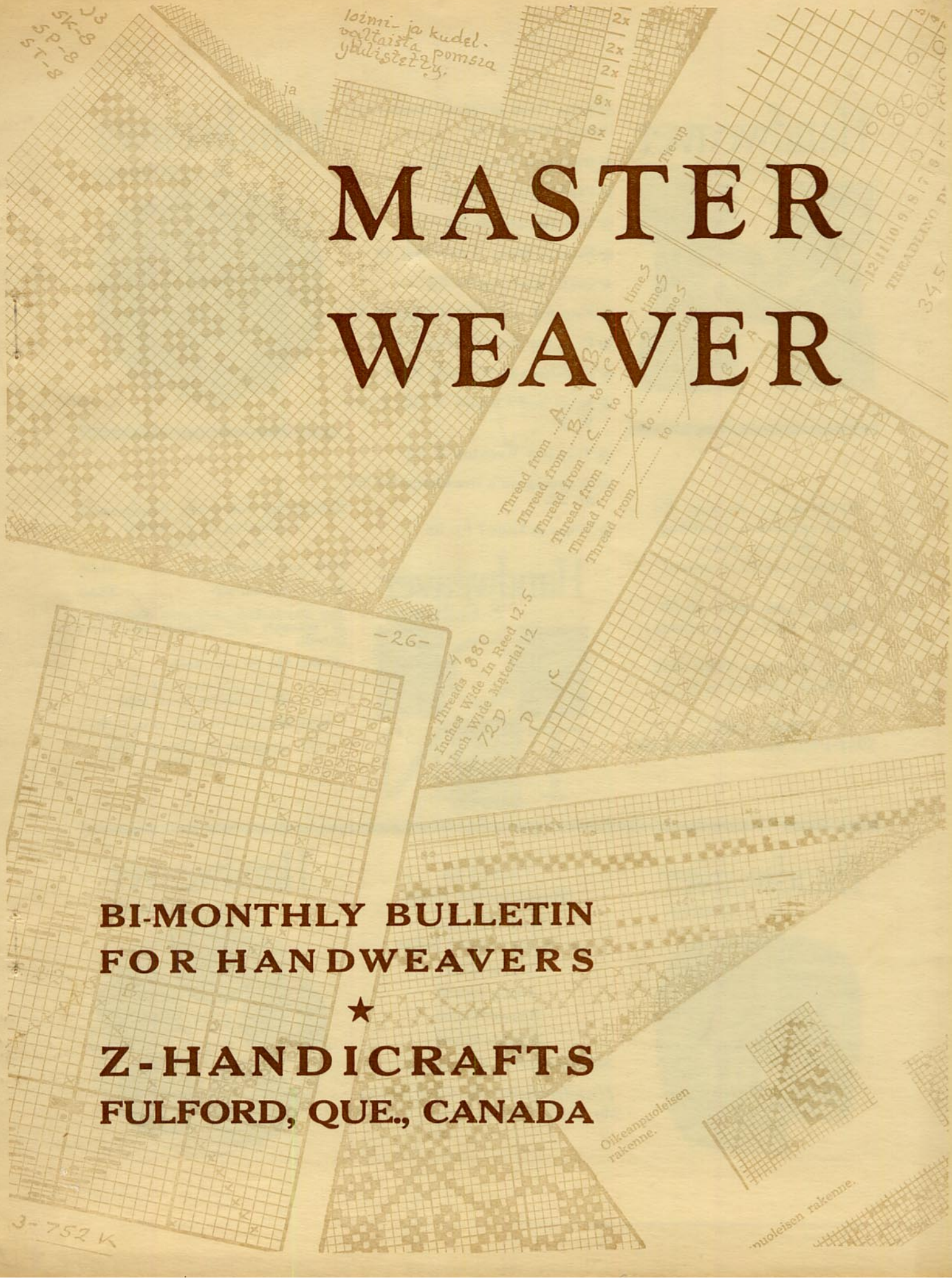

MASTER WEAVER

BI-MONTHLY BULLETIN FOR HANDWEAVERS

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Z-HANDICRAFTS

FULFORD, QUE., CANADA

MASTER WEAVER

Z-HANDICRAFTS - FULFORD - QUEBEC - CANADA

July, 1956 No.28

SETT OF WARP.

FOR A PERFECT FABRIC

How to figure it out?

We wrote on this subject twice (MW 8/1, 19/3) and explained the difficulties of the problem. The graphs we have given help selecting the proper number of ends per inch or rather the lowest number of them. One curve is for tabby, another for twill, without specyfying what kind of twill. This however does not help when we have an entirely different weave, or a mixture of tabby and pattern.

If we really want to calculate the warp sett wihout taking any risk we must use the same methods as employed in the textile industry. The surest way is to use a formula which is not too difficult and which can be adapted to handweaving. We are not going to explain the formula because it takes higher mathematics to do so.

