SATIN AND OTHER WEAVES

Serial 507 ———— Edition 1

SATINS

1. Satin, or sateen, weaves constitute one of the most valuable classes of fundamental weaves, and are used in almost every branch of weaving and with yarns of every material. They are used in woolen cloths to produce *doeskins*, in cotton cloths for the production of *sateens* and *satinettes*, and in silk goods for *satins*. One of the largest uses of satin weaves is in the production of linen damasks, in which warp-flush and filling-flush satins are combined to produce figured table cloths, napkins, etc. They are also largely used as ground weaves for spotted and figured cloths and are often combined to form check and stripe effects in various fabrics.

2. Comparison of Twills and Satins.—Satin weaves, in a certain sense, are the exact opposite of twills, since while it is the object of a twill weave to show a twill line running diagonally across the cloth, in the satin weave all twill lines are avoided as far as possible, although in some cases a slight twill effect is shown in a cloth woven with a satin weave, by means of the direction of the twist in the warp and filling yarns. Another of the principal features of a twill weave is the supporting of one end by another, but in a satin weave this is carefully avoided; that is, in a satin weave the interlacing of each end is at least 1 pick apart from the interlacing of either of the ends next to it. In a regular satin weave, each end interlaces with the filling only

once in one repeat of the weave. Fig. 1, which shows a 5-end warp-flush twill, and Fig. 2, which shows a 5-end warp-flush satin, illustrate these points. Although in the twill weave only one interlacing is made on each pick, the ends support each other, since on the first pick the first end is down and on each succeeding pick the next end is down, thus forming a twill line. With the satin weave, only 1 end is down on each pick, it being in this respect similar to the twill weave, but the interlacing of each end is at least 1 pick apart from the interlacing of either of the 2 ends next to it. Thus on the first pick, the first end is down; on the next pick, the fourth end is down; on the third pick, the second end is down; on the fourth pick, the fifth end is down; and on the fifth pick, the third end is down; consequently, the points of interlacing do not run up in regular order, as is the case in a regular twill weave, but are scattered over the weave. By this means the interlacings of the warp and filling are almost entirely hidden, while the cloth produced is smooth and soft, this being the object of the weave.

FIG. 1   FIG. 2

3. Base for Satin Weaves.—The order in which the ends are raised or lowered when forming a satin weave is generally indicated by a series of figures, in which each figure represents an end, while its position in the series indicates the pick on which it is moved. Thus, referring to the 5-end satin in Fig. 2, the ends would be said to be lowered in 1, 4, 2, 5, 3 order: 1 being the first number, shows that the first end is lowered on the first pick; 4 being the second number, shows that the fourth end is lowered on the second pick; 2 being the third number, shows that the second end is lowered on the third pick; 5 being the fourth number, shows that the fifth end is lowered on the fourth pick; and 3 being the fifth number, shows that the third end is lowered on the fifth pick.

Considering the order of moving the ends, as shown in Fig. 2, on each successive pick, the third end (counting

from left to right) from the one previously lowered is down. Thus, on the first pick, the first end is down; on the second pick, the third end from that, or the fourth, is down; on the next pick, the third end from the fourth, or the second, is down; and so on for the 5 picks that complete one repeat of the weave. This is known as *moving in threes;* that is, 3 is taken as a base for constructing the weave. When determining the base on which to construct a satin weave, any number may be taken that is neither a factor of the whole number of ends in one repeat nor a multiple of any such factor, exclusive of the number 1 and the number that is 1 less than the number of ends on which the satin under consideration is complete. Thus, in the case of the 5-end satin, 3 is a number that cannot be equally divided into 5, the number of ends in the repeat; neither can any number that is equally divisible into 5 be equally divided into 3. The number 2 could also be taken as the base for a 5-end satin, in which case the ends would be moved in the following order: 1, 3, 5, 2, 4.

4. Warp- and Filling-Flush Satins.—Satin weaves may be either **warp-flush** or **filling-flush**; the former contains more warp yarn on the face, while the latter contains more filling on the face. Warp and filling satins, as shown on design paper, may be readily distinguished, for if there are more filled-in than blank squares, as in Fig. 2, the warp will predominate, since filled-in squares represent the warp ends lifted, and the weave will be a *warp satin.* In case there are more blank than filled-in squares, as in Fig. 3, the weave will be a *filling satin*, since the blanks represent filling over warp.

FIG. 3

When a satin is a warp satin, the ends are said to be *lowered* in a certain order, while with a filling satin the ends are said to be *raised* in a certain order. Thus, for example, in speaking of the weave in Fig. 2, the ends are said to be lowered in 1, 4, 2, 5, 3 order, while the ends of the filling satin shown in Fig. 3 are said to be lifted in 1, 4, 2, 5, 3 order.

