

June 19, 1951

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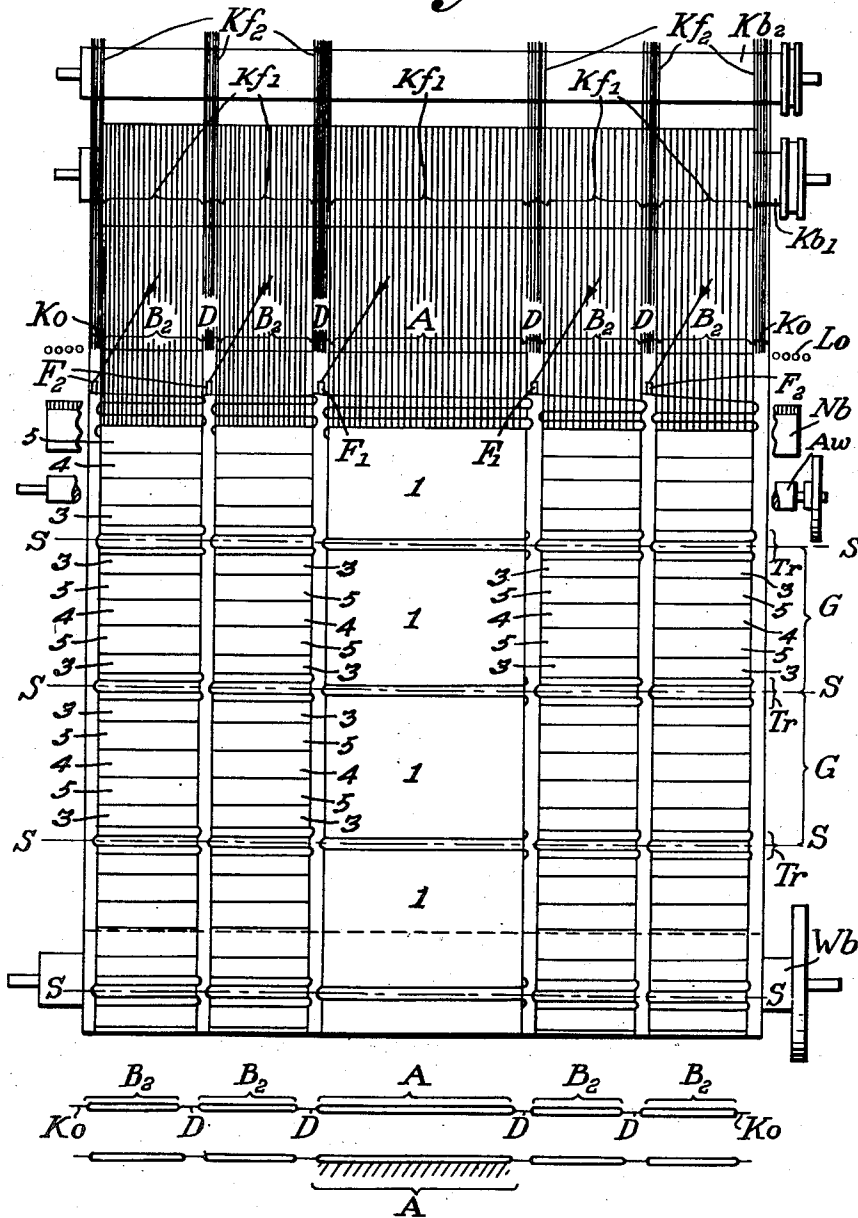
2,557,482

METHOD OF MANUFACTURING WARP-KNITTED FABRIC

Filed Aug. 7, 1947

4 Sheets-Sheet 1

Fig. 1.