The idea is to find first a so called "diameter number". As we have already explained the diameter of yarns cannot be measured with any accuracy, but it can be calculated. What we are really interested in is not so much the diameter, but the number of ends which will cover one inch just touching each other. This is found from the formula:

$$N = .9 \times \sqrt{\text{yds/lb.}}$$

Since not everybody remembers how to figure out a square root, we are giving a table (Table No.1) of the value for N. This table should be kept handy when we figure out a new warp.

To find out the sett of warp we use a second formula:

$$S = \frac{N \times R}{R + T} ;$$

where S is sett of warp; N - diameter number; T - number of ties in one pick of weft in one repeat, and R - number of ends in one repeat of the weave.

All these factors are selfexplanatory except the T. The number of ties means the number of times the weft comes from

the back to the front of the fabric and vice versa (fig.1). For instance in tabby it is 2, so it is in basket and simple twills in 2:2:1:1 twill it is 4 (fig.1), and in 3:1:1:1:1:1 twill (fig.2) it is 6. Whenever the black changes to white and the white to black in the draw-down of a weave, we count it as a tie. So far this is simple. But there are weaves

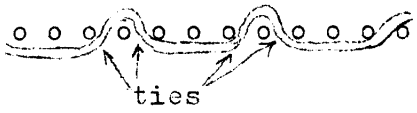

Fig.1

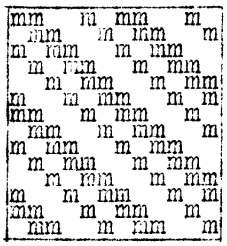

Fig.1a

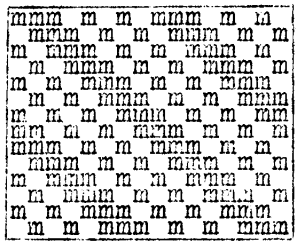

Fig.2

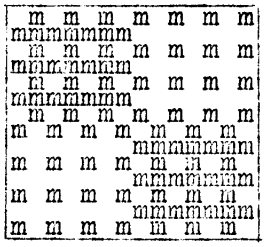

Fig.3

where one pick of weft may make 14 ties, and another only 2, as in fig.3 for instance. Here the proper way to calculate the T is to count all the ties in one repeat of the weave and divide it by the number of picks in one repeat. In the case of fig.3 we have 124 ties, which divided by 14 gives roughly 9.

TABLE 1

Yds/lb	N	Yds/lb	N	Yds/lb	N
100,000	285	10,000	90	1,000	29
90,000	270	9,000	85	900	27
80,000	254	8,000	81	800	25
70,000	238	7,000	76	700	24
60,000	221	6,000	70	600	22
50,000	201	5,000	63	500	20
45,000	191	4,500	60	450	19
40,000	180	4,000	57	400	18
35,000	168	3,500	53	350	17
30,000	156	3,000	49	300	16
25,000	142	2,500	45	250	14
20,000	127	2,000	40	200	13
18,000	121	1,800	38	180	12
16,000	114	1,600	36	160	11
14,000	107	1,400	34	120	10
12,000	99	1,200	31	100	9

In most pattern weaves where tabby alternates with pattern shots we take the average between tabby and pattern. E.g. for overshot we can take a repeat of 12 with 12 ties in tabby and 6 ties in overshot, which gives an average of 9.

For those who do not like formulas we give also a second table which contains the coefficient: (R+T):R.

TABLE 2

Warp-face fabrics, double weaves	1,0
4:4 basket	1.25
16-frame damask, twill od satin 1:7	1.25
3:3 basket	1.3
10-frame damask, twill or satin 1:4	1.4
twill 2:2, 1:3; basket 2:2; 8-frame damask	1.5
waffle, dornick (8-frame), dropped tabby	1,5
1:2 twill, 6-frame dimity, spot weave	1.7
twill with tabby, crackle, summer-&-winter	1.75
huckaback lace	1.8
huckaback	1.9
tabby, swivel	2.0
Overshot, crackle, summer-&- winter, heavy weft	2,5
Diamond twill, heavy pattern weft & binder	2.7
Satinet, weft twice as heavy as warp	3.0
Pattern weaves with weft 4 times heavier	3.5
Weft face fabrics, bound weaves, rugs (flat)	4.0

Now, to find a sett of warp we simply divide the number found in the first table by the number found in the second table. For instance: we are making towels of fine single linen No 30. The number of yds/lb is 30 times 300 = 9,000. In the first table we found the diameter number which is 85. In the second table, if the towels are going to be woven in tabby - 2. Now we divide 85 by 2 which is 42.5. The nearest convenient sett will be 42 - reed No.14, 3 ends per dent. Another possibility is reed No.22 if available with 2 ends per dent, which gives us a sett of 44 - close enough.