Clòths with a satin weave are sometimes woven face down, in which case a warp satin has the ends *raised* according to the base of the satin, while a filling satin has the ends *lowered* according to the base. In this Course, however, cloth will always be considered as woven face up unless a definite statement to the contrary is made.

A filling satin generally contains more picks per inch than ends, so that the ends that are raised over the picks are nearly covered, thus causing the cloth to have a very soft feeling. A similar effect is produced in a warp satin, which generally contains more warp ends per inch than picks, thus causing the warp ends to crowd over the picks that are raised.

5. Six-End Satin.—The smallest number of ends on which a regular satin can be constructed is 5. It cannot be constructed on 6 ends, although in many cases a weave known as an *irregular satin* is made on 6 ends, the order of moving the harnesses being either 1, 3, 5, 2, 6, 4 or 1, 4, 2, 6, 3, 5. With weaves in which the ends are raised or lowered in either of these orders, no two adjacent ends are moved on successive picks; or in other words, no two ends support each other, and yet the same number of ends are not skipped between successive picks. Take, for example, the first order. If a warp satin is being considered, on the first pick the first end is lowered; on the second pick the second end from the one previously lowered, counting from left to right, or the third, is lowered; on the the third pick the second end from the previous one, or the fifth, is lowered; but on the next pick the third end from the fifth, or the second, is lowered; on the next pick the fourth end from the second, or the sixth, is lowered; while on the last the fourth end from the sixth, or the fourth, is lowered. Thus, in certain parts of the weave the base for counting off the ends is 2; in others it is 3; while in still others it is 4.

6. Construction of Satin Weaves.—To illustrate more fully the method of obtaining the base for any satin weave, it will be supposed that it is desired to make a regular satin on 7 ends. In any case where it is desired to construct

a satin weave on an odd number of ends, 2 can always be taken as the base, since 2 is neither a factor of any odd number nor a multiple of any factor of an odd number. Thus, in a 7-end satin the ends can be moved in 1, 3, 5, 7, 2, 4, 6 order, in which case the order of moving the ends is regular, and at the same time no two ends support each other; consequently, the satin will be regular. Another order of moving the ends in a 7-end satin is by threes, in which case the following results: 1, 4, 7, 3, 6, 2, 5; that is, on the first pick the first end is moved; on the second pick, the fourth end; on the third pick, the seventh end; on the fourth pick, the third end; on the fifth pick, the sixth end; on the sixth pick, the second end; and on the seventh pick, the fifth end. Still another base that may be taken for a 7-end satin is 5, in which case the ends are moved in the following order: 1, 6, 4, 2, 7, 5, 3. Another base is 4, in which case the ends are moved as follows: 1, 5, 2, 6, 3, 7, 4.

For another example, suppose that it is desired to construct a satin weave on 9 ends. It is first necessary to obtain a number smaller than 9 that is not equally divisible into the total number of ends and that cannot be divided equally by any number that can be divided into 9. The number 5 answers these conditions, and if taken as a base for moving the ends will give the following: 1, 6, 2, 7, 3, 8, 4, 9, 5. With this order, the first end is moved on the first pick; on the second pick, the sixth end is moved; on the third pick, the second; on the fourth pick, the seventh; and so on until all the ends are moved once, which gives one repeat of the weave.

Fig. 4 shows a 7-end filling satin constructed on a base of 3. On the first pick, the first end is raised; on the second pick, 2 ends are missed and the fourth end raised; on the next pick, 2 ends again are missed and the seventh end raised. This method of skipping is continued for 7 picks, which is one repeat of the weave. When the last end, or in this case the seventh, is reached, the next end to be counted is the first. Thus, for instance, on the third pick of this weave the seventh end
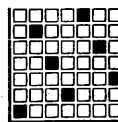

Fig. 4

is raised. Counting from this end to see which end will be raised on the next, or fourth, pick, the first end is considered

FIG. 5

as 1, the second as 2, and the third end from the seventh will be the third end of the weave, which will be the end to be raised on this pick. This is due to the fact that as one repeat of the weave occupies only 7 ends, the eighth end of the weave is like the first, the ninth like the second, and so on.
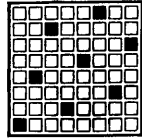
Fig. 5 shows an 8-end filling satin constructed on a base of 3; that is, one end is raised on one pick and on the next pick the third end from the one previously raised is lifted.

Fig. 6 shows a 9-end filling satin weave constructed on a base of 4. Thus, on the first pick, the first end is raised; on the second pick, the fourth end from this one, or the fifth, is raised; on the third pick, the

FIG. 6

fourth end from the fifth, or the ninth, is raised; on the fourth pick, the fourth end from the ninth, or the fourth, is

FIG. 7

raised. This is continued for the 9 picks, which completes the repeat.
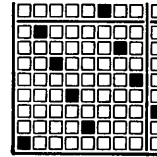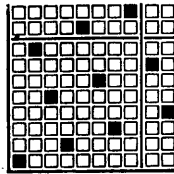
Fig. 7 shows a 10-end filling satin with a base of 3.

