Jan. 2, 1934. O. SAUER 1,942,152

PROCESS OF WEAVING

Filed April 23, 1932 2 Sheets-Sheet 1

Fig. 2

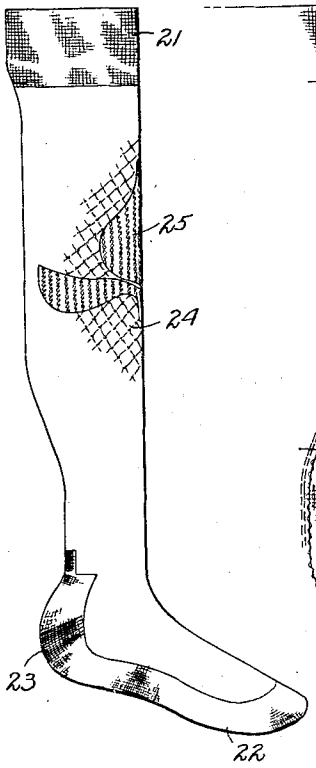

Fig. 1

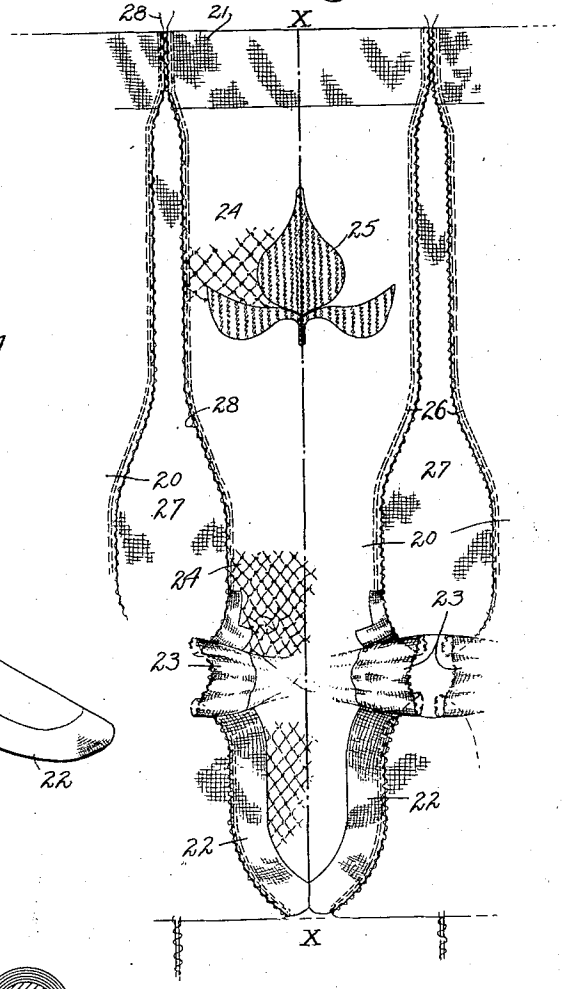

Fig. 5

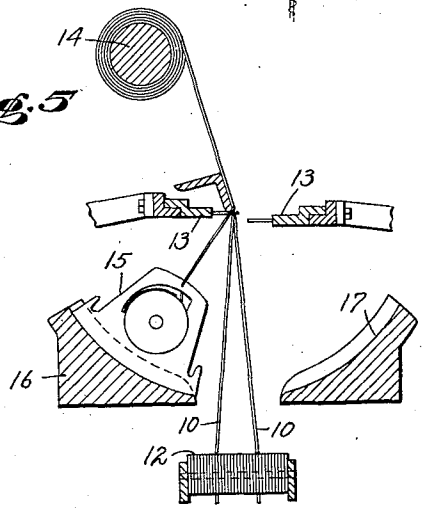

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Fig. 3

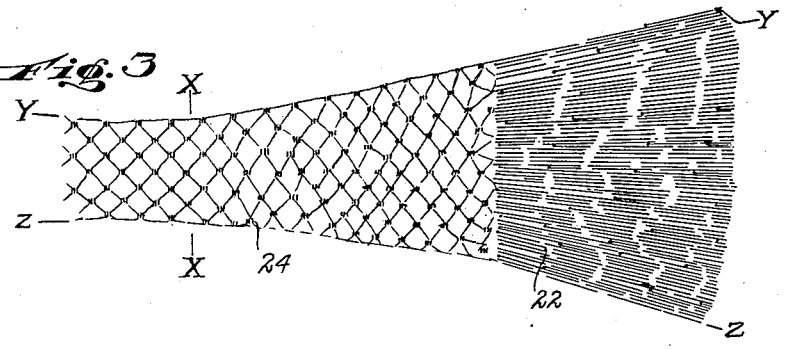
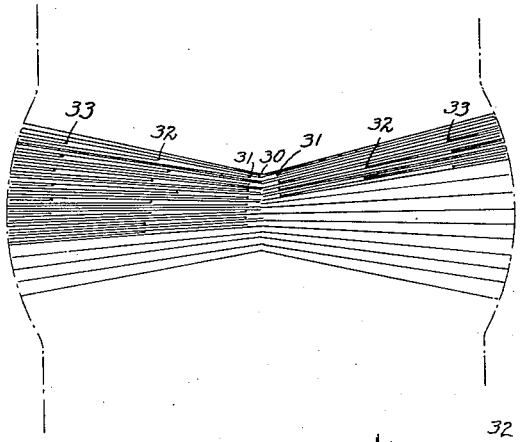