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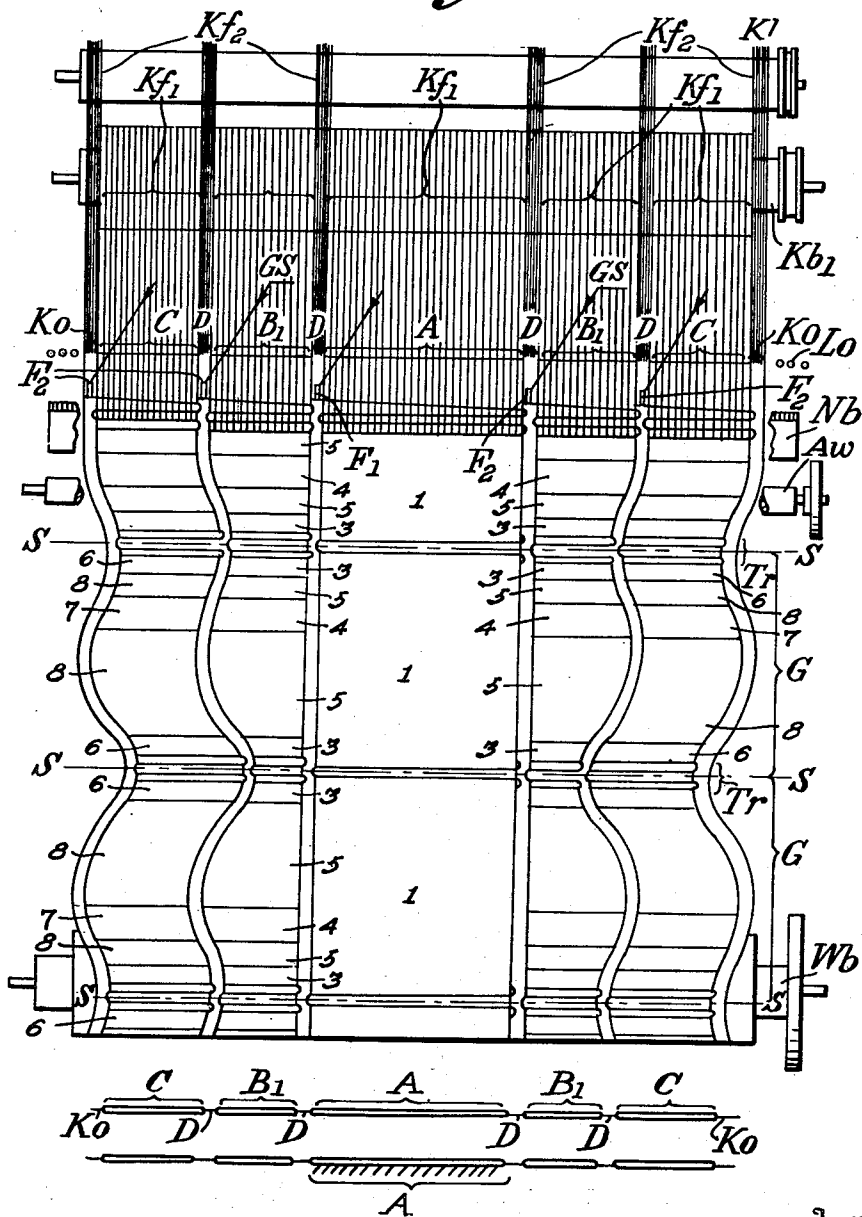
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4 Sheets-Sheet 2

Fig. 2.



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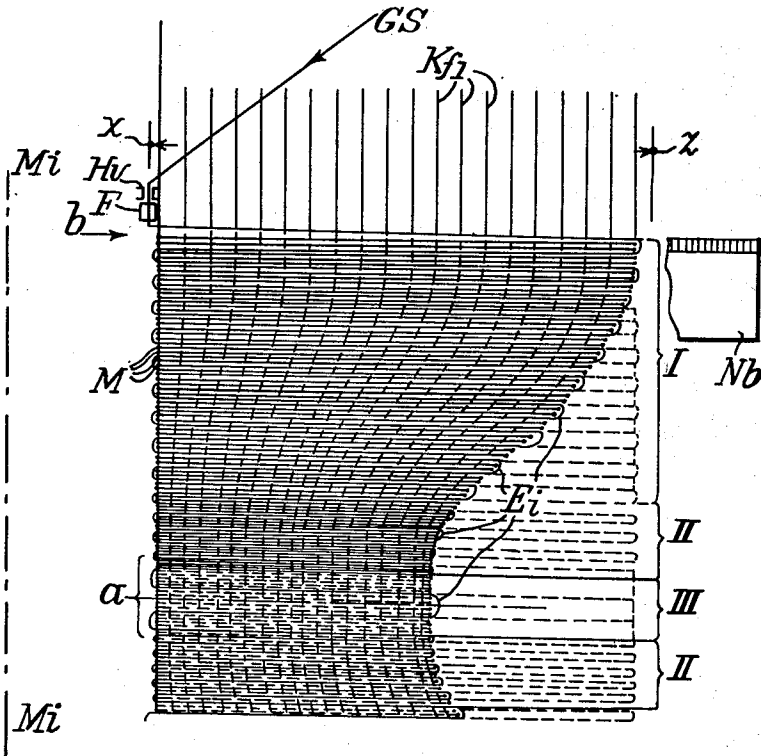
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Filed Aug. 7, 1947

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Fig. 4.