Fig. 8 shows a 9-end warp satin weave constructed on a base of 4. In warp satins all the ends in one repeat of the weave are up on each pick with the exception

of one pick. Thus, in the case of Fig. 8, on the first pick all the ends are raised with the exception of the first end; on the second pick, the fourth end from this first end, or the fifth, is lowered; on the third pick, 3 ends are skipped and the ninth end is lowered; on the fourth pick, 3 ends are skipped and the fourth end is lowered. This is

FIG. 8

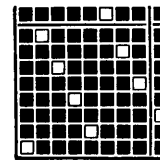continued for the 9 picks that complete one repeat of the weave.

Fig. 9 shows a 10-end warp satin weave constructed on a base of 3.

7. The lifting of the harnesses in a filling satin weave is given in the order that the ends are raised on each successive pick. Thus, for instance, in Fig. 5 the harnesses are raised in 1, 4, 7, 2, 5, 8, 3, 6 order. This indicates that on the first pick, the first harness is raised; on the second pick, the fourth harness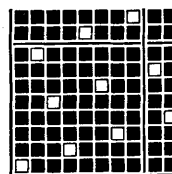 is raised; on the third pick, the seventh harness is raised; on the fourth pick, the second harness is raised; on the fifth pick, the fifth harness is raised; on the sixth pick, the eighth harness is raised; on the seventh pick, the third harness is raised; on the eighth pick, the sixth harness is raised.

FIG. 9

5-END SATINS	10-END SATINS
1, 4, 2, 5, 3	1, 4, 7, 10, 3, 6, 9, 2, 5, 8
1, 3, 5, 2, 4	1, 8, 5, 2, 9, 6, 3, 10, 7, 4

6-END SATINS	11-END SATINS
1, 3, 5, 2, 6, 4	1, 3, 5, 7, 9, 11, 2, 4, 6, 8, 10
1, 4, 2, 6, 3, 5	1, 10, 8, 6, 4, 2, 11, 9, 7, 5, 3

7-END SATINS

1, 4, 7, 3, 6, 2, 5   1, 4, 7, 10, 2, 5; 8, 11, 3, 6, 9

1, 3, 5, 7, 2, 4, 6   1, 9, 6, 3, 11, 8, 5, 2, 10, 7, 4

1, 6, 4, 2, 7, 5, 3   1, 5, 9, 2, 6, 10, 3, 7, 11, 4, 8

1, 5, 2, 6, 3, 7, 4   1, 8, 4, 11, 7, 3, 10, 6, 2, 9, 5

    1, 6, 11, 5, 10, 4; 9, 3, 8, 2, 7

8-END SATINS   1, 7, 2, 8, 3, 9, 4, 10, 5, 11, 6

1, 4, 7, 2, 5, 8, 3, 6

1, 6, 3, 8, 5, 2, 7, 4   **12-END SATINS**

    1, 6, 11, 4, 9, 2, 7, 12, 5, 10, 3, 8

9-END SATINS   1, 8, 3, 10, 5, 12, 7, 2, 9, 4, 11, 6

1, 3, 5, 7, 9, 2, 4, 6, 8

1, 8, 6, 4, 2, 9, 7, 5, 3

1, 5, 9, 4, 8, 3, 7, 2, 6

1, 6, 2, 7, 3, 8, 4, 9, 5

Generally a chain draft for a satin weave is made like the weave; that is, in most cases the weave is also the chain draft, and when this is the case the ends are drawn in straight, or in other words, through the harnesses in consecutive order.

The preceding table gives the different orders of moving the ends in satin weaves complete on 12 ends or less.

8. Double Satins.—Weaves known as **double satins** are sometimes constructed from regular satins. These are made by adding one mark to each mark in a regular satin; that is, in case the satin is a filling satin, each end will be raised an extra time during one repeat of the weave, and in case the satin is a warp satin, each end will be lowered an extra time during one repeat of the weave. These marks may be placed above, below, or at the side of the regular satin marks. Double satin weaves are principally used when it is desired to increase the strength of the goods and yet retain the satin face.
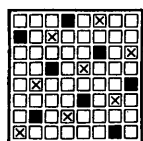
FIG. 10

Fig. 10 illustrates a double satin. The crosses represent a regular 8-end satin weave constructed on a base of 3, giving the following order of lifting the harnesses: 1, 4, 7, 2, 5, 8, 3, 6. In order to convert this regular satin weave into a double satin, one riser is placed on each pick in addition to the riser of the regular satin weave. Thus, on the first pick, in addition to the first end being raised the seventh end is also raised. In all double satin weaves the extra risers must be placed in regular order; that is, on the second pick the extra riser must be placed in the same relative position to the riser of the regular satin on that pick as was the extra riser on the first pick to the riser of the regular satin weave on that pick. Thus, on the first pick of the weave shown in Fig. 10, 5 ends are skipped after marking the riser for the regular satin, and the seventh end marked with an extra riser; on the second pick the fourth end is marked with a riser of the regular satin, 5 ends skipped, and the second end raised, which corresponds to the method of marking the extra riser on the first pick of the weave. This is continued throughout the 8 picks that complete one repeat of the weave.