Another example: woolen fabric woven in 2:2 twill; yarn - 16/2. The first table gives for 4480 yds/lb (8x560) the diameter number: 60. The second - 1,5. Therefore the sett is 40.

When using table No.2 we must remember that the numbers from one to two apply to the frabics with approximately the same count of warp and weft. The number higher than 2 are only for fabrics which have the weft much heavier than the warp.

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D. D.

TWILLS WITH DOUBLE DIAGONAL

This weave may be woven on four or more harness-frames. In industrial weaving it is hardly ever used for patterns, nevertheless it has very interesting possibilities in this direction.

By "double diagonal" we mean 1-st that there are two diagonals in threading, like in fig.1, and 2-nd that the distance between two diagonals in the pattern is twice the usual distance in plain twill

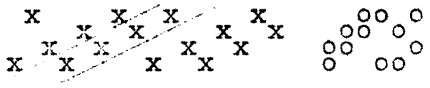


Fig.1

This peculiarity of DD may be of some interest to those weavers who like diamond twills. As we all know diamond twills produce very intricate but also very small designs. The same patterns can be woven with DD, but they will be twice as large with the same number of frames.

Another peculiarity of DD is that it is always woven with one shuttle only. As it is obvious from the draft in fig.1, there is no tabby, and the usual tabby treadles produce pattern shots, exactly as the remaining 4 treadles. Thus the pattern has six blocks: rather unusual number with 4 harness-frames.

Double Diagonal Twill on 4 frames.

We shall first describe the possibilities of DD woven on four frames, and then a few examples of the same weave for 6 and 8 frames.

The principle of drafting is as follows: in ascending (mounting) diagonal a heddle on frame 1 is always followed by a heddle on frame 4; 2 is followed by 1; 3 by 2; and 4 by 3. In descending diagonal 1 is followed by 2; 2 by 3; 3 by 4; and 4 by 1. We can change the direction of the diagonals as often as required by the pattern.

The treadling is found in exactly the same way as in diamond twill or overshot (see MW 16/8). The only difference is that we have here 6 pattern treadles. For instance in case of the draft in fig.1 we start from the right and rear: 34 = treadle 4; 24 = tr.1; 23 = 5; 13 = 2; 12 = 6, etc. The whole treadling will be: 4,1,5,2,6,1,3,2,4,1,5,2,6,1,3,2. The last treadle (2) will be used if we keep repeating the same threading.

If in the treadling we have the same treadle used twice in a row (at the point of turning of the diagonals) then we must skip one of the two shots, because we have not tabby. The following two complete drafts show the application of all these principles of drafting. One (fig.2) is for a small and simple pattern, the other (fig.3) for a more involved one. Please examine them carefully.

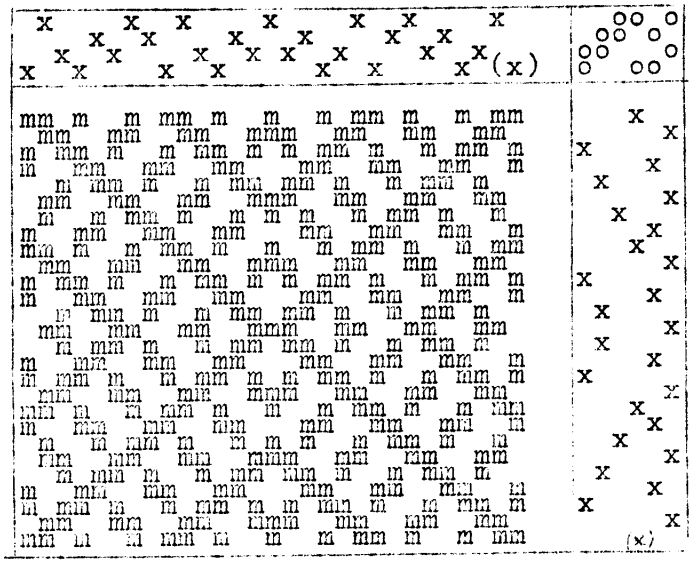


Fig.2

The diagonals in the drafts are broken at every turning point. This happens also in diamond twills woven without tabby. The space between two parallel diagonals is filled with a sort of broken twill.

The pattern is very clear if contrasting colours are used for warp and weft; usually dark for weft and light for warp.

