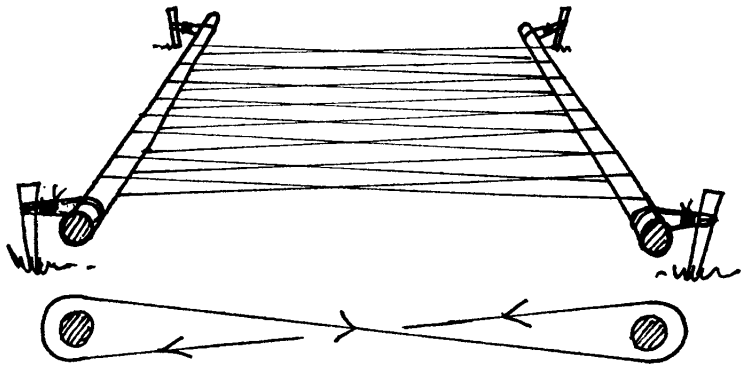

Fig. 1. Horizontal Ground Loom

the four pegs. The two sheds are obtained by means of a shed stick and leashes. The shed stick takes an over-one-under-one course through the warp, and the leashes encircle each end that passes under this stick. The leashes are generally made from a continuous thread and are attached to a rod as they are made. One shed is obtained by twisting the shed stick on its edge or if it is a thick rounded stick by pulling it towards the weaving. The counter-shed is obtained by raising the rod to which the leashes are attached and pushing the shed stick away from the weaving. Some provision may be made for holding the leash-rod in its raised position, such as posts or a pile of stones on either side of the warp. Sometimes the weaver erects over the loom a large wooden tripod, from which is suspended the leash-rod. The weaver sits or squats on the completed part of the rug and so works in a rather cramped position.

(ii) THE WARP-WEIGHTED LOOM

The warp-weighted loom is first portrayed on a Greek vase of about 600 B.C.; though a very schematic representation on an earlier urn from Oedenburg, Hungary, may also be of this loom. But traces in the shape of loom weights and post holes are found from as early as 2500 B.C., for example, at Troy. It is on this loom that the Neolithic and Bronze Age fabrics were woven in Europe. From that time to the present day the loom has been in use, in a practically unchanged form. It now only survives in Scandinavia. A settlement of Lapps in northern Norway still use it for the production of *grene*, flat-woven woollen rugs.

For a very full account of this loom, see *The Warp-Weighted Loom* by Marta Hoffman.

(iii) a. THE VERTICAL FRAME LOOM

At its simplest the vertical frame loom consists of a rectangular framework, an upper and lower beam between which the warp is stretched and two side pieces. The latter hold the two beams apart, thus taking over the function of the ground in the horizontal ground loom.

Its earliest portrayal is in a tomb painting at Thebes of about 1400 B.C. Two centuries later, the tomb of the head weaver of Thebes was similarly decorated. In Europe, drawings of the loom first appear around A.D. 1000, generally as illustrations in psalters, Bibles, etc.

The vertical frame loom has always been the type most favoured for weaving knotted rugs. It is easy to knot onto a vertical warp. The rug fork can be used to full advantage in this position. The fact that the weft has to be slowly passed, not thrown, through the shed is immaterial, as this takes up such a small proportion of the total weaving time. Its very simple design lends itself to the building of massive looms on which the largest carpets can be woven in one piece.

It still exists in three forms, which in the order they are described below would seem to present a possible line of development.

(i) With warp arranged in a continuous figure-of-eight between the two beams.

This is just the horizontal ground loom upended, see Fig. 2 (a). It has three disadvantages; the weaver's bench has to be raised as the work proceeds, the weaving becomes progressively more difficult as the upper beam is approached, and the rug can be no longer than the loom is high. The contemporary Navajo loom is a refinement of this type.

In this and the following type, the warp is given its final tightening by driving wedges between the lower beam and the sockets cut for it in the side pieces.

A variation of this type has nails or pegs in the upper and lower beams and the warp is carried around these instead of around the beams themselves.

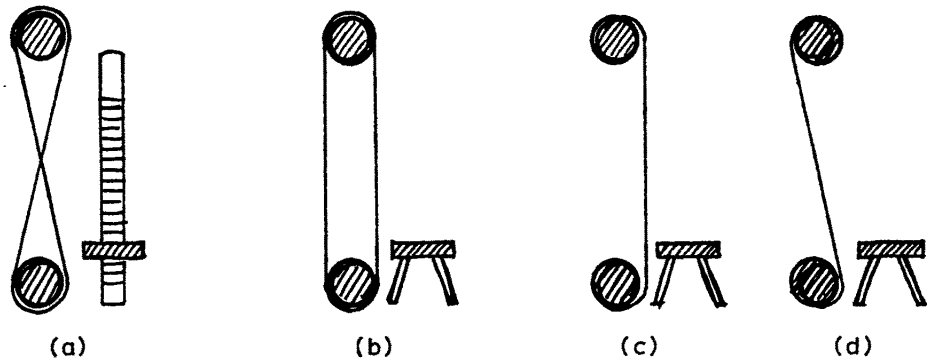

Fig. 2. Types of Vertical Frame Loom

(ii) With warp arranged in a continuous spiral around the two beams.

Only the layer of warp nearest the weaver is woven in this type, see Fig. 2 (b). After every foot or so of weaving, the tension of the warp is slackened and the warp slipped round the two beams and re-tensioned. Thus the weaver can work at one level and the carpet can be almost twice as long as the loom is high.

When beating the weft, there is a tendency for the warp to slip as it is only held by the friction between it and the two beams. This can be overcome if a stick, woven in with the first few picks, is tied to one or other of the beams to prevent this movement.

Warp-face rugs are often woven on this type of loom.

(iii) With warp wound round upper beam and the carpet rolled onto lower beam.

With this type, see Fig. 2 (c) and (d), there is no longer any limitation on the length of the rug that can be woven and, having two revolving beams, it lends itself to far more sophisticated ways of adjusting warp tension. As Fig. 2 (d) shows, the warp can be tilted away from the weaver, giving a more comfortable working angle, if it is wound in the opposite direction on the upper beam.

This loom exists in very many forms, from the relatively light upright rug loom sold to handweavers, to massive looms which have to be built into a workshop, some of which can weave carpets up to 48 feet wide. They all have two features in common, great strength to withstand the high warp tension and some mechanism for producing and adjusting this tension. These two features are somewhat at variance with each other, because the greater the diameter of the two beams, the more difficult it is to exert enough force on them to tighten the warp. This can ideally be solved with metal gearing, but on more primitive looms levers have to be used. Fig. 3 shows one solution from an eighteenth-century French workshop. From the end of a long lever, attached to the upper beam, a rope passes to a winch on a nearby wall. The latter is tightened until the warp tension is correct and then the long lever is lashed to the side frame. Fig. 4 shows another method in which levers from upper and lower beams are connected by chain and turnbuckle. Tightening the latter naturally tightens the warp.

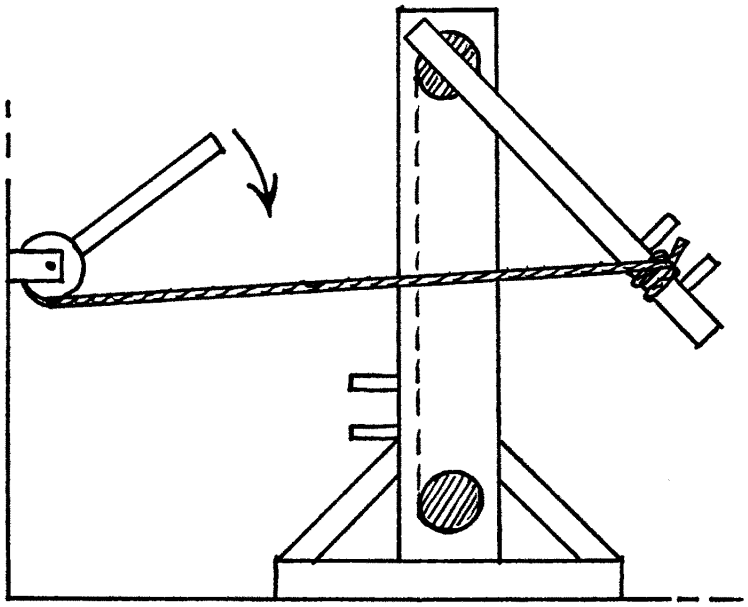

Fig. 3. Eighteenth-century French method of tightening a rug warp

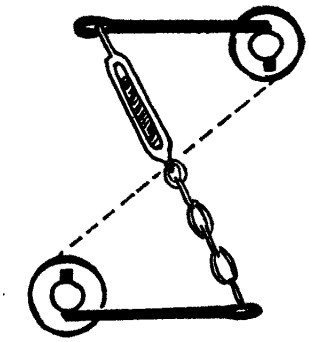

Fig. 4. Twentieth-century Yugoslav method of tightening a rug warp

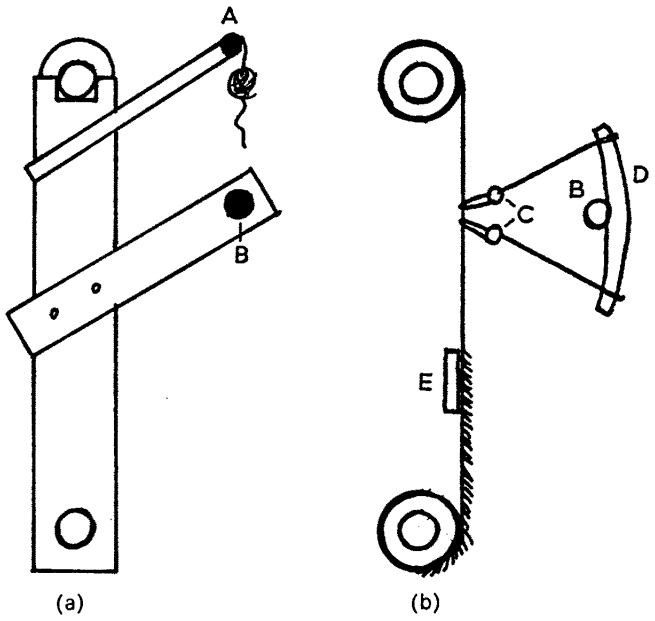

Fig. 5. Typical Vertical Frame Loom

Fig. 5 (a) shows the side view of a typical primitive loom of this type, as found in India and Persia. The massive side frame is seen, with a socket at the top for the warp beam and a hole at the bottom for the cloth beam. The upper arm supports a rod, A, that stretches the width of the loom and from which are hung bobbins or balls of wool for knotting. Sometimes the bobbins are put on pegs on a board that is similarly placed. The lower, much heavier, arm supports a very strong pole, B, that also stretches the width of the loom. Two leash-rods, C, are used, each with its set of leashes, see Fig. 5 (b). These can be thought of as two very primitive shafts; pulling one forward raises the even numbered ends, pulling the other forward raises the odd-numbered ends. At several points across the width, a cord from each rod goes to either end of a strong stick, D, which lies vertically, hard up against the pole, B. This is comparable to a heddle horse on a horizontal loom. By manipulating it, one or other of the leash-rods can be pulled forward. E is a temple on the back of the rug. One advantage of a vertical frame loom is that a temple can easily be inserted in this position, where it does not interfere with the knotting.

Although the above loom has been described as typical, there is an infinite variety among vertical frame looms used for rug weaving, many depending on what material is locally available and almost all involving a good deal of improvisation.

At first it can be a little shaming to a Western weaver to realize that rugs of unequalled beauty and quality have been, and are being, produced on such simple looms and he may wonder which parts of his gadget-loaded loom are really essential. But when the element of time is taken into consideration, most additions to the present day hand loom become justified, as time-savers.

The vertical frame loom has probably reached its highest development in Holland. See Fig. 6 which shows a diagrammatic side view of this all-metal loom. Each warp

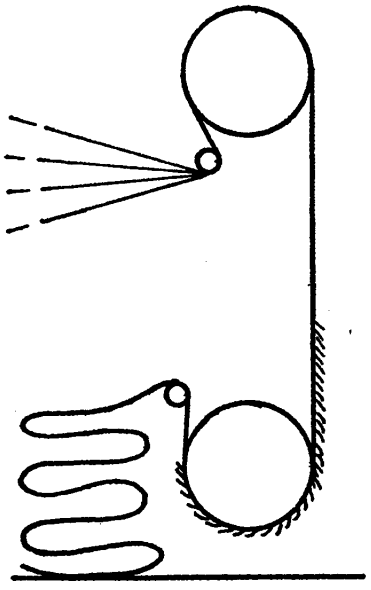

Fig. 6
Dutch Vertical Frame Loom

end comes from a separate bobbin held in a creel (not shown) which is part of the loom. These ends pass under a metal bar and then over the upper beam. The latter has a specially roughened surface, so that the warp is gripped through contact with its large circumference and cannot slip. The warp then drops vertically to the lower beam, which is covered with small spikes so that it grips the back of the knotted rug. The latter then passes over a bar to lie in folds on the floor behind the loom. Both beams are turned by gear wheels, the lower having a worm gear. The two strong shafts are moved by chains controlled by a metal wheel at the side of the loom. The shed obtained is so deep that a whole ball or tube of weft can literally be thrown across. A reed is used for spacing the warp but the weft is beaten with a heavy rug fork. As will be understood, this loom banishes any warping problems and makes possible the weaving of rugs of any length or shape without their building up on the cloth beam. A rug is started by tying the warp to a stick which is attached to an apron impaled on the spikes of the cloth beam.

Between the two extremes of the primitive Indian loom and the highly developed Dutch loom, comes the vertical rug loom as sold to handweavers. It has two shafts operated by pedals, which may be duplicated if the loom is very wide, to enable several weavers to work side by side. Exceptionally, four shafts are fitted. It has a batten which may slide on runners on the side frame or may be pivoted at the back. The batten is generally held up by springs but the back-pivoted type may have its swords prolonged backwards to support a counterweight. This is preferable as the weaver does not have to beat against the pull of the springs. Sometimes the batten is held up by a catch which is released by pressing a third pedal. It then falls with its own weight and has to be lifted back to engage with the catch.

(iii) b. THE HORIZONTAL FRAME LOOM

The horizontal frame loom has now become the normal type. It has many advantages; the shafts, which can be of any number, are operated by the feet, leaving the hands free: the shuttle can be thrown easily from side to side of a wide warp: there is a superstructure from which to hang a batten and the working position is comfortable.

From the evidence of surviving textiles, this loom was known in Syria before A.D. 256. It is first mentioned in European sources in about A.D. 1100 and it is generally, and conveniently, assumed to have first appeared in Europe around A.D. 1000. It then quickly supplanted the warp-weighted loom and was the mainspring of the terrific expansion in the cloth trade that followed. The earliest pictures of the horizontal frame loom date from the thirteenth century. Some of these look like horizontal ground looms on stilts, i.e. there is very little frame-work above the warp level and the pulleys for the shafts are sometimes shown attached to the workshop ceiling. In the early examples the reed was very light and was either not attached to the loom or hung on cords. In either case, it was the weaver who had to ensure that the beat was straight.

Later, when a heavier frame was built (and this was nearly always of the four-poster type), a proper rigid batten was hung from it. The harness always consisted of pulleys. Small pedals, sometimes no bigger than shoes, were tied directly to the lower half of each shaft. It is obvious from examining these pictures that the early horizontal frame loom was not strong enough for rug weaving.

Later looms became sturdier and the typical peasant loom was evolved on which could be woven all the textiles required by the household, from fine linen sheets to heavy rugs. The latter would be flat-woven, either weft-face, or warp-face, or woven with a rag weft. The vertical frame loom was still regarded as the proper type for knotted rugs.

This division still exists in the East where, as already mentioned, almost all knotted rugs are produced on the vertical frame loom, but flat-woven rugs are produced on the horizontal ground loom or horizontal frame loom. The latter sometimes has two

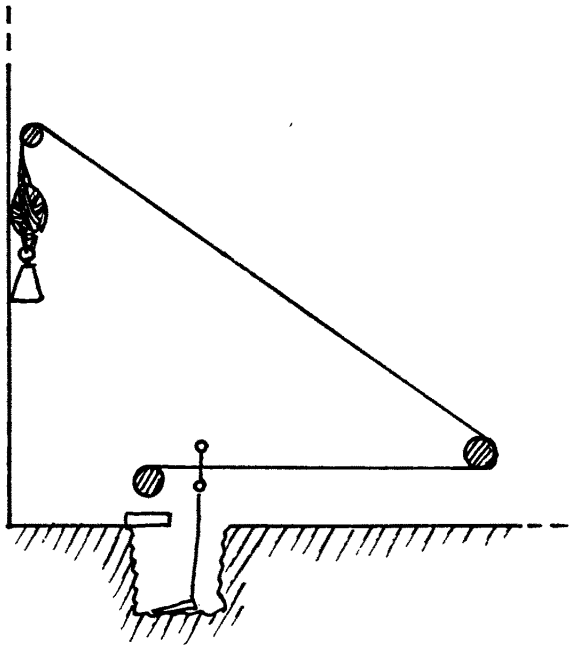

Fig. 7
Middle Eastern pit-loom for rug weaving

special features. The warp is almost at ground level and the weaver sits on a plank across a specially dug pit, with his feet in this pit working the pedals, see Fig. 7. The warp passes under the back beam and then up over a bar or hook on the wall above the weaver's head, to end in a ball or chain of warp. To the latter is attached a heavy weight. When the warp is turned on, a little more is let off the ball. Thus the warp is never beamed and small adjustments to tension can be made as weaving proceeds.

It is in Scandinavia that the horizontal frame loom has become most accepted for weaving both pile and flat rugs. This may have a historical basis. The earliest written

record of Scandinavian pile fabrics is in a MS. of 1451, and these together with those subsequently mentioned are all bed covers. So although the structure was basically similar to that of knotted Eastern rugs, they were not thought of as rugs, and it was natural to weave them on horizontal looms. Later, when they were woven in a heavier form suitable for the floor, the same loom was used.

In Great Britain, the newly developed techniques such as Wilton (cut warp pile), Brussels (uncut warp pile), Kidderminster (plain weave double cloth) and Chenille rugs were all originally woven on hand looms. These were exceedingly heavy horizontal frame looms of the four-poster type. Sometimes the whole frame was of metal. The Brussels carpet loom had a drawloom mechanism and the leashes controlling the various sheds were pulled by a drawboy standing at the side of the loom. He also had to insert a wooden 'sword' to hold open the shed so formed. The weaver then inserted a wire into the shed, the drawboy withdrew the sword and the weaver wove some picks of weft. It was essential to keep the number of pile tufts per inch constant, so that the pattern would match on two strips of carpet sewn edge to edge. So a bell was made to ring after the number of tufts that should exist in a quarter yard had been woven. The weaver could then measure his work and either repeat the last row of pile or omit a row, if he had woven less or more than nine inches from the last point the bell rang. A weaver could produce about five yards a day on this loom, compared with the twenty-five yards produced by the earliest power-driven Brussels carpet looms.

B. The Requirements of a Modern Horizontal Rug Loom

The two essentials for rug weaving, a high warp tension and a heavy beat, dictate most of the features in an ideal rug loom.

(i) THE LOOM FRAME

The loom frame must be exceedingly strong. This applies especially to all cross members, i.e., warp and cloth beams, breast and back beams, knee bar. They have to be completely rigid, for if each of them gives at its centre even a fraction of an inch, the result will be a progressive slackness of the warp towards its centre. Obviously the wider the loom, the stronger these parts must be; and to avoid woodwork of immense and cumbersome proportions, metal should be introduced appropriately on very wide looms. If the batten is overslung, the upper part of the loom frame must be strong enough to support the extra weights fixed to the batten for rug weaving.

The length from front to back of the loom should be as great as possible. This enables the sheds to be easily made although the warp is at high tension. The apparent length of the loom can be increased by having a back beam that can revolve or is made of polished metal. Then the fixed end-point of the warp threads is the warp beam itself, and the threads can move slightly around the back beam when a shed

is opened. The length from breast beam to the front shaft should be about twenty inches to allow a good weaving space.

(ii) THE CONTROL OF WARP TENSION

The warp and cloth beams are generally controlled by pawl and rachet wheels. A ratchet wheel with a few large teeth is adequate for the warp beam. But for the cloth beam a much finer adjustment is necessary, especially when an inelastic warp like linen or hemp is being used.

The ideal is for the cloth beam to be furnished with a toothed wheel which meshes with a worm operated by a crank handle. A more usual way is to add an extra pawl to the existing ratchet, in such a position that when one pawl engages with the ratchet, the other pawl is halfway between two teeth, see Fig. 8. In this way the ratchet gives

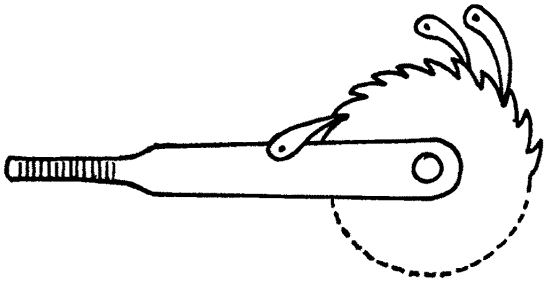

Fig. 8
Lever for turning cloth beam; also showing ratchet with two pawls

as much adjustment as one with twice as many teeth. Sometimes the same principle is used, but with a pawl and ratchet at each end of the cloth beam.

Some way has to be found of applying sufficient force when tightening the cloth beam. A turning handle with spokes is the usual device, but it should have more than two spokes, otherwise it will often happen that these are awkwardly placed for applying force. With any spoked handle, the weaver's knee may have to be used, pushing down on a spoke on one side of the handle while the hands pull up a spoke on the other side. The knee also helps when one hand has to be free to disengage the pawl when releasing tension. A good way of applying force is the lever shown in Fig. 8. This is a metal or wood strip with a handle at one end and a hole at the other through which passes the cloth beam's axle. A pawl is attached to it, engaging with the ratchet, so as this lever is pumped up and down the cloth beam is turned. The longer the lever, the greater the force that can be applied.

Because of the high warp tension, there is a great strain thrown on the fixings of the pawl and ratchet. The former should be bolted, not screwed, to the loom frame. There are many ways of fixing the latter. Screwing the ratchet into the end of the cloth beam, see Fig. 9 (a), is not very satisfactory, as the screws go into the end-grain

of the wood and will eventually tear out. This type of fixing can be greatly strengthened by bolting two heavy metal angle-pieces as shown in Fig. 9 (b). Sometimes the ratchet is itself attached to a metal sleeve which slides over the end of the beam and is screwed into position, see Fig. 9 (c). Another method is to screw the ratchet to the centre block of the turning handle, see Fig. 9 (d). This obviously necessitates a thick axle as shown; it has the advantage that the ratchet is outside the loom frame and so is not in the way when weaving at full width.

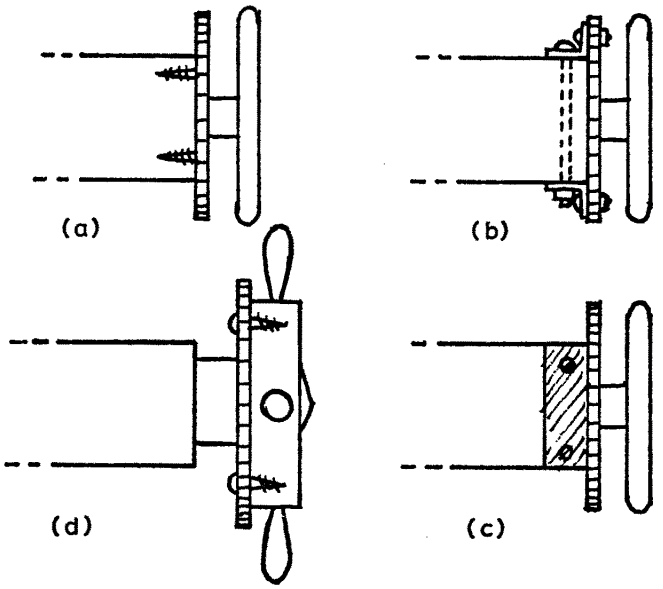

Fig. 9. Methods of fixing ratchet to cloth or warp beam

(iii) THE BATTEN AND THE REED

The ability of the batten to compact the weft depends on its momentum when it strikes the fell of the cloth. Its momentum is simply the product of its speed and its weight. In other words, the heavier it is, the slower it need be swung to produce a given effect. Conversely, a light batten has to be swung with great speed to produce the same effect. The matter is not quite as simple as this because the batten is not swinging freely, but has the added pull of the weaver. It is however true that a batten must be specially weighted for rug weaving. On the old Wilton hand looms, the whole of the batten, except for the part gripped by the hand, was of metal; this is the sort of weight to be aimed at.