Fig. 11 is another illustration of a double satin weave. In this case the extra risers are placed at the right of the risers

of the regular satin weave. Thus, on the first pick the first end is raised for the regular satin weave, and in order to make a double satin the square to the right of the one containing the riser of the regular satin weave is marked, or in other words the second end is raised with the first. The same method is followed with each pick of the weave.

FIG. 11

Fig. 12 shows an 8-end double satin. The crosses show the order of lifting the ends for a regular satin weave, while the filled-in squares show the extra ends that are raised in order to make the satin double.
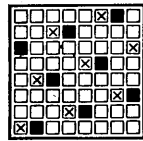
FIG. 12

Double satins are sometimes constructed by dividing the base that would be used for a regular satin into two numbers and using these numbers alternately for marking the risers of the double satin. Fig. 13, which is a 12-harness double satin constructed on this principle, illustrates these weaves. In this case the number 7, which could be used for the base of a regular satin on 12 ends, is divided into the two numbers 3 and 4 and these numbers used for constructing the weave. Considering first the squares that are marked with crosses, on the second pick, the fourth end from the end raised on the first pick is raised; on the third pick, the third end from the end raised on the second pick is raised; on the fourth pick, the fourth end from the end raised on the third pick is raised; on the fifth pick, the third end from the end raised on the fourth pick is raised. This is continued for the 12 picks, when it is necessary to return to the first pick; since on the twelfth pick the fourth end from the end raised on the eleventh pick is raised, on the first pick the third end from the end raised on the twelfth pick is raised. . The filled-in squares show the risers that are obtained by continuing the process through the ends and picks the second time.
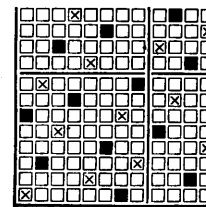
FIG. 13

Fig. 14 shows a weave made on somewhat the same principle as Fig. 13. In this case, however, the two risers are

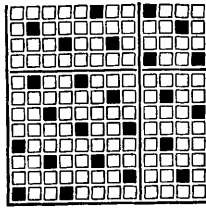marked on 1 pick before moving to the next pick. Thus, on the first pick the first end is raised and also the third end from the first.   Moving to the second

FIG. 14

pick, the fourth end from the last end raised on the first pick is raised, which gives a riser on the eighth end for the second pick.   In addition to this end being raised on the second pick, the third end from it is also raised, which gives a riser on the eleventh end.   Moving to the third pick, as the eleventh· end was the last end to be marked on the second pick, the third end, which is the fourth end from the eleventh, will be raised on the third pick.   In addition to this end the third end from it, or the sixth, is also raised on the same pick.   This method is continued throughout the 12 picks.

EXAMPLES FOR PRACTICE

1. Make a warp satin on 16 harnesses, moving in fives.

2. Make a filling satin on 16 harnesses, moving in sevens.

3. From the weave formed in answer to question 2 construct a double satin by adding one riser on each pick of the satin weave.

4. (*a*) What is the smallest number of harnesses on which a regular satin weave can be constructed?   (*b*) Show a satin weave on this number of harnesses.

DERIVATIVE WEAVES

9. Satin Derivatives.—Satin weaves provide a ready means for constructing other weaves, or **derivatives,** as they are called. In almost every case satin derivatives are formed by adding one or more extra risers to the risers of a regular satin. Fig. 15 shows one that might be considered
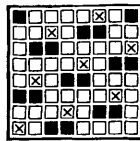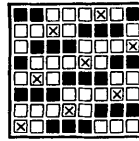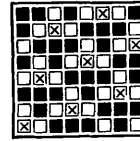

FIG. 15   FIG. 16   FIG. 17   FIG. 18

a double satin, and yet would form a fine, upright twill in the weave. In the figures illustrating satin derivatives, the crosses show the method of raising the ends for the regular satin, while the filled-in squares show the risers that are added in order to form the derivatives. Fig. 16 is a satin derivative formed by adding two filled-in squares to each riser in a regular 8-end filling satin weave. Fig. 17 is one formed
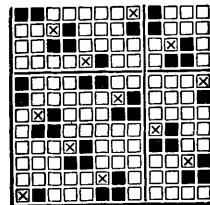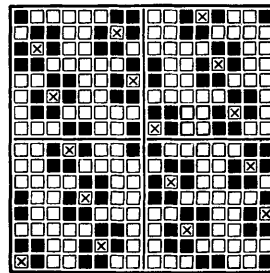
FIG. 19   FIG. 20

by adding three risers to each riser in a regular 8-end satin. Fig. 18 is one formed by adding four risers to each riser of a regular 8-end satin weave. In all these cases, whenever it is necessary to extend the risers beyond the last end of the

weave they are carried to the first end, and in case it is necessary to extend the risers beyond the bottom pick of the weave they are carried to the top pick, or vice versa. Fig. 19 shows a derivative weave formed by adding three risers to each riser of a regular 12-end filling satin. Fig. 20 shows a satin derivative formed by adding six risers to each riser of a regular 16-end filling satin.