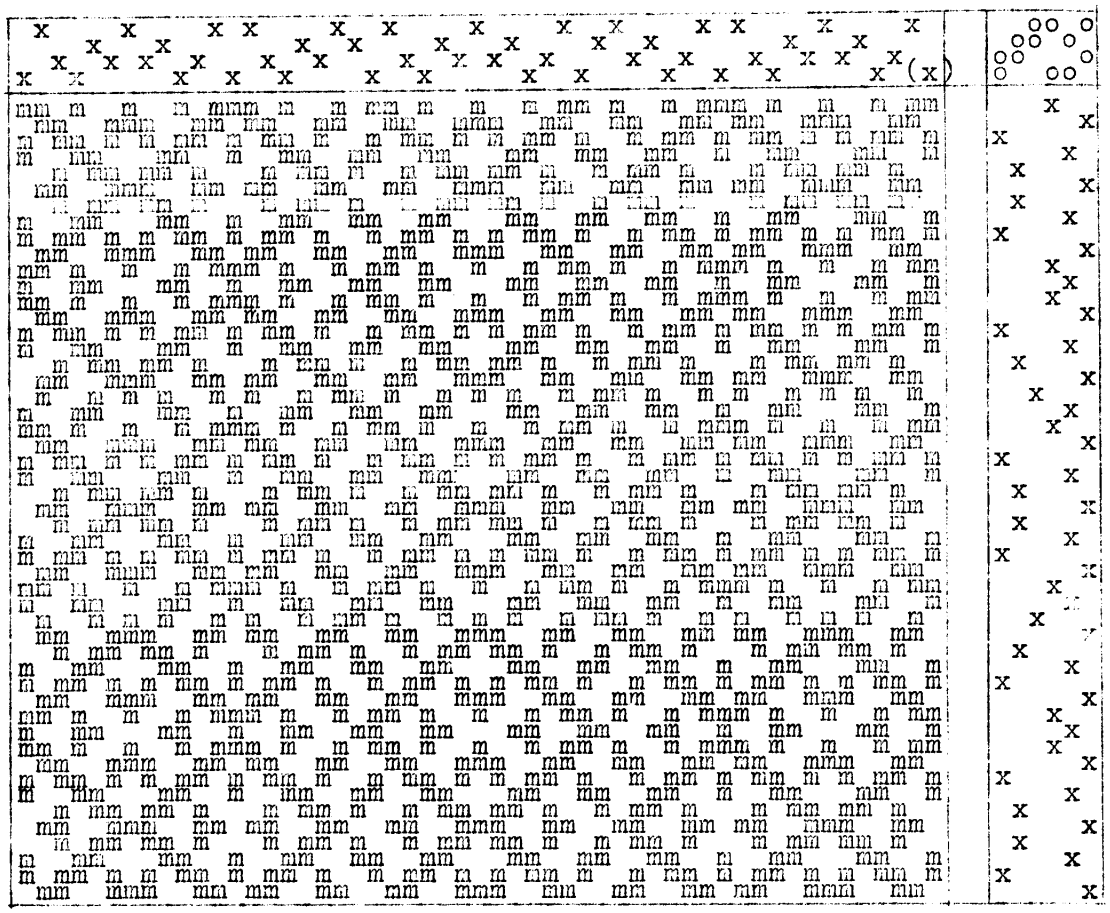


Fig.3

Fabrics woven in DD twill have very good qualities: short floats, firm and uniform structure comparable to diamond twills, crackle and summer-&-winter. They can be used for upholstery.

If the pattern is too obvious for our project, we can either use less contrasting colours for warp and weft, or change the treadling for a simpler one. Try the following treadlings:

1) 615241324152; 2) 61523142; 3) 6162515231324142; 4) 31425162;

But avoid straight sequence, like: 6543; it gives a very poor texture. For clothing and so on, the draft on fig 1 is the best. For curtains, upholstery etc., more fancy drafts like 2 or 3 may be better suited.

The yarn for both warp and weft should be of the same count and the sett of warp as for 2:2 twill.

DD twill for 6 and 8 frames

When with 4 frames we can have only one type of twill, with each added frame the number of variations increases. Thus with 6 frames the second diagonal may follow closely the first as in fig.4 or be farther removed as in fig.5