Fig. 4



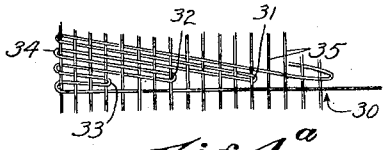
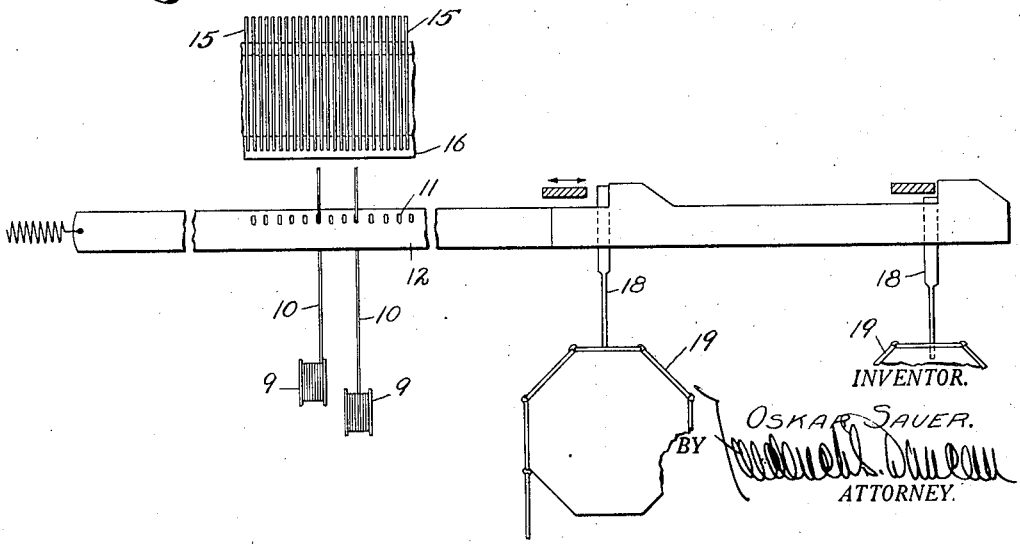


Fig. 4a

Fig. 6



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Patented Jan. 2, 1934 1,942,152

UNITED STATES PATENT OFFICE

1,942,152

PROCESS OF WEAVING

Oskar Sauer, Philadelphia, Pa.

Application April 23, 1932. Serial No. 607,016

4 Claims. (Cl. 96—24)

My invention relates to a novel method of weaving and to a novel fabric produced thereby.

An object of the invention is to produce a fabric with a three-dimensional surface.

My invention relates more particularly to hosiery and has for an object to provide a novel method of making the same.

Heretofore it has been the practice to make hosiery on knitting machines but such machines are limited as to the number and variety of designs that they can knit. Furthermore, knit hosiery is very perishable because the break of a thread will result in a disfiguring run. It has also been impracticable, heretofore, to produce a blank for a full-fashoned stocking in a single piece on a single machine. Instead the various parts, such as the top, leg, heel, and foot and toe are knit on separate machines so that the blank has to be transferred from one machine to another.

Recently there has been a demand for highly ornamented hosiery, the ornamentation taking the form of embroidery or inserted medallions of lace. In other cases the hosiery is made entirely of lace. In the latter case the hosiery blanks are cut out of woven lace fabric by hand and then are sewed together. Such lace blanks necessarily have raw edges and a heavy seam is necessary to cover these raw edges.

An object of my invention is to provide a woven hosiery blank and thereby to avoid the disadvantages of a knit blank. The woven fabric will not ravel or run and the variety of designs that can be formed on it are practically unlimited.

Another object of the invention is to provide a hosiery blank of woven material with a selvage edge so that it may be sold as an article of manufacture, to be assembled by the purchaser.

Another object of the invention is to provide a method of weaving a hosiery blank with any desired fullness at any selected points, so that the entire stocking blank including, the foot and the leg, may be made in one piece and be formed with the necessary fullness at the heel or in other desired points.