Metal strip, $\frac{3}{8}$ or $\frac{1}{2}$ inch thick, is suitable. Fig. 10 (a) shows how it can be fixed to the underside of the batten, with a bolt at each end. To avoid it whipping when beating, bend the strip into a very slight bow and bolt it with the convex curve uppermost.

Fig. 10 (b) shows an alternative method. Two strong angle brackets are screwed to the batten as shown and the strip fits tightly between the front of the batten and the vertical arms of the brackets. As different widths and types of rug require different weights, it is advisable to have two strips both the full length of the batten but one strip half the width of the other and therefore half the weight. Then by using them singly or together, three different weightings of the batten are possible. As an example, the wider strip for a 5 foot wide batten might weigh about 22 lb.

Horizontal rug looms are made with either overslung or underslung battens; the majority of the large professional looms have the former type.

Because of the heavy beat, a rug loom has to be fastened to the floor to prevent it

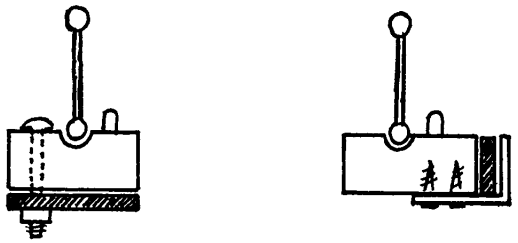

Fig. 10. Two methods of adding extra weight to the batten

slipping. A pad of foam rubber under each corner post is a simple expedient, but something more permanent is preferable, such as floor blocks. To prevent distortion and weakening of the frame of a four-poster loom, brace the upper part against nearby walls.

As with everything else in rug weaving, the reeds need to be especially strong. Most manufacturers have a range of different gauge metal for the wires and the thickest gauge, suitable for the required dentage, should be chosen. Normal reeds can be used, but if for example a rug warp is spaced out in 12-dents-per-inch reed, the latter will become so distorted after a few rugs have been woven that it will no longer be fit for normal fine weaving. Remember that if a reed is being specially ordered, it does not need to have a whole number of dents to the inch. It could, for instance, have 3½ dents per inch. There is a considerable difference between a setting of 3 and 4 ends per inch and it is useful to be able to bridge the gap in this way.

(iv) THE SHEDDING MECHANISM

Because a highly tensioned and often inelastic warp is being used, it is far easier to obtain a given depth of shed with a system that raises some shafts and lowers others

than with one that only raises shafts. In the former, the shafts have only to move two inches above or below the normal warp line to give a four inch shed; in the latter, they have to move four inches above the line. In other words, a counterbalanced or countermarch loom is very suitable. When at rest, the shafts of a jack loom are so positioned that the heald eyes are below the line from breast to back beam. To keep them in this position, when a highly tensioned warp is being used, they have to be specially weighted. Otherwise they will rise and decrease the depth of the shed.

The countermarch loom has the advantage that any number of shafts can be used and a perfect shed is obtained however many or few shafts are lifted at a time. Its drawback is the amount of tying up required. But this can be greatly simplified as in the Cyrus loom or by using the method described in the *Quarterly Journal of the Guilds of Weavers, Spinners and Dyers, number 49.*

All the cording connected with the shafts, lams and pedals should be of thick loom cord or it can be replaced where possible with chains.

String healds are best as every kind of warp can easily be threaded through the eyes. If only weft-face rugs are to be woven, then the normal wire healds are adequate.

(v) THE PEDALS

Pedals pivoted at the back of the loom are better than those pivoted at the front, because of the force needed to open the shed, especially with a wide warp.

(vi) APRON, FRONT AND BACK STICKS

A strong canvas apron from cloth beam to front stick is preferable to cords. Cords strong enough for rug weaving would have to be very thick and therefore tend to build up unevenly on the cloth beam. Whatever is used, make sure it is long enough. (See Marking the Length and Viewing the Rug in Chapter 3.)

Front and back sticks should be of metal, especially if the loom is wide. The front stick must be very strong if a narrow rug is being woven on a wide loom, as there is a tendency for the central pull of the warp to bow the front stick and thus curve the starting edge of the rug.

(vii) THE SEAT

A bench seat that is part of the loom and stretches its full width is preferable to a separate stool. It provides a useful shelf while weaving, but it really comes into its own when knotting a wide rug or weaving a kilim, when the weaver does not only want to sit centrally. Some looms have the added refinement of a small upholstered trolley seat which runs on wheels along the bench. The height of the bench should be adjustable.

(viii) PROTECTING THE WOVEN RUG

Some looms are fitted with a narrow strip of wood that rests in slots just in front of the breast beam. This is useful because as the woven rug passes between the strip and the breast beam, it is protected from being rubbed by the weaver as he moves from side to side. See Fig. 11. The underside of the rug, as it passes from the breast beam to the knee bar, will collect wool fluff, unless a cloth is fixed as shown in Fig. 11. It can be attached to a metal rod that is fixed to the far under-edge of the breast beam.

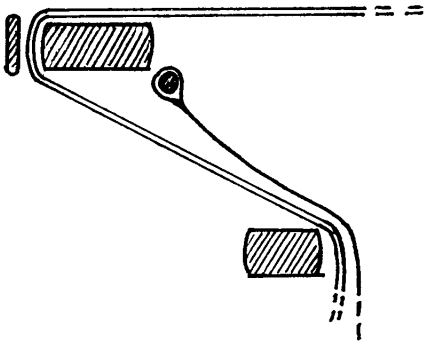

Fig. 11
Methods of protecting the woven rug

(ix) AN EXTENSION FOR DIFFICULT WARPS

Some warps are very difficult to manage on a normal warp beam, e.g., sisal and coconut yarns. The following simple extension to a loom makes their use very easy; it also 'corrects' a badly-made warp of any material.

Fig 12 (a) shows the side view of a loom. Two strong wooden beams, A, are bolted to the side frame, as shown, a little below the warp line. At their far end, they each have a small upright, B, to support their weight. C is a cross bar that fits between the

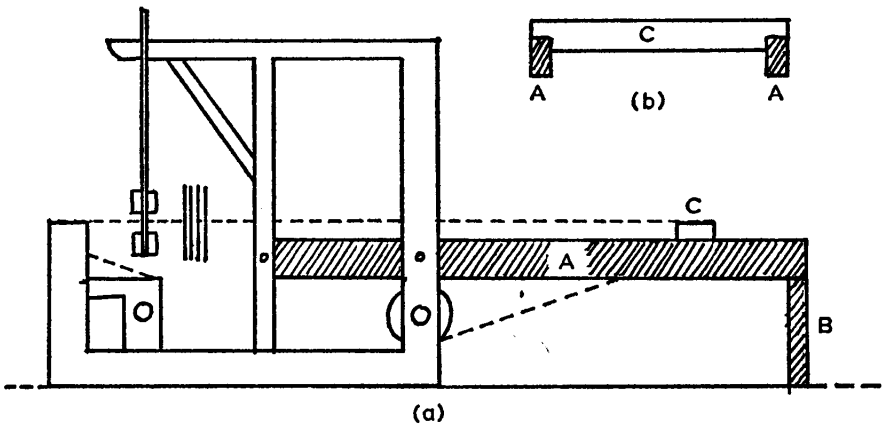

Fig. 12. An extension to the loom for difficult warps

two beams and can slide along them. See Fig. 12 (b). Some device such as large clamps (not shown) are used to fix the cross bar in any desired position. The top of each beam is marked off in inches.

The warp comes from the warp beam, passes backwards around the cross bar and then forwards into the loom as shown. Whenever the warp has to be turned on, the cross bar is simply moved the appropriate distance towards the loom. The warp beam is not touched throughout the weaving. If the beams, A, extend, say, 4 feet beyond the loom, then a rug nearly 8 feet long can be woven. As long as the initial tying to the front stick is accurately done, the warp tension will be perfect throughout the weaving, because the total length of required warp is exposed.

A one-rug warp need not be beamed. One end can be looped round the back stick on the warp beam to tether it and the rest carried round the sliding cross bar as described.

To ensure that threads lie parallel, pass a raddle down the warp before starting to weave.

From the above description of an ideal rug loom, the weaver will know whether his own loom is adequate and, if not, where and how it should be strengthened. To withstand the high warp tension and heavy beating, a rug loom should look *unnecessarily* strong.

(x) VERTICAL AGAINST HORIZONTAL FRAME LOOMS

The vertical rug loom takes up less room,

—is cheaper,

—is slower to operate with weaves in which the weft passes regularly from selvage to selvage,

—generally only has two shafts so makes complex weave structures impossible,

—is specially made for rug or tapestry weaving and so is not suitable for other types of weaving,

—cannot give such a heavy beat, unless a rug fork is used.

2. ADDITIONAL EQUIPMENT

A. Shuttles

For a horizontal loom, a shuttle that will slide easily through the shed is essential and the type generally known as a 'ski-shuttle' is without doubt the best. Two views of this are shown in Fig. 13 (a), with approximate measurements. The weft is wound around the two wooden hooks in a circular manner As the shuttle is only $1\frac{1}{4}$ inches high, it can find its way through a very shallow shed. Also as the tips of the shuttle

curve up to the same level that the hooks curve down, it is impossible for the latter to catch on the warp.

To avoid unnecessary winding and rewinding, at least twelve of these shuttles are needed per weaver. Occasionally sandpaper the shuttle where it strikes the reed, otherwise a roughened, thread-catching area will develop.

A normal throwing shuttle is useful for finer wefts, e.g., plain weave binding picks. The best size is about 14 inches long as this takes a cardboard tube as a bobbin. The type without rollers slides better across the fairly open rug warp than that with rollers.

For a vertical loom, the most useful feature in a shuttle is its length, so that it can if possible be passed from hand to hand, without being poked through the shed. A very long stick shuttle with one end fashioned like a netting shuttle works well, see Fig. 13 (b).

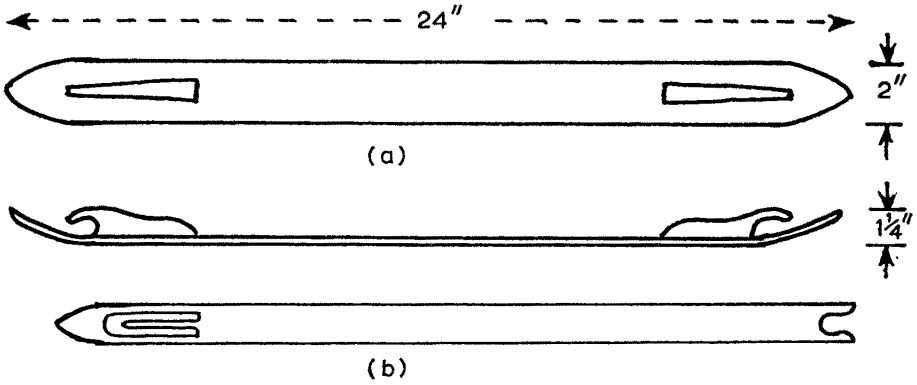

Fig. 13. (a) Two views of a ski-shuttle (b) A stick shuttle

For making narrow samples, stick shuttles notched at both ends or smaller versions of the above are quite adequate.

B. Temples

To make a weft-face rug with really firm and straight edges, it is essential to use a temple from the first woven pick to the last. The temple needs to be of stronger construction than those usually supplied, and the type shown in Fig. 14 (a), consisting of two similarly-shaped halves, is better than the conventional type shown in Fig. 14 (b). One half of the latter, (B), is weaker and tends to bend under the strain of rug weaving. The two halves of the upper type are held together by a bolt, those of the lower type by a pin.

The length of any type of temple should be as finely adjustable as possible. The best way to achieve this, without having so many holes that the temple is weakened, is to use the vernier system. In one half, (B), make holes every $\frac{1}{2}$ inch for the whole of its

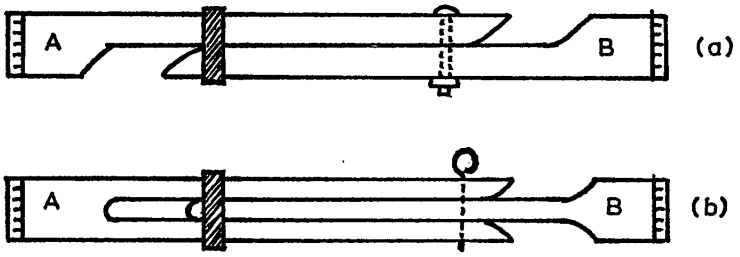

Fig. 14. Two types of temple

usable length. In the other, (A), make just four holes, $\frac{3}{8}$ inch apart, where the bolt or pin is to be. By this means the length of the temple can be altered by increments of $\frac{1}{8}$ inch. It greatly helps inserting the bolt or pin, if there is an incised line, on the upper surface of the temple, over each hole. Such marks on A and B can be aligned and the bolt pushed through.

C. Rug Forks or Beaters

Rug forks are chiefly used to beat the weft on a vertical loom, but they can be used to supplement the batten on a horizontal loom if a particularly close beat is wanted. The fork can weigh $\frac{1}{2}$ to $1\frac{1}{2}$ lbs.

The two essentials in a rug fork are to have weight and to have it in the right place, i.e., as near the tines of the fork as possible. It is an item of equipment that has never become standardized and there are many types. If made of metal, the fork can be cast in one piece from brass, or constructed of strips of metal bolted together at the handle. If made of wood, the fork is generally weighted with lead; or it may have a wooden handle with metal tines. Sometimes the handle is set at an angle to the body of the fork, presumably to facilitate beating.

There is no real need for the number of tines per inch on the fork to correspond with the ends per inch in the warp. Forks are usually made with 3–5 tines per inch. The tines should be smooth and polished to prevent damage to the warp.

D. Yarn Winder

If rug weaving is carried out on any scale, some method of winding yarn, other than into balls by hand, is essential. Most rug and carpet wool is bought in hank form, so the first requisite is a strong skeiner. The wooden umbrella-type skeiner from Scandinavia is adequate and works best if set up so the axle is horizontal. More useful is an expanding metal skeiner as used in industry. This is also set up with its axle horizontal. In addition, it can be used for making skeins from cones and tubes, etc. Remember that carpet wool hanks are larger than normal ones, so make sure the skeiner will expand sufficiently.

The most easily obtainable forms of yarn winder are those made for use with home

knitting machines. These clamp to a table and are worked by hand. The majority wind neat, but small balls. The yarn can be drawn from the centre, so such balls can be placed together in a box and they will not roll about while being unwound. Others are made to wind the normal industrial paper or plastic cones and these are preferable as the cone is the ideal yarn package for the rug weaver.

As ½ to 1 lb. of wool may be needed per square foot of rug, a mechanical winder is a great help. Fig. 15 shows diagrammatically an electrically-driven winder that can be used for cones, tubes and small wooden bobbins.

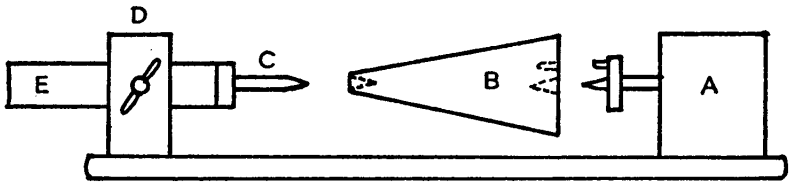

Fig. 15. Electrical yarn winder

A is the electric motor from which the driving axle emerges at the left. This has a tapered point and a disc near its end with a small pin fixed as shown. B is a piece of wood shaped to receive the cones. At its base, (right-hand end), it has a central hole and another smaller one off-centre to receive the axle and its pin. At its left-hand end, it also has a central hole. This is to receive C, a small axle, similar to that of the motor. It is housed so that it can revolve—for instance, in a ball bearing. It is attached to the end of the arm, E, which can slide through the upright block, D, and can be fixed in any position with a butterfly screw.

B has a strip of sandpaper or rubber material running down its length to anchor the cones to it. It may be necessary to cut the points off the cones to allow C to pass through.

The speed of the motor is controlled by a foot-operated rheostat, so that both hands are free. When winding tubes or wooden bobbins, C is moved in until the two tapered axles grip them.

On this simple piece of apparatus the yarn is guided on by hand; there is quite an art in winding a firm cone. (See Chapter 3).

More complex industrial machines, which automatically wind perfect cones or cheeses, are well worth the investment if much rug weaving is to be done. The split-drum type is fairly slow, so a machine which will wind several separate cones at once is suitable. With high-speed, more expensive types, a single head machine is adequate.

The large metal drums, (used in Scandinavia for winding warp yarn), are very useful for any type of yarn which cannot be wound on cones, e.g., horsehair, sisal and seagrass. One is shown in Fig. 16. It has a special hand-operated winder. Due to its large diameter and the gearing in the winder, it winds yarn at high speed. It holds a great weight of yarn.

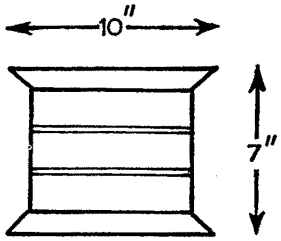

Fig. 16
Metal drum for yarn

It is very difficult to wind cones of such a slippery yarn as mohair, e.g., for the warp of a warp-face rug. However carefully the yarn is guided on by hand, it slips off the top of the cone in loops as it is unwound. For this purpose it is necessary to use some type of flanged bobbin. Flanged cardboard tubes are made but more easily obtainable are so-called warper's bobbins, used in industry and made of wood or plastic. They should have a flange about 4 inches in diameter and be up to 8 inches in length. Choose a size that can be fitted onto the winder described above.

E. Miscellaneous Items

A number of other items of equipment are useful, such as a doubling stand (see Colour Plying in Chapter 4), a magnet fixed to the loom to hold darning needles, and a clip also fixed to the loom to hold designs. A mousetrap screwed to the upper cross bar of the loom frame serves well for the latter purpose.

Suppliers for most of the equipment described above are given in the appendix at the end of the book.

2 · Warp and Weft Yarns

1. WARP YARNS

A. For Weft-face Rugs

In a weft-face rug, the warp only appears at the two fringes. Elsewhere it is hidden, running through the centre of the fabric, where it contributes nothing to the appearance of the rug but considerably affects its handle and the way it lies on the floor.

Yarns used for the warp are cotton, wool, linen, hemp, jute, ramie, synthetics and others.

A 7/7s cotton yarn is often used by beginners as it is easy to obtain and easy to use. But it is a very soft yarn with little body. The various cotton twines, used in the fishing industry for net-making, are more tightly-spun and greatly preferable. They are produced in a large range of counts. Cotton is easy to use because of its elasticity; so an imperfectly made warp will weave satisfactorily. It is also easy to dye, if the weaver wants the fringe in some colour other than its natural white.

Wool is the traditional warp for Eastern knotted rugs and it would be more used by present day rug weavers if a suitable yarn were available. The yarn needs to be worsted-spun from a long staple, coarse, fibre. The latter could be goat or camel hair, not necessarily wool. It must be tightly spun so that it does not fluff in the reed. The warp yarn used by tapestry weavers is of this type. The commercially used belting yarns make a good warp but have the disadvantage that they are so springy that any rug finish will soon work loose—even an overhand knot will not hold. A satisfactory warp can be made from the 6-ply wool, sold as rug weft.

Linen (and the other inelastic fibres) gives a firmness to the rug, lacking in those with cotton or wool warp. In its unbleached state, it has a pleasant neutral colour and so can be used for most rugs without having to be dyed. The best type has a fairly rough surface, i.e., it is spun from tow. Line yarns (spun from long fibres) are often so smooth and glossy that there is no cohesion between them and the weft. However tightly beaten, the latter will tend to slide on the warp. A count of 6/10s lea or 4/8s lea will be found suitable. A linen warp has to be perfectly made.

The above remarks also apply to hemp, jute and ramie. Jute is the least satisfactory of the three, as it is generally loosely spun, rubs in the reed, rots if damp and becomes a darker colour after long exposure. Hemp was used as the warp for the first knotted rugs produced in England.

Synthetics tend to be too slippery for the warp of weft-face rugs, but in time a suitable synthetic yarn is bound to be produced

B. For Warp-face Rugs

Warp-face rugs can have a warp of 2-ply carpet wool, 6-ply rug wool, belting yarns, mohair, goathair, in fact all the materials suitable for the weft of weft-face rugs. If the mohair is to be brushed, the amount of twist in the yarn is critical. It has to be high enough to give the yarn strength for the weaving process and yet low enough to allow a few surface fibres to be brushed out without tearing.

C. For Warp- and Weft-face Rugs

All the materials described for weft-face rugs are suitable, with the addition of the synthetic netting twines, (nylon, polypropylene, polythene) and sisal and coir, (coconut fibre yarn).

2. WEFT YARNS

A. For Weft-face Rugs

Wool is the most used fibre. It can be easily compacted by the beater to give a smooth, hardwearing surface and is very easy to dye. The yarn should be worsted-spun, with medium twist, from fairly coarse fibres. The 2-ply wool used in the carpet trade with a count of about 2/50s, (the 50 here means 50 yards per ounce), is quite suitable and can generally be obtained in a large range of colours. The same yarn is sometimes made up in a 6-ply form specifically for rug weaving, but the 2-ply yarn has more flexibility in use.

The Norwegian yarn, spun entirely from the fleece of the Spaelsau sheep, is ideal, giving a heavy, strong, practical rug.

A singles yarn, spun from a mixture of wool and cowhair, is specially produced in Scandinavia for the weaving of weft-face rugs. It lacks the springiness of an all-wool yarn, but is cheaper and at least as hardwearing.

Other tougher animal fibres, such as goat- and horsehair, are eminently suitable, especially for rugs that are going to receive a great deal of hard wear. Due to their incompressibility, they probably need to be combined with wool yarns to produce a structure that is entirely weft-face.

Ideally, a different type of yarn should be used for all cut-pile techniques, (knotting, corduroy, etc.). The need here is for a long staple fibre, worsted-spun, giving a yarn which after some wear acquires a paintbrush-like tip. A woollen-spun yarn will shed fluff until it is almost completely worn away. Scandinavian suppliers produce special

yarns for this purpose, called rya yarns and flossa yarns. The Spaelsau yarn, mentioned above, and the various belting yarns are very suitable.

Other weft materials include unspun fleece, thick cotton, linen (and the other bast fibres) and synthetics. Due to their varying elasticity, it is difficult to combine two such materials in one rug. See Chapter 4, for details of handspun weft yarns.

B. For Warp-face Rugs

A heavy thick yarn, such as horsehair, thick cotton or 6-ply wool, is needed.

C. For Warp- and Weft-face Rugs

The field is large here. Sisal, coir, cane, seagrass, various ropes, unspun hemp and jute, rayon tow can all be used, in addition to materials already mentioned.

This is only an outline of the materials that can be used for weaving rugs. There are, for instance, many excellent yarns employed in industry, which are difficult for the handweaver to obtain, but which are well worth searching for.

Suppliers for most of the yarns described above are given in the appendix to this book.

Weight of Yarn used in Rug

A flat-woven rug uses about $\frac{1}{2}$ lb of weft per square foot.

A pile rug uses $\frac{3}{4}$ lb upwards of weft per square foot.

A $3' \times 5'$ rug uses about $\frac{3}{4}$ lb of warp.

3 · General Rug-Weaving Techniques

1. MAKING AND BEAMING A WARP

A. Using Warping Mill or Frame

It is extremely important that a rug warp should be as perfectly mounted in the loom as possible; that is, with every end at an equal and high tension and of an equal length. In a weft-face rug, there is no take-up of the warp in weaving, so a loose thread or group of threads will remain loose throughout the rug. Such looseness may not seem important when the rug is stretched on the loom but once it is off and lying on the floor, the loose areas may bulge and prevent the rug lying flat.

A ONE-MAN METHOD OF BEAMING A WARP OF ANY WIDTH

Make the warp on a mill or frame, with a cross at both ends. Raddle it. Attach warp to backstick on warp beam. Mount raddle on the back beam of the loom and work at the back of the loom. So the warp is passing in the wrong direction over the back beam, (see Fig. 17 (a), where the arrow is pointing to the front of the loom).

Turn the warp beam once, applying no tension to the warp. Then tighten the warp by picking up 1- or 2-inch-wide sections and pulling on each in turn. This is done all across the warp, always picking up the same number of threads and always pulling with an equal force. Give the beam another complete turn and tighten again.

Sometimes tighten from the right to left, sometimes from left to right, sometimes from the centre outwards, in order to cancel out any inequality in the force applied. The simplest way to apply an equal force is to pick up the section and lean back with one's full weight. This becomes quite a rhythmic sequence of movements: pick up section, comb ends out through fingers to equalize their length, lean back, lean forwards, repeat.