GRANITE WEAVES

10. In a **granite weave**, the intersections of the warp and filling are disposed throughout the weave in an irregular manner so that the floats of warp and filling will produce an indistinct yet regular pattern consisting of small broken effects. Granite weaves are largely used in almost every class of fabric, the cloths often being piece-dyed, but sometimes having the warp of one color and the filling of a contrasting color, thus giving the cloth a speckled appearance. They are made largely from regular satins by adding one or more risers to the risers of the satin weave; Figs. 16, 17, and 18 are good examples of granite weaves constructed in this manner. These weaves may also be obtained by rearranging a regular twill in so-called satin order; that is, taking the ends of the twill in the order followed when making a satin weave. For example, if the ends of an 8-end regular twill are rearranged in satin order on a base of 3, the ends are taken as follows: 1, 4, 7, 2, 5, 8, 3, 6; that is, the first end of the new weave will be like the first end of the twill; the second end will be like the fourth end of the twill; the third end will be like the seventh; the fourth end, like the second; the fifth end, like the fifth; the sixth end, like the eighth; the seventh end, like the third; and the eighth end, like the sixth. In other cases, granite weaves are constructed from regular twills by taking a certain number
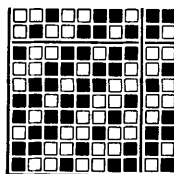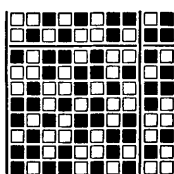
FIG. 21   FIG. 22

of ends of the twill and then skipping a certain number, this being continued until the weave repeats. In the granite weave shown in Fig. 22, the ends of the regular twill shown in Fig. 21 have been rearranged by taking 2, skipping 4, and so on until the weave repeats.

BASKET WEAVES

11. Regular Basket Weaves.—Basket weaves are used frequently in all classes of woven fabrics; their chief feature is the regular occurrence of large floats of both warp and filling. The first type of basket weaves consists of those in which the squares of warp and filling are of equal size. These baskets are simply extensions of the plain weave both warp way and filling way, and it is always possible to weave them on 2 harnesses. Fig. 23 is a basket weave of this type, in which each square marked in a regular plain weave has
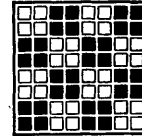
FIG. 23
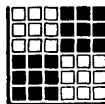
simply been extended for 2 ends and 2 picks, thus making each mark occupy four squares instead of one. Fig. 24 shows another basket weave of this type, in which each mark of the plain weave has been extended for 3 ends and 3 picks; thus, instead of occupying only one square, each mark occupies

FIG. 24

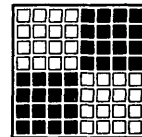nine. In Fig. 25, each mark is extended for 4 ends and 4 picks, and consequently occupies sixteen squares instead of one.

12. Twill Baskets.—A second type of basket weaves consists of **twill baskets,** which are generally constructed on a satin base and produce much neater effects than the basket weaves just described. In making these weaves

FIG. 25

from a satin base, first mark out a satin weave on the desired number of ends and picks; then fill in squares around each of those marked off for the satin base, in such a manner that these groups of filled-in squares will form squares that run up in twill order. Fig. 26 shows a twill basket weave

constructed in this manner from an 8-end satin weave with a base of 5. The crosses show the satin weave, while the filled-in squares show the risers that are added in order to obtain the basket weave. In making these weaves, care should always be taken to have the filled-in squares around each mark of the satin base correspond in every particular;
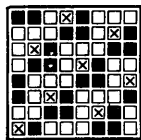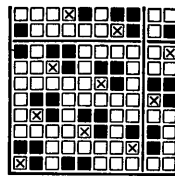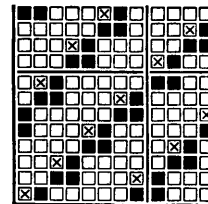

FIG. 26   FIG. 27   FIG. 28

that is, if on the first mark of the satin weave one square to the right and two below are filled in, as in Fig. 26, in the case of every other mark of the satin weave the corresponding squares must be filled in. Fig. 27 shows a twill basket weave constructed from a 10-end satin with a base of 7. Fig. 28 shows another one constructed from a 12-end satin with a base of 7.