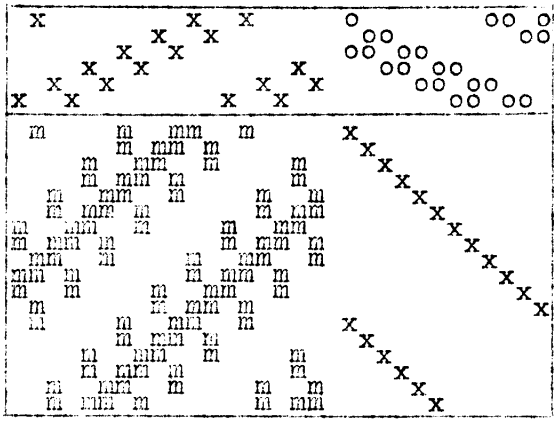


Fig.4

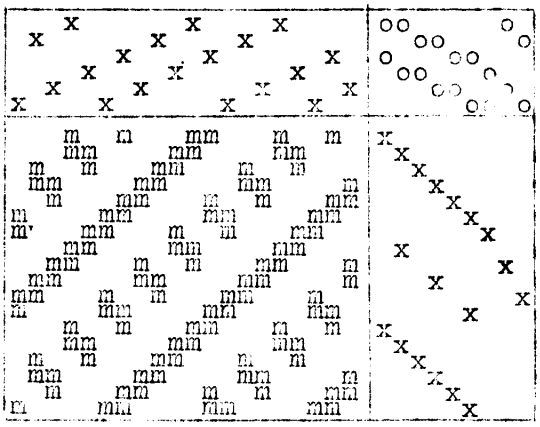


Fig.5

Here as in case of 4 frames we can have diamond twill patterns by reversing the diagonals as in fig.6.

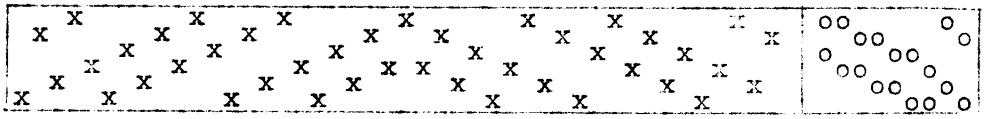


Fig.6

With 8 frames we shall have still more variations. The second diagonal in threading can be spaced from the first one by one, two, or three frames. Compare figures 7,8 and 9.

With each of the variations a number of tie-ups is possible. The simplest tie-up is the one which produces a diagonal only, or a tie-up for "woven-as-drawn-in" fabric. Such tie-ups have been used in figs: 8 and 9. If the floats are too long, we must introduce additional ties as in fig.7, 10 and 11. These additional ties may result in a hit and miss effect between the diagonals (fig.7 and 10) or in secondary faint diagonals running in the