If the warp is being beamed tightly enough, the hand holding the sections will soon develop blisters. So carry a small 1 inch thick rod in that hand, and each time twist the warp once around it, then pull on the rod, see Fig. 17 (b).

Roll in warp sticks where required. After sticks have been inserted, give the beam two turns before tightening, otherwise they will slip.

Headless nails knocked into the beam, the width of the warp apart, will stop it spreading. (See Fig. 352 (a) in Chapter on Warp-Face Rugs.)

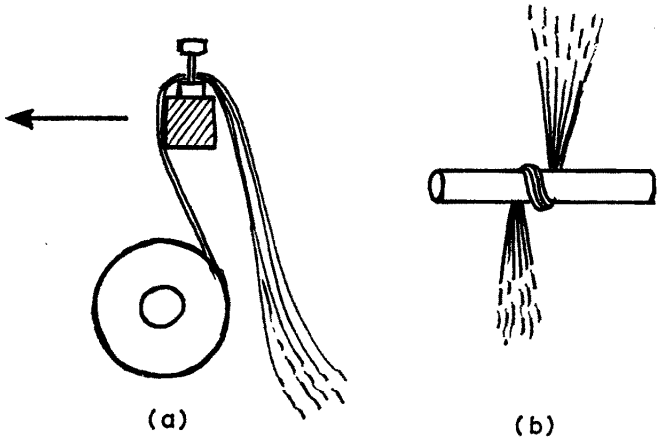

Fig. 17. (a) Beaming a warp by the one-man method (b) Method of gripping the warp sections

The warp wound on the beam should feel hard and solid. Remember that if the warp is beamed at a tension lower than that used when weaving, it will bite into itself and any semblance of equal tension will be lost. Once the warp is wound on, reverse its direction around the back beam and thread the shafts normally.

B. Using Sectional Warp Beam

A sectional warp beam is ideal for rug warps. It is quicker, very efficient and guarantees a warp of perfectly even tension for as long a rug as is wanted. The beam itself should be very strong with metal pins, (about $\frac{1}{4}$ inch diameter) every 2 inches, to separate the sections.

Though a conventional tension box may be adequate, a slightly more complex one has advantages. See Fig. 18 where (a) is a cross-section and (b) a view from above.

The ends come from a creel and enter the tension box through a collecting plate at the right. They then pass over bar A, under B, over C and through a section of reed D. They now pass under bar E, around the drum F, under G, through the adjustable reed H and over bar I to the warp beam.

The drum F, is a wooden cylinder about 4 inches diameter and as long as the box is wide. It turns on a central axle. It is covered for most of its length with some material, e.g., thick rubber, to prevent the warp ends slipping (shaded in Fig. 18(b)). The rest of its length is uncovered and over this part runs a leather strap, (dotted line in Fig. 18 (a), labelled in Fig. 18 (b)). One end of the strap is fastened to the floor of the box, the other passes over a wheel under the collecting plate and then hangs free. Weights can be attached to its free end. Thus when the drum is turned by the warp ends (as they are wound on to the sectional beam), the weighted strap acts as a simple friction brake, and as high a tension as is wanted can be applied to the warp. As the ends cannot slip

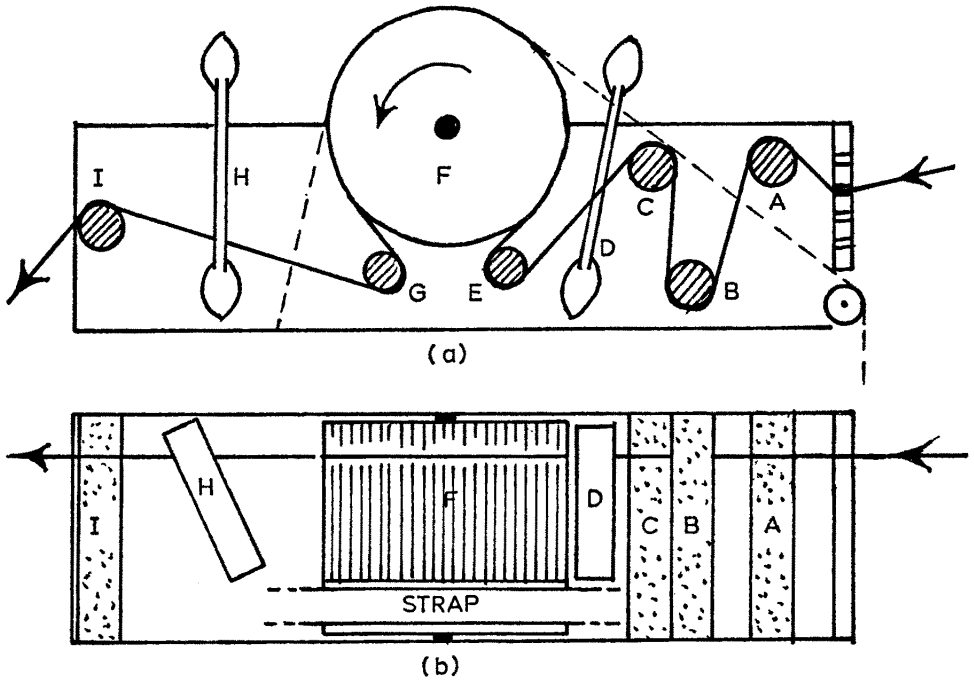

Fig. 18. Tension Box for sectional warping. (a) Side view (b) View from above

on the drum, the latter also ensures that an equal length of each end is delivered to the beam. The final reed H is mounted so that it can swing to give minute adjustments to the width of the sections.

Most of the warps for weft-face rugs described in the following chapters have six ends to the inch. So only twelve ends at a time have to be dealt with by the tension box.

C. Putting a Warp on a Vertical Rug Frame

In the normal method of putting a spiral warp (see Fig 2 (b)) on a simple vertical frame, a ball or cheese of yarn is continually carried around the upper and lower beams. But there is an ingenious method, used in the Middle East, whereby the package of yarn is never moved; the warping is done entirely with a blind *loop* of yarn.

It is simpler if there are two workers, who stand on opposite sides of the frame. To the left side piece of the frame a thick stick is tied so that it projects horizontally and nearly reaches the right side piece. See Fig. 19. The ball of yarn lies on the floor beside the worker on the near-side of the frame. He ties the end of it to the stick, then passes a *loop of yarn* over the upper beam to the far-side worker. The latter draws the loop down the back of the frame and passes it, under the lower beam, to the near-side

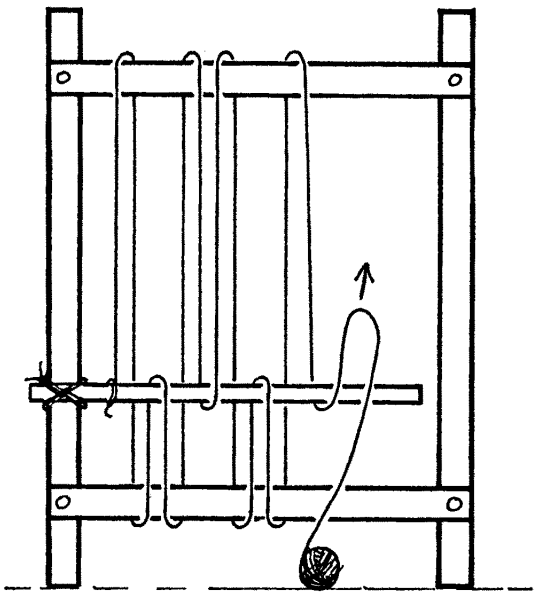

Fig. 19
A method of warping a vertical rug frame

worker, who slips it on the stick. The near-side worker then puts the yarn (that runs to the ball) behind the stick and passes a second loop of yarn upwards as before. This is repeated, always working towards the right, until the full width has been warped. The final end of the yarn is then knotted to the stick. Fig. 19 shows diagrammatically the course taken by the yarn as the third loop is begun. The stick is untied from the side piece and serves as a firm foundation for the weaving that starts directly above it. Whenever the warp is moved on, the stick is naturally carried round with it. When the rug is finished, the stick is slid out leaving loops of warp at both ends of the rug.

Note—That each time a loop is passed around the frame, two ends have been warped.
—That the way the warp loops wrap around the stick (upward and downward loops alternating in strict succession) establishes their order.
—That throughout the whole process, the ball of yarn lies on the floor.

2. TYING TO FRONT STICK

After the warp is drawn in and sleyed, it has to be tied to the front stick, and the method that wastes least warp is the following.

Pick up a 2 inch wide section of the warp. Comb the fingers through it, so that all the ends it contains are of equal tension. Divide it into halves and knot these two halves around the front stick with a reef (square) knot. At either selvage, tie a much smaller group of ends, i.e., those that come through the first two dents of the reed.

As each knot is tied, test the resulting warp tension, always comparing it with that

of the first part of the warp that was tied. If it is compared with the adjacent section, which was tied last, there is far less control and the tension may gradually increase with each successive knot.

After the first tying, push the cross sticks back to the back beam and secure them and make sure every end is running in a straight line from that beam to the reed. Tighten the knots where required.

Now tie a piece of heavy cord to one end of the front stick and thread it through the

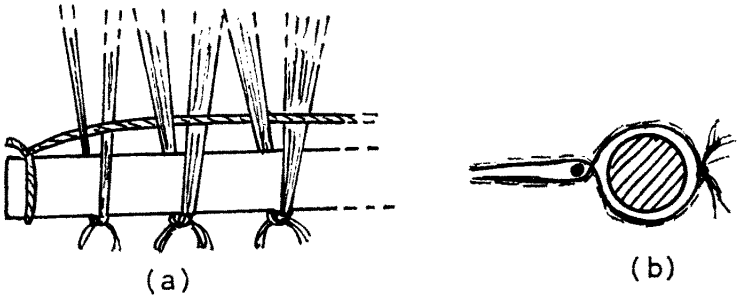

Fig. 20. Tying warp to front stick

warp as shown in Fig. 20 (a) i.e., pass it over the ends that pass over the stick and under the ends that pass under the stick. Pull it tight and tie to the opposite end of the front stick. This brings all parts of the warp to the same level, see cross-section at Fig. 20 (b). This is important as the front stick, to be strong enough, may have to be an inch thick.

3. OPENING OUT WARP GROUPS

However the warp is knotted to the front stick, its ends are crowded together at each knot, and they have to be opened out to the spacing that exists at the reed. The simplest way to do this, is to weave three or four picks (in plain weave sheds if possible) of some very heavy material, such as warp linen used six to eightfold. These are thrown and only beaten after the *final* pick. It may need several blows with the batten to drive these picks up against the front stick. The warp should then be evenly spaced or it may need two or three more picks woven in the same manner.

This manœuvre also shows up any loose ends, which will loop upwards over the picks, or any loosely knotted groups. The latter reveal themselves by a curving of the fell away from the front stick.

These preliminary picks (and those put in at the far end of the rug) also act as temporary weft protectors for the finished rug, before a proper rug finish is carried out.

The temple is fixed into these picks before the weaving of the rug proper begins.

4. WEAVING THE HEADING

Whatever weave is used for the main part of the rug, it is best to begin and end with a heading of plain weave. Naturally this is not possible with some threadings, such as a straight draft on three shafts. The heading can be $\frac{1}{2}$–2 inches in depth and can be woven of one of the weft yarns used in the rug. It provides a firm basis against which to carry out any of the rug finishes and an opportunity to use any of the two-shuttle patterns.

5. STARTING THE WEFT

If the thick weft used in a weft-face rug is begun in the normal way, i.e., an end, left hanging out in the first pick, is tucked into the second pick, the resulting double thickness of weft will not beat down to cover the warp and the latter will show at this point.

In Fig. 21 (a), the weft has been thrown from left to right. Split the weft into two halves. Here the weft is fourfold so each half consists of two threads. Bring one half, A, out of the shed a little short of the selvage. Wrap the other half, B, twice round the selvage thread. Reintroduce it into the same shed and bring it out two raised warp ends beyond A.

Note—That B passes over two ends as it re-enters the shed.
—That the only extra thickness of weft is between the emerging points of A and B and here the thickness is only increased by a half.
—As this is the beginning of the rug, A and B have to be darned upwards (i.e., away from the weaver).

The same diagram can serve as an illustration of finishing the final weft in a rug. Where thinner wefts are used, the normal ways of starting and finishing are possible.

6. JOINING WEFTS

As with starting and finishing wefts, the aim here is to avoid too much extra thickness of weft. This is done by tapering both wefts where they overlap.

In Fig. 21 (b), two wefts consisting of four threads are joined. The white (old) weft has been thrown from left to right. Half, A, is brought out under end 11 and half, B, some inches away under end 3. The black (new) weft is also thrown from left to right. Half of it, C, is brought out two raised ends away from A, and the other half, D, two raised ends away from B.

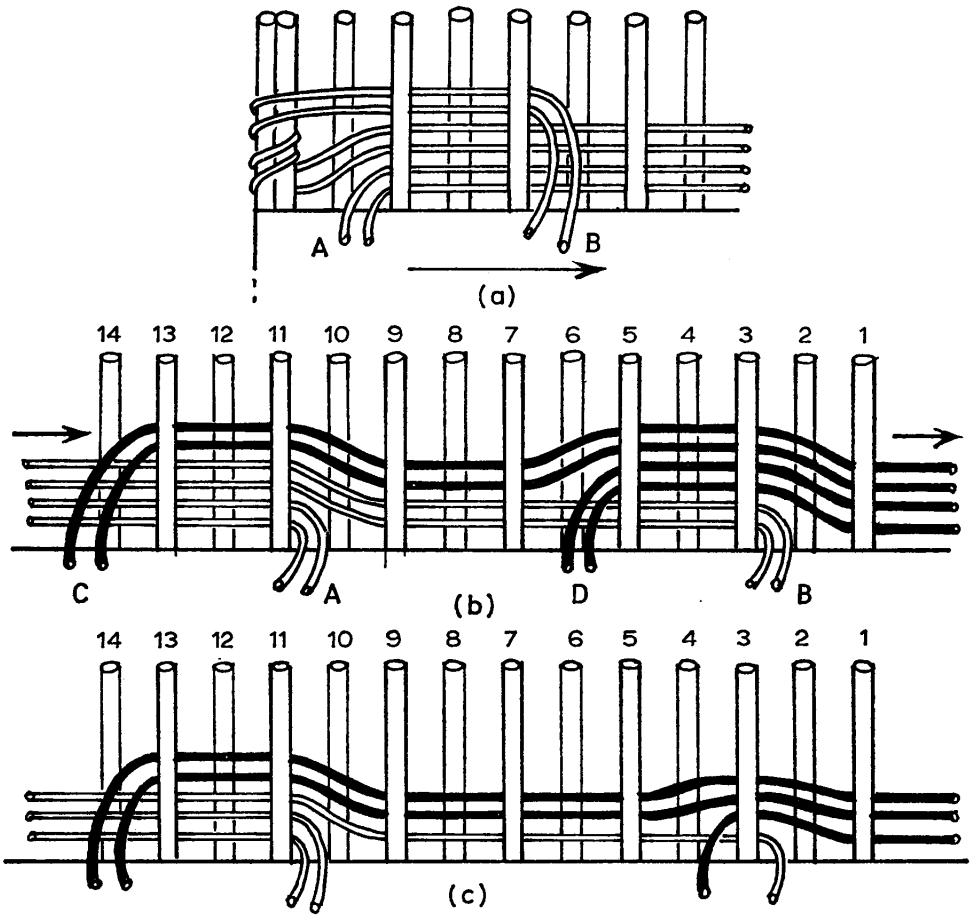

Fig. 21. (a) Starting the weft (b) and (c) Joining two wefts, fourfold and threefold

Note—There are two places where the weft thickness is increased by a half.
—The number of ends brought out depends on the number that it is practical to darn into the rug in one place. Two ends of normal 2-ply carpet wool can be darned in easily, so two have been brought out together.

Fig. 21 (c), in which the two wefts consist of three threads each, shows how it is still possible to bring the ends out in pairs.

Almost all colour changes in a rug can be carried out as weft joins. It is not necessary, for instance, to finish one colour at one selvage and start the next colour at the opposite selvage. Weft joins can be made anywhere across the width of the rug. If for any reason the rug needs building up slightly at one side, then make all the weft joins at this point: and make them so that there is more extra weft thickness than shown in Fig. 21 (b) and (c).

7. DARNING IN THE WEFT

All short lengths of weft that protrude from the rug surface (whether due to weft joins or knots in the weft), must be darned in as the weaving proceeds.

As this process takes up a considerable part of the weaving time of a flat rug, the following quick method is a help.

A 4 inch long packing needle is required, the type with a flattened curved end, see Fig. 22 (a). Blunt the point on a stone or file. Make a fine wire noose, as shown in Fig. 22(b). It can be twisted from a dismantled wire heald. The noose itself should be small enough to slide easily through the eye of the needle.

Thread the noose into the eye of the needle and using it as a handle, push the needle into the rug at the appropriate point. Make it slide down in front of a warp end for about ¾ inch and then come out onto the surface again. Put the weft end into the noose. Then pull the noose to the left (upper arrow in Fig. 22 (b)) to thread the weft

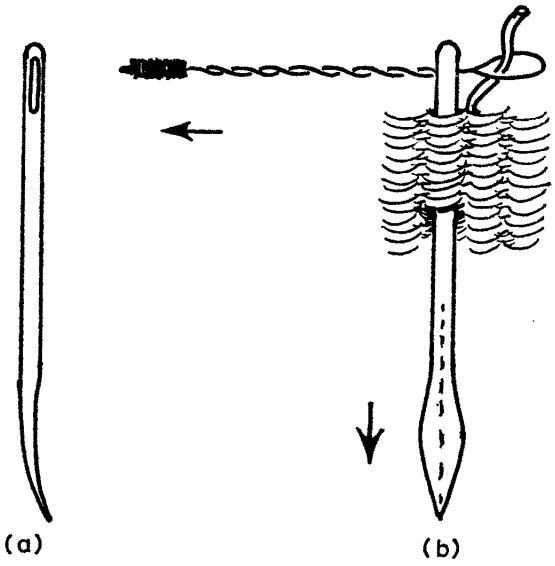

Fig. 22
Darning in the weft.
(a) The needle
(b) Using the needle and and the wire noose

into the needle, and pull the needle downwards (lower arrow) to darn the weft into the rug. Then trim the darned-in weft threads by pulling on them and cutting them flush with the rug.

Note—The needle moves down towards the weaver.

—The needle is blunted so that it will slide down in front of a warp end and not pierce it.

—A piece of weft only ½ inch long or shorter can be darned in, using scissor points to push it into the wire noose.

—It is important always to give the weft end a pull before darning it in, as there is often unwanted slack in the weft near its point of emergence.

It is important to darn the weft down the correct warp end. Where two weft threads emerge at the same point, darn them down the warp end they would next cross if they were weaving in normal plain weave sequence. Thus, referring back to Fig. 21 (b), weft A is darned down end 10, weft B down end 2, C down 14 and D down 6.

Where two wefts emerge from either side of an end (see end 3 in Fig. 21 (c)) then they are darned together down this end.

Always try to space out weft joins evenly over the surface of the rug, so that any slight unevenness caused by the darning is well distributed. When darning in a tough yarn, such as horsehair, unply and untwist the protruding piece with the needle's point, pulling out any loose fibres. This reduces its bulk to a tapering bunch of fibres, that can be unobtrusively darned in.

8. WEAVING

A. Warp and Weft Tension

Always weave with the warp as tight as possible, because the tighter (i.e., the more rod-like) the warp ends are, the easier it is to beat successive picks of weft close against each other.

In a weft-face rug, the warp ends run in a straight line through the centre of the structure, and the weft curves over and under these ends. Therefore it is necessary that each pick be laid in the shed with enough slack or extra length to make this serpentine course possible. This is why waving (also called bowing, bubbling and curving) the weft is necessary, with every pick of a weft-face rug.

WAVING THE WEFT

I. Throw the shuttle from right to left. Hold the right selvage thread with the right hand and pull the weft with left hand. This both pulls in the small amount of slack that always exists in the previous pick and ensures that the weft fits tightly round the selvage. Leave the weft well towards the reed at the left selvage, so that slack can easily be drawn into the shed.

II. Keeping the shed open, work from right to left (i.e., following the direction of the shuttle's flight) waving the weft thus:

Grip the weft between right thumb and index at point A (Fig. 23), i.e., where the crest of the first wave is to be. Push down the weft at point B with a finger of the left hand to make the trough of the wave. Repeat for points C and D, E and F. It is important that the weft be gripped as described. Otherwise making the second wave will just draw in slack from the first and flatten it.

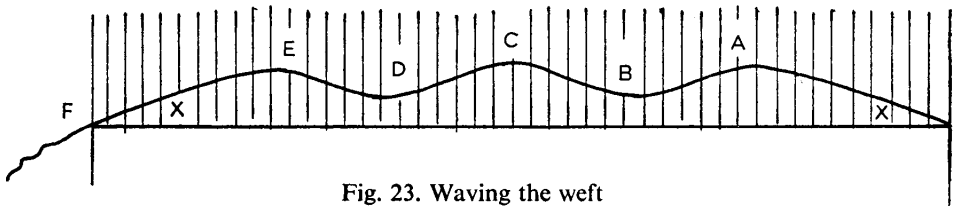

Fig. 23. Waving the weft

Note—There should be approximately one wave for each foot width of the rug.

—Keep the troughs of the waves at least 2 inches from the fell of the rug, otherwise the weft will loop out at this point when beaten. But make the last wave join the fell of the rug at the left selvage.

—Although the shed must be open while waving the weft, slightly diminishing its depth does help to control the positioning of the waves. So raise the appropriate pedal a small amount while waving the weft.

—Steep-sided curves are hardly ever necessary. This applies especially at the selvages, where angle X should be small, and so overcome the tendency for the weft to be slack at either selvage. More slack is always needed at the centre of the rug than at the selvage.

—The size of the waves varies with the weave being used. The more intersections of warp and weft, the bigger the waves should be and the more waves there should be. Thus plain weave needs more waves than a twill with the same warp set.

—The waves also vary with the type of weft yarn used. Thus with an elastic yarn, like wool, one wave per foot width of rug is satisfactory. But with a non-elastic yarn, like linen, it will be found better to make more and smaller waves. Also the more inelastic a yarn is the more accurately the waves must be made. A slight excess of yarn in any place will loop out.

—It is easy to have a perfect-seeming face to the rug but with loops of weft protruding at the back, so inspect the back periodically.

III. Having waved the weft successfully, change the shed and beat. Beating on the opposite shed helps to even out the extra length of weft across the full width of the rug.

Then repeat the above sequence. This time the shuttle will be thrown from left to right. So after the weft has been tightened around the left selvage the waving is carried out from left to right and the hands switch roles. The left hand now grips the crests of the waves and the right hand pushes down the troughs.

Change shed and beat.

As every pick of weft has to be curved in this way before being beaten in, it is very important to develop the ability to do it both quickly and accurately. Exactly the same amount of slack must go into each pick, hour after hour, day after day. An apparently well woven rug will, in use, gradually show by its undulating selvage how and where the weft tension varied. However, if two yarns of differing elasticity are being woven in stripes, it is practically impossible to so adjust the tension that the selvages remain straight.

When weaving on an upright loom and beating with a rug fork, start by making one large curve from selvage to selvage. The curve can be kept in position by almost closing the shed. Beat this curve in its centre, making two half-width curves. Beat

these two curves in their centres making four quarter-width curves. Continue thus, beating each curve in its centre, until all the weft is dealt with.

B. Beating

As already mentioned the batten should be weighted with metal, the wider the rug the heavier the piece of metal.

For greater efficiency the batten should be handled in such a way that the last pick is squeezed up against the preceding picks; it should not be used as a hammer dealing the weft sharp blows and then rebounding. So grip the batten with both hands and then lean back on the loom seat, adding the weaver's weight to that of the batten. This is far less tiring than sitting upright and pulling the batten with the arm muscles.

As the last pick is always beaten with the shed changed, it should stay in position.

C. Cone Winding

The difficulty in learning to wind a cone by hand is that in order that the cone be firmly wound, it has to revolve at a high speed, and the beginner finds it hard to control the thread at this speed.

Begin by passing the yarn once round (in the direction the cone is going to turn), so that it is caught under the part coming from the hank, see Fig. 24 (a). Then as soon as the cone starts to revolve, move the hand that is guiding the yarn quickly backwards and forwards, so that the yarn does not build up in any one place. This is to ensure that the first few turns of yarn grip the cone securely. Thereafter the guiding hand can move more slowly.

