

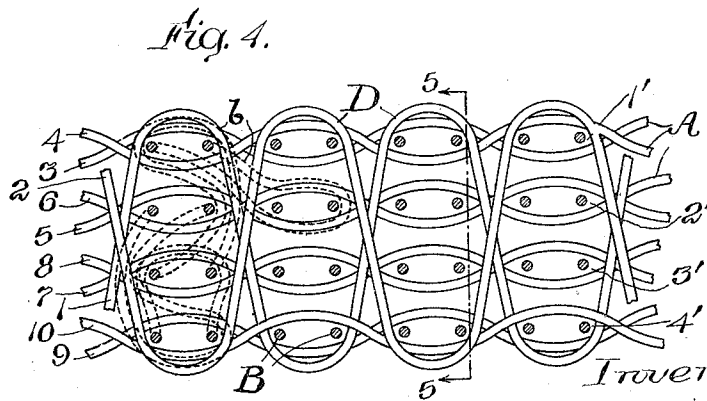
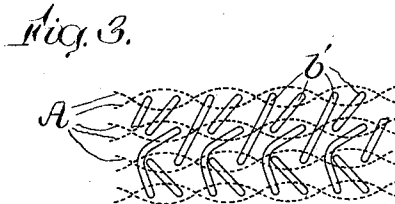
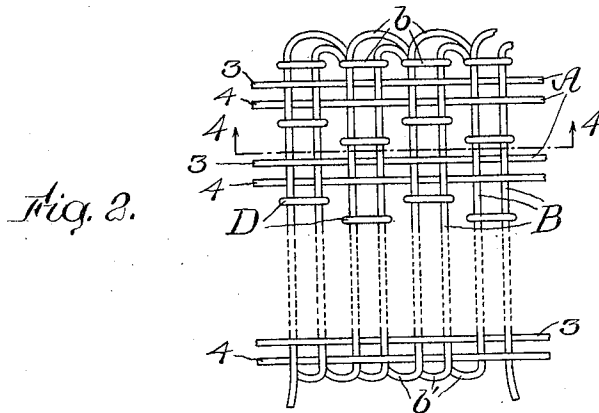
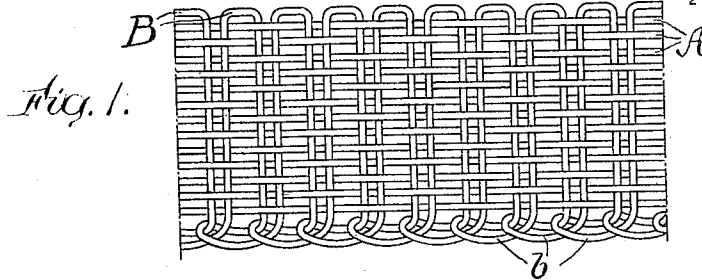
E. E. WAITE.
FABRIC.

APPLICATION FILED JULY 6, 1915.

Patented Oct. 23, 1917.

2 SHEETS—SHEET 1.

1,243,905.



Inventor:

Edwin E. Waite

by *Patent* *Attys.*

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2 SHEETS—SHEET 2.

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Fig. 5.

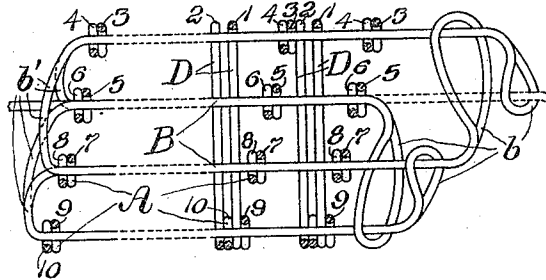


Fig. 6.

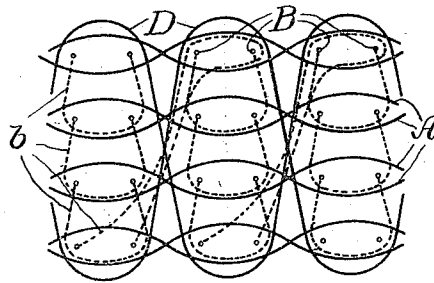


Fig. 7.

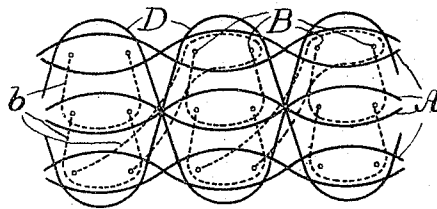
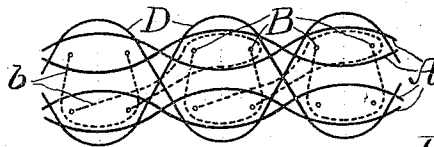


Fig. 8.



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UNITED STATES PATENT OFFICE.

EDWIN E. WAITE, OF FRAMINGHAM, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO STANDARD WOVEN FABRIC COMPANY, OF FRAMINGHAM, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

FABRIC.

1,243,905.

Specification of Letters Patent.

Patented Oct. 23, 1917.

Application filed July 6, 1915. Serial No. 38,270.

To all whom it may concern:

Be it known that I, EDWIN E. WAITE, a citizen of the United States, residing at Framingham, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Fabrics, of which the following description, in connection with the accompanying drawings, is a specification, like reference characters on the drawings indicating like parts in the several figures.

This invention relates to fabrics and is especially concerned with narrow fabrics such as tape, straps, brakelining and the like.

It is a particular object of this invention to devise a fabric of this general character which can be manufactured at a greater speed and consequently with greater economy than fabrics of this class now known.

The invention will be readily understood from the following description, reference being made to the accompanying drawings, in which—

Figure 1 is a plan view of a single ply fabric manufactured in accordance with the invention, the threads or yarn composing the fabric being shown widely separated or spread out for the purpose of better disclosing the weave;

Fig. 2 is a plan view of a piece of a four-ply fabric embodying the invention;

Fig. 3 is a diagrammatic edge view of the fabric shown in Fig. 2;

Fig. 4 is a longitudinal, sectional view taken on the plane indicated by the line 4—4, Fig. 2;

Fig. 5 is a diagrammatic, sectional view of the fabric shown in Figs. 2, 3 and 4, and is taken substantially on the plane indicated by the line 5—5, Fig. 4;

Fig. 6 is a view similar to Fig. 4 of the four-ply fabric in which the weft is inserted in a slightly different order from that shown in Fig. 4;

Fig. 7 is a view similar to Fig. 4 of a three-ply fabric embodying this invention; and

Fig. 8 is a view similar to Fig. 4 of a two-ply fabric constructed in accordance with this invention.

The fabric shown in Fig. 1 comprises a series of warp threads A and a weft thread

or filler B interwoven with the warp to form the body of the fabric but the weft thread, instead of being inserted in the usual manner, is doubled back upon itself between the adjacent crossings or intersections of the warp threads with each other in such a manner that a double length of weft is laid between each of these adjacent intersections and a loop *b* is formed at one end of each of these doubled lengths. The crossings of the warp threads lock the weft against raveling at one selvage edge, that is, the upper edge as the fabric is shown in Fig. 1, in the same manner that it is locked in an ordinary piece of goods. The warp, however, does not lock the loops *b* at the opposite selvage edge since each of these loops lies between two adjacent intersections of the warp thread. According to the present invention, however, this locking operation is effected by extending each loop *b* through the next adjacent loop, the loops thus forming the series of chain stitches along one selvage edge of the fabric.

In manufacturing this fabric the warp threads preferably are arranged in the usual manner in weaving and for this purpose the warp supporting and operating mechanism of a loom may conveniently be employed. Preferably a needle loom is used for this purpose, the weft being inserted by a needle or hook or some similar instrument, thus laying the weft in double lengths and forming the loops *b* at one selvage edge. Each loop is caught and held by another needle operating transversely to the first needle while the first needle withdraws and the harnesses change. When the weft inserting needle lays in the next double length of weft, the stitch forming or selvage needle is advanced to hook into the new loop and is then operated to pull this loop through the loop previously formed. The latter needle continues to hold the new loop while the weft inserting needle again withdraws, the harnesses again change and the weft needle carries another length of weft through the shed, the loop thus formed being caught by the stitch forming needle and drawn through the loop which it now holds. This operation, of course, is repeated until the required length of fabric has been manufactured. The weft thus is laid across the

fabric in pairs in the different sheds, one pair in each shed, and the adjacent pairs of weft threads are connected at one selvage edge of the fabric by single threads and at the opposite selvage edge by each loop encircling or inclosing the threads of the next adjacent loop so that a chain of knitted stitches is formed along the selvage edge of the fabric.

It is obvious that a fabric of this construction can be produced much more rapidly than fabrics of the usual construction since the warp and weft can be handled by mechanisms capable of operating at much higher speeds than the mechanisms which are used in manufacturing fabrics of the usual kinds.

Multi-ply fabrics can obviously be manufactured by following the method above described and making merely those variations necessary to a multi-ply weave, although the invention involves certain novel features of particular advantage in multi-ply goods, as hereinafter explained. A four-ply fabric manufactured in accordance with this invention is shown in Figs. 2 and 5, inclusive, enough only of the fabric being shown in Figs. 2 and 5 to make the weave entirely clear. Each ply is substantially like that shown in Fig. 1; that is, the warp and weft in each ply are interwoven in the same manner as they are in Fig. 1 to form the body of the ply but the several plies are united by binding threads D. The plies are indicated in Fig. 4 by the reference characters 1', 2', 3' and 4', respectively. The warp, weft and loops are indicated by the same reference characters as those used in Fig. 1, and in addition the warp threads and binders are designated by numbers in Figs. 2, 4 and 5, which numbers indicate the harnesses that control the movements of the respective sets of threads in weaving a fabric of the form shown. Of these numbers 1 and 2 indicate the binders; 3 and 4 indicate the warp threads of the topmost ply 1'; 5 and 6, the warp threads of the second ply 2'; 7 and 8, the warp threads of the ply 3'; and 9 and 10, the warp threads of the bottom ply 4'. Fig. 5 indicates the manner in which the warp and binders are arranged to shed and is a diagrammatic section rather than a true section of Fig. 4, the diagram showing the structure of the goods better than an actual section would.

In the fabric shown in Figs. 2 to 5, the weft is inserted in the different plies in the order 2', 4', 3' 1' and then repeats. Consequently, the loops b of one ply will be interlocked with those of an adjacent ply. As clearly shown in Fig. 4, the loops of the first ply extend through and lock the loops of the third ply, while the loops of the third ply extend through and lock the loops of the fourth ply. The loops of the

fourth ply lock the loops of the second ply and the loops of the second ply lock the loops of the first ply of the preceding cycle. At the opposite selvage edge of the fabric the parts of the weft connecting the pairs of weft threads lying in the adjacent sheds appear substantially as shown in Fig. 3 at b'.

The order in which the weft is inserted in the different plies may, of course, be varied to suit the requirements of individual cases without departing from the spirit or scope of the present invention. Fig. 6 shows a four-ply fabric like that shown in Figs. 2 to 5 in all essential particulars but in the arrangement shown in Fig. 6 the order in which the weft is inserted is 1', 2', 3', 4', instead of 2', 4', 3', 1', as in Fig. 4.

Figs. 7 and 8 show, respectively, three-ply and two-ply fabrics made according to this invention, the three-ply fabric being exactly like the four-ply fabric shown in Fig. 6 except that one of the middle plies is removed; and the two-ply being exactly like that shown in Fig. 6 except that both the middle plies are removed. In Fig. 7, the weft is inserted in the order 1', 2', 3' and in Fig. 8 it is inserted in the order 1', 2'. In Figs. 6, 7 and 8 the threads are each indicated by single lines instead of double lines, as in Figs. 4 and 5.

In making multi-ply goods I prefer to lay the weft in each cycle (the cycles, of course, being determined by the change or shifting of the binders) by inserting the weft first in one of the intermediate plies and then in the other plies. Consequently in making four ply goods I prefer to lay the weft in the order indicated in Fig. 4 instead of that indicated in Fig. 6. In the arrangement shown in Fig. 4 it will be noted that the weft is inserted, first in the second ply, then in the fourth ply, next in the third ply and finally in the first ply. This order of laying the weft in each cycle results in subjecting the binding threads to a more uniform strain than would be obtained if they were inserted in the order shown in Fig. 6; and is very important in the manufacture of some kinds of mechanical fabrics, particularly those made out of asbestos yarn, which of course has a relatively low tensile strength. This arrangement also produces the advantage of making the loops b of weft of more uniform length than does the arrangement shown in Fig. 6; although this same advantage might be obtained by inserting the weft in a different order from that shown in Fig. 4; as for instance, in the order 3, 1, 2, 4, or 1, 3, 4, 2. It is obvious that in following these principles in making three ply fabric, the order of laying the weft would be 2, 1, 3, or 2, 3, 1; although the advantage of keeping the

loops of as nearly a uniform length as possible could also be obtained by following the order 1, 3, 2 or 3, 1, 2. A still further advantage of laying the weft in the manner above indicated is that the loops of weft of each ply are interlocked with adjacent loops of another ply, thus producing a smooth selvage and causing the selvage loops to aid the binders in securing together the different plies. This arrangement is clearly distinguished from the bare multiplication of the single ply fabric shown in Fig. 1, which would produce a multi-ply fabric in which the weft loops in each ply would be interlocked with other loops of the same ply, thus forming what might be called a "split" selvage. This selvage is serrated, lacking entirely the characteristics of the selvage made by the preferred method, and is objectionable in some classes of goods, as for instance, the brakelinings and clutch rings.

Multi-ply fabrics are much used for mechanical purposes and the multi-ply weaves above described are well adapted for these purposes, particularly for the requirements of brakelining, clutch facings, and similar goods manufactured from asbestos yarn, and for other classes of mechanical fabrics. The fabric shown has what is known as a "basket weave" but it will, of course, be understood that the invention is equally applicable to other weaves.

A machine designed to make the fabric disclosed in this application is shown and described in my co-pending application Serial No. 38,269, filed of even date herewith.

Having thus described my invention, what I claim as new and desire to secure

by Letters Patent of the United States is:—

1. A multi-ply fabric, each ply comprising warp and weft threads interwoven with each other, the weft threads being laid in pairs in the different sheds, one pair in each shed, and each pair terminating in a loop at one selvage edge of the fabric, said loops of the weft in each ply being interlocked with adjacent loops of weft in another ply, the weft threads being laid in an intermediate ply in each cycle before they are laid in either of the outer plies in the cycle, and binders uniting the plies.

2. A multi-ply fabric, each ply comprising warp and weft threads interwoven with each other, the weft threads being laid in pairs in the different sheds, one pair in each shed, and each pair terminating in a loop at one selvage edge of the fabric, the weft loops in the outer plies being interlocked with adjacent loops of an intermediate ply, and binders uniting the plies.

3. A multi-ply fabric, each ply comprising warp and weft threads interwoven with each other, the weft threads being laid in pairs in the different sheds, one pair in each shed, and each pair terminating in a loop at one selvage edge of the fabric, and binding threads uniting the plies, said loops of the weft in each ply being interlocked with adjacent loops of weft of another ply.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWIN E. WAITE.

Witnesses:

FREDERICK J. GLEASON,
ARTHUR H. BURDICK.