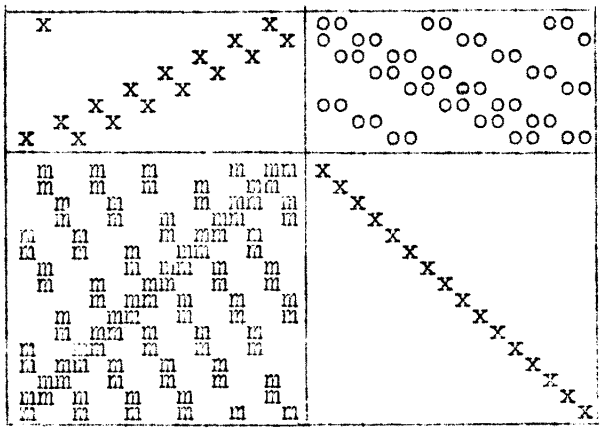


Fig.7

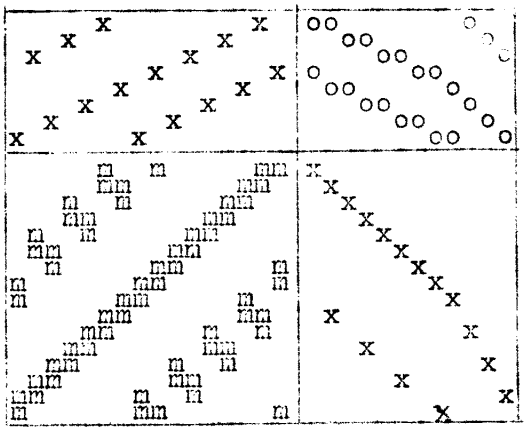


Fig.9

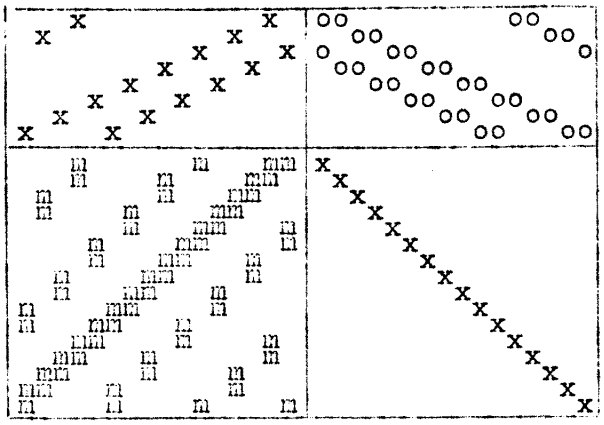


Fig.8

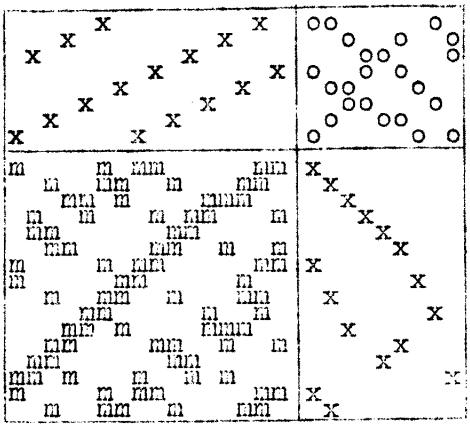


Fig.10

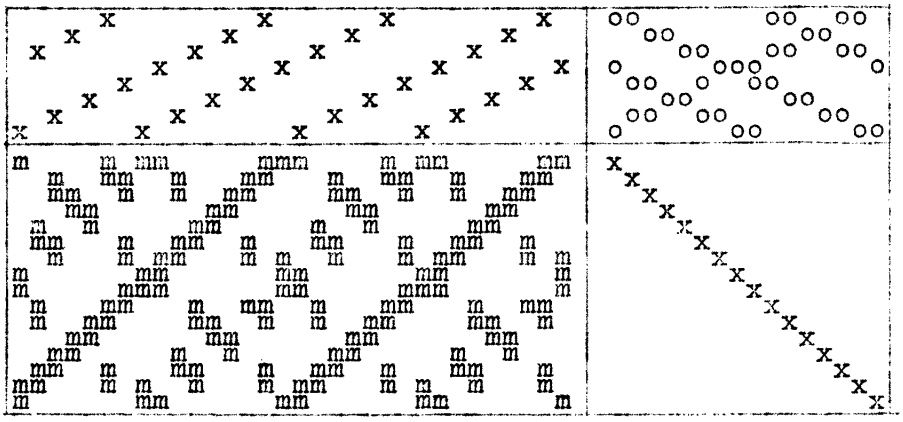


Fig.11

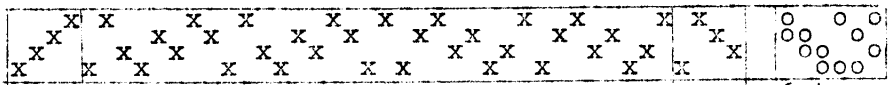
opposite direction as in fig.11. The directions for treadling given with all the above drafts are for biased twill. By changing the treadling we can have all kinds of broken twill as well.

Whatever the tie-up, and whatever the number of frames, tabby is impossible to get. Therefore we cannot have binder between shots of pattern.

Probably by this time you have noticed that many of the tie-ups for the DD twills require an unusually high number of treadles. If the loom has less than the necessary number, the only way to weave is to use a direct tie-up and press two or three treadles at the same time. This whole subject of combining treadles in multiharness looms is too large to be treated here. We shall have a special article on this problem. In the Practical Project described here, we give an example of how to arrange the treadles, but the same method may not be practical in other cases.

Practical Project for 4 frames.

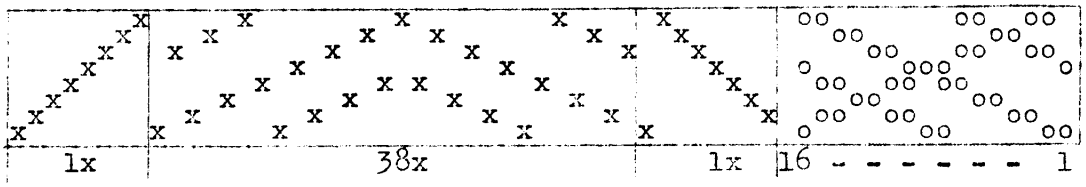
Upholstery in 10/2 cotton, 36" wide. Sett of warp - 24 ends/". Number of ends: 866. Reed No.12. Two ends per dent. Draft:



Warp: 10/2 old gold; weft: 10/2 brown.
Treadling: 3142516231425162313261524132 61524132.

Practical Project for 8 frames.

Curtains in 20/2 cotton, 30" wide. Sett of warp - 36 e/". Number of ends: 1080. Reed No.18. Two ends per dent. Draft:



Warp: 20/2 silver grey; weft: 20/2 navy blue.

Treadling: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,15,14,13,12,11, 10,9,8,7,6,5,4,3,2.

Since our loom probably has only 10 or 12 treadles, we must use a direct tie-up. A plain tie-up as in fig.12 will not do because for instance instead of treadle No.16 we would have to press treadles 8, 4 and 1, which would require three feet. Therefore we rearrange the tie-up as in fig.13. Now we press treadles 3 and 4 with one foot, and treadle 8 with the other. The new treadling will be: 48,238,236,16,15,235,237,478,48,467, 267,25,15,167,367,348, and reverse.

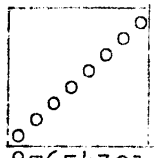


Fig.12

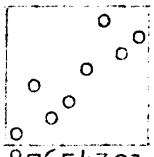


Fig.13

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WE HAVE SAMPLE CARDS FOR THE PRACTICAL PROJECT FOR 4 FRAMES.
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LESSONS OF DRAFTING

ANALYSIS - I

We have already described one method of analyzing fabrics and patterns in the 2-nd and 3-rd issue of MW (1952). Now we shall take up this subject again and discuss it more thoroughly.