Never bring the yarn nearer than 1 inch from the top of the cone and nearer than $\frac{1}{4}$ inch from the bottom of the cone. These furthest extremes of the yarns traverse should be reached almost as soon as winding begins, and each succeeding traverse should be shorter. The pear-shaped outline shown in Fig. 24 (b) is a good one to aim at. Do not try to save time by overfilling cones.

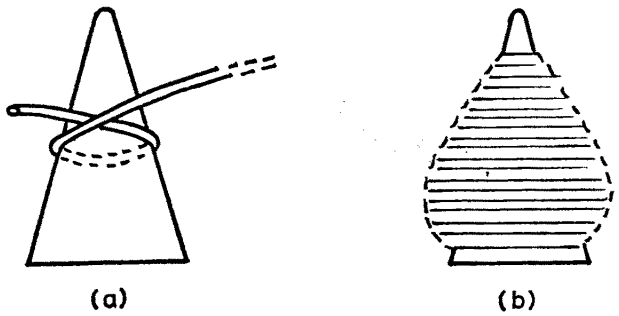

Fig. 24. Cone Winding. (a) How to start (b) Shape to aim at

When winding a cone at full speed, the wool passes so quickly through the fingers that to avoid burning them, they just guide the yarn and in no way grip it. The necessary tension in the yarn is best obtained by having some simple friction brake on the skeiner, e.g., a weighted leather loop hung on the axle. Such brakes are supplied with industrial skeiners and are also useful as the skeiner stops almost immediately the winding does and so does not overrun.

When winding slippery yarns, first wind a few turns of ordinary yarn to provide a foundation, and move the guiding hand more quickly than normal as the slippery yarn is wound on top.

A badly-wound cone with loops of yarn coming off the top can best be unwound from the base rather than the top. Keep handy a dowel rod with a wooden block fastened at one end, see Fig. 25 (a). Pass this up through the centre of the cone. Then, holding this rod, let the yarn be pulled off, as shown in Fig. 25 (b), straight onto a fresh cone. The ballooning of the yarn prevents it fouling the cone's base until the latter is practically empty.

A yarn, such as camel belting yarn, that kinks as it dries after scouring or dyeing, can be wound onto cones while still slightly damp. Drying thus, under tension, it develops no kinks.

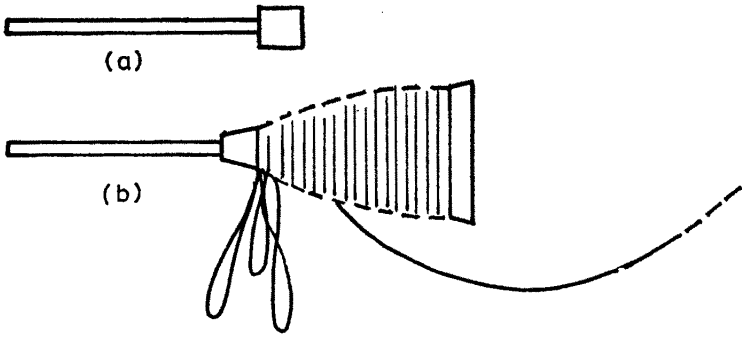

Fig. 25
Unwinding a faulty cone

D. Shuttle Winding and Throwing

Assuming the various weft yarns are wound on cones, stand these on the floor with their ends hanging over a warp stick, or a stretched piece of string, so they do not get tangled. Try to arrange them so that colours that will be wound together on the shuttle stand close to each other. If this is not possible, the weft threads can be led up through a reed supported on two chairs, to ensure that each thread comes off vertically, see Fig. 26 (a).

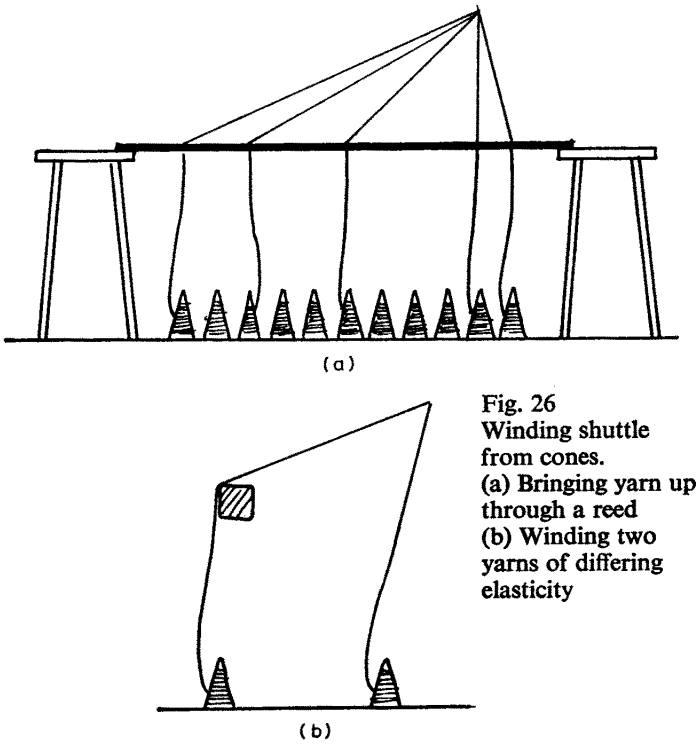

Fig. 26
Winding shuttle from cones.
(a) Bringing yarn up through a reed
(b) Winding two yarns of differing elasticity

It is a false economy to overfill shuttles. Wind on so much weft that the shuttle can be thrown, not poked, through the shed right from the start. If a weft has to be joined during winding, tie either a reef knot or the overhand slip knot shown in Fig. 29 (a).

If two wefts of unequal elasticity are being used, wind the less elastic one under a higher tension. Assuming both wefts come from cones, then the less elastic one can drag over some bar as shown in Fig. 26 (b), and the other weft can go straight from cone to shuttle. Without some such precaution, there will always be some extra slack in the inelastic weft when the shuttle is thrown.

The one disadvantage of a ski-shuttle is its length. So throw it like a normal shuttle, with an index finger on its point giving the final flick, but catch it in its centre. To catch it at its end stretches the arms unnecessarily. With practice the shuttle can be caught thus without looking. Unwind from the ski-shuttle only the minimum amount of weft that will allow it to be thrown across the width of the rug.

If several shuttles are being used in a certain sequence, put down the shuttle that has just been thrown in a place that accords with that sequence. Thus if shuttle A and B are being thrown in a pick-and-pick sequence, when A has been thrown it is placed next to the weaver, so B is close to the fell of the rug and at hand to be picked up. When B is thrown it is placed next to the weaver, pushing A up towards the fell.

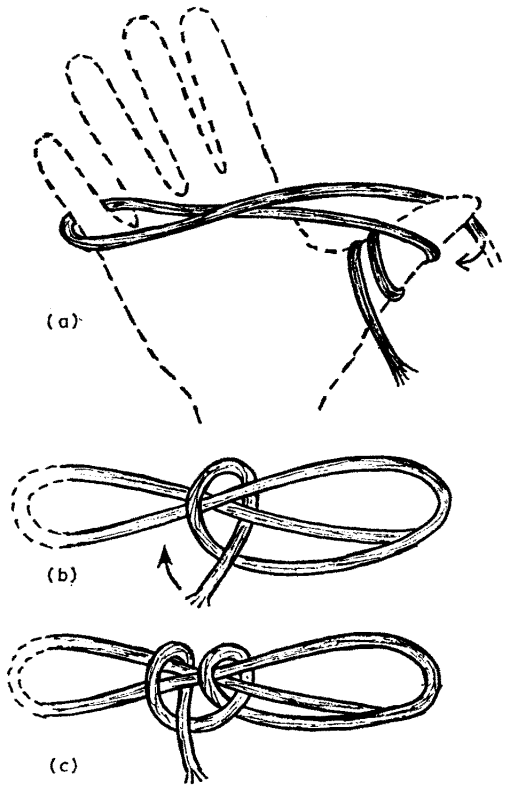

Fig. 27
Making a finger hank.
(a) Starting
(b) (c) Fastening the free end

More complex sequences demand more complex placings of the shuttles but there is always a logical way which will save time and tangles.

With a very wide rug, the weaver may not have sufficient stretch to both throw and catch the shuttle without shifting his position on the seat. In such a case, throw normally but catch the shuttle as it emerges at the opposite selvage by suddenly closing the shed. Then move across and pick it up.

E. Making Finger Hanks

It is often useful to have weft wound in small packages, and not on a shuttle, for instance, in soumak, and the other hand-manipulated techniques. Finger hanks (also called Butterflies) are made in the following way from cones or hanks or balls of yarn.

First carry the end of the yarn or yarns twice round the thumb to anchor it, see Fig 27 (a). Then wind the yarn in a continuous figure-of-eight between the thumb and little finger, with the hand stretched wide open.

When enough yarn has been wound, cut the yarn from its source. Finish by carrying it around the thumb and tying the end round the waist of the figure-of-eight with two

hitches. These are shown in Fig. 27 (b) and (c), and they are tied with the left hand while the finger hank is still on the right hand.

Remove the finger hank from the little finger first, then from the thumb. The end of yarn wrapped round the thumb, is the end that is used and it will pull out of the finger hank, without tangling. As long as the final knot follows a turn round the thumb, as described above, it will undo itself as the finger hank finishes.

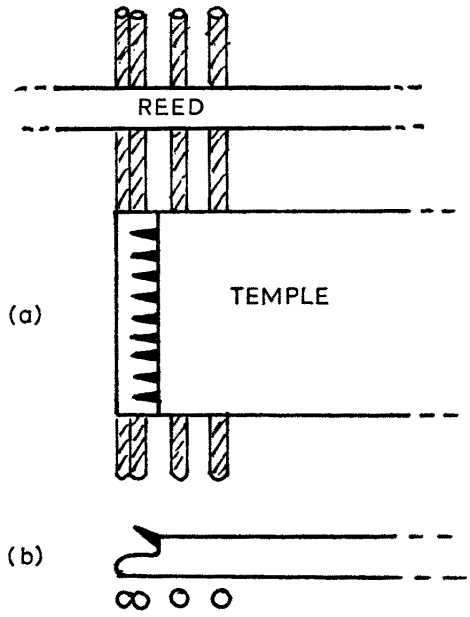

Fig. 28
Setting temple to correct width

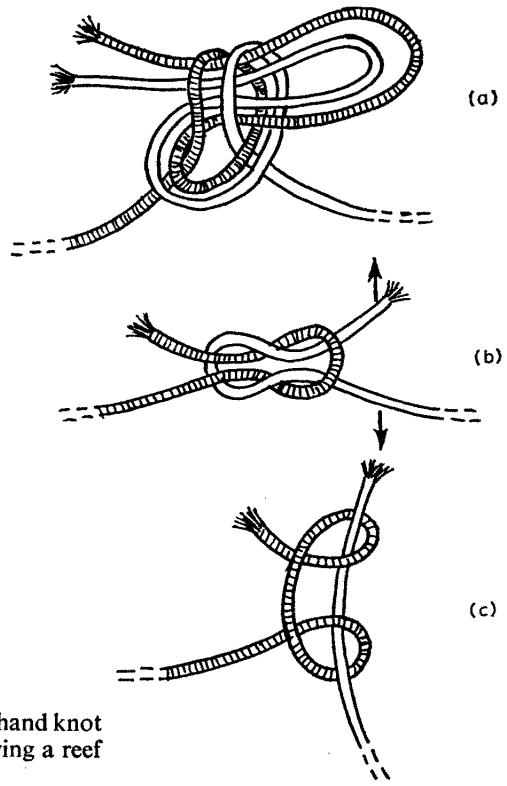

Fig. 29. Knots for the weft. (a) Slip overhand knot (b) Reef knot (c) Quick method of untying a reef knot

F. Temple

Set the width of the temple, by holding it upside down over the warp as it emerges from the reed. The bases of the temple's pins should be in line with the first warp interspace at each side. See Fig. 28 where (a) is a view from above and (b) is a cross-section.

Use the temple right from the start of the rug, inserting it first into the preliminary picks of thick yarn which open out the warp groups.

Move the temple up after every half inch of weaving. Insert it so that it is as close to the fell of the rug as possible and ensure that the pins are really embedded in their correct position before the two halves of the temple are pushed down and locked.

By slightly varying the temple setting it is possible to counteract the effect on the

selvage of yarns of differing elasticity, i.e., set it wider for a stripe of the more elastic yarn. This can be very important, if a large rug is being woven in strips and absolutely straight selvages are therefore essential. The amount by which the temple setting is altered can only be found by trial and error.

Always release the temple if a rug is being left for any length of time, otherwise it will cause a bulge at the selvage.

G. Turning on the Warp

With a well-designed loom about 6 inches can be woven before the warp has to be turned on. First release the tension on the cloth beam, then let off another 6 inches from the warp beam and finally tighten the cloth beam. Before resuming weaving, beat the weft hard several times and retighten the cloth beam.

H. Knots Encountered in Weaving

IN THE WEFT

Beat the pick, then untie the knot. If it is the overhand slipknot, shown in Fig. 29 (a), just pull the two free ends. If it is a reef, capsize the knot by pulling either the two parts that point to the right (arrows in Fig. 29 (b)) or the two parts that point to the left. In either case it becomes a slip knot and can be quickly undone, see Fig. 29 (c). Bring out the two ends of the weft on either side of a raised warp end and darn them in later.

If yarn is bought with knots in it, they are generally weaver's knots. It is simpler to leave these, and later pick them undone with a needle's point and darn the ends in.

IN THE WARP

The warp of a weft-face rug is such that it should not break under normal circumstances. However, a badly thrown shuttle may foul the warp and break an end. Mend it by knotting a new piece of warp (with a weaver's knot), to the far part of the broken end, and darning it into the rug down beside the near part of the broken end. After 3 inches of darning, bring the thread to the surface and fasten it round a stout pin, set in the rug. Because a warp end runs straight through a weft-face rug, there are no curves in its course to anchor it (as in a 50/50 plain weave structure), so it is best to leave this pin in position until the rug is finished.

I. Marking the Length of the Rug

It is as well to make a habit of marking the length of a rug every 6 inches as it is woven. This is not always essential; but it can be, as in the case of a large rug being woven in strips, when some motif or stripe has to tally across the joins.

Keep a curved needle threaded with warp yarn by the loom. Only put in a marker when the warp is slack, i.e., do it while the warp is being turned on.

At 6 inches, tie a reef knot.
At 1 foot, tie one overhand knot.
At 1 foot 6 inches, tie a reef.
At 2 foot, tie two overhand knots.
Carry on thus, tying as many overhands as there are feet in length, and tying a reef at each intermediate 6 inch mark.
At 5 feet, tie two overhand knots on top of each other. This makes a double-size knot.
At 6 feet, tie the above double overhand, plus a normal overhand.
At 10 feet, tie two double overhand knots, and so on.

One way to ensure that the markers are accurately spaced is to make two notches, 6 inches apart, on a strip of wood, see Fig. 30. Place this on the edge of the slack rug, so that the last marker is in one notch, and then insert the threaded needle down into the rug through the other notch.

If accuracy of length is essential, test the markers by inserting one every yard in the following way. Release the cloth beam ratchet, so that a loop of rug can be pulled out towards the weaver. Into this loop, put a strong bar with cords at each end which are

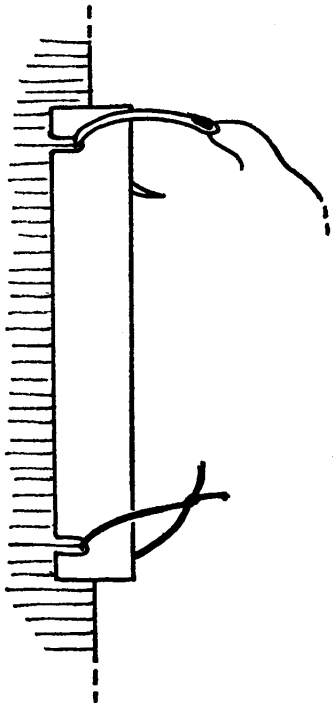

Fig. 30
Using a wooden gauge for marking the length of a rug

tied to something solid, e.g., a wall. Pull out enough rug, so that a yard is exposed, see Fig. 31. Using a wooden or steel yard measure (not a tape measure which can be very inaccurate), put in the next marker, say, for 6 feet, 1 yard from the 3 foot marker. These yardly checks cancel out any inaccuracies in the 6 inch markers.

In order to be able to put the first yard marker in thus, the apron or strings, stretching from cloth beam to front stick, have to be longer than usual. But this is in any case desirable, see below.

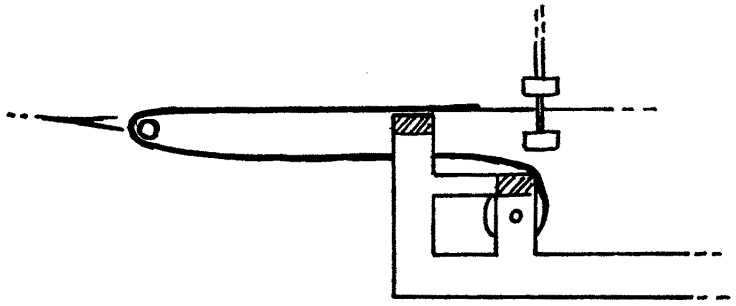

Fig. 31
Viewing the rug during weaving

J. Viewing the Rug during Weaving

It is often used as an argument against weaving rugs on a horizontal loom, as compared with a vertical loom, that so little of the finished work can be seen. But at least a yard of the finished rug can be quickly exposed in the manner described above. Much more, say 6 foot can be exposed if a really long rug is being woven. If the weaver then stands on the breast beam of the loom or something equally high, he can obtain a true view of that section of the finished rug.

K. Taking the Rug from the Loom

After the final pick of the rug proper, weave about six picks of a heavy weft, as used at the beginning.

Turn the warp on, until the fell of the rug is at the breast beam. Now the rug finish to be used dictates where the warp is to be cut. The minimum length for even the simplest rug finish is about 8 inches. So draw a line across the warp at least 8 inches from the end of the rug. A wax crayon drawn along the edge of a warp stick, pushed hard onto the warp, will make a sufficient mark.

Now, every 3 or 4 inches across the warp, cut two adjacent ends at the marked line and tie them in a half-knot or a bow. This is simply a safety measure to hold the thick picks in position until the rug receives its proper finish. Then cut all the way across, following the marked line, knotting the far ends so that they do not fall back through the reed.

As the rug is unwound from the cloth beam, examine its reverse side carefully and

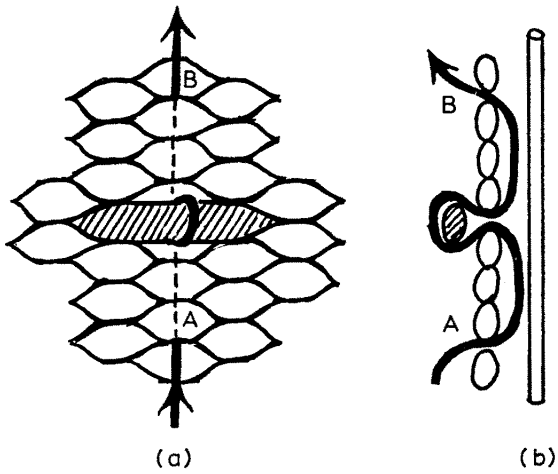

Fig. 32
Darning in a weft float.
(a) Front view
(b) Longitudinal section

darn in any weft threads that need it. Where a weft thread floats instead of weaves it can be darned in thus. Fig. 32 (a), shows a weft (shaded), floating over three ends where it should be passing over one, under one, in plain weave sequence. Thread a short length of warp on the darning needle, only a single thickness even if the warp is being used double in the rug. Insert it into the rug about $\frac{1}{4}$ inch below the float, point A in Fig. 32 (a), and slide it along the warp end that the float should have passed under, bringing it out under the float. Carry the thread over the float as shown, re-enter it into the rug beyond the float and slide it up the same end as before, for a further 1 inch or so to emerge at point B. Pull the entering and emerging ends of this thread apart and slide the thread up and down a few times. The float will sink back into the rug, and disappear into the weave. The very diagrammatic longitudinal section in Fig. 32 (b) will make this clear.

When all repairs have been completed on the back of the rug, untie the rug from the front stick, again tying a knot every 3 or 4 inches to keep the initial thick picks in position.

This is the time to weigh the rug for costing, before parts of the warp are trimmed off as the rug finish is completed.

L. Problems Connected with Weaving a Large Rug in Strips

As no weaver will ever have a loom big enough to weave in one piece the largest rugs required of him, it is best to develop a technique of weaving rugs in strips and later joining them. This has the advantage that any sized rug can be woven by one weaver on one loom.

WARP TENSION

A warp equally tensioned is essential. If as weaving proceeds, the warp becomes slack, say, on the right side and nothing is done to correct this, then the right side of the finished rug will be longer than the left, and the rug will lie on the floor in a slight curve. If it is straightened, the right side will buckle. So either start with a perfectly made warp or correct any tension inequalities the moment they arise. It sometimes happens that a warp becomes progressively slacker towards one side (as if the warp beam were conical rather than cylindrical), this is generally due to a badly placed warp stick. It can be corrected thus.

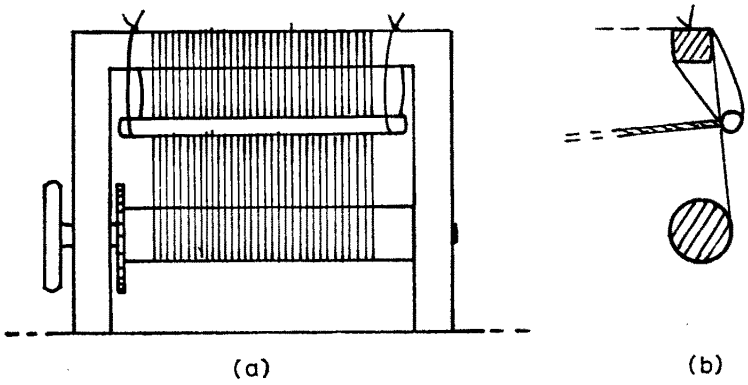

Fig. 33
Method of adjusting warp tension with an iron bar

Hang a strong metal bar half-way between the back beam and the warp beam, see Fig. 33 (a) and (b). Attach a thick cord to each end of the bar and bring these cords forward and tie them to some upright of the loom frame. Then if the warp is slacker towards the right side shorten the right-hand cord.

LENGTH OF STRIPS

Measure accurately as already described. It is safest to weave a few extra inches and then adjust the length as the strips are sewn up. See below.

WEAVING THE STRIPS

There is probably an overall design or plan for the rug, but this may not show every slight colour change. So as the first strip is woven, make a note of where each colour change is made. For simplicity give each colour a number, and use these numbers rather than names, in the notes. Then follow the notes when weaving subsequent strips. If a rug has pick-and-pick stripes, say, in black and white, remember that if one strip has a black stripe at its selvage, then the next strip must have a white stripe.

JOINING THE STRIPS

The following sequence ensures accurate results.

(1) Fringe all the strips at one end.

(2) Sew the strips together, starting from the fringed ends. Stop a few inches short of the unfringed ends.

(3) Make a plan of the rug, the actual size, on the floor, chalking or otherwise marking the rectangle exactly.

(4) Put the rug on the plan with its fringed end along the appropriate chalked line and the sides of the rug along the side lines. Then the fourth chalked line shows exactly where the other rug fringe should be.

(5) Unweave the end of the rug to bring the fringe to the right place. As the initial picks (heading) are probably different from the main part of the rug, unpick the correct amount of the main part, then slide the heading along the warp ends into its new position.

(6) Bring the sewing right up to the corrected ends of the strips and fringe these ends.

This method may sound over-complex, but experience shows it is necessary. It is very easy otherwise to make a large rug that proves to be more a parellelogram than a rectangle.

Always try to obtain a plan of the site for the rug, for this will show which of its dimensions are absolute (e.g., wall-to-wall,) and which can be exceeded or diminished by an inch or so.

The sewing is best done with a large curved needle. If the stitches will be quite invisible, as with a pile rug, use ordinary warp yarn; but if they may show, as with a flat woven rug, dye the warp yarn an appropriate colour.

The stitch used is shown in Fig. 34 (a). Kneel on the floor, moving backwards as the sewing proceeds. Insert the needle downwards into the first warp interspace of one strip and bring it out between the two strips, see Fig. 34 (a). Then insert it downwards into the first warp interspace of the other strip and up again between the strips. Keep the stitches tight by holding the emerging thread with the non-sewing hand.

An alternative method is to enter the needle into the weft loops only, as they turn around the selvage. The needle slides down beside the selvage thread for $\frac{1}{4}$ to $\frac{1}{2}$ an inch, then emerges between the strips. It then enters the weft loops of the other strip, see Fig. 34 (b). This join is quite invisible but less secure.