Another object of the invention is to provide a lace stocking blank formed on a lace making machine in which a large number of stocking blanks are formed in a single sheet, each blank having its own selvage edge, so that the blanks may be cut apart and sold to the trade.

The invention also has for an object to provide an entire stocking shaped to full fashion form but made in a single piece without transverse seams at the heel and toe and with a single seam running down the back of the leg and along the sole.

Other objects of my invention will appear in the following specification of a preferred embodiment of the invention and a modification thereof and thereafter the novelty and scope of the invention will be pointed out in the claims.

In the accompanying drawings;

Figure 1 illustrates a portion of a lace fabric showing one complete hosiery blank and its relation to other blanks shown in part, surrounding the complete blank;

Fig. 2 is a view of the blank folded along the line X—X of Fig. 1;

Fig. 3 is a somewhat diagrammatical view of a portion of the lace fabric in the region where the fullness is formed;

Fig. 4 is a diagrammatic view of another form of weave having a fullness therein;

Fig. 4*a* is an enlarged detail view of said weave;

Fig. 5 is a view in cross-section of a portion of a Levers lace machine illustrating one way in which to produce the fabric shown in Fig. 1; and

Fig. 6 is a diagrammatic fragmental view in front elevation of a Levers lace machine.

The preferred method of forming the hosiery blanks is to weave them on a Levers lace machine. Such machines as is well-known in the art operate on a different principle from the ordinary loom. The shuttles instead of being thrown through a shed in the plane of the fabric, pass back and forth between the warp threads in planes at right angles to the fabric. The weaving is therefore produced by shifting certain of the warp threads laterally, after the shuttles or bobbins have passed between them, so that on the return stroke the shuttles will not pass between the same warp threads. Each warp thread is taken from an independent beam, instead of being drawn from a common beam as in the ordinary loom. There is a separate shuttle for each warp thread or a given number of threads. The warp threads are threaded through guide bars which are shifted by jacquard mechanism, and this mechanism determines whether a shuttle after passing between the warp threads in one direction will return on its next stroke through the same space and produce no weaving or will return through a space between a different pair of warp threads, so as to be interwoven with the intervening thread or threads. Thus, referring to Figs. 5 and 6, the warp threads are indicated at 10 and run from individual beams or spools 9, through slots 11 in thread guide bars 12. Thence the warp threads pass between the points of one

of a pair of opposed comb bars 13 to a take-up roller 14. The bobbins 15 which carry the weft or filler threads are thrown from a guide 16 on one side of the fabric to a guide 17 on the other side and back again. At each throw of the bobbins the points of one or the other of the combs 13 pick up the weft threads and beat them against the completed portion of the fabric. The warp bars 12, as shown in Fig. 6, are reciprocated by means not shown and the extent of the reciprocation is controlled by droppers 18, which in turn are dropped out of the path of the thread bars under control of cards 19. With this brief explanation of an operation of a Levers machine, it will be understood that a great variety of patterns may be formed, depending upon the arrangement of the cards 19.

Referring now to Fig. 1, I have so arranged the Levers machine that an entire stocking blank 20 may be treated as a single design which is repeated throughout the width and length of the fabric formed on the machine. Preferably the upper part 21 of the stocking as well as the sole 22 and heel 23 are made with a close weave, while the main portion of the leg of the stocking is formed with a resilient open work mesh 24 which may be stretched in all directions, so that it will conform to the shape of the leg. This mesh forms a background for any desired ornamental design, such as indicated at 25. Along the margin of the blank a selvage 26 is woven and between the blanks are waste areas 27. Lacer threads 28 connect the blanks along their selvage edges to the waste or to one another, so that by pulling out such lacers each blank may be separated readily from the rest of the fabric. Of course, the warp threads will also have to be cut where the selvage departs materially from parallel to the longitudinal axis X—X of the blank.

To provide the necessary fullness at the heel, the cards 19 are so punched that while warp threads at the margins of the blank are shifted at each throw of the shuttles to produce weaving, intermediate warp threads are shifted at intervals, said intervals become progressively less frequent as the axis X—X is approached. At the same time the feed of the take-up roll 14 is interrupted. As a result of this arrangement the weft threads will build up more fabric at the margins than along the axis X—X and this building up of fabric will be tapered outwardly from the center line. For instance, if ten throws of the bobbins at the center line take place before there is a shift of the threads along said line, while the threads are shifted for each throw of the bobbins along the margin of the blank obviously ten times as much fabric will be beaten up by the points at the margin as at the center and a fullness will be formed, as clearly shown in Fig. 1. Preferably the fullness does not increase uniformly from the center outward and most of this fullness will be formed, not in the net, but in the closely woven fabric used to form the heel and sole of the stocking.