The object of analysis of the cloth or pattern or both is:

1. To be able to reconstruct from a sample of a fabric complete directions for weaving, i.e. threading, tie-up, treadling yarn used, sett of warp, sleying, number of picks per inch, and in certain cases - finishing. The ultimate object may be either to copy the sample, or to change it and adapt the draft to our requirements.

2. To adapt to handweaving drafts from books about industrial weaving. These "drafts" in most cases contain only the draw-down (as for instance in Oelsner), sometimes the threading (e.g. Reed), but not the tie-up and treadling.

3. To create our own fabrics. Our imagination can supply the picture of the fabric, from which a draw-down can be made, and then analysed.

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In each case before we can start the analysis, we must have a complete draw-down (compare the 2-nd lesson of drafting) of at least one repeat both in the threading and treadling.

Thus the first step to be taken is to establish one repeat in both directions, i.e. the number of ends and picks which form a unit repeated such a number of times as to produce the necessary width and length of the cloth.

In case of an actual sample of cloth we start by inserting two pins in the fabric crossing each other at right angle: one parallel to the weft and the other - to the warp. This point can be selected at random, unless the structure of the fabric is so obvious that certain points will suggest themselves as the best place to start with.

Now we examine one after another all the warp ends to the right of the starting point, until we come to another warp-end which is not only woven exactly as the first one, but has the same relationship to the one on the left and another on the right. Now we can reasonably assume that we came to the beginning of the next repeat. To make sure we compare not only the first end of the first repeat with the first end of the second, but we do the same with all remaining ends. If even one of them is different, then what we thought to be the second repeat is still a continuation of the first.

Fortunately, with the exception of accidental threading drafts, the repeats are fairly obvious at a glance, because they

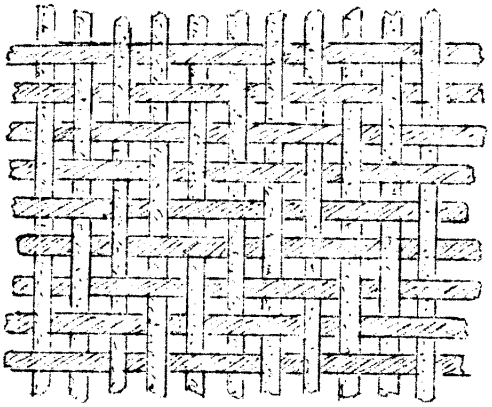
produce a sort of "rhythm" in the composition of the fabric, and they can be picked out even by a complete beginner. At any rate, when in doubt, take more than what you think is one repeat. It will mean more work later on, but the repeat will show during the analysis.

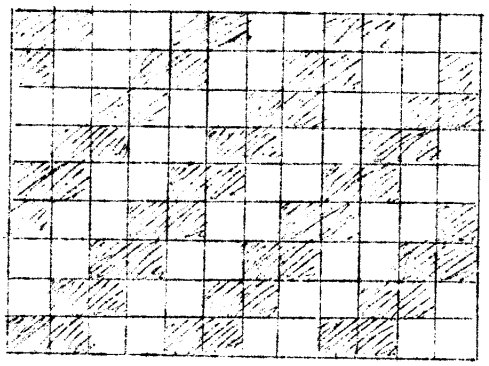
When trying to find one repeat, we may be puzzled by its size. The length of one repeat may be anything from 2 to 500, and sometimes even more, but this length does not indicate much as yet. For instance a repeat 500 ends long may be still woven on 2 frames, and another only 12 ends long may require 12 frames. We should not jump to any conclusions at this stage.

As soon as we have found the repeat in threading we insert another pin along the warp between the last end of the first repeat and the first end of the second repeat. Then we start looking for the repeat in treadling exactly in the same way as we did for the threading: we examine one after another all the picks of weft below the one marked with a pin in our starting point, until we come to a repetition. We take a fourth pin and insert it parallel to the weft at the end of the repeat.

These four pins outline one repeat in both directions. If we want to, we may use four more pins to mark all four corners, but this is hardly necessary except in case of a very large repeat.

What we have now between the marking pins must be drawn on graph paper. We disregard the actual colours of the yarn, and make the drawing as if all the weft were black, and all the warp - white. We disregard also the count of yarn at this stage. Whether the warp is fine and the weft heavy, whether there are more than one kind of yarn in warp or in weft - we still use only one space between the lines of the paper to mark one warp end, or one shot of weft, as in the drawing below:





First we outline with pencil on the graph-paper a rectangle with as many squares in the horizontal direction as there are ends in one repeat of threading, and with as many squares in the vertical direction as there are picks of weft. There should be plenty of space <u>above</u> the rectangle, and also to the right.