Join on a new length of yarn with a reef knot. Capsize the knot as shown in Fig. 29 (b) and (c), slide it down snug against the rug, then uncapsize it. Begin and finish the sewing with a knot and darn all ends into the rug.

Note—It is wise before sewing to join the two strips every 2 foot or so with a temporary tie. This will stop the strips shifting while sewing.

—That a strip newly cut from the loom should never be joined to a strip completed some days previously. This is because it takes some time for the rug to assume its final length. According to the elasticity of the warp this will be a varying number of inches shorter than its off-loom length.

—When joining strips of pile rug, work from the back, i.e., have the pile downwards. Use the scissor points to tuck the pile of each strip out of the way, so that it does not foul the sewing thread.

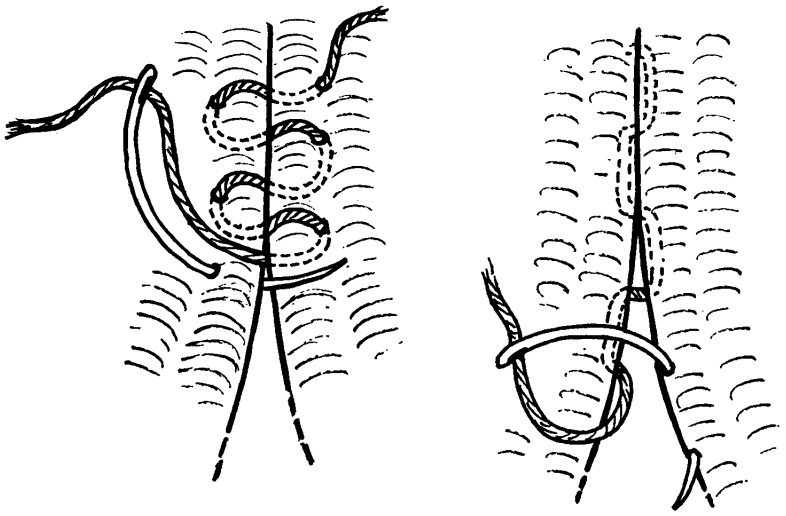

Fig. 34. Joining two strips of rug

4 · Weft-face Rugs in Plain Weave

PART ONE: TECHNIQUES IN WHICH THE WEFT RUNS FROM SELVAGE TO SELVAGE

1. GENERAL DETAILS

A. Introduction

In weft-face plain weave rugs, the surface is made up entirely by closely beaten weft, on which therefore the colour, design and texture all depend. The warp lies hidden in the middle of the thickness of the rug and only appears at the fringes. It is like an invisible skeleton which the weft clothes with flesh. In the finished rug, the warp ends lie as straight parallel lines, but the weft takes a serpentine course, curving over and under the warp. So a cross-section of the rug is as shown in Fig. 35. This gives the clue

Fig. 35. Cross-section of a weft-face rug

to two essentials in weaving weft-face rugs, a very tight warp to allow the weft to be well beaten down and a very loose weft to allow of its serpentine course. With slight exceptions, these rugs are identical on both sides and so are fully reversible in use.

B. Warp and Weft Settings

In England during this century, there has risen a convention that the warp for a rug (generally a 7/7s cotton used double) is always set at 3 ends per inch and that the weft is always a 6-ply rug wool. This is firmly established and manufacturers advertise a reed with 3 dents per inch as a rug reed. Although this does give a possible texture for a rug, it is certainly not the only one, as the following will show.

In describing warp settings in rugs, one difficulty is often encountered. This is that

the warp is very often used twofold, threefold or even fourfold, simply because a yarn thick enough to be used singly is not easily available. So there is a difference in the number of ends per inch on the warp beam and the number of actual *working* ends per inch in the weaving.

By a working end is meant the warp unit that works independently in the weaving, be it a single thread or many threads working as a single thread. So the number of working ends per inch gives the number of dents and healds per inch needed. Also, in the case of plain weave, it gives the number of warp/weft intersections per inch, which is the chief factor in controlling the texture of the rug. The best way to avoid confusion is to speak of a rug warp with, say '12 ends per inch, double in the heald, therefore 6 working ends per inch'. This method of describing warp settings will be used throughout this book. To give another example, if a standard warp with 6 ends per inch is used, this can be arranged double in the heald to give 3 working e.p.i., or alternately double and single in the heald to give 4 working e.p.i., or 4 single, 1 double in the heald to give 5 working e.p.i., or singly in the heald to give 6 working e.p.i.

The use of a multiple warp is so much a habit that it is well to remember that there is no special virtue in it, and that a single thicker yarn is, if anything, better being more compact. In the latter case, the ends per inch in the warp and the working ends per inch in the weaving would be the same number. However, two advantages go with a multiple warp. A long warp can be put on the loom and then split into different numbers of working e.p.i. as is required by each successive rug, following the examples given above. A corollary to this is that the weaver need only keep a stock of one standard warp yarn for weft-face rugs.

Coming to actual settings of the warp and weft, the rule governing weft-face plain weave is that the more warp there is per inch (i.e., the thicker the working ends are or the more ends there are), the finer the weft must be that crosses it. If the correct relationship between warp and weft is obtained, a rug of any desired thickness can be woven and it will possess a firm practical texture. A table can be constructed to give a rough guide to this relationship, see Fig. 36. As materials, a warp of 6/10s lea linen is taken and a weft of 2/50s carpet wool; the settings for other materials can be worked out from this basis.

Note—That the first column shows working ends per inch, the actual ends per inch in the warp are obtained by multiplying this by the number in the second column.

—Where alternatives are given in the warp and the weft columns, the higher numbers will always give a firmer rug, but they may need heavier beating than some weavers can muster. So if the loom or the weaver is not made for heavy beating, use the lower numbers.

Working e.p.i.	*Warp* 6/10s *linen*	*Weft* 2/50s wool	*Character of Rug*
3	2–3 fold	4–6 fold	THICK
4	2 fold	3–4 fold	
5	1–2 fold	2 fold	
6	1 fold	1 fold	THIN

Fig. 36
Table showing relationship of warp and weft in a weft-face rug

The table illustrates the rule already mentioned, that the more warp there is per inch the finer the weft must be. But it also shows that there are always three variables, which must be correctly related to each other to give a satisfactory rug, namely, the working e.p.i., the warp thickness and the weft thickness. Once the rigidity of this table is departed from, it is necessary to juggle with these three variables. The problem can arise in several forms.

For instance, a certain specific weft may have to cross a certain specific warp. Then the third variable, the working e.p.i., has to be adjusted until a suitable texture is achieved. Or the loom may be set up with a certain warp set at so many working e.p.i. and the problem then is to vary the weft thickness until the correct texture is produced. Or again, an unusually stiff and stubborn weft may be encountered, and then both warp thickness and its setting have to be varied to reach a satisfactory solution. Remember all the time, the aim is to make a firm-textured rug.

The above juggling with variables implies the weaving of experimental samples. This, rather than following recipes and books, is the best way to acquire an insight into the problem. If this principle of three variables is understood, then the two most obvious faults in weft-face rugs will be avoided. These are either having the warp too thin for the weft (or vice versa) giving a spongy, sleazy, rug that a finger can poke through, or having the warp too thick for the weft (or vice versa), giving a hard,

board-like rug which will not lie flat and in which the weft barely covers the warp.

Apart from the thickness, there is another property in yarns which affects the warp/weft relationship. This is their firmness or degree of compressibility. For example, to judge from its visible diameter alone, a horsehair yarn used two- or threefold might be thought suitable for the weft. But its lack of compressibility will prevent it beating down and covering the warp and so it may have to be used singly. Though really obvious, this is mentioned to emphasize how rough a guide the table is. It is based on a certain warp and weft, and a different table could be constructed for any combination of other warp and weft yarns.

Most weft-face rugs woven by western hand weavers nowadays, have a weft far thicker than the warp. But the reverse relationship is the one typical of these rugs in the past and among most weavers in the East today.

These have a different surface, with strong warpway ribs made by the fine weft curving over the thick solid warp ends. It might be thought that this relationship would have the disadvantage of slowness in weaving as there are so many more picks per inch. But as the fine weft can be wound onto normal bobbins and thrown in ordinary shuttles, this is not so. Also as the warp makes up so much of the weight of the rug, it means there is less weft per square yard than in the more normal type, an advantage if, as is likely, the weft is a more expensive yarn than the warp. The reduced time needed to dye the weft is another advantage.

An all-wool rug of this type can be made with a warp of 6-ply rug wool, 4 e.p.i., single in the heald, therefore 4 working e.p.i., and a weft of 2-ply carpet wool used singly. Another type has a 6/10s linen warp, 12 e.p.i., double in the heald, therefore 6 working e.p.i., and a weft of 2-ply carpet wool used singly or a tapestry worsted yarn used double or treble.

C. Selvages

In rugs, selvages have considerable importance, because, unlike a piece of cloth that is cut and shaped before it is finally used, a rug is used as made. Its selvages, good or bad, are always on view. They have to stand a great deal of hard wear. A rug generally begins to wear out somewhere on its periphery, either at the selvages or at the fringes.

In some rugs woven on primitive equipment (for instance, kilims woven on a horizontal ground loom) the selvages curve and waver. A rug may lose a foot in width between its starting and final end. This may have a certain charm to sophisticated eyes but it is only the result of weaving without the physical help of a batten and temple, and without the mental concept of parallel selvages. It should not be cited as an excuse for irregular selvages on a rug woven on a better equipped loom.

The rule for the warp at the selvage is to increase its thickness and to set it closer in the reed. Thus if the main part of the rug has a warp formula of 6 e.p.i., double in the heald, therefore 3 working e.p.i., at the selvage have one or two working ends in

which the warp yarn is used threefold instead of twofold, and place these thicker working ends closer together. This is shown diagrammatically in Fig. 37, where such a warp is seen sleyed in a reed with 6 dents per inch. Generally, the wider the rug, the more thickened selvage ends are needed: but the limit is about three such ends at each selvage.

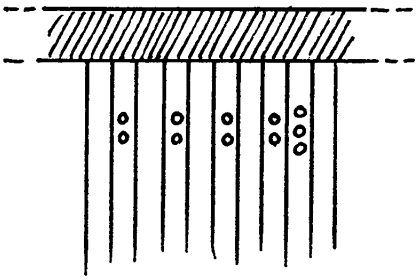

Fig. 37
Method of sleying selvage in the reed

It will be seen that using a reed with more dents than are actually needed, e.g., a reed with 6 dents per inch instead of 3, has the advantage that the selvage spacing can be more finely adjusted. Also there need never be two selvage working ends in one dent where they tend to catch on each other in the shedding.

A selvage setting as described, combined with correct weft tension and the use of a temple, should give perfectly satisfactory edges to the rugs, They will be firm and strong, and need no extra overcasting with weft as is sometimes advised.

All the points described in Chapter 3 apply to the weaving of weft-face rugs and the weaver should be conversant with them before trying the following techniques.

2. ONE-SHUTTLE TECHNIQUES

A. Colour Blending

Colour blending is the making of an area of colour more alive and interesting by using mixtures of different shades of that colour. This can be used by itself or to enhance the interest of other rug techniques.

If, for example, a red rug is to be made, many reds are used (instead of using one shade throughout) some lighter and some darker, with perhaps excursions into purples and pinks. This can be done in two main ways. Assume that the warp is set up so that a 2-ply carpet wool used fourfold is the appropriate weft.

(i) One way is to wind several shuttles each carrying only one colour, i.e., four threads of colour A on one shuttle, and four threads of colour B on another, etc. Then in the weaving, use these shuttles in some order, such as 1 inch of A, 2½ inches of B, 1¼ inches of C and so on. So that the result is irregular stripes of different, but closely-related colours. Such irregular stripes can be woven without a pre-arranged

plan, merely letting what has just been woven suggest the colour to use next. An arrangement of colours like this is always more interesting than regularly repeating stripes or a scientific grading from one colour into another. Its unpredictability is its strength: such a rug cannot be 'solved' at a glance.

(ii) The other type of colour blending starts as the shuttles are being wound. Instead of each shuttle holding only one red, it now holds a mixture of different reds. A shuttle could be wound with four different reds and the whole rug woven of that particular mixture. But it is more interesting to wind each shuttle with a different mixture and then to use these shuttles in the irregular way described above. So in the first method, the weaving mixes plain colours, but here it mixes mixtures and gives the possibility of richer effects.

Colours can be changed during the winding of a shuttle, e.g., one of the four threads can be broken and a different colour knotted on. But as it is difficult to judge where this new colour will appear in the weaving, the weaver has less control and this method should not be used to excess.

It will be noticed that the weft used for the first method could have been some single yarn whose thickness was similar to that of a 2-ply carpet wool used fourfold and this single thread could have been wound on the shuttles. But for the second method, the finer yarn is essential.

Though ideas about colour slip through any net of words, some things can perhaps be said. If colours very close to each other are mixed, a new colour will be produced, especially when the rug is seen at its proper distance, i.e., on the floor, not on the loom. Mixed dark colours will enrich each other, mixed light colours tend to become muddy. If, instead of a rich mixture a flecked one is wanted, then colours very dissimilar in depth are mixed, the extreme case being black and white. For very gentle grading of colour, change only one of the four colours in each successive mixture. Colours which look well together when seen in the mass, i.e., in hanks, may not be so successful when they are finally mixed on a shuttle, so when choosing colours always hold single threads together.

The practical side to colour blending is mentioned in Chapter 3, where Fig. 26 (a) shows the cones of different colours arranged on the floor with their threads being led up through a horizontal reed to prevent tangling. The reed is only necessary if many colours are being used. If only about twenty cones are being used, they can just be stood in a group on the floor, as a thread will pull off the top of a cone at quite an oblique angle; a vertical pull-off is not essential.

The different colours are wound on to the shuttle without any attempt to twist or arrange them. The fact that they are not twisted adds to the haphazard effect. If black and white are used, a different result can be produced by arranging the cones either as in Fig. 38 (a) or in Fig. 38 (b), the latter giving a finer fleck than the former.

Apart from the visual effect, colour blending has two practical advantages.

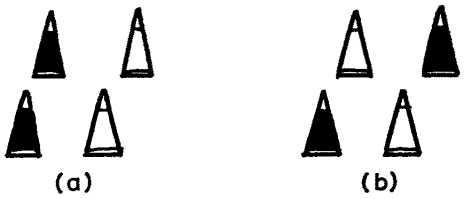

Fig. 38
Two ways of arranging cones

(a) A wool whose colour is too crude or dull to be used by itself can often be employed very satisfactorily in a mixture.

(b) A small amount of wool of one colour, not sufficient for a whole rug, can be used up in a mixture. Even threads only a few inches long can be laid in, in addition to the normal weft, and so not be wasted.

B. Colour Plying

This really differs from colour blending only in that some control is exercised over the way the different colours are arranged as they are wound on the shuttle.

Though yarns can obviously be plied on a spinning wheel, not many fliers have a large enough opening to take the thickness of yarn being dealt with here. So one of two other methods can be used.

(i) The first is that shown in Fig. 39. Put one colour on a cone and stand it on a reed supported in some way. Put the other colour on a cone on the floor, and lead its thread up through the horizontal reed and through the centre of the first cone. As the

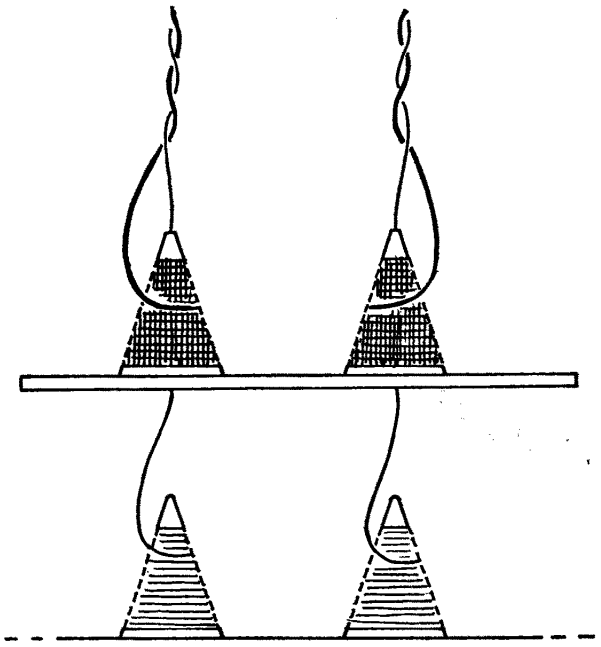

Fig. 39
Plying two yarns to give
Z twist and S twist

two threads are wound together on to a shuttle, that from the upper cone will wrap round that from the lower cone giving a plied thread. The direction of twist will depend on whether the upper cone was wound clockwise or anticlockwise, so it is controllable. The amount of twist depends on the average diameter of the cone, a small cone giving more twist than a large one, so this is less controllable. But packages other than cones can be used to vary the amount of twist, e.g., pirns or tubes, if fixed upright, can replace the upper cone; or a cone can stand on a large warping drum on the floor, the thread from the drum twisting round that from the cone. The former arrangement will give far more twist than the latter.

(ii) In the second method, both the yarns to be used are wound together on to a cone. Then, as they are drawn off, they twist around each other. If more twist is needed they are wound onto another cone, and if necessary then on to yet another. So the twist in this method is more controllable than in the first method.

This technique can be put to various uses, such as the following:

(i) S AND Z TWIST STRIPES

If the warp requires a weft used fourfold and black and white are the colours chosen, then wind some cones with white twofold, and some with black twofold. But wind the cones of one of the colours, say, black, so on some the yarn lies in a clockwise spiral and on others in an anticlockwise spiral. Put a black cone of each type on the horizontal reed, with white cones underneath, see Fig. 39. A shuttle wound from the right-hand cones will have the black and white yarns Z-twisted and one from the left-hand cones will have them S-twisted.

If an inch or so is woven with one shuttle, then an inch or so with the other, vague stripes will appear. In one stripe, indistinct black and white streaky lines will be seen inclining up to the right, in the next stripe the lines incline up to the left. The effect naturally varies with the amount of twist; the less twist, the vaguer the lines. With exactly the right amount of twist—and only experiment will show what this is—a fairly rigid effect can be obtained, looking very like a rug woven in twill, with reverses in the twill direction. The thicker the weft, the better this will show. So if using a warp with 3 working e.p.i., a weft of two threefold carpet yarns twisted together will give a better effect than the same yarns used twofold as described above. But this will require a very hard beat in the weaving. It will be realized that 2-ply carpet wool used threefold is about as thick as 6-ply rug wool. This latter will be more convenient to use for this technique, if a solid, rather than a mixed, colour is wanted.

(ii) PLYING UNEQUAL THICKNESSES

Assuming a weft of 2-ply carpet wool used fourfold is needed, cones can be wound with many threefold mixtures and then these be plied with one colour, wound singly on to a

cone. In other words, the cone of threefold weft will be on the floor and the cone of single weft will be on the reed. The colour of the single yarn can be something a little different in depth or tone from that of the threefold mixtures, so that it is seen as a regular small fleck against a changing background. This idea can naturally be combined with S and Z twist stripes. It can also be reversed, so that the threefold mixture is a constant colour, and the single yarn changes its colour.

(iii) PLYING DIFFERENT MATERIALS

Many combinations of materials can be tried, e.g., wool and linen, wool and cotton, wool and jute, horsehair and linen, and so on. In most cases, these materials will weave together more successfully if plied than if merely wound together onto a shuttle.

C. Handspun Wefts

Very few rug weavers now spin their own materials, either warp or weft. A rug uses much yarn in proportion to its size, e.g., 6 to 8 lb. of weft for a rug 3 foot x 5 foot, so the days spent in spinning for it would far outnumber the days spent in weaving it. But for those for whom this is not a deterrent, the hand-spun weft-faced rug offers many possibilities.

The spinning should be of the worsted, not woollen, type, both for strength and for resistence to fluffing out in use. Also it is quite inappropriate to spin a light woollen yarn and then beat it up close in the weaving and obliterate its characteristics. The long staple lustre fleeces are the best therefore, if wool is to be used. A tightly spun 2-ply yarn should be aimed at. This can be used two, three or fourfold in the weaving, which is far easier and more controllable than spinning a very thick yarn to be used single.

Many different materials can be used alone or in combination, such as wool, hairs (horse, camel, goat, alpaca, mohair), linen, hemp, jute and synthetics. When spinning together materials whose fibre length is very dissimilar, cut the longer one to the staple length of the shorter before carding. Plate 1 shows a sample spun of black and white delustred rayon with hemp and jute. For this, the hemp and jute were cut into 6-inch lengths because the rayon happened to have a 6 inch staple. These were all carded together, but only to give a slight mixing of the materials. They were then roughly combed by pulling through the hands and tightly spun. In subsequent cardings, different proportions of black to white rayon and of hemp to jute were used, so that the yarn produced would not be uniform and therefore the rug would have a more interesting surface. So here the rug is being designed in the spinning.

There are many variations possible, such as dyeing the fibre and mixing different colours during spinning. Because the yarn is tightly spun and will be tightly beaten in the weaving, fibres can be spun together which are very dissimilar in such physical

properties as elasticity and resilience. An example is a yarn spun from wool, rayon and shreds of raffia, which gives a very interesting texture to both hand and eye when woven. There is obviously a large field for experiment in the spinning of rug yarns and many as practical as the commercially produced wool and hair yarns could very likely be designed.

Because the aim is a tightly spun 2-ply yarn, the initial singles must be very tightly spun. And as this will be thicker than normal hand spun yarn, it is often difficult to spin it on a wheel. The problem is that the thicker a yarn is, the less twists per inch it needs to become tightly spun. This implies that the hands have to move very fast, controlling the entry of the wool into the spinning area, in relation to the speed of the pedalling. Another difficulty is to so adjust the wheel that it will draw in the thick tightly spun yarn quickly and easily before it is overspun.

The historically older great wheel, in which a metal spindle is driven by a large hand-turned wheel, overcomes both these difficulties. Very few weavers have such a wheel but they all have a bobbin winder and this can be used in exactly the same way, as described below.

Tie some strong yarn onto the spindle of the bobbin winder near its thicker end. Rotate the spindle and guide the yarn up to its tip. If the spindle continues to rotate, the yarn will slip off the tip at each revolution, and with each revolution one more twist will be put into the yarn. To prevent damage to the yarn, hold it at an oblique angle, not a right angle, to the spindle. Now attach the prepared fibres to the piece of yarn, rotate the spindle and start spinning. One hand controls the bobbin winder, the other the fibres. The latter hand, the spinning hand, naturally draws further and further away from the spindle as the yarn is spun. At the limit of stretch, reverse the spindle sufficiently to unwind the yarn from the tip of the spindle. Then rotate it in the normal direction, but with the spinning hand guiding the yarn so that it is wound on to the spindle. When the yarn is nearly all wound on, again lead it up to the tip and continue spinning.

Continue thus until the spindle is full and then wind the yarn to await plying. Alternatively, a tube can be fixed on the spindle before spinning and the yarn wound on to this as it is spun. This tube is then simply slipped off when full and replaced with an empty one. Plying is done in the same way, but rotating the spindle in the opposite direction.

With practice a thick single yarn can be spun on a bobbin winder. If woven without being plied this unexpectedly gives the appearance of twill lines. With a Z twist yarn these lines incline up to the right.

D. Tie and Dye Wefts

The various tie and dye techniques offer almost limitless scope to the handweaver. Perhaps the reason for their being so little used is that the weaver, on seeing complex

examples in museums, decides that such meticulously accurate work is beyond him. There are, however, some very simple applications of the technique to rug weaving which are quick to prepare and interesting to weave.

Repeating Designs

In this method, the whole of the design of the rug comes from the tying and dyeing of the weft. Its special feature is that the weft is dyed whilst still in hanks.

As the weft is wound straight on to the shuttle from the hank, the latter must have yarn of the correct thickness for weaving, e.g., it could be a hank of 6-ply rug wool, if the warp is to be set at 3 or 4 working e.p.i. The technique can be best understood if one example is described in detail.

Tie the hank so as to exclude its outer quarters from the dye, see Fig. 40 (a). A thick, but soft, cotton yarn is the best to use, and the tying must be as tight as possible. A time-saving alternative is to slip sections of rubber tube over the outer quarters, as these only have to be tied at one end, see Fig. 40 (b).

Dye the hanks, say, black, suspending them in the bath by the tied portions. After dyeing, rinse and untie, and then dry the hanks. They will now consist of yarn in which a length dyed black follows an equal length which is undyed, see Fig. 40 (c).