13. Irregular Baskets.—A third type of basket weaves consists of **irregular baskets**; in these the squares of warp and filling are not exactly equal. Thus, in Fig. 29,

FIG. 29   FIG. 30   FIG. 31

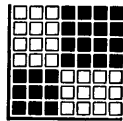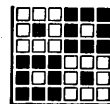the filled-in squares in one portion of the weave occupy 3 ends and 3 picks, while in another portion they occupy but 2 ends and 2 picks. In Fig. 30, the weave is formed by extending the warp floats in one case for 3 ends and 3 picks and in the other for 4 ends and 4 picks.

14. Fancy Basket Weaves.—A fourth type of baskets consists of **fancy basket weaves**. In Fig. 31, the squares of filling are broken in the center by a float of warp, while the squares of warp are broken by a float of filling. Fig. 32

is another fancy basket weave constructed in the same manner. Fig. 33 shows a fancy basket weave constructed by separating warp floats of 4 ends and 4 picks each by 3 ends and 3 picks and filling in these intervening ends and picks with a suitable
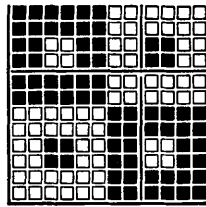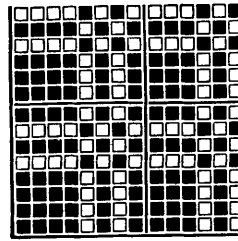

FIG. 32

FIG. 33

weave. Two repeats of this weave in both ends and picks are shown in this figure. Fig. 34 is another weave made in somewhat the same manner. In this case, a plain basket weave consisting of warp and filling floats of 4 ends and 4 picks has the floats separated by 2 ends and 2 picks, which are filled in with a suitable weave. Two repeats of the weave in both ends and picks are given.
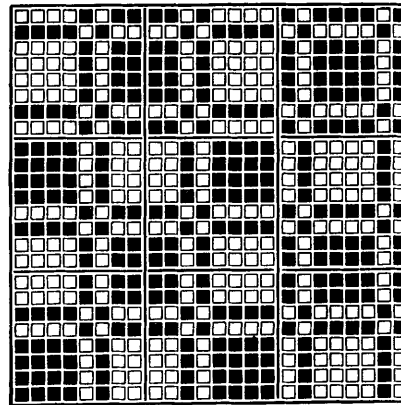

FIG. 34

RIB WEAVES

15. Warp Ribs. Rib, or cord, weaves are simply extensions of the plain weave in either the ends or picks alone and are of two classes— *warp ribs* and *filling ribs*. A warp-rib weave is an extension of a plain weave in its picks. In order to illustrate the construction of these weaves, Fig. 35, which shows a warp-rib weave, has been divided into two sections (*a*) and (*b*). In (*a*), all the odd numbered ends float over the filling for

4 picks, while the even-numbered ends are down. In (*b*),
the reverse is the case; that is, the even-numbered ends float
over the filling, while the odd-numbered ends are under the
filling.   With this class of weaves, a distinct line is formed
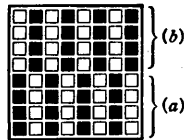across the cloth by means of the ends covering the filling.

Thus in Fig. 35 (*a*), for the 4 picks in which
the odd-numbered ends are over the filling
the ends will have a tendency to crowd
together, especially if there are more ends
than picks per inch in the weave, as there
should always be in a warp-rib weave; that is,
the first and third ends will cover the 4 picks

Fig. 35

of filling that are raised over the second end; the third and
fifth ends for these 4 picks will cover the filling that is raised
over the fourth end; the fifth and seventh ends will cover
the filling that is raised over the sixth end; and the seventh
and first ends will cover the filling that is raised over the
eighth end.   For the next 4 picks the reverse will be the
case; that is, in (*b*) the second and fourth ends will cover
the filling that is raised over the third end; the fourth and
sixth ends will cover the filling that is raised over the fifth
end, and so on.   Consequently, in these 8 picks two distinct
lines will be formed across the cloth because of different
ends covering the filling in these two sections.   This weave
repeats on 2 ends and 8 picks, but four repeats of the weave
in the ends are shown here in order that the
construction of the weave may be understood
more clearly.
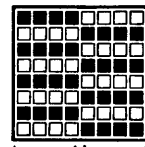
16.   Filling-rib weaves are the exact
opposites of warp-rib weaves.   As the filling
covers the ends in these weaves, ribs are
formed lengthwise of the cloth, and for this
reason the cloth should always contain more picks per
inch than ends.   Fig. 36 is an illustration of a filling-rib
weave.   In (*a*), all the odd-numbered picks float over the
4 ends, while all the even-numbered picks are under the
ends.   In this case, the first and third picks will crowd over

(*a*)   (*b*)

Fig. 36

the ends that are up on the second pick and completely cover them; the third and fifth picks will cover the ends that are raised on the fourth pick; the fifth and seventh picks will cover the ends that are raised on the sixth pick; and the seventh and first picks will cover the ends that are raised on the eighth pick, thus showing a distinct line of filling floats lengthwise of the cloth. In (*b*) the exact reverse is the case; that is, all the even-numbered picks are raised over the ends, while the ends are raised on the odd-numbered picks. By this means the second and fourth picks will cover the ends that are raised on the third pick; the fourth and sixth picks will cover the ends that are raised on the fifth pick, and so on, thus forming another rib of filling floats lengthwise of the cloth. This weave is complete on 2 picks and 8 ends, four repeats of the weave in its picks being shown here.