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UNITED STATES PATENT OFFICE

2,557,482

METHOD OF MANUFACTURING WARP-KNITTED FABRIC

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Application August 7, 1947, Serial No. 767,142
In Germany May 12, 1944

5 Claims. (Cl. 66-84)

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This invention relates to the knitting of arti-
cles, such as medical body belts, maternity gir-
dles, bandages, corselets and roll-ons, on warp-
knitting machines having two movable needle
bars (Raschel machines), and has for its object
to provide a method whereby such articles can
be manufactured in a specially economical way.

The method according to the invention con-
sists in this that the warp threads are knitted to-
gether in zones located side by side with narrow
intervening spaces between the zones, the knit-
ting of the fabric within the said zones being
carried out by two sets of needles while the
fabric within the said spaces is knitted by means
of a single set of needles, one or more nappable
or non-nappable weft threads being inserted in
one or more zones so as to extend in straight
lines in the warp-knitted courses, and an elastic
weft thread being inserted in one or more zones
so as to extend in straight lines in the courses.
By this method, the articles produced from the
knitted fabric made on the Raschel machine ac-
quire at the same time, in a single operation, all
the elastic and non-elastic zones, as well as the
nappable zones, when required, with practically
no waste of material.

In carrying out the invention, dividing sel-
vedges are interposed in the fabric subsequently
to the knitting of a predetermined number of
courses, corresponding to the size of the indi-
vidual articles, so as to enable the fabric to be
subdivided to form the articles, whereby any de-
sired number of articles of one kind can be pro-
duced consecutively in the form of a continuous
band with the use of long warp threads.

In order to enable the articles produced from
the fabric not only to acquire the necessary
elastic, non-elastic and nappable or raisable
parts or zones but also the necessary shape
(fashioning) and leave the warp-knitting ma-
chine finished to such an extent that only very
little additional work is required for their final
completion, the tension of the elastic weft thread
or threads is varied from course to course to con-
tract the fabric in such a manner as to fashion
the articles made from the fabric.

Thus, the manufacture on warp knitting ma-
chines of fashioned articles requiring both elastic
and non-elastic, as well as raisable zones, such
as medical body belts, bandages, maternity and
other corselets, etc., as well as the procedure in
manufacturing these goods on warp knitting
machines, is entirely new, offering the following
advantages as compared with the existing manu-
facturing methods.

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1. 60-80% saving on factory hands,
2. Saving on working hours,
3. Saving on material, e. g. cotton, cellulose,
silk and above all, in covered rubber threads,
4. Eliminating the chance of the rubber
threads being damaged by sewing during the
finishing of the garments,
5. Considerable reduction in the initial cost
of such articles.

These results are a result of the new manu-
facturing method by which the articles herein-
before mentioned are practically completed on
the warp knitting machine so that only insignifi-
cant finishing touches are necessary. According
to the old manner of production still in use, arti-
cles of the kind referred to had to be made in
a much more complicated manner, namely as
follows:

Elastic and various non-elastic metre goods
were cut into pieces, whereby an average waste
of 10-18% occurred. The parts or zones thus ob-
tained had to be sewn together in an elaborate
way, according to the shape (fashioning of the
articles desired). Damage done to the rubber
threads by sewing could not be avoided. Due to
these damaged rubber threads, the garments
very soon became worn out. This old manufac-
turing process thus involved more working hands
and working hours, since considerably more sew-
ing had to be done and more material was re-
quired. As a result, the initial cost of the goods
was much higher.

The accompanying drawings are explanatory
of the new method of knitting flexible fashioned
articles having elastic, non-elastic and raisable
parts on warp knitting machines.