If this were woven on a warp as wide as the hank is long, a rug as in Fig. 40 (d)

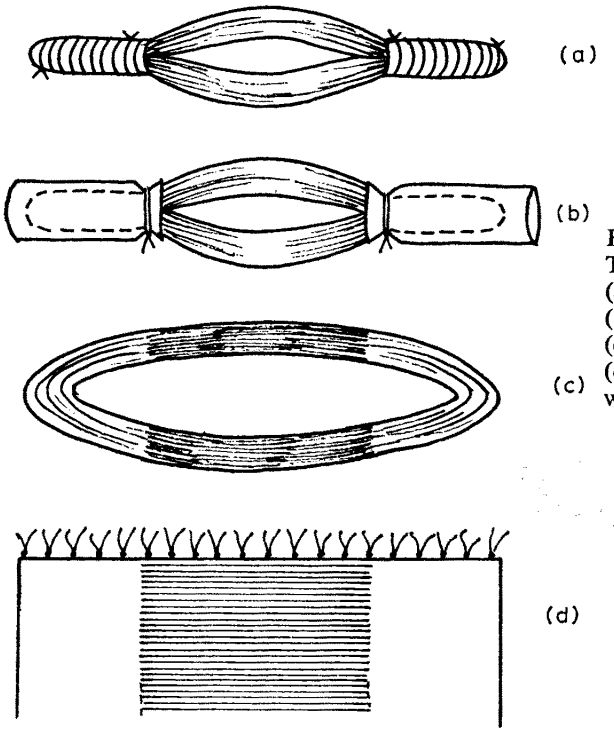

Fig. 40
Tie-dyeing a hank.
(a) By wrapping
(b) By using rubber tubes
(c) The resulting hank
(d) How it appears when woven

would be the result. The black and white parts of each pick would lie exactly over the black and white parts of the preceding pick. This suggests possible rugs with warpway stripes and blocks. But here, use a warp whose width is *slightly more or slightly less* than the hank length, i.e., if the hank when stretched measured 36 inches, then use a warp 1 or 2 inches wider or narrower. This is done so that in each pick the black and white parts do not lie exactly over each other, but a little to one side. This shift becomes greater with each succeeding pick.

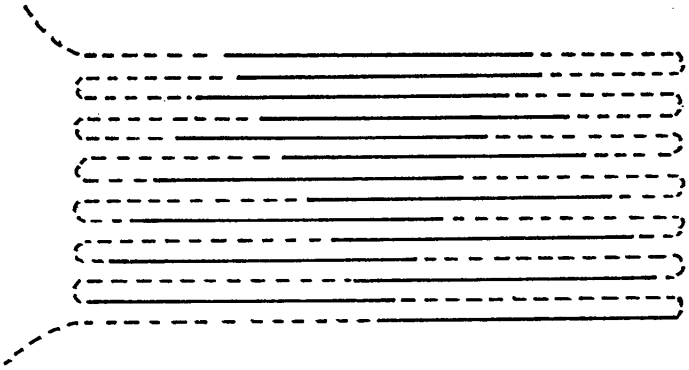

Fig. 41
Detailed plan of tie-dyed weft to show colour shift

Assuming that the warp is wider than the hank length, Fig. 41 shows diagrammatically what happens to the weft. Three areas are produced, namely, a triangle of solid black in the centre, two triangles of solid white at the sides, and two triangles of black and white, pick-and-pick, in between. These triangles become diamonds as the weaving continues. Plate 2 shows the completed rug.

Once the right width of warp has been found—and a little trial and error is necessary to establish this—the weaving is perfectly straightforward. If at any point the pattern jumps, due perhaps to a loose thread in the hank, take up the slack by winding the weft once or twice round the selvage threads. Overcome other small irregularities in the hank, by varying the weft waving.

It will be understood that the closer the hank length approaches the warp width, the smaller will be the colour shift in each succeeding pick and therefore the bigger, in the warp direction, the diamonds will become. Another facet of this principle is that by varying the size of the weft waves or their tension, the size of the diamonds can be varied in the course of one rug. But for practical reasons, this should only be done within narrow limits.

It will be obvious that because of this hank size/warp width relationship, a bought hank may have to be rewound to the desired size. Do this either on a skeiner adjusted so that its circumference is twice the required hank length or by finding a combination of pegs on a warping board that gives the correct length and winding the yarn round these by hand. In both methods be very careful to keep the tension of the yarn constant and avoid it building up on itself.

Other Developments of this Method

(a) A tie and dye weft can be combined with a normal weft in some such sequence as two picks of one then two picks of the other. The normal weft could be one of the colours of the tie and dye weft, or it could be a colour mixture that changes throughout the rug and robs the repeating design of some of its severity.

(b) Two tie and dye wefts can be used at once in a pick-and-pick sequence. This will give bigger diamonds in the warp direction and diamonds of cross stripes will replace those of pick-and-pick stripes.

(c) Instead of tying and dyeing a hank of 6-ply wool, a hank can be made of three or four differently coloured 2-ply yarns, i.e., all three or four yarns are run on to the skeiner together. Make the hanks with different mixtures of colours, say, reds, then tie and dye them all in black or very dark red. The rug will then have a play of reds against a constant black.

(d) The hanks can be tied in some different way, for instance, to exclude the dye from one half only (giving a rug like the right hand half of Fig. 41) or to exclude the dye from the outer sixth of the hank (giving a rug with a large dyed central diamond alternating with a small undyed one).

The beauty of this method is that as long as the hank is the correct size, it will result in some sort of repeating design based on diagonal lines, in whatever manner it is tied up before dyeing. There is, therefore, great scope for experiment.

Non-Repeating Designs

The tying and dyeing of hanks which do not have the above relationship to the warp width can be used as an alternative method of colour blending or to produce haphazard two-colour effects. The simplest and quickest way is to tie very tight overhand knots in the hank itself. Due to the bulk of the material, it is generally difficult to tie more than two.

With this method there is not the crisp boundary between dyed and undyed portions obtainable with normal tie and dye methods. But these blurred boundaries, which may appear as a third colour some way between the other two, add variety to the yarn. Such a yarn can be used by itself (or mixed with another) where an area consisting of two colours intimately mixed is required. The effect is quite different from that obtained if yarns of the two colours had been blended in the usual way; it is a coarser-grained mixture.

Plate 3 shows the result of tying a hank of red wool in three places in the normal way and then dying it black. The hank was 36 inches long and the sample about 9 inches wide. It was while trying to produce this effect on a full-sized warp that the technique described above was chanced upon.

E. Twisted Wefts

In Coptic tapestries there are often areas woven with a weft consisting of a purple and white thread. This generally gives an over-all speckled appearance but occasionally by chance the two strands lie in such a way as to give an ordered sequence. The present technique sprang from the idea of making this chance happening deliberate, and led to the finding of other variations not present in the Coptic textiles.

As these are all small scale effects, they show best when the two colours used differ widely in tone. Black and white are suitable for trying the technique. Assuming the warp to have 3 working e.p.i., wind a 6-ply yarn of each colour on to the same shuttle. This means that the combined weft is equivalent to six 2-ply yarns, whereas four has been given earlier as a normal amount. But if this extra thick yarn can be beaten in, it will give a better effect and will prove easier to handle.

The various effects that can be produced are now described.

(i) HORIZONTAL LINES

Throw the shuttle, arrange the two colours so that the black is nearest to the fell of the rug, all across the width of the warp. Beat.

In the next pick, make the white nearest the fell of the rug. Beat.

Repeat these two picks.

Note—That this gives straight horizontal lines, quite unlike the wavy lines if two picks of black alternate with two picks of white. See Fig. 42 (a).

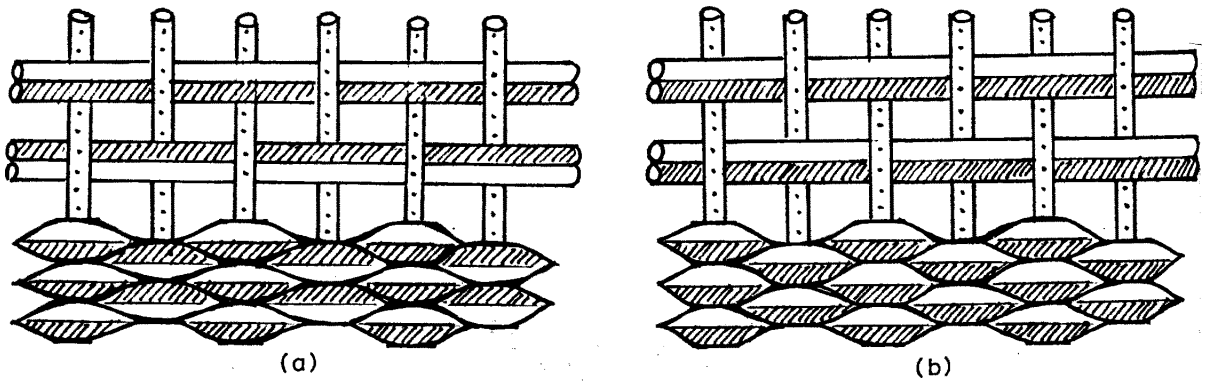

Fig. 42. Twisted Wefts (a) Giving horizontal lines (b) Giving spots

(ii) SPOTS

Arrange wefts so that either black or white is nearest the fell of the rug in every pick. See Fig. 42 (b).

(iii) COMBINED LINES AND SPOTS

(*a*) *An Area of Spots on a Background of Lines*

In the first pick arrange the colours so that the white is nearest the fell of the rug. Insert the fingers through the top of the shed and twist the middle portion of both wefts so that the position of the colours is here reversed.

In next pick, make the black nearest the fell on the rug, all the way across. Do not twist the central portions.

Repeat these two picks. See Fig. 43 and Plate 4.

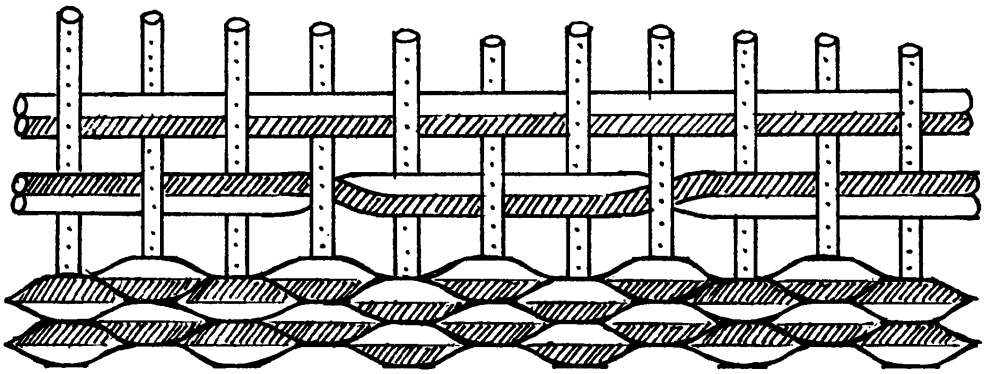

Fig. 43. Twisted Wefts. Area of spots on background of lines

Note—That the size and shape of the area of spots is completely controllable by the amount of weft which is twisted in the first pick of each repeat.

—That there can be several such areas across the width of the warp, not just one in the centre as described and illustrated.

(*b*) In an exactly similar way, an area of lines can be produced on a background of spots. Arrange the wefts to make the black nearest the fell of the rug in every shed, and twist the central part of the weft in every other shed.

(iv) DIAGONAL LINES ON BACKGROUND OF HORIZONTAL LINES

Arrange the wefts as for horizontal lines but twist the central portion, thus reversing the colours, in every shed. Make the twist so one colour, say, the black as in Fig. 44, is always on top where the yarns cross. Twist a progressively larger amount of weft in each pick, so that the crossing points move outwards. Do this carefully, making sure the black crosses the white in between two raised warp ends, as in Fig. 44, which shows only one diagonal line. Plate 5 shows both black and white diamonds produced in this way.

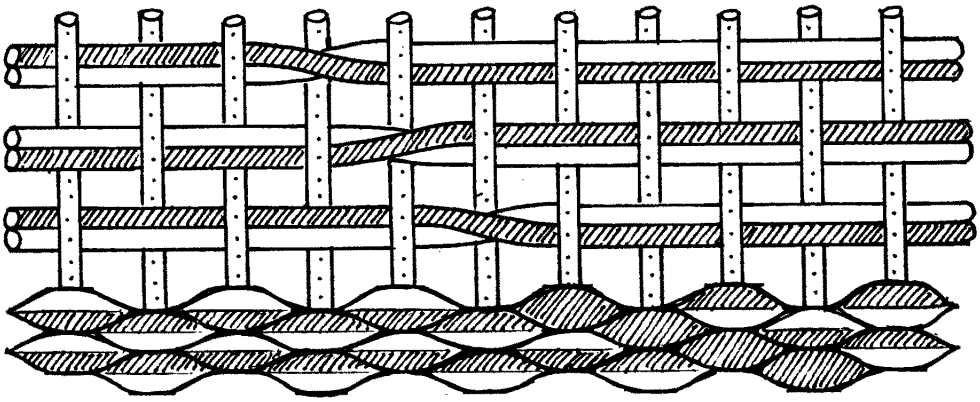

Fig. 44. Twisted Wefts. Diagonal lines on background of horizontal lines

(v) VERTICAL BLACK AND WHITE LINES ON BACKGROUND OF HORIZONTAL LINES

Make a double twist of the wefts as in Fig. 45 (a), ensuring that the black crosses the white between two raised warp ends and that the white crosses the black between the next two raised warp ends. On either side of this double twist, make the black nearest the fell of the rug.

In the next pick, make a similar double twist, but in the reverse direction, and arrange the weft on either side to make the white nearest the fell.

Repeat these two picks making the twists in exactly the same place, see Fig. 45 (a) and Plate 6 (lower half).

Note—The lines need not be vertical. They can be moved to either side by changing the position of the twists.

—There can be many lines across the width of the warp.

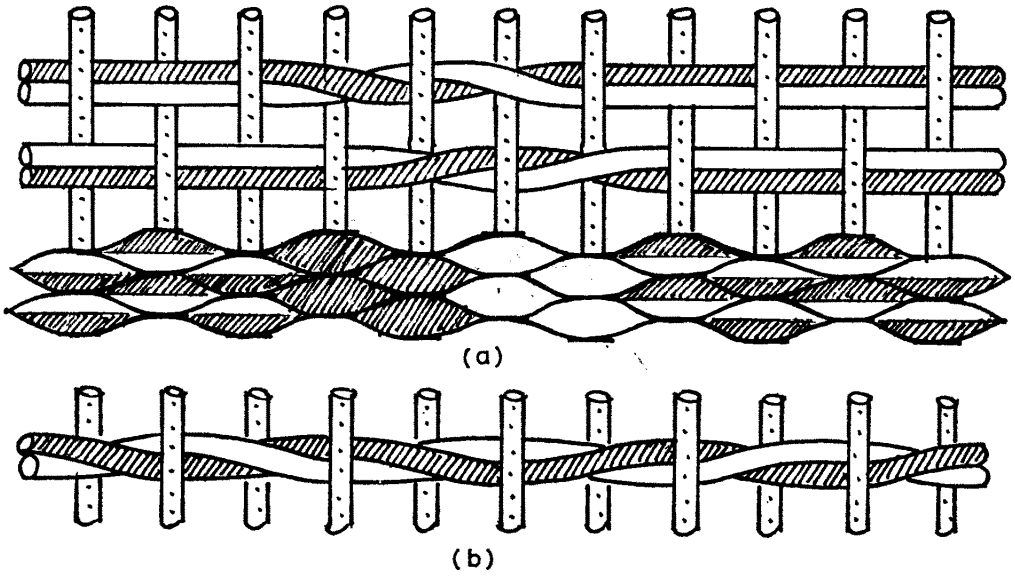

Fig. 45. Twisted Wefts
(a) Vertical lines on background of horizontal lines
(b) Twisting wefts at centre

(vi) MULTIPLE TWISTS

(*a*) *Uncontrolled*

Throw the shuttle; then, with the shed still open, insert the index finger and thumb of both hands through the centre of the raised warp ends. Picking up the wefts in the centre, twist them several times in one direction, either away from or towards the fell of the rug. Close shed and beat. The weft will now be twisted so that half is S-twist and half Z-twist, see Fig. 45 (b).

Repeat this for about 2 inches of weaving, always twisting in the same direction. Then weave another 2 inches but twist the weft in the reverse direction.

The result is an area with vague concentric oval lines see top of Plate 6. The more twist that is put in, the more obvious the lines will be. On the back of the rug, there is a vague cross shape.

(*b*) *Controlled*

This is really an extension of (v). Throw the shuttle. Twist the weft many times in the centre of the pick so that a different colour comes up between each pair of raised warp ends, see Fig. 46. Arrange the weft on either side of the twisted area to give the black nearest the fell of the rug.

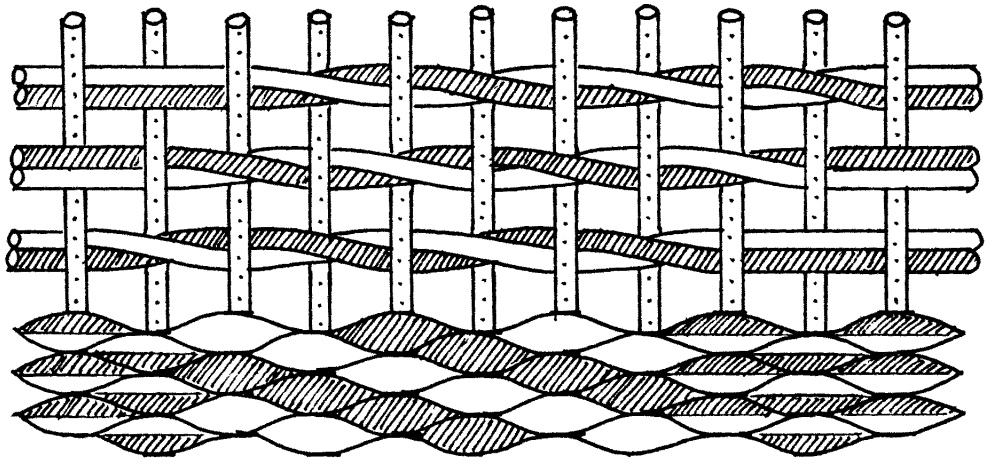

Fig. 46. Twisted Wefts. Controlled Multiple Twists

In the next pick, twist the central part in the same direction, and arrange the colours to produce diagonal lines. Arrange the weft on either side to give the white nearest the fell.

Continue thus, always twisting in the same direction and always arranging the colours so that the diagonal lines are built up. To reverse the direction of the diagonal

lines, reverse the direction of the twist. Plate 7 (lower half) shows a rectangle produced in this fashion. Another variation is to twist the wefts in the opposite direction in each successive pick, and to arrange the colours so that vertical lines are built up. These lines have a characteristic zigzag appearance, as seen in the upper half of Plate 7. Both of these controlled twist effects are very similar to those obtained with weft twining (see Chapter 13).

General Note—Although all of these techniques have been described as being woven with a black and white weft on one shuttle, some of them may be easier to weave with the two wefts on separate shuttles.

3. TWO-SHUTTLE TECHNIQUES

By using two shuttles carrying different colours and always throwing them from selvage to selvage, three basic effects can be obtained. These are weftway or cross stripes, warpway or pick-and-pick stripes and spots. In the following descriptions the two wefts will be called A and B.

A. Weftway or Cross Stripes

Start weft A at the left selvage, and weave two picks. Start weft B at the right selvage and weave two picks. Repeat these four picks.

The thin cross stripes produced will have a wavy appearance which is characteristic of such stripes in a weft-face weave. The one described is called a 2-and-2 stripe. In a similar way, a 4-and-4 stripe or a 6-and-6 stripe can be woven; and also, of course, uneven stripes, such as 2-and-4, and 4-and-6.

If each stripe contains an even number of picks, there are no complications at the selvages. But there is one thing to notice. After 2, 4 or 6 picks of A, when B is introduced it forms a small loop at the selvage between its last pick and this new pick. Pull the yarn tight here.

If there is a stripe of more than six picks of A, then this loop of B becomes a weakness and should be dealt with in the following way Weave weft A from left to right normally Then catch it around weft B and make the returning pick from right to left. Weft B will then be held by and hidden by weft A as the latter loops around the selvage. This may be understood by referring to Fig. 47, and also perhaps by imagining that B is glued to the selvage thread on its side, so whatever A does in relation to the selvage, it does the same in relation to B. This gives a slight extra thickness to the right selvage but it is hardly noticeable. However, if stripes of many picks are to be woven, it is better visually and economically (the above procedure slows down the rhythm of weaving) to finish off each colour at the end of its stripe, and then start it again at the beginning of its next stripe.

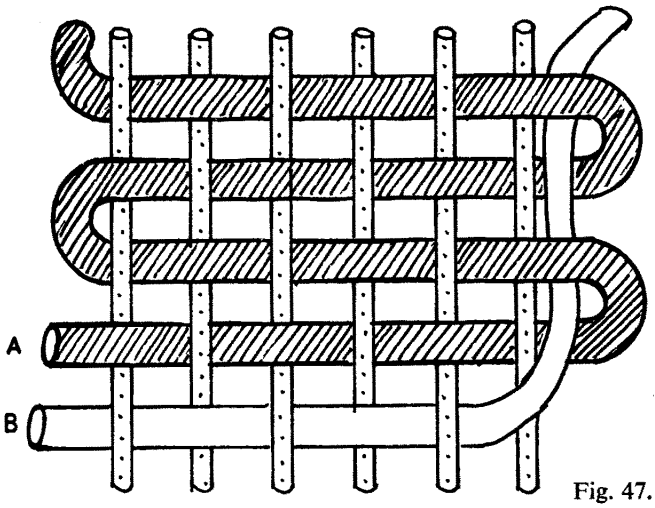

Fig. 47. Carrying weft up at selvage

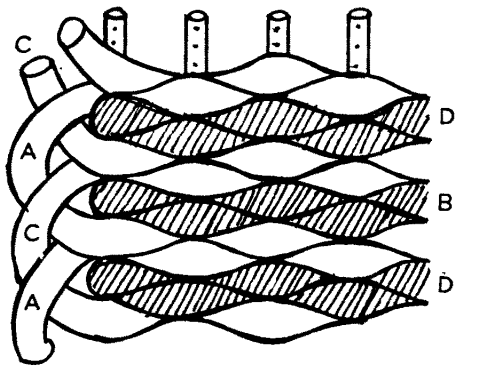

Fig. 48. Selvage when using four shuttles for weaving cross stripes

The small loop at the selvage when weaving 2-and-2 stripes adds strength and substance to the edge of the rug. But it can be made use of even when not weaving stripes. For instance, instead of using one shuttle in an area of solid colour, use two shuttles each carrying the same colour and weave two picks with one and two picks with the other, remembering to start them from opposite selvages as described above.

A development of this uses four shuttles, though not necessarily four colours, and gives a decorative edge, see Fig. 48, which shows a left-hand selvage. Two wefts A and C (white) have started from the left selvage, and two other wefts B and D (shaded) have started from the right selvage. The picking order is two picks A, two picks B, two picks C and two picks D, repeat. Notice how A and C twist round each other. B and D twist similarly at the right selvage. A begins its first pick by passing over C, then under the first warp thread, and ends its second pick by passing over the same warp thread and under C.

B. Warpway or Pick-and-Pick Stripes

If two colours are used alternately, i.e., pick-and-pick, in a weft-face weave, they give thin lines of the two colours in the warp direction. If the warp has 3 working e.p.i. there will be three such lines to the inch: in other words, each line lies over a warp thread. These lines are a characteristic feature of weft-face weaving and have been known and used for centuries in rugs and tapestries. They can be used all across a rug or in small areas. The same principle can lead to warpway stripes in more complex weaves, e.g., twills and block weaves.

The extreme simplicity of the technique is slightly offset by the difficulties that arise

at the selvage. In ordinary weaving, the fine wefts are generally locked round each other at the selvage when weaving pick-and-pick. The same method using thick rug wefts leads to untidy lumpy edges.

The correct method will be described in detail together with suggestions for speeding up the process. In essence, it is to let one of the wefts not weave with the selvage thread at all, and to wind the other weft round the selvage to make up for the thickness of the missing weft. The exact manipulation of threads depends on the number of working ends in the warp. It is different for an odd and even number.

(i) WITH ODD NUMBER OF WORKING ENDS

Fig. 49 shows a miniature warp with seven working ends. The sequence of the four picks in the repeat is thus.

Start with two wefts, A (shaded) and B (white) both at the right selvage, the last pick having passed *over* the selvage thread. See arrow in Fig. 49.