In warp-rib weaves the filling, and in filling-rib weaves the warp, is usually considerably coarser than the other series of yarn, in order to accentuate the ribbed effect in the cloth. In cloths woven with warp-rib weaves, there should be more ends than picks, and with filling-rib weaves, more picks than ends per inch.

17. Unequal Rib Weaves.—In Figs. 35 and 36, the ribs formed by the weaves are of equal size. This is not always the case, however, for **unequal rib weaves** are frequently used. Fig. 37 is an illustration of a weave of this kind. In the lower section, the odd-numbered ends float for 5 picks, while in the upper section the even-numbered ends float for only 3 picks. In this case there are two ribs of unequal size across, one rib being the width of 5 picks, whi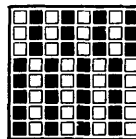le the other is the width of 3 picks. Unequal filling-rib weaves are formed in the same manner; that is, by having the filling float over an unequal number of ends.

FIG. 37

CORKSCREW WEAVES

18. Corkscrew weaves may be considered a class of rib weaves; but while in rib weaves the ribs extend in a straight line either across the cloth or lengthwise of it, in corkscrew weaves the ribs from a twill line, and for this reason are sometimes known as *corkscrew twills*. Although these weaves may be formed on any number of ends or picks above 5, the best effects are obtained with weaves complete on an uneven number of ends and picks. One method of making a corkscrew weave that will be found as simple as any is as follows: Suppose that it is desired to form a corkscrew weave that will be complete on 7 ends and 7 picks.
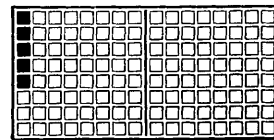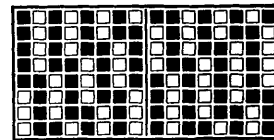
(a)
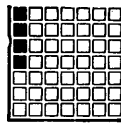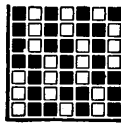
Divide 7 into two numbers one of which will be larger than the other by 1—in this case 3 and 4—then take 3 down and 4 up as the basis on which to mark each end in the corkscrew weave. The first end, as shown in Fig. 38 (*a*), will be lowered for 3 picks and raised for 4 picks. For the second end of the weave, begin on the first pick on which the first end is raised and mark the second end 4 up and 3 down, counting down. For the third end of the weave, commence on the first pick on which the second end is raised and mark 4 up and 3 down, counting down.

(b)

Fig. 38

Continue in this manner until the weave is complete. Corkscrew weaves that are complete on an odd number of picks will always be complete on the same number of ends as picks. Thus, in the case under consideration, since the weave is complete on 7 picks it will also be complete on 7 ends. The complete weave is shown in Fig. 38 (*b*). This weave is termed a *warp corkscrew*, since the warp ends cover the filling and, consequently, nothing but warp shows either on the face or the back of the cloth. In order that these weaves may appear to best advantage, it is necessary, as in the case of warp-rib weaves, to have more ends than picks per inch. Any warp corkscrew weave when turned quarter way around will give a filling corkscrew weave.

Warp corkscrews made on an even number of ends and picks will not repeat until carried out for twice as many ends as picks. In constructing these weaves the number that represents the number of picks on which the weave is complete must be divided into two numbers, one of which will be larger than the other by 2. Suppose, for an example, that it is desired to construct a corkscrew weave that will be complete on 8 picks. The two numbers into which 8 is divided are 5 and 3. Mark the first end of the weave 3 down and 5 up, as shown in Fig. 39 (*a*). For the second end of the weave, commence on the first pick on which the first end is raised and raise the second end on this pick and also on all the picks on which the first end is lowered. The second end will therefore be up 4 picks and down 4 picks, whereas the first end is down 3 picks and up 5 picks. Marking the third end in the same manner as the second, this end will be up for 1 pick, down 3, and up 4 picks; it will thus be similar to the first end with regard to the length of the floats. The complete weave is shown in Fig. 39 (*b*).

