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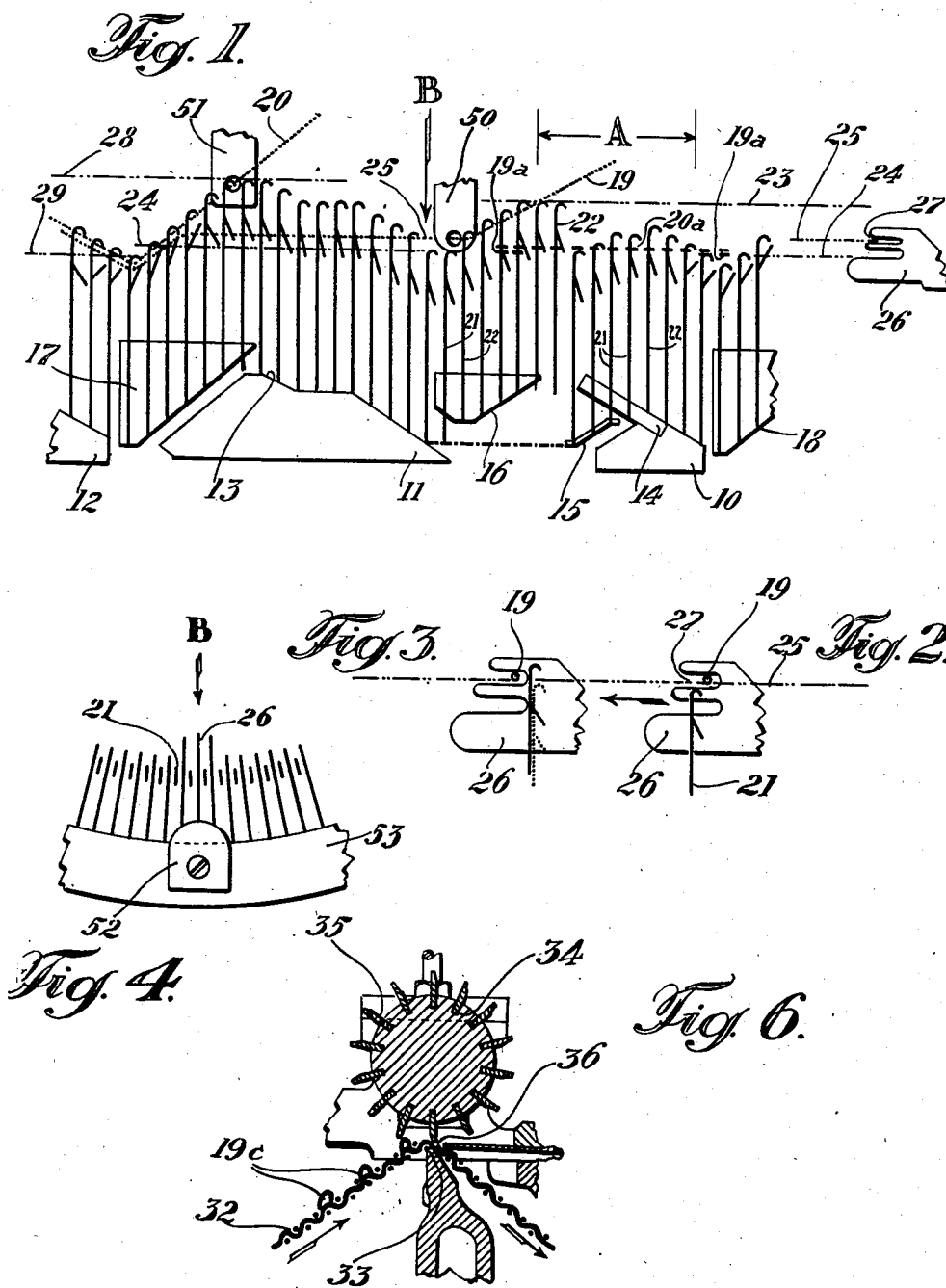
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2,255,293

METHOD AND APPARATUS FOR MAKING KNITTED FABRICS

Original Filed Oct. 29, 1940

2 Sheets-Sheet 1



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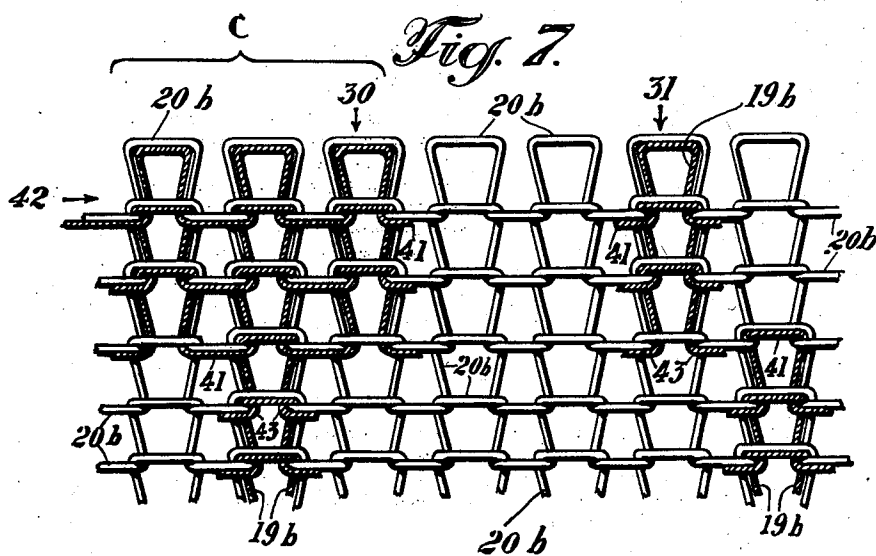