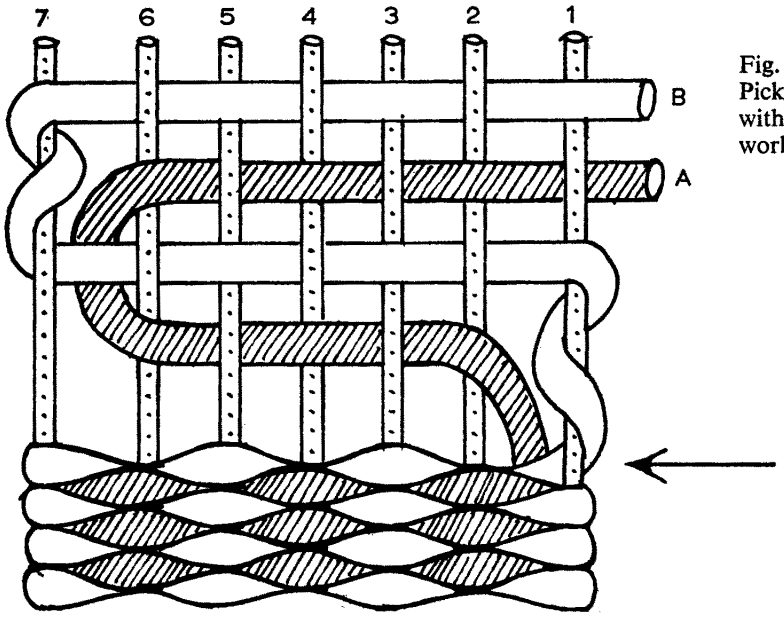

Fig. 49
Pick-and-pick stripes with an odd number of working ends in the warp

Lift odd-numbered ends, throw A from right to left. Note that A does not weave with the selvage thread at all. It misses it completely, jumping up vertically from its preceding pick and leaving a small loop at the back of the rug between the first and second working end.

Lift even-numbered ends, wrap B twice around selvage thread in a downwards direction, then throw from right to left.

Lift odd-numbered ends, throw A from left to right as before. It now leaves a loop at the back between the sixth and seventh working ends.

Lift even-numbered ends, wrap B twice around selvage thread in a downwards direction and then throw from left to right.

Repeat these four picks.

Be careful of the weft tension. Do not pull A too tight or its loop will kink the weft B and bring it onto the surface of the rug. Pull tight the twists of B around the selvage thread before allowing the usual slack for waving the weft. The number of twists can be increased if necessary to make level the fell of the rug.

The top surface of the rug will be perfect but the reverse will have small 'jump-up' loops of weft A visible at each selvage. When first practising this technique, frequently examine the underside of the rug to make sure these loops are regular.

Always wrap weft B in the correct direction, otherwise it will cause a float over two ends at the selvage.

Always start with the picks exactly as in Fig. 49. If the sequence is started with both wefts at the right selvage but with the last pick going *under* the selvage thread, the loops of weft A, where it misses the selvage, will be on the top surface of the rug. Also the twists of weft B round the selvage will have to be in the opposite direction to those described, i.e., upwards instead of downwards.

As will be imagined, the twisting of weft B twice round the selvage thread is time-consuming, but there are ways of quickening the process. Note that the only effect of the first downward twist is to make the weft B lie under the selvage thread instead of over it. So if, when weft B is thrown, the hand catching the shuttle lifts the selvage thread (normally down where B is thrown in either direction) the shuttle will pass under it instead of over it. Weft B will now lie under the selvage thread. Throw weft A normally. Weft B now only needs *one* downward twist before it is thrown back, and made to pass under the selvage thread on the opposite side. This method is a help, but can be developed further by using a floating selvage.

Floating Selvage

A floating selvage is one which is not threaded through any heald, but is sleyed normally through the reed. So it is unattached to any shaft. When a shed is made, e.g., for plain weave, half the threads rise and half fall but the floating selvage on each side stays unaltered, lying horizontally in the neutral position of the warp, bisecting the angle of the shed. It is shown as a dotted line in Fig. 50 (a). This means that there are two openings through which the shuttle can be entered, X above the floating selvage and Y below the floating selvage. Naturally at the opposite side the shuttle will always tend to leave the shed *below* the floating selvage.

Using the floating selvage, the sequence is thus:

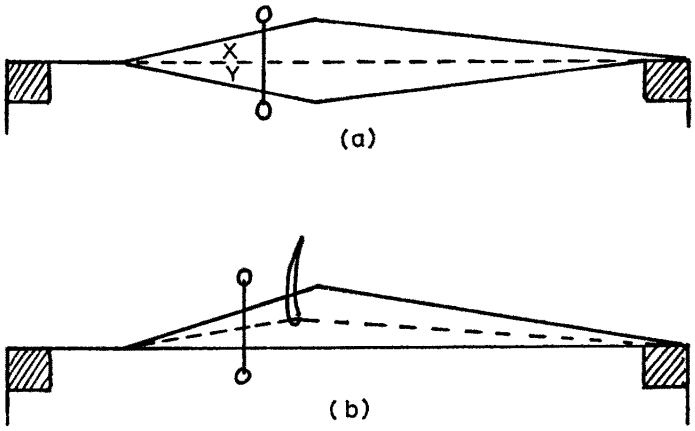

Fig. 50. Floating Selvage. (a) With rising and falling shed (b) With rising shed only

Lift odd-numbered ends, throw A right to left, entering it *under* right floating selvage, and catching it from *under* left floating selvage.

Lift even-numbered ends, wrap B *once* downwards round right selvage thread, throw it right to left, entering it *over* right floating selvage and catching it from *under* left floating selvage.

Lift odd-numbered ends, throw A from left to right, entering it *under* left floating selvage and catching it from *under* right floating selvage.

Lift even-numbered ends, wrap B *once* downwards around left selvage thread, throw it left to right, entering it *over* left floating selvage and catching it from *under* right floating selvage.

Repeat these four picks.

Note—That A always enters under floating selvage.
—That B always enters over floating selvage.
—That both A and B always leave shed under floating selvage.

It will be obvious that a floating selvage is only possible with a loom which has a rising and falling shed as shown in Fig. 50 (a). This is produced by a counter-balanced or counter-march loom or by a jack loom, in which the warp line when the shafts are at rest is well below the line from breast beam to back beam. A table loom, which generally has a rising shed only, and a warp line which is horizontal at rest, is not suitable as it stands. But it can be made suitable by fixing the floating selvage with a string loop to the upper frame of the loom, so that it is always in a half raised position, as in Fig. 50 (b).

Such a string loop may also be necessary with a rising and falling shed, so that the height of the floating selvage can be exactly adjusted. It should be at such a level that the shuttle leaving the shed just passes under it, and so that at the same time there is

as much space as possible over it for the entering shuttle. The deeper the over-all shed, the easier it is to strike this balance.

There is a simpler, quicker, but less tidy way of using the floating selvage in pick-and-pick areas. In this, each shuttle always enters the shed *over* the floating selvage and always leaves it *under* the opposite floating selvage. Fig. 51 shows that one weft A

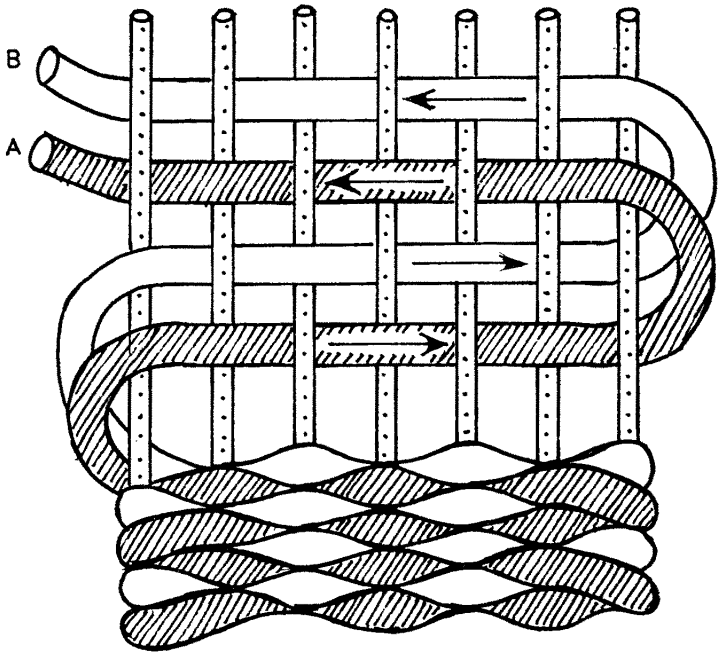

Fig. 51
Alternative method of weaving pick-and-pick stripes with a floating selvage

(shaded) floats over two ends at each selvage and the other weft B floats under two ends at each selvage, thus slightly blurring the pick-and-pick stripes at the selvage. The obvious danger is that the weaving at the selvage will become slack, as there are fewer warp/weft intersections than in the rest of the rug. This can be overcome if the two outer threads are set very close together.

Adjustable Floating Selvage

While weaving pick-and-pick, the floating selvage is a great help, but it will be a nuisance if in the same rug areas of one colour or stripes of 2-and-2, are wanted, so a simple method is used to allow the selvage either to float or behave normally, rising and falling with the rest of the warp. See Fig. 52 (a).

Assume the selvage thread should be drawn in on shaft 1. Do not draw it in, but encircle it with a loop of strong cotton twine, the ends of which go through the eye of an empty heald on shaft 1 and then up to the shaft above. Bring one end up behind the

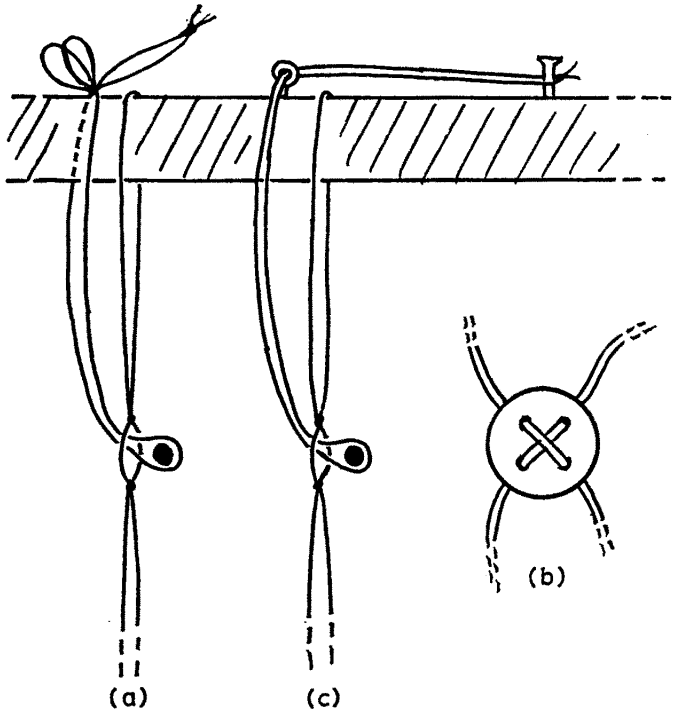

Fig. 52
Adjustable Floating Selvage.
(a–c) Three methods of fastening

shaft, the other in front. Leaving about 6 inches of slack, knot the two ends together.

If this loop is left slack, the selvage will be free to float. If, however, it is pulled tight (and fastened with a slip knot above the shaft), the selvage thread will be pulled tight up against the heald eye and will then have to move as if it were threaded through this eye. So for areas of pick-and-pick the loop is left slack, and for any other area it is pulled tight.

There are two alternatives to a slip knot for tightening the loop. One is to thread the twine through the four holes of a button, as shown in Fig. 52 (b) then slide the button up or down as required. There is enough friction in this system to fix the button in any position. But if many rugs needing the adjustable floating selvage are to be woven use the second, more permanent, method, as in Fig. 52 (c). Pass the ends of the twine through a screw eye fixed in the top of the shaft vertically above the selvage. About 6 inches away from the screw eye, fix a screw or nail also in the top of the shaft. Bring the ends of the twine round this screw, pull them tight and knot, making the knot of such a size that it cannot pass through the screw eye. With the cord in this position the selvage is tight against the heald and will work with it; to make it float, just slip the twine off the screw.

(ii) WITH EVEN NUMBER OF WORKING ENDS

A pick-and-pick rug looks better with an odd number of working ends, as the same colour or type of yarn forms the selvage on both sides. But there may be occasions when an even number has to be used, e.g., when making a rug to an exact width or when making a rug in two strips, to be later sewn together. The sequence of events is then different. Fig. 53 shows a miniature warp of six ends with the four picks that make up the repeat not beaten down.

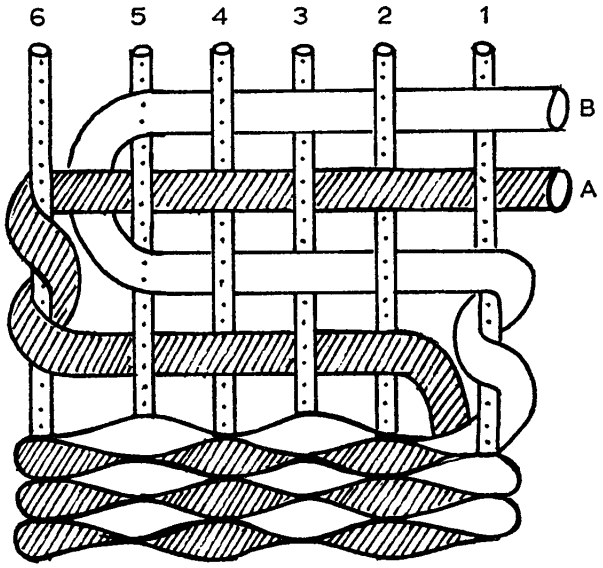

Fig. 53
Pick-and-pick stripes with an even number of working ends in the warp

The procedure is as follows. Start with both wefts at the right selvage, the last pick (white) having gone over the selvage thread.

(*a*) *With Normal Selvage*

Lift odd-numbered ends, throw A from right to left, noting that it misses right selvage.

Lift even-numbered ends, wrap B twice *downwards* around right selvage thread, then throw from right to left.

Lift odd-numbered ends, wrap A twice around left selvage in an *upwards* direction, then throw from left to right.

Lift even-numbered ends, throw B from left to right, noting that it misses left selvage.

Repeat these four picks.

It will be seen that only the third and fourth pick differ from the sequence used with an odd number of warp ends.

(*b*) *With Floating Selvage*

Lift odd-numbered ends, throw A from right to left, so that it enters shed *under* right selvage and leaves shed *over* left selvage.

Lift even-numbered ends, wrap B once *downwards* around right selvage and throw from right to left, so that it enters shed *over* right selvage and leaves it *under* left selvage.

Lift odd-numbered ends, wrap A once *upwards* round left selvage, and throw from left to right so that it enters shed *under* left selvage and leaves shed *under* right selvage.

Lift even-numbered ends, throw B from left to right, so that it enters shed *under* left selvage and leaves shed *under* right selvage.

Repeat these four picks.

The only slightly awkward pick is the first, as the left floating selvage has to be pushed downwards by the hand that catches the shuttle, to allow the shuttle to pass over it. Naturally the adjustable floating selvage can also be used with an even number of warp ends.

Design Possibilities

When using pick-and-pick, two wefts appear in close association and the colour or material of both are under the weaver's control.

The prominence of the warpway stripes can be finely controlled by the contrast between the two wefts. Take as an example, a rug set at 3 working e.p.i., so that each weft consists of four 2-ply carpet wools. If one shuttle has 4 threads of colour A and the other shuttle has 4 of colour B, the stripes will be at their most apparent. But if one shuttle has 3 A and 1 B and the other 2 A and 2 B, the stripes will hardly read at all; there are several stages between these two extremes.

An area of pick-and-pick in two colours, A and B, is often used as a transition between a cross stripe of solid A and one of solid B. If this is combined with varying the proportions of the two colours in the pick-and-pick area, as described above, a very gradual transition can be managed.

If the colour of one weft is kept constant while the colour of the other weft changes either gradually or suddenly, a unity will be given to the latter colours not obtained if used by themselves.

C. Spots

Spots are produced by weaving one pick of colour A and two, three, four or more of colour B and then repeating this sequence.

If there is an odd number of picks of B, the spots in each row will lie vertically above those in the previous row.

If there is an even number of picks of B, the spots in each row will lie to one side of those in the previous row.

(i) WITH ODD NUMBER OF PICKS

If there are three or five picks of B, use the same principle as described for pick-and-pick stripes.

Start with weft A at right selvage and weft B at the left selvage, exactly as in Fig. 54.

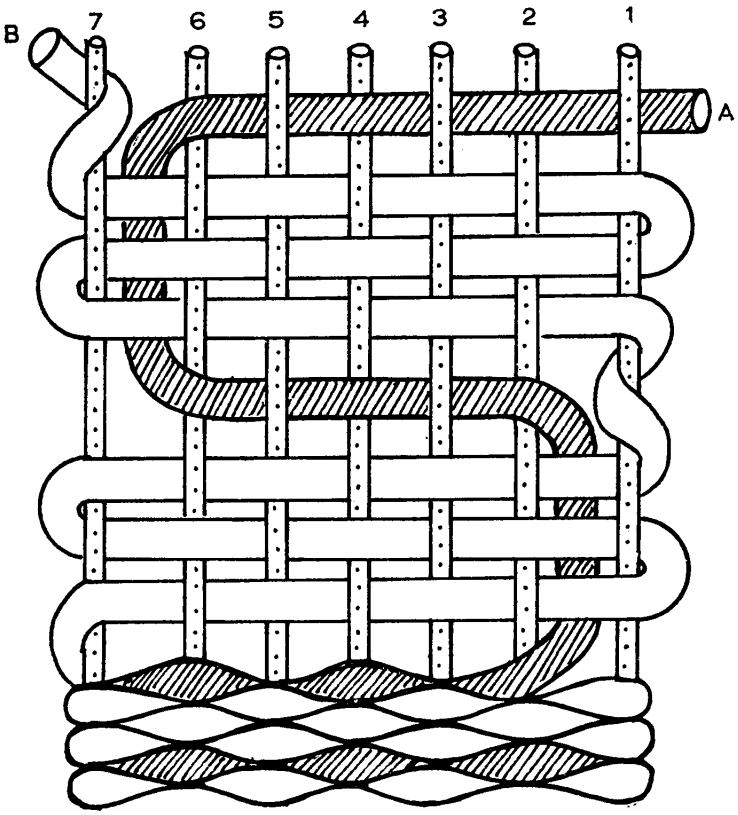

Fig. 54
Spots, with an odd number of intervening picks

Weave three or five picks of B, ending with a double downward twist around right selvage.

Weave one pick of A from right to left, missing selvage thread. The 'jump-up' loop on the reverse of the rug is over three or five picks of B.

Weave three or five picks of B, ending with a double downward twist at left selvage.

Weave one pick of A from left to right, missing left selvage thread.

Repeat this sequence.

The loops of A on the reverse become impractically long, if more than five picks of B are woven. In this case, catch A in the loops of B as they turn round the selvage thread, as described for cross stripes.

(ii) WITH EVEN NUMBER OF PICKS

Start as above with B at left selvage and A at right selvage, see Fig. 55.

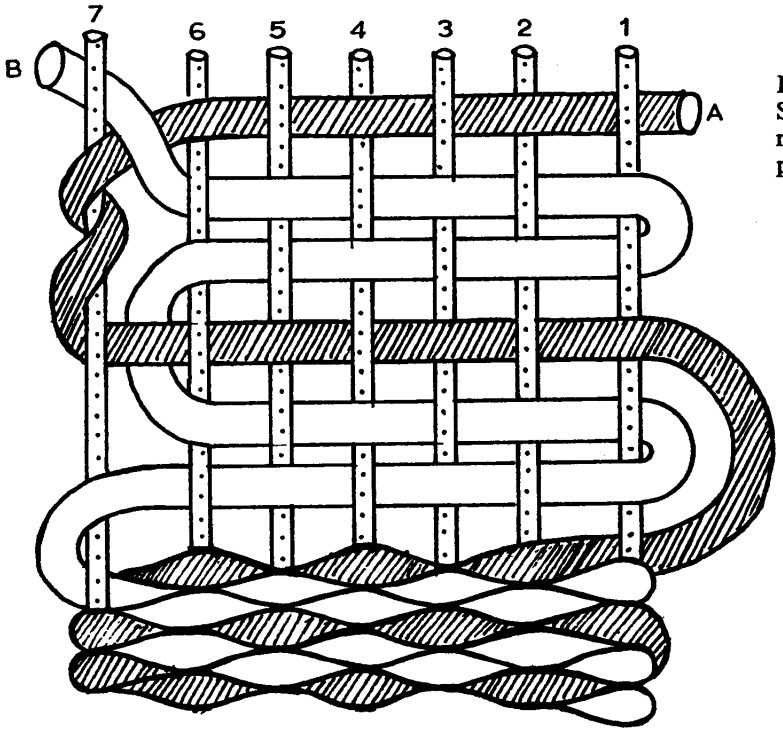

Fig. 55
Spots, with an even number of intervening picks

Weave two picks of B.
Weave one pick of A from right to left.
Weave two picks of B, noting that it misses left selvage.
Twist A twice downwards and then throw from left to right. Note that this begins by floating over two ends.
Pass B over this float and under the selvage thread exactly as in Fig. 55.
Repeat this sequence.

Variations

Much can be done using just these three elements, cross stripes, pick-and-pick stripes and spots, see Plate 8. Difficulties may be encountered at the selvage, when combining

the different elements or playing variations upon them, but by following the principles explained above they can be solved.

Take as an example the reversing of colours in a pick-and-pick area. At the bottom of Fig. 56 stripes of colour A (shaded) lie over the even-numbered warp ends. At the top of Fig. 56, colour A lies over the odd-numbered ends.

The switch-over is managed thus:

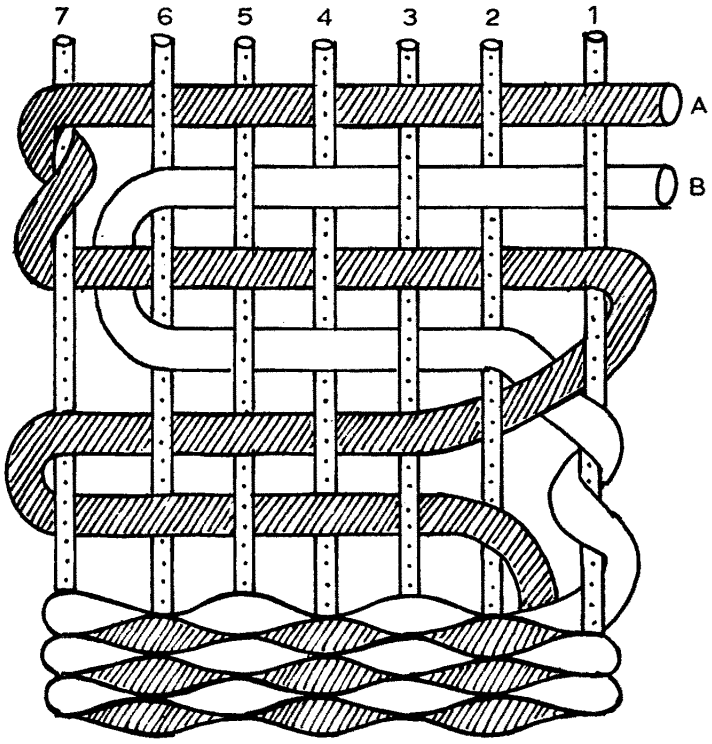

Fig. 56
Reversing colours in pick-and-pick stripes

Weave two picks of A.

Twist B twice downwards around right selvage thread then throw from right to left. Note that it floats over two ends at right selvage.

Take A over this float, then under right selvage thread and throw from right to left.

Weave one pick B from left to right, missing left selvage.

Twist A twice downwards around left selvage then throw from left to right.

Continue thus with B missing the selvage and A wrapping round it, i.e., the reverse of what is occurring at the bottom of Fig. 56.

The switch-over can be done similarly but starting with two picks of B instead of A.