It is to be noted that the fullness is not made by stretching the fabric or by varying the size of the mesh. The mesh remains substantially the same per square inch of flat surface, but there is an increase in the number of meshes and hence an increase in linear dimensions of the fabric in one part with respect to an adjacent part. This is shown in Fig. 3 which depicts somewhat diagrammatically a flattened segment of the fabric in the region of the fullness. The upper and lower margins of the segment Y—Y and Z—Z respectively were normal to the central axis X—X during the weaving, since each of said margins represents the line of comb points in that part of the stocking but there is more fabric between said lines at the outer end of the segment than along the central axis. Obviously, the fullness could take any form of depending upon the punchings in the cards 19. It is thus possible to weave a fabric with conical, spherical or any other three dimensional surface. The fabric is separated into blanks by pulling out the lacer threads 28 and cutting away the warp threads which connect certain parts of each blank to the waste. The lateral margins of the blank are selvaged so that they will not ravel and hence the blanks may be sold to the trade to be made up into stockings. This is done by folding the blank along the axis X—X and then sewing the selvage edges together, as shown in Fig. 2.

While I have referred to the Levers machine as a means of producing a fabric with a fullness, it is obvious that such a fullness can be formed also on an ordinary loom, provided, of course, that each warp thread was carried on a separate beam. Thus, in Fig. 4, I have indicated diagrammatically a woven fabric in which the shuttles are thrown in the plane of the fabric instead of transversely thereto, as in the Levers machine. However, to produce a fullness the shuttles are thrown only part way across the fabric. Thus a shuttle may be thrown first from each margin to the center 30 of the fabric and then back again to the margin. On the next throw each shuttle may be thrown to a point 31 and back, the third to a point 32 and on the fourth to a point 33, so that successive weft threads 34 will be interwoven with progressively fewer warp threads 35 after which each shuttle may be thrown across to the opposite margin and the part thrown may then be repeated. In this way a double conical surface will be woven. Obviously, the surface may be varied as desired by varying the throw of the shuttles. Obviously too, a single shuttle could be used which would be thrown all the way across each time and the progressive variation of weave would be produced by forming a shed first on one side central axis and then on the other and varying the number of warp threads in each shed. My invention is thus not limited to lace hosiery but is also adapted for other applications in which three-dimensional fabric is desired.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is as follows:

I claim:

1. The method of weaving a fabric which consists in passing a plurality of individual weft threads back and forth through a warp at right angles to the plane of the warp, shifting certain of the warp threads laterally in predetermined order and to predetermined extent to interweave the warp and weft threads, gradually suppressing the shifting of the warp threads in a predetermined region to reduce the number of interwoven threads in said region with respect to that in the laterally adjacent portion of the fabric, beating up the interwoven threads at each pick into alinement normal to the longitudinal axis of the fabric, and drawing the warp threads from individual beams so as to permit increased take-up of the warp threads passing through said portion with respect to that of the warp threads passing through said regions.

2. The method of producing a woven fabric

with a fulness in opposite marginal regions thereof, which consists in passing a plurality of individual weft threads back and forth through a warp at right angles to the plane of the warp, shifting certain of the warp threads laterally in predetermined order and to predetermined extent to interweave the warp and weft threads, gradually suppressing such interweaving intermediate said marginal regions and then gradually increasing the interweaving until it corresponds substantially to that of said marginal regions, beating up the interwoven threads at each pick on a line normal to the longitudinal axis of the fabric, and drawing the warp threads from individual beams so as to permit increased take up in said marginal regions with respect to the intermediate portion of the fabric.

3. The method of weaving a stocking blank with a fulness at opposite margins in the region of the heel, which consists in passing a plurality of individual weft threads back and forth through a warp at right angles to the plane of the warp, shifting certain threads of said warp laterally in predetermined order and to predetermined extent so as to interweave the warp and weft threads in a design conforming to the outline of the stocking blank and with a selvage along the border of said design, gradually suppressing the interweaving medially of the blank in the region of the heel and then gradually increasing interweaving in such median portion until it corresponds substantially to that at the margins, beating up the fabric at each pick into alinement normal to the longitudinal axis of the fabric, and drawing the warp threads from individual beams so as to permit increased take-up of the warp threads in such marginal regions.

4. The method of weaving stocking blanks, which consists in passing a plurality of individual wefts back and forth through a warp at right angles to the plane of the warp, shifting certain threads of said warp laterally in predetermined order and to predetermined extent to interweave the weft and warp threads and form a plurality of designs separated by waste fabric, each design conforming to the outline of a stocking blank and having a selvage along the border thereof and with lacer threads connecting said blanks to said waste fabric, gradually suppressing such interweaving medially of each blank in the region of the heel, with respect to the interweaving at the margins and then gradually increasing the interweaving in such median portion until it corresponds substantially to that at the margins, beating up the fabric at each pick into alinement normal to the longitudinal axis of the fabric.

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