Figure 1 represents the making of a constant
width waist belt,

Figure 2 the making of a girdle of varying
width for expectant mothers,

Figure 3 the making of a girdle having a
somewhat different shape from that shown in
Figure 2,

Figure 4 shows a specimen on a larger scale
of an elastic part of the articles shown in Fig-
ures 2 and 3,

Referring to the drawings, the invention is
carried out in the following way:

On a warp beam Kb_1 a warp of non-elastic
warp threads (silk, cotton, cellulose, etc.) of any
desired length is beamed. The warp threads
 Kf_1 from this warp beam pass through thread-
guide needles with eyes Lo right across two nee-
dle bars Nb and cloth beams Aw to the cloth
roller Wb . The warp threads Kf_1 passing

through the needles are subdivided in such a manner that the following parts are evolved:

In Figure 1, the zones A and B₂

In Figure 2, the zones A, B₁ and C

In Figure 3, the zones F, E and B₃.

The warp consisting of the warp threads K_{f1} may also be of such a composition that threads of different materials are provided, e. g. cotton threads, cellulose threads, silk threads and so on, in the individual rows. To improve the quality of the articles, rubber warp threads may also be used.

Between these zones, narrow spaces D are provided within which only the front needle bar N_b is provided with latch needles, so as to enable the various zones to be connected together laterally by strips of simple warp-knitted fabric. These connecting strips are formed from non-elastic warp threads K_{f2} with the aid of separate thread-guide needles, the said warp threads being beamed on a separate beam K_{b2}, since they are subjected to different tension from the others, being operated on by latch needles on the front needle bar only.

During the knitting of the fabric, the respective warp threads K_{f2} are knitted to the adjacent zones which are formed by the aid of the needles on the front and rear needle bars, so as to connect the individual zones securely to one another at the sides.

The outer zones are each provided with an integral selvedge of simple warp-knitted fabric formed from warp threads K_{f2} and serving as a sewing strip during the finishing of the article.

The reason for creating the zones referred to is to provide the articles to be made from the semimanufactured product with both flexible, elastic and rigid, non-elastic parts necessary for the perfect fit of the garments.

This method of manufacture also permits the articles shown in Figures 1 and 2 to be provided with a raisable or nappable zone for protection against cold, thus satisfying a general demand in the trade for such a zone in the articles in question.

The number and sizes of the elastic, non-elastic and raised zones, as well as their distribution in the articles to be made, depends upon the kind of article desired. Figures 1 to 3 show this diagrammatically, viz.:

Figure 1 shows a warp-knitted fabric for waistbelts and bandages, comprising a central vertical strip or zone A of raisable or nappable non-elastic fabric areas 1 separated by dividing selvages Tr and provided with a closely spaced non-elastic teasable or nappable weft thread, and a pair of narrow vertical strips or zones B₂ on either side of the zone A and comprising fabric areas separated by the dividing selvages Tr. The fabric areas of the zones B₂ each comprise two elastic reinforcing and terminal strips 3 with a closely spaced rubber weft thread, a similar strip 4 spaced from said terminal strips and intermediate porous elastic strip 5 having a widely spaced rubber weft thread.

The fabric for maternity girdles shown in Figure 2 also comprises a central vertical strip or zone A of raisable or nappable fabric areas 1 separated by dividing selvages Tr, as in Figure 1, the said fabric areas, however, being of greater depth. On either side of the central zone A is a narrow zone B₁ of elastic fabric areas, comprising strips 3, 4, 5 of fabric with closely and widely spaced rubber weft threads, respectively, between the dividing selvages Tr,

On the outside of the zones B₁ are non-elastic zones C of fabric areas comprising terminal strips 6 with closely spaced non-elastic weft threads, and intermediate strip 7 similar to the strips 6 and spaced therefrom, and strips of porous non-elastic fabric 8 having a widely spaced non-elastic weft thread connected to the strips 6 and 7.

The fabric for roll-on girdles shown in Figure 3 comprises a central zone F of fabric areas separated by dividing selvages Tr, with adjacent zones E on either side and zones B₃ on the outside of the zones E. Each fabric area of the zone F between the dividing selvages Tr comprises a non-elastic portion 8 with widely spaced non-elastic weft thread, a non-elastic terminal strip 6 extending along one horizontal edge of the portion 8, a porous elastic strip 5 with a widely spaced rubber weft thread, extending along the opposite horizontal edge of the portion 8, and an elastic reinforcing and terminal strip 3 having a closely spaced rubber weft thread. Each fabric area of the zones E between the dividing selvages comprises an elastic reinforcing and terminal strip 3 adjacent the non-elastic terminal strip of the zone F, a porous elastic strip 5, a porous non-elastic portion 8 with widely spaced non-elastic weft thread, and a non-elastic terminal strip 6 adjacent the elastic terminal strip 3 of the zone F. Each zone B₃, between the dividing selvages, comprises fabric areas having elastic terminal strips 3 adjacent the terminal strips of the areas of the respective zones E, and porous elastic sections 5 between the said terminal strips.