D. Crossed Wefts

(i) IN CONTRARY MOTION

In *Costumes of the Bronze Age in Denmark* by H. C. Broholm and M. Hald, there are details and diagrams of a strange characteristic of these textiles. This is the frequent occurrence of several separate wefts in each shed. Each weft travels in the opposite direction to its neighbour (i.e., in contrary motion) and when two neighbouring wefts meet, they cross each other as in Fig. 57 (a), and then continue on in their original

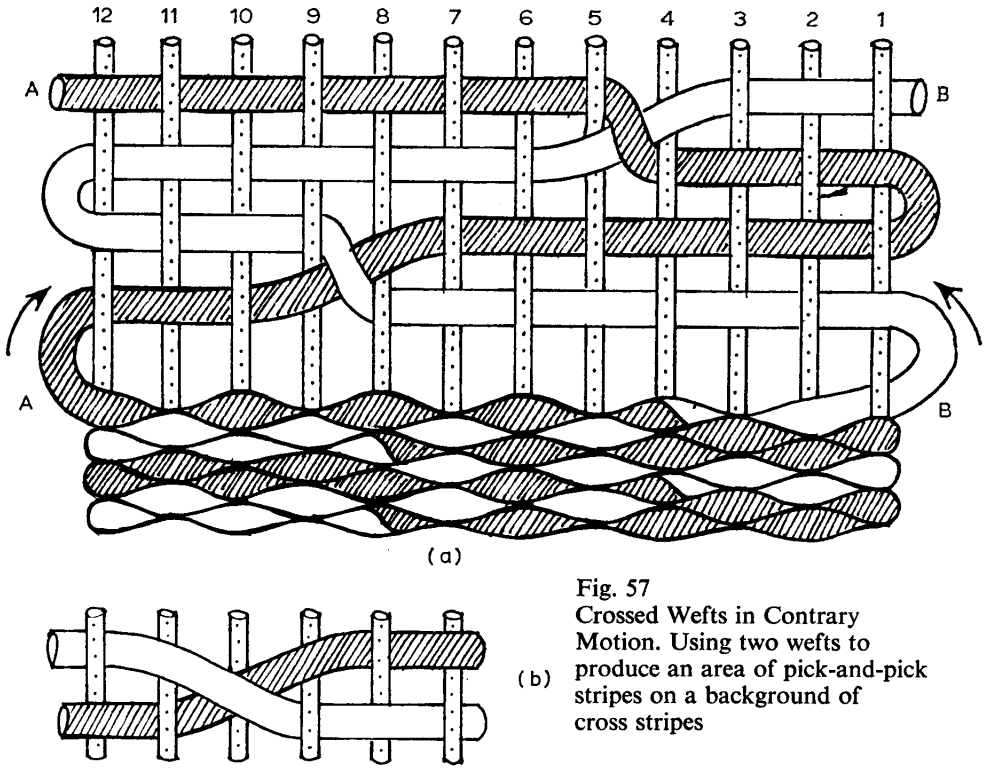

Fig. 57
Crossed Wefts in Contrary Motion. Using two wefts to produce an area of pick-and-pick stripes on a background of cross stripes

direction in the next shed. As some of the Bronze Age cloths are over four feet wide, the supposition is that two or more weavers were employed simultaneously at one loom and that the use of several wefts saved time. All the wefts are identical and the weave is a 50/50 plain weave, but there are interesting results if the wefts are of different colours and the weave is weft-face plain weave. The resulting technique can employ two, three or more wefts.

(a) Using Two Wefts

Two wefts, A (shaded) and B (white), start from opposite selvages, A from the left, B from the right, see arrows in expanded part of Fig. 57 (a).

Lift the even-numbered ends.

Take A across in this shed, from left to right, for a little way, then bring it out of the shed between the raised ends 8 and 10.

Take B across in the same shed, from right to left, and also bring it out between ends 8 and 10.

Lift odd-numbered ends.

Put A into this shed down between raised ends 9 and 7, and take straight across to right selvage. Note that in entering shed, A crosses two ends, 8 and 9. This float cannot be avoided but it is tied down by the next move of B.

Put B in the same shed between ends 9 and 7 and take it across to left selvage. At this crossing point, B is lying almost parallel to the warp.

Lift even-numbered ends.

Take A across in this shed, from right to left, for a short distance, then bring it out between raised ends 4 and 6.

Take B across in the same shed, from left to right, and also bring it out between ends 4 and 6.

Lift odd-numbered ends.

Put B into this shed down between raised ends 3 and 5 and take it across to right selvage. Note that this floats over ends 4 and 5.

Put A into the same shed down between ends 3 and 5 and carry it across to left selvage. Here it is A which is sharply angled as it ties down the float of B.

Repeat this sequence.

The result of these manœuvres is to give an area of 2-and-2 stripes on either side, and an area of pick-and-pick stripes in the centre, see lower part of Fig. 57 (a). As this pick-and-pick area is bound by the weft crossings and these can be made anywhere at will, it is clear that this is a way of weaving a pick-and-pick area of any desired shape on a background of 2-and-2 stripes. See Plate 9.

Note—In this description B crosses A in the first crossing, and A crosses B in the second crossing. But there is nothing special about this arrangement; equally well, both crossings could have been A over B or B over A.

—A common fault is to contrive two floats at the crossing, both over two ends, as in Fig. 57 (b). This is the result of putting the second weft to move (white in Fig. 57 (b)) down between the wrong two ends. It is an obvious weakness and should be avoided.

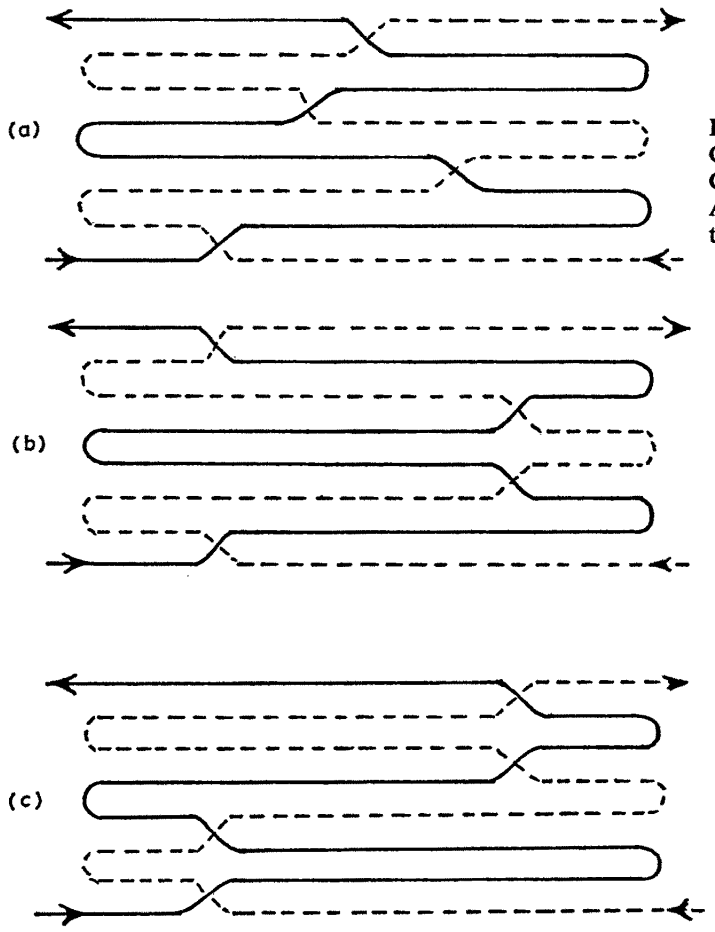

Fig. 58
Crossed Wefts in Contrary Motion. Alternative sequences for two wefts

Fig. 57 (a) gives a detailed view of this technique, but in the following descriptions, simplified diagrams will be used. Fig. 58 (a) as an example, shows how to weave a triangular pick-and-pick area on a background of 2-and-2 stripes. Notice that the crossing points occur alternatively on the right and left boundary of the pick-and-pick area. This is the general rule, but by disobeying it, other effects can be obtained, as the following two examples show.

To reverse colours in a pick-and-pick area, make the crossing points twice on one side, then proceed normally, see Fig. 58 (b).

To make quite a different two colour pattern in the central area, make the crossing points twice on the right boundary of the area, and then twice on the left and repeat this sequence, as in Fig. 58 (c).

Many other variations of this type are possible.

(b) Using Three Wefts

Fig. 59 shows a possible arrangement of three wefts, black, white and shaded. The difficulty when using more than two wefts is starting correctly, because in the first shed each weft must move in the opposite direction to its neighbour.

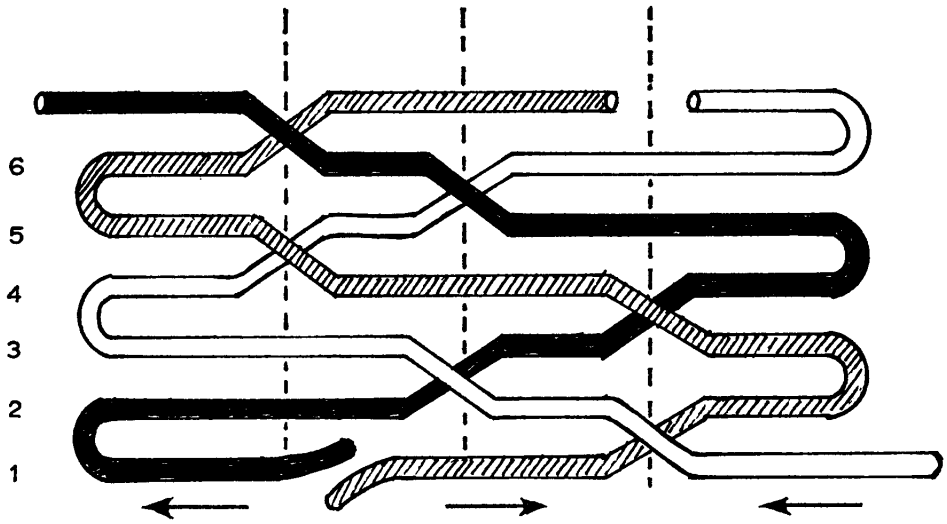

Fig. 59. Crossed Wefts in Contrary Motion. Using three wefts

Looking at the first pick in Fig. 59, the white weft begins from right selvage, but the black and shaded wefts have to start within the shed to fulfil the above conditions. Overlap their free ends as when joining two wefts.

Note—That there are three places where wefts cross, left, right and centre.
—That the shaded weft takes a symmetrical course through the fabric. All its crossing points are at the right or left and never at the centre.
—That the black and white wefts have crossings at all three points, but only cross each other at the centre.

When weaving with three or more colours, it becomes more important to decide which colour moves first at any crossing point. The rule is always to move the weft which will go into the correct opening and this is found by counting ends.

For example, imagine that at a crossing point two wefts have been brought out between raised ends 4 and 5, counting from the left selvage, see Fig. 60 (a). The shed is then changed, see Fig. 60 (b). The correct weft to move first is the one which will go naturally into the opening between the *new* fourth and fifth raised ends. This is the white weft; the black, if moved first, would go into the opening between third and fourth raised ends. So the white moves first and the black crosses it in the normal way.

Plate 10 shows a sample using three wefts, black, white and grey. These three

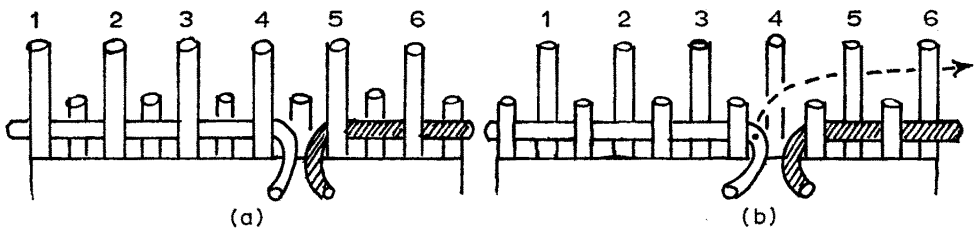

Fig. 60. Crossed Wefts in Contrary Motion. Determining correct point to enter wefts after crossing

colours appear as cross stripes at either side. The central area (bounded by right and left crossing points as in Fig. 59) has discontinuous pick-and-pick stripes. The outline of this area can of course be altered by shifting the right and left crossing points. The two small rectangles of spots were obtained by moving the central crossing point from side to side, so that the black and white weft (see Fig. 59) alternately cross a little to the right and a little to the left of the centre. These two new crossing points defined the boundaries of the spotted area, thus three distinct areas with controllable boundaries are obtained. It will be understood that the areas differ because, although in one complete repeat each area must have two picks of all three colours, the sequence of these three colours varies from one area to the next due to the weft crossings between them.

(*c*) *Using Four Wefts*

Fig. 61 shows a possible plan using four wefts. Each of the wefts follows a similar course through the fabric, always crossing at all three possible points (right, left and centre) on its passage from selvage to selvage. In the first pick, the black and white weft start from the selvages but the two other wefts start from the centre of the shed. This is in order to preserve the contrary motion of the four wefts.

Nothing very interesting results if wefts of four different colours are used, the central area being a mixture of spots of all four colours. More is obtained by limiting the colours, but still using four wefts. For instance, in the first pick the two right-hand

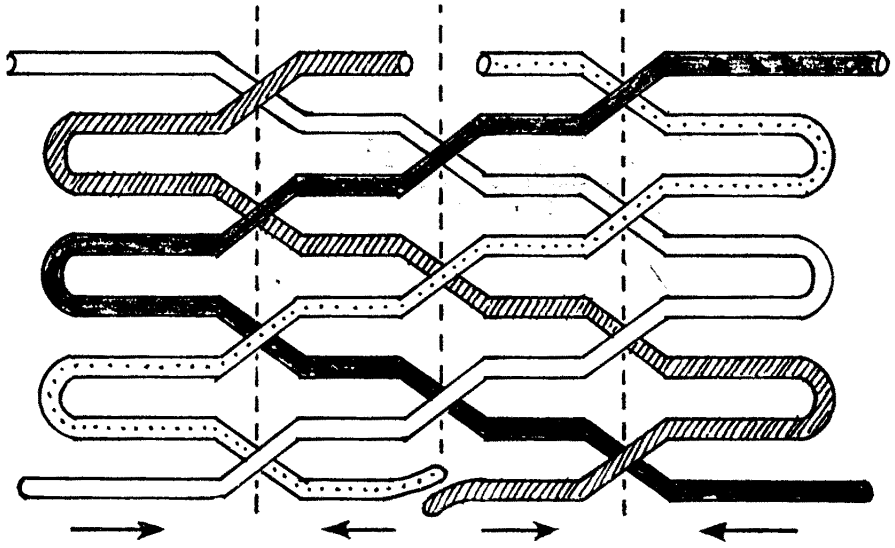

Fig. 61 Crossed Wefts in Contrary Motion. Using four wefts

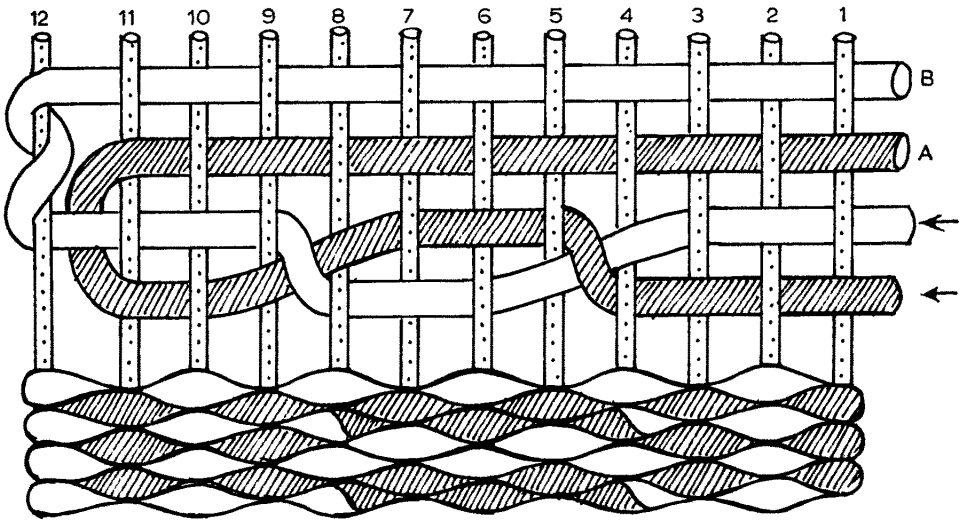

Fig. 62. Crossed Wefts in Parallel Motion. Using two wefts to produce an area of cross stripes on a background of pick-and-pick stripes

wefts could be black and the two left-hand wefts white, see Plate 11.

There are probably many more variations waiting to be discovered in this slow but rewarding technique.

(ii) IN PARALLEL MOTION

Seeing and analysing an American Indian textile brought the realization that there is another type of Crossed Weft technique, one in which both wefts start from the same side, i.e., they move in parallel motion. This opens many more possibilities, some of which are described below.

(a) The first example gives an area of 2-and-2 stripes on a background of pick-an-pick stripes. Referring to Fig. 62, start weft A and B from right selvage, see arrows.

Lift even-numbered ends. Take A across in this shed then bring it out of the shed between raised ends 4 and 6.

Lift odd-numbered ends, take B across similarly and bring it out between raised ends 3 and 5.

Lift even-numbered ends, continue B across inserting it down between ends 4 and 6 and bringing it out again between ends 8 and 10. Note that it forms a float over ends 4 and 5.

Lift odd-numbered ends, continue A across, inserting it down between ends 3 and 5, and taking it out again between the ends 7 and 9. Note that this ties down the float of B.

Lift even-numbered ends, insert A down between ends 8 and 10 and bring it out at the left selvage. Note that it forms a float over ends 8 and 9.

Lift odd-numbered ends, insert B down between ends 7 and 9, tying down above float, and carry it on to left selvage.

Note—That the order of moving the wefts is A, B, B, A, A, B.
That six changes of shed are necessary to carry these two picks of weft from right to left selvage.
That the crossing points are structurally similar to those in the first type of crossed wefts.

Lift even-numbered ends, throw A to right selvage with no crossings.
Lift odd-numbered ends, twist B in the usual way for a pick-and-pick selvage and throw to right selvage with no crossings.

This is the complete repeat, see lower block in Plate 12. Remember to make a pick-and-pick selvage at both sides; Fig. 62 shows this only at the left selvage. The crossing points define the boundaries of the central area of 2-and-2 stripes, so the size and shape of this area can be easily controlled. Moreover, unlike the Contrary Motion Crossed Weft technique, there can be as many such areas across the width of the rug as desired. In other words, crossing twice as described above gives one area of 2-and-2 stripes, crossing four times gives two such areas, crossing six times gives three such areas, see Fig. 63. This applies to all the variations described below, so therefore there is much more scope for design with this method.

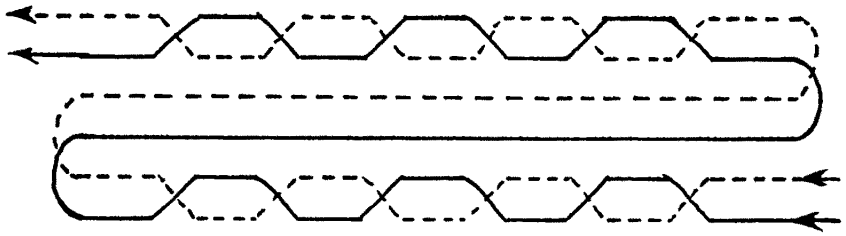

Fig. 63. Crossed Wefts in Parallel Motion. Producing many areas across width of rug

(b) This is the type seen in the American Indian textile mentioned above. The sequence is the following:

Take both wefts from right to left twisting as described above.
Take both wefts from left to right also twisting as above.
Then weave one pick of A, right to left, with no twisting.
Weave one pick of B, right to left, with no twisting.
Weave one pick A, left to right, with no twisting.
Weave one pick B, left to right, with no twisting.
Repeat this sequence; see upper block in plate 12.

(c) The same central block can be woven but with 4-and-4 stripes at the side instead of pick-and-pick stripes. Fig 64 (a) shows the sequence. The result is similar to that produced by one of the four weft variations of the Contrary Motion Crossed Weft technique, but it is much simpler to carry out; see Plate 13.

(d) The first type described under the Contrary Motion Crossed Weft technique,

i.e., a block of pick-and-pick stripes on a 2-and-2 stripe background, can also be produced. Fig. 64 (b) shows the sequence. The advantage of using the Parallel Motion method is that many such blocks, instead of only one, can be produced in the width of the rug.

(e) There are many other variations. They all result from varying the order or number of the twisting picks and the normal non-twisting picks. The reader who has understood and tried the variations described will be able to discover new ones for himself.

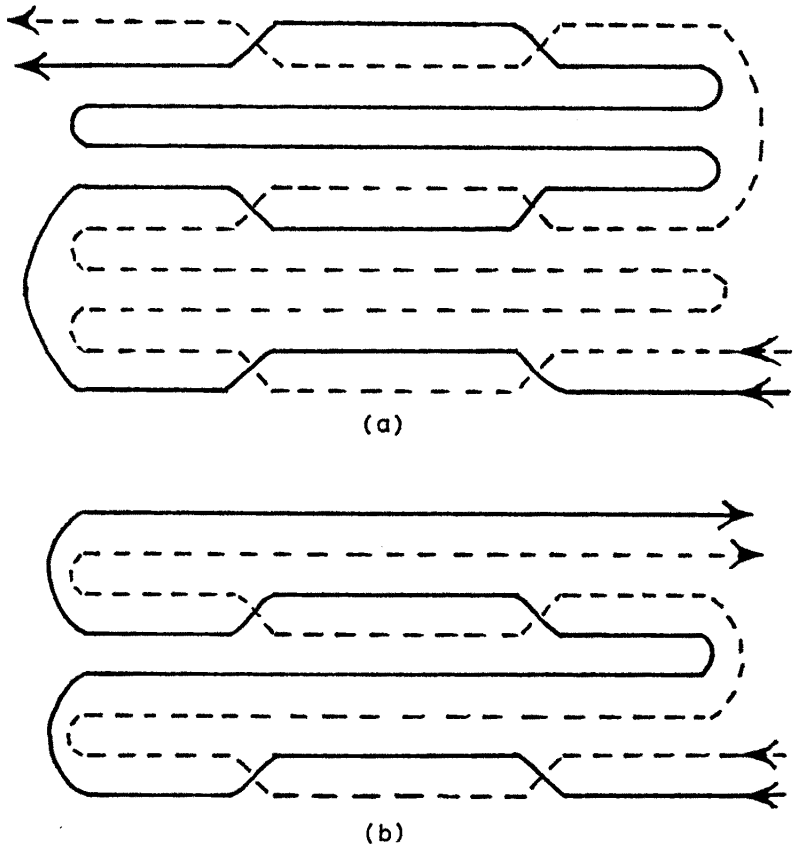

Fig. 64
Crossed Wefts in Parallel Motion. Alternative weft sequences

In conclusion, note that there are two main differences between the Contrary Motion and the Parallel Motion varieties of the Crossed Weft technique.

(1) Many wefts can be used in the former technique, the more wefts, the more complex it becomes; whereas all the variations of the latter technique are produced with only two wefts.

(2) If both techniques are limited to two wefts, then the former only gives one block, but the latter gives any number of blocks across the width of the rug.

E. Skip Plain Weave

This is a traditional Middle Eastern technique for rugs. It is also found in Peruvian textiles, but with an approximately equal warp and weft count, i.e., not as a weft-face weave.

The basis of this technique is plain weave, with two wefts in each shed. Both wefts travel from selvage to selvage but they pass in and out of the back layer of the shed, forming floats on the reverse of the rug. Where one weft is in the shed, the other is floating.

The two wefts start from the right selvage, see the arrows in Fig. 65 (a).

Lift even-numbered ends.

Insert A (black) into this shed. Let it pass *over* two ends (1 and 3) of the back layer of the shed in the normal way, then push it backwards through this layer so that it passes *under* the next two ends (5 and 7), forming a float on the reverse. Bring it back into the shed and let it pass *over* ends 9 and 11. Then bring it out again to pass *under* ends 13 and 15. Continue thus all the way across, taking the weft alternately over 2 and under 2 ends of the back layer of the shed. See Fig. 65 (a).

Still with the even-numbered ends lifted, take B (white) across following an exactly opposite course to that taken by A. So it begins by passing *under* ends 1 and 3, then comes up into the shed to pass *over* ends 5 and 7 then back out of the shed to pass *under* ends 9 and 11 and similarly, all the way across. Wherever A was in the shed, B floats on the reverse, and vice versa. Fig. 65 (b) shows a cross section through the back layer of the shed at this stage.

The shed is closed and the two picks beaten. The floats slip behind and the two picks combine to give the appearance of a single pick, which is coloured alternately black and white along its length.

Lift odd-numbered ends.

Pass A from left to right, going in and out of the back layer of the shed as before.

Presuming it is desired to build up blocks of black and white, as at the bottom of Fig. 65 (a), then take A over ends 18 and 16, under 14 and 12, over 10 and 8, etc. until it reaches the right selvage.

In the same shed take B from left to right, making it follow exactly the opposite course to A.

This is the whole repeat.

Note—That as B does not weave at the left selvage, it has to be caught in the returning loop of A. The way it is caught looks awkward in the diagram, but in practice it is an effective method. The two wefts will be similarly caught together at the right selvage, before the next two picks.

—That there are two picks, one of A and one of B, for each change of shed.