(*a*)

(*b*)

FIG. 39

Since the ribs of this weave are formed by the ends that are raised crowding over the filling, two ribs will be formed diagonally across the cloth, one of which will be the width of 5 picks, while the other will be the width of only 4 picks.
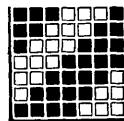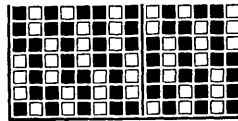

FIG. 40

FIG. 41

19. Corkscrew weaves are often formed from twills: (1) by rearranging the ends or picks of a regular 45° twill; (2) by combining two twills end and end or pick and pick. Considering first the formation of corkscrew weaves by rearranging the ends of a regular 45° twill, suppose that it is desired to rearrange the ends of Fig. 40 in satin

order on a base of 4 to form a corkscrew weave. This will result in the corkscrew shown in Fig. 41, which gives two repeats of the weave in its ends. By rearranging the ends of a weave in this manner *warp corkscrews* are formed, while by rearranging the picks *filling corkscrews* are formed. Corkscrew weaves cannot readily be formed by rearranging the ends of every 45° twill; weaves similar to that shown in Fig. 40 are most suitable for this purpose.

When combining twills end and end or pick and pick to form a corkscrew weave, care should be taken to select such weaves as will give the desired effect. Figs. 42 and 43
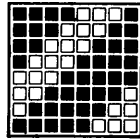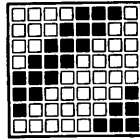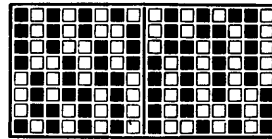

FIG. 42   FIG. 43   FIG. 44

show two 8-end twills that it is desired to combine end and end to form a corkscrew weave. Fig. 44 shows a weave formed in this manner; the first end of Fig. 44 is the first end of Fig. 42; the second end of Fig. 44 is the first end of Fig. 43; the third end of Fig. 44 is the second end of Fig. 42; the fourth end of Fig. 44 is the second end of Fig. 43, and so on for the 16 ends. By combining these two twills, the ends of which have different lengths of floats, there is formed a corkscrew twill that will have ribs of unequal size running diagonally across the cloth, since all the odd-numbered ends are up 5 picks and down 3 picks, while the

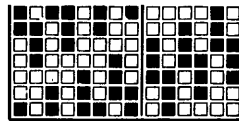
FIG. 45

even-numbered ends are up 3 picks and down 5 picks.

20. Another class of corkscrew weaves includes those known as *warp corkscrews with filling effects*. These weaves may be formed by taking the ends of any filling-flush twill in such a manner as to form ribs in a twill line

across the cloth and at the same time show a distinct line of filling floats. Fig. 45 is such a weave, constructed by taking the ends of the regular 45° 7-end twill $\frac{3}{4}$ in 1, 6, 2, 7, 3, 1, 4, 2, 5, 3, 6, 4, 7, 5 order.


HONEYCOMBS

21. Honeycomb weaves are very common and are extensively used in making towels. When coarse, soft-twisted yarns are employed they make a spongy cloth well suited to this purpose. It is possible to make honeycomb weaves on any number of ends from 4 upwards, but the best effects are obtained with an even number of ends. When making these weaves the first thing to be decided on is the number of ends to be used. Suppose that it is desired to make a honeycomb weave on 8 ends and 8 picks. Raise all the ends, except the first, on any one pick of the weave, preferably one near the center of the design, as shown in Fig. 46 (a), in which the fourth pick has been selected and all the ends raised except the first. Next form a warp spot by marking the risers in regular 45° order from the first and last ends, as shown in Fig. 46 (b). After the spot has been formed, run a line of risers around it, leaving one blank space between these risers and those forming the spot, and confining this line of risers to 8 ends and 8 picks. On the pick shown in (a), which is the fourth pick in (b), no riser can be added to those in the spot figure, since it would not be possible to have a blank space between them; consequently, commencing with the next, or fifth, pick, mark the first end, which will leave a blank space between it and the first end marked in the spot figure on this pick. Running up this line in a regular 45° manner, it stops on the fourth end on the eighth pick. Continuing this line of risers completely around the spot, Fig. 46 (c) is obtained.
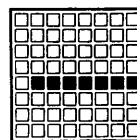
(a)
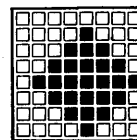
(b)
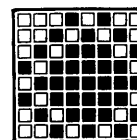
(c)

FIG. 46

EXAMPLES FOR PRACTICE

1. Make a twill weave with the base $\frac{3}{3}\frac{2}{2}\frac{1}{1}$ T.

2. From the weave given in answer to question 1 construct a weave by taking the ends in satin order, moving in sevens.

3. Construct a 15-end twilled basket.

4. Construct a rib weave that will make uneven ribs across the cloth.

5. Construct a rib weave that will make even ribs lengthwise of the cloth.

6. Make a twill weave with the base $\frac{3}{7}$, and from this twill construct a warp corkscrew weave; state the order in which the ends of the twill are taken to form the corkscrew.

7. Construct a honeycomb weave on 10 ends.