These elastic, non-elastic and raisable zones are made simultaneously and are located closely side by side, within each zone or part of the warp formed by subdivision of the warp threads K_{f1}, either an elastic or non-elastic or a raisable endless thread acting as a weft thread is inserted by a separate thread guide F₁, F₂, respectively, the said thread being inserted between the back row of latch needles and the warp threads K_{f1}, in such a manner that the weft thread will be embedded in a straight line in horizontal mesh rows (in the courses) as illustrated in Figures 1-4. The insertion of the weft threads on the warp knitting machine is done in the usual manner and the various weft threads may consist of the following materials:

a. For the elastic zones, a cotton-covered, cellulose-covered or silk-covered elastic rubber thread is used;

b. For the non-elastic zones, a strong weft thread is used, consisting of non-elastic material, such as cotton, cellulose, wool or waste yarn. In order to make this non-elastic weft thread look attractive it is covered with fancy thread, such as, e. g. artificial silk.

c. For the raisable zones, a readily teasable, strong, non-elastic thread of cotton, cellulose or wool is used.

In zones E and F of the articles as shown in Figure 3, an elastic and a non-elastic weft thread are inserted to extend alternately in straight lines between the courses, thus saving costly rubber threads, while the article still remains satisfactory. In this way, the problem of making a waist girdle (roll-on girdle) with the least possible use of rubber is favourably solved.

The thread guides F₁ move to and fro much faster than the thread guides F₂, they are actuated separately, each by its own weft-inser-

tion device, the two weft insertion devices operating independently and automatically.

By means of the invention, it is further possible to impart to the articles during their manufacture, i. e. while being knitted on the Raschel machine, the required shape peculiar to each garment. This feature is due to the fact that on the one hand to the fact that the articles receive their shape or fashioning by the size, nature and distribution of the respective elastic and non-elastic zones connected to each other (Figure 1) and on the other hand a specific shape is obtained (Figures 2 and 3) by subjecting the respective elastic rubber weft threads (GS) to tension during the laying of said rubber threads in the courses M of the elastic zones within the regions B₁, B₃ and E, the tension being varied progressively from course to course. The increased extension or contraction of the elastic rubber weft thread laid in or knitted in is performed in one of the many ways generally known, which are not outlined here.

The elastic rubber weft threads which are embedded in the fabric whilst being more or less extended will contract again as soon as the courses leave the needle bars Nb. Thus the courses M (Figure 4) also—owing to their close adherence to the embedded rubber weft threads and to the small loops at the positions of reversal E₁ of the endless rubber weft thread—become more or less compressed in the direction of these rubber weft threads, contracting towards the middle of the object. Thereby the articles e. g. of Figures 2 and 3 receive their individual shape. This is also shown in Figure 4.

Figure 4 represents the following working phases:

1. Over the area *a*, the elastic rubber weft thread while sliding through a holder device H_v has been held for a period sufficiently long to cause the said thread to be laid in by a thread guide F and embedded in place while in an extremely extended state (nearly to its full extent). As the formation of the article proceeds, the periods during which this elastic thread is held are gradually reduced after each traverse of the holder device H_v and thread guide F, whereby the extension to which the thread is subjected is reduced until finally at the point *b*, after being held for the minimum time, the thread is knitted in without any tension, in an almost unstretched condition. The same procedure takes place in the reverse manner during the insertion of the elastic thread prior to the knitting of the area *a*.

2. The horizontal lines M represent the courses between which the endless rubber weft thread is now tightly embedded after having being laid. In the zone I, the endless rubber weft thread was inserted in every other course, in zone II, in every single course and in zone III, in every fourth course.

3. The reference letter E₁ marks the reversing points which, not only in the case of the endless elastic weft thread but also in that of the non-elastic and raisable threads, are in the form of small loops forming the lateral margins of the different zones.