Now we look at the first (highest) pick of weft and draw it in the first (highest) line of the space reserved for the drawdown. When it comes <u>over</u> a warp end we mark the corresponding

square black. If it is below the warp we leave the square white. In this way, pick after pick of weft we fill the whole draw-down. We must be very careful when doing it: a single mistake means one more harness-frame, and of course it remains a mistake which will be repeated over and over again if we actually use the draft for weaving.

When a sample of cloth does not show very well the warp and weft, the only way to make the draw-down is to cut out a piece of the sample (more than one repeat) and with a pin pull out one pick of weft after another. When one pick of weft is detached from the fabric but still remains between the warp ends it is quite easy to count the "unders" and "overs" and to mark them on the draw-down. A magnifying glass is a great help.

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COMPOUND SLEYING.

The proper time to think about sleying is not when the warp is already made, but when we start figuring it out. The first step in any weaving project is to decide on the yarn to be used. The second - on the weave. Then we turn to the selection of the sett of warp. Whether we use formulas (as in the article in this issue of MW) or graphs, or somebody else's advice - the number of ends per inch is never so definite as not to allow certain deviations one way or another. If not for this fact, the life of a weaver would be a misery.

Fortunately we can always change a little the sett to suit our means, but the question is how much we can change this number.

If the number is accurate i.e. found from a formula, or taken from a recipe, we can change it both ways by about 5% For instance if the theoretical sett is 19, then we can take either 18 or 20, but not 16 or 24. But if we have a sett like 37, then there is no choice except 36, because neither 35,37,38,or 39 can be sleyed in the usual way.

When the sett of warp is found in the graphs giving only the lowest possible number of ends per inch, then whatever correction we make must go only up, never down. The graphs cannot be very accurate - one more reason to keep on the safe side. Thus we do not correct the found number for a smaller one, but we can go up by about 10%. Thus if we found a sett of 25, we can go up to 27½, which in this case means 27 (3 ends in No.9 reed).

But there are cases when we cannot find a satisfactory way of plain sleying even with a complete selection of reeds such as: 5,6,8,9,10,12,14,15,16,18,20 and 24. For instance a formula gives us 13 ends per inch. Even with 5% both ways we can only have 13 and nothing else. If the quality of the fabric does not allow greater deviation than 5% then the thing simply cannot be done. With a smaller selection of reeds there are many quite common setts which cannot be used. What do we do then?

The answer is Compound Sleying, i.e. passing unequal numbers of ends through different dents. For instance we find that the best sett for our project is 22½. If we use straight sleying, we have a choice of 20 or 24, both beyond the 5% limit. But if we take reed No.15 and sley: one end in the first dent, and two ends in the second, and so on - we get exactly 22½ ends per inch.

The mathematics of compound sleying are a little involved; therefore we give the following table for setts from 4 to 120 ends per inch. We have number of reed on top, sleying on the left, and the sett is found in the table.

Reed:	5	6	8	9	10	12	14	15	16	18	20	24
Sley:												
0-1			4	4½	5	6	7	7½	8	9	10	12
0-1-1		4	5½	6	6½	8	9½	10	10½	12	13½	16
1	5	6	8	9	10	12	14	15	16	18	20	24
1-1-2	5½	8	10½	12	13½	16	18½	20	21½	24	26½	32
1-2	7½	9	12	13½	15	18	21	22½	24	27	30	36
1-2-2	8½	10	13	15	17	20	23½	25	26½	30	33	40
2	10	12	16	18	20	24	28	30	32	36	40	48
2-2-3	11½	14	18½	21	23	27	32½	35	37	42	46	56
2-3-3	13	16	21½	24	26½	32	37	40	42½	48	53	64
3	15	18	24	27	30	36	42	45	48	54	60	72
3-3-4	17	20	27	30	33½	40	46½	50	53½	60	66	80
3-4-4	18	21	29½	33	36½	44	51	55	58½	66	73	88
4	20	24	32	36	40	48	56	60	64	72	80	96
4-4-5	22	26	35	39	43	52	61	65	69	78	86	102
4-5-5	23½	28	37½	42	46½	56	65	70	75	84	93	106
5	25	30	40	45	50	60	70	75	80	90	100	120

Sleying for instance 0-1-1 means: skip one dent, one end in one dent, one end in one dent; 2-3-3 means: 2 ends in one dent, 3 ends in one dent, 3 ends in one dent.

Of course compound sleying leaves marks on the fabric, but so does any sleying except when we have one end per dent. The sleyings: 0-1-1, 1-1-2, and 1-2-2 leave more distinct marks than any other and should be avoided except when the fabric is thoroughly washed after weaving.

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