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A. J. GASH

2,159,264

BIAS WOVEN FABRIC

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2 Sheets-Sheet 1

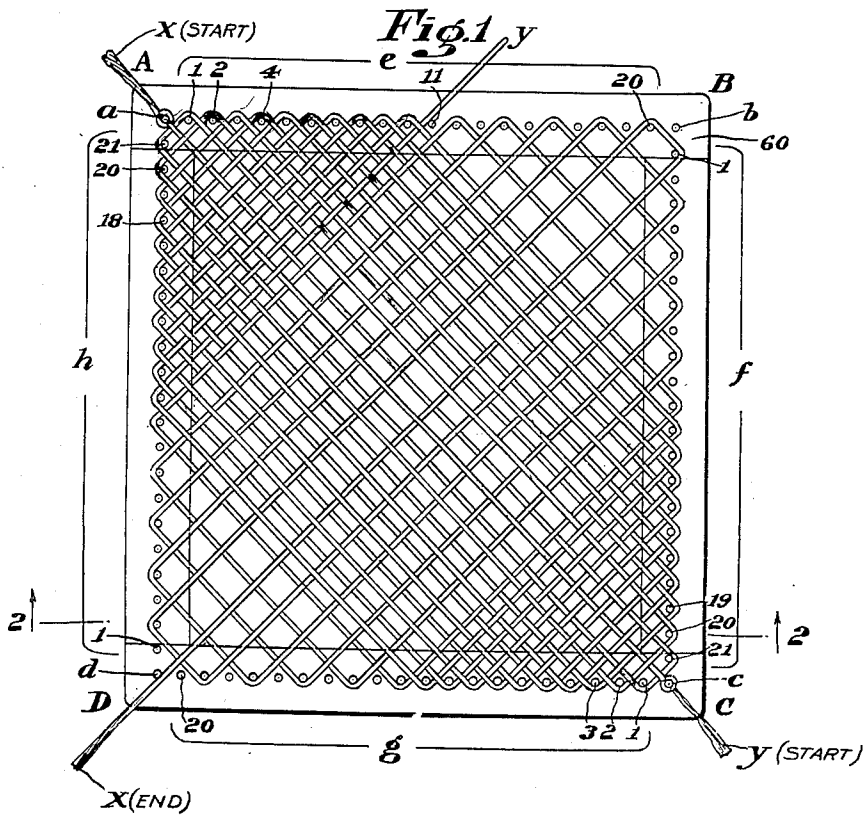
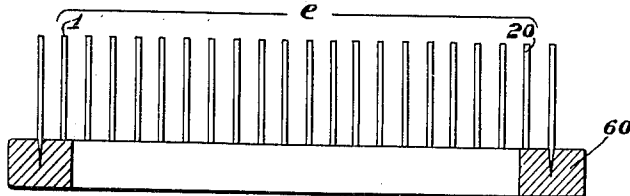


Fig. 2



INVENTOR
BY *Angie Jean Gash*
Howard V. Patrick
ATTORNEY

May 23, 1939.

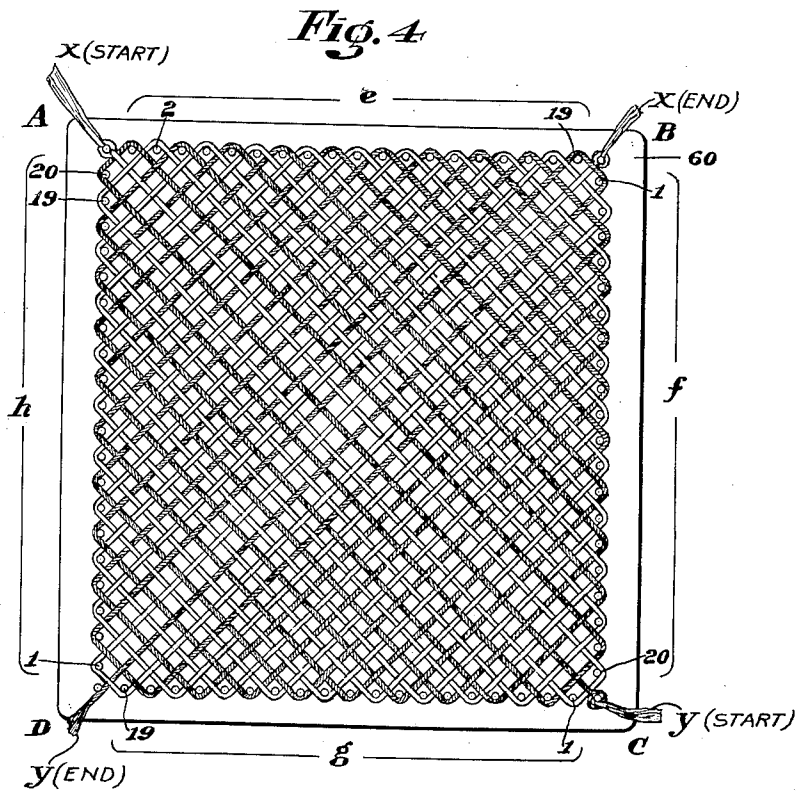
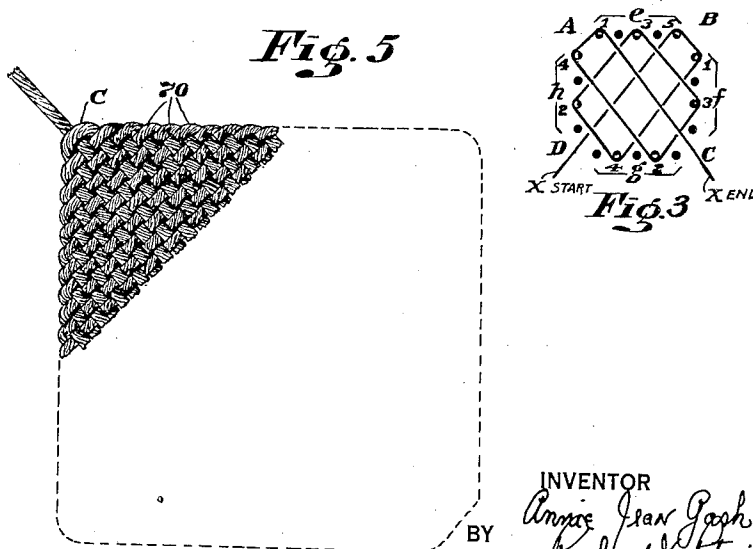
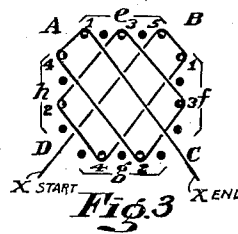
A. J. GASH

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2 Sheets-Sheet 2



INVENTOR

Annie Jean Gogh
Rowland V. Tuttle
ATTORNEY

ATTORNEY

ATTORNEY

UNITED STATES PATENT OFFICE

2,159,264

BIAS WOVEN FABRIC

Annie Jean Gash, Pisgah Forest, N. C., assignor
to Donar Products Corporation, Medford,
Mass., a corporation of Massachusetts

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9 Claims. (Cl. 139—383)

This invention relates to weaving, and is directed more specifically to a bias woven fabric having a selvage, which may, if desired, be provided throughout the entire periphery of the fabric.

In one aspect, my invention relates to hand woven fabrics of the type which are initially formed, usually with yarn or the like, in convenient small size units, and later assembled into a variety of composite articles, as clothing, blankets, rugs, women's accessories, and household sundries. Such articles in woven form are well known products of the "Weave-It", described in Simonds Patent No. 2,011,916.

However, the selvage of each unit woven on a "Weave-It" or similar hand loom is of a scalloped formation, due to the fact that the woven strands appear in the fabric as if successive picks were formed by separate shuttles. This form of selvage is oftentimes undesirable, as it forms an uneven seam, which is unsightly when the unit is attached to an adjacent unit, as by sewing, in the production of a composite article. It is therefore an object of this invention to provide a woven fabric unit having four selvages, each of which is straight and even, as distinguished from the "Weave-It" and similar loom products, permitting the unit of this invention to be incorporated in a composite article in such manner that the unsightly seams heretofore encountered are completely avoided.

In addition, as before stated, my fabric is a bias woven fabric having all the advantages thereof, including that of great flexibility along fold lines parallel or at right angles to the selvage. For example, when employing the unit in a form doubled over upon itself, as in forming a collar or a cuff for a dress or coat, my unit may be folded upon itself along a fold line parallel to the selvage which forms the collar or cuff extremity. Yet, the unit will still have uniform flexibility along the fold line, so that the article conforms itself to the neck line or wrist line of the wearer. If a straight line collar or cuff effect were desired in a unit product of a "Weave-It" or similar loom, such uniform flexibility would be sacrificed, as is well known.

My fabric will be described in connection with a novel strand supporting device and preferred hand method of operating the same, which is the subject matter of my divisional application, Ser. No. 232,113, filed September 28, 1938, and which may be used, if desired, in weaving my novel fabric.

In its broader aspect, my invention is adapted

for general use in the weaving art, whether employed in hand or machine weaving, and it is to be understood that the accompanying description, while directed particularly to the composite unit type article woven by hand, is equally applicable to larger, single unit fabrics,—the weave, the bias selvage, and the method, being applicable to any fabric made of any type of strand material.

Further objects and advantages of my invention will be hereinafter referred to in connection with a description of the drawings, in which:

Fig. 1 is a plan of a novel strand supporting device having thereon a partially completed novel bias woven fabric;

Fig. 2 is an elevation taken on the line 2—2 of the supporting device, but omitting the strands of Fig. 1;

Fig. 3 is a diagrammatic illustration of a further modified form of strand supporting device, showing completion of one step in the operation of forming my novel bias woven fabric;

Fig. 4 is a plan of a modified form of my strand supporting device, showing a completed novel bias woven fabric formed thereon; and,

Fig. 5 is a partial view of the complete novel woven fabric, after removal from the strand supporting device.

My novel strand supporting device comprises a support 60, having thereon a series of pins arranged along the perimeter of a rectangle. The support 60 may be a solid plate, but, preferably, it is cut out in the center or formed of separate pieces to allow more convenient operation, as will be hereinafter described.

In the embodiment shown in Fig. 1, there are provided four corner pins, *a*, *b*, *c*, *d*, corresponding to the corners of the support, A, B, C, D. Intermediate pins *a* and *b* is a row *e* of substantially equally spaced pins, which row, in this case, happens to comprise 20 pins, an even number.

On the opposite side of the support, between corner pins *c* and *d*, is a row *g* of pins in number equal to the number of pins in row *e*, and substantially equally spaced as in row *e*. The other two rows of pins, *f* and *h*, between corner pins *b* and *c*, and *d* and *a*, respectively, are also substantially equally spaced, with intervening distances being substantially equal to those between adjacent pins in rows *e* and *g*, but each of the rows *f* and *h* contains 21 pins, or one more pin than either row *e* or row *g*. This is a fundamental requirement of my novel strand holding device, that each row in one set of opposite parallel rows of pins shall have one more pin

than either of the rows of the other set of opposite parallel rows, whether corner pins be counted or not, provided that if one or both corner pins are counted in one set, one or both corner pins shall likewise be counted in the other set. Within this requirement, the total number of pins on the support may vary in accordance with the size of fabric desired.

In Fig. 4, I illustrate a device wherein rows *e* and *g* happen each to consist of 19 pins, an odd number, and rows *f* and *h* each to consist of 20 pins.

As is obvious, by correct mathematical placement, the pins may be made to form a perfect square. Such formation is diagrammatically illustrated in Fig. 3, wherein, in addition, the corner pins (which, as hereafter explained, are not necessary) have been omitted. In Fig. 3, the pins of rows *e* and *g* are somewhat more closely spaced than those of rows *f* and *h*, so that the total formation is along the perimeter of a square.

Fig. 3 is also a diagrammatic illustration of a device having a slightly different arrangement of pins, rows *e* and *g* having an odd number (5), and rows *f* and *h* having an even number (4), as in Fig. 4, but the odd rows, *e* and *g*, having one more pin than the even rows.

My novel bias woven fabric may be formed conveniently on this device in the following manner: The operation consists primarily in two steps, (1) a winding operation, and (2) an alternate winding and weaving operation. Each of these steps is very simple when understood.

Winding operation

This operation comprises the formation of a framework of two layers of crossing courses by winding yarn or similar strand material around selected pins of the strand holding device, as will be hereafter explained. The corner pins, *a*, *b*, *c*, *d*, can be utilized for tying ends of the strand, but these pins have no other function, and therefore may be omitted, as shown in Fig. 3, since other suitable means can be provided on the support 60 for conveniently fastening the ends.

The principle of the winding operation is as follows:

Starting from a corner of the support, fastening an end of a strand *x* in some manner, as to a corner pin, the strand is coursed to and around the diagonally opposed end pin of the opposite row having the greater number of pins; then to and around the end pin of the opposite row having the less number of pins; then back to and around the starting corner next-to-end pin of the other greater row; then to and around the next-to-end pin of the other less row; then diagonally across, to and around another pin in the first named greater row, skipping one pin away from the one already wound; and continuing from one row to an adjacent row, always skipping one pin in each row until the yarn is brought out at another corner from the starting corner, which corner will always be at the other end of the row having the odd number of pins from the starting corner. Thus, as diagrammatically shown in Fig. 3, if the strand *x* is started at corner D, the strand is coursed to and around successively pins *e5*, *f1*, *g4*, *h2*, *e3*, *f3*, *g2*, *h4*, *e1*, and out corner C; or in Fig. 3, if the start is made at corner C, the same courses are made, but the layers will be reversed, crossing each other on opposite sides, as is obvious.

In Fig. 1, a study will reveal that the operation starts from corner A, and the strand *x* is coursed

successively to and around pins *f21*, *g1*, *h20*, *e2*, *f19*, *g3*, *h18*, *e4*, and so on until the strand reaches pin *e20*, and then *f1*, after which it is coursed diagonally across to corner D, which corner is at the other end of the row having the odd number of pins from the starting corner A (row *h*).

In Fig. 4, the winding strand *x* (unshaded) is shown as starting at corner A, and is coursed to and around successively pins *f20*, *g1*, *h19*, *e2*, and so on until it reaches pin *g19*, and then, *h1* after which the strand is coursed diagonally across to corner B, which, in this embodiment, is the corner at the other end of the row having the odd number of pins from the starting corner A, (row *e*).

In the same manner, in Fig. 1, the winding operation might be started at corner B, coursing strand *x* first to and around *h1* (the diagonally opposed end pin of the opposite row having the greater number of pins); then to and around *g20* (end pin of the opposite row having the less number of pins). In this case the strand will come out at corner C (the corner at the other end of the row having the odd number of pins from the starting corner B, row *f*).

Or, if the strand *x* is started in Fig. 1 at corner C, it is coursed first to and around *h21* (the diagonally opposed end pin of the opposite row having the greater number of pins); then to *e1* (end pin of the opposite row having the less number of pins). In this case the strand will end at corner B (the corner at the other end of the row having the odd number of pins from the starting corner C, row *f*).

Or, if the strand *x* is started in Fig. 1 at corner D, it is coursed first to and around *f1* (again the diagonally opposed end pin of the opposite row having the greater number of pins), and so on, and will end at corner A (again the corner at the other end of the row having the odd number of pins from the starting corner D, row *h*). In other words, it will be like Fig. 1, with the layers of the strand *x* reversed.

Likewise, in the device shown in Fig. 4, strand *x* may be started at any corner, provided it is coursed first to and around the diagonally opposed end pin of the opposite row having the greater number of pins.

The framework thus formed may be described as a framework of two layers of crossing courses, with the courses of one layer being disposed over the courses of the other layer, and with course changes forming an equal number of loopings on three sides of the framework, and loopings one different in number on the fourth side of the framework, no one of the courses of one layer being equal in length to any other course in the same layer.

Having formed the two layers of crossing courses by the winding operation, the second step is performed, that of forming another framework interlocking with the first framework by alternately winding and weaving another strand *y*, while coursing it to and around all the pins unoccupied by the previously laid winding strand *x*.

Winding and weaving operation

The principle of the preferred method of performing this operation is to start at the corner opposite the starting corner of the winding operation with a new strand *y*, the end of which again may be conveniently attached to a corner pin or equivalent means. The strand *y* is coursed from the starting corner, always to and around

the diagonally opposed, unoccupied end pin of the opposite row having the greater number of pins; then is woven under the previously laid winding strand *x*, to and around the end pin of the opposite row having the less number of pins; then back to and around the starting corner next-to-end pin of the other greater row; and then is woven under previously laid courses of winding strand *x*, and over the previously laid course of itself, to and around the next-to-end pin of the other lesser row; then diagonally across to another unoccupied pin in the first named greater row, skipping one pin away from the pin already wound by the winding and weaving strand *y*, and continuing alternately weaving and winding from an unoccupied pin in one row to an unoccupied pin in an adjacent row, always skipping one pin in each row until the strand is brought out at the unoccupied fourth corner of the strand holding device.

Thus, as illustrated in Fig. 1, the winding and weaving strand *y* is started from corner C, and is shown coursed to and around pin *h21*, then under strand *x*, to and around *e1*; then over the layers of strand *x* to and around *f20*; then woven under previously laid courses of strand *x*, and over the previous course of itself, to and around *g2*, and so on, with the result being as shown in Fig. 1, when the strand *y* has reached pin *e11*. If the alternate winding and weaving is continued, the strand will come out at corner B, the unoccupied fourth corner.

In the embodiment shown in Fig. 4, the alternate winding and weaving of strand *y* (shaded) starts at corner C, and ends at corner D.

As will be obvious, the winding and weaving operation may be started from the corner opposite the ending corner of strand *x*, but the operation will be more difficult because the winding courses must be laid under the previously laid layers of strand *x*. If such method is employed, then the strand *y* will be woven over previously laid courses of strand *x*, and under previously laid courses of itself, as will be obvious from an examination of Fig. 4, if the shaded strand is started at corner D.

For use in the weaving operations, a suitable needle is convenient, the needle being preferably of a greater length than the diagonal of the strand supporting device, and of a size relative to the pin spacing to allow the needle to pass between pins of one row and pins of an adjacent row at the same time, at the angle required by the operations above described. The space formed in the center of the support is helpful in allowing manipulation of the needle to perform the weaving.

Fabric

My fabric is well shown in Fig. 4, although I have also shown a partial detail thereof in Fig. 5, after removal from the supporting device, the corner illustrated being a bottom view of the corner woven at corner C of the device shown in Fig. 4. The closeness of the weave is dependent upon the elasticity and/or size of the strands used relative to the pin spacing. I find that with the use of yarns, sufficient tension is normally applied to the yarn during the formation of the fabric on the strand holding device, to provide a shrinkage after removal, due to the relaxation of the strands, so as to provide a sufficiently close and tight weave.

As shown in Fig. 5, the selvage provided on all four sides of the fabric comprises a series of loops 70, each loop being formed by angularly disposed

portions of one strand, interwoven with strand portions of adjacent loops. In the preferred form shown in the drawings, each alternate loop is formed by the same strand, and each selvage is disposed at an angle less than 90 degrees to all the strand portions of its loops.

Such selvage is very even and is readily adapted for attachment to other articles, as by sewing, without resulting in unsightly seams.

In Fig. 4, the fabric is provided with four selvages, two of which obviously each have one more loop than either of the other two sides. The same feature would be present in the fabric of Fig. 1 when completed. The shape of the fabric is dependent upon the pin formation; if a square fabric is desired, the pins may be formed as shown in Fig. 3, an equal number of pins being added to each row according to the size of fabric desired.

In the fabric shown in Fig. 4, every course of both strands, with the exception of the two courses adjoining the ends of each of strands *x* and *y*, integrally join parallel courses of unequal length. It will also be noted that every course change is located at a selvage; that successive courses of one strand alternate in diagonal directions; that alternate courses of either strand either increase or decrease in length, and intervening courses, conversely, either decrease or increase in length.

These and other characteristics inherent in the fabrics shown in the drawings, are set forth in the appended claims.

In the above specification, the word "courses" has been used as a generic term to indicate what would be warp and weft threads in a fabric not bias woven. The terms "warp" and "weft" have not been used to avoid confusion. Therefore, in the appended claims, the word "course" refers to that portion of a strand of my woven fabric which, before removal of the fabric from the support, lies between a pin of one row and a pin of another row, or between a pin of one row and a corner of the support (the four courses of maximum length); or, in other words, to a strand which, after removal of the fabric from the support, would constitute either a warp or a weft thread in a normally woven fabric. Accordingly, the term "coursing" in the appended claims refers to the act of laying a "course", as above defined.

It will be obvious that instead of employing a single strand *x* any number of strands might be employed, but another pin for each new strand used must be added for each pin now present, so that in winding a plurality of strands, there will be a plurality of pins positioned to receive the plurality of strands at each change of course. In such arrangement the pins may be suitably spaced in groups, without equal spacing of all the pins.

After winding a plurality of *x* strands, either one or more strands *y* may be used. Additional pins will likewise have to be added for each new *y* strand used, and the indicating means can be arranged to distinguish pins intended to hold strands *x* and those intended to hold strands *y*.

I claim:

1. A rectangular bias woven fabric consisting of two continuous strands interwoven with each other, adjoining courses of each strand being disposed at substantially right angles to each other, and every course of both strands except the two courses adjoining the respective ends of each of said strands joining parallel courses of unequal length.

2. A rectangular bias woven fabric having woven selvages on all four sides comprising two continuous interwoven strands, adjoining courses of each strand being disposed at substantially right angles to each other, and each course change being located at a straight selvage which is disposed at an angle of less than 90° to said courses.
3. A rectangular bias woven fabric having woven selvages on all four sides, every strand course in the body portion of said fabric being either substantially parallel to or disposed at an angle of approximately 90° to every other strand course in said body portion and every strand course in said body portion being disposed at an angle of approximately 45° to all four of said selvages and being integral with a course disposed at substantially right angles to itself.
4. A rectangular unit of bias woven fabric comprising diagonally arranged interwoven courses of yarn, said yarn having loops forming woven selvages on all four sides of said unit.
5. A rectangular unit of bias woven fabric comprising interwoven courses of yarn, said yarn having a series of approximately 90° loops forming woven selvages on all four sides of said unit.
6. A rectangular bias woven fabric having a woven selvage on all four sides, all of said selvages being formed, between corners of said fabric, by a series of loops comprising successive continuous strand portions disposed at an angle of approximately 90 degrees to each other, each loop being interwoven with adjacent loops, every strand course in the body portion of said fabric being either substantially parallel to or disposed at an angle of approximately 90 degrees to every other strand course in said body portion, and every strand course in said body portion being disposed at an angle of approximately 45 degrees to all four of said selvages.
7. A woven fabric having four straight selvages, each selvage comprising interwoven loops of strands, two of said selvages being parallel and each having one more loop only than either of the other two selvages.
8. A foldless woven fabric having two selvages connecting at right angles to each other, each selvage comprising a series of successive loops formed by non-parallel angularly disposed strand portions interwoven with strand portions of adjacent loops.
9. That step in weaving which comprises forming a rectangular framework of two layers of crossing courses of a single strand, with the courses of one layer disposed over the courses of the other layer at an angle of approximately 90° thereto, and with course changes forming an equal number of loops on three sides of said framework and loops one different in number on the fourth side of said framework, no one of the courses of one layer being equal in length to any other course in the same layer.

ANNIE JEAN GASH.