4. The contraction of the elastic rubber weft threads and the contraction of the courses take place automatically in the direction towards the middle M_i—M_i of the article owing to the reverse force exerted by the other side of the article. See Figures 2 and 3.

5. The change over from increasing to decreasing tension of the rubber weft thread and,

vice versa, from reducing to increasing being gradual (the tension of the rubber weft thread after each course being either increased or decreased after each course), there is only a gradual transition from the wider parts to the narrower parts in the elastic zones of Figures 2 and 3.

6. The laying in and embedding of the weft threads within an article is in some places done in every course, so that these parts receive a greater number of weft threads and will therefore be stronger and more resistant, whereas in other places the rubber threads are laid and embedded in the fabric after every second mesh row or course, so that these parts receive a smaller number of weft threads and assume a porous, loose-mesh appearance. The useful application of this feature and the manner in which areas are provided in the individual articles having densely and less densely incorporated weft threads is shown in Figures 1 to 3. As each of the articles shown in Figures 1 to 3 may be made continuously from warps of any desired length, dividing selvages Tr are interposed between the individual articles. These dividing selvages are obtained by discontinuing the insertion of weft threads between the various articles G within the raisable parts A, whereas within the other zones the dividing selvages Tr are due to the weft thread being inserted in only the fourth mesh row or course. The result is a cross stripe formed by widely spaced weft threads. As soon as a sufficient number of coherently produced articles G of the same kind are beamed on the cloth beam Wb in the shape of a piece of fabric, the piece is taken off the cloth beam.

7. If the piece of fabric consists of articles such as shown in Figure 3, it is cut through the middle of the dividing strips Tr along the lines S, while a piece of fabric consisting of articles such as shown in Figures 1 and 2 is cut through the middle of the dividing strips Tr along the lines S only after the napping of the raisable zones has been carried out. This done, there remains but little finishing work to be done in order to complete the articles as shown in Figures 1, 2 and 3. Due to the fact that by this method several articles with raisable zones are produced coherently in the form of a continuous piece of fabric, there is no difficulty in napping the raisable zones on an ordinary napping machine, since the zones not to be napped can be turned over and attached to the reverse side of the nappable zones which are not to be napped or raised prior to the napping operation. Thus, only the surfaces of the nappable zones which have actually to be raised touch the napping roller of the raising or napping machine.

We claim:

1. A method of manufacturing a warp-knitted fabric having elastic and non-elastic portions on a warp-knitting machine having two movable needle bars, one of said bars having a continuous series of latch needles and the other having latch needles arranged in zones to co-operate with the needles of the first-mentioned needle bar and separated by spaces without needles, so that within said spaces the fabric is only knitted by needles of the first-mentioned needle bar, said method comprising the steps which consist in supplying separate groups of warp threads to the needles of the respective zones and to the needles of the first-mentioned needle bar located in the spaces between the zones, inserting at least one non-elastic weft thread during the knitting of

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the fabric in the courses knitted by the needles located in at least one zone, so as to extend in a straight line in the respective courses, and inserting an elastic weft thread during the knitting of the fabric in the courses knitted by the needles located in at least one of said zones, so as to extend in a straight line in the respective courses.

2. A method of manufacturing a warp-knitted fabric as set forth in claim 1, including the step consisting in inserting a non-elastic raisable weft thread during the knitting of the fabric, in the courses knitted by the needles located in at least one zone, so as to extend in a straight line in the respective courses.

3. A method of manufacturing a warp-knitted fabric as set forth in claim 1, in which the elastic weft thread is subjected to progressively varying tension during its insertion in the courses, so as to cause differential contraction of the fabric for the purpose of producing a fashioned article.

4. A method of manufacturing a warp-knitted fabric as set forth in claim 1, including the step consisting in knitting dividing selvages in the fabric subsequently to the knitting of a predeter-

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mined number of courses, corresponding to the size of the individual articles to be formed from the fabric.

5. A method of manufacturing a warp-knitted fabric as set forth in claim 1, including the step consisting in knitting selvages at the margins of the fabric by means of needles provided solely on said first-mentioned needle bar.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,148,988	Houseman	Feb. 28, 1939

FOREIGN PATENTS

Number	Country	Date
485,872	Great Britain	May 26, 1938
496,043	Germany	Apr. 12, 1930
602,470	France	Dec. 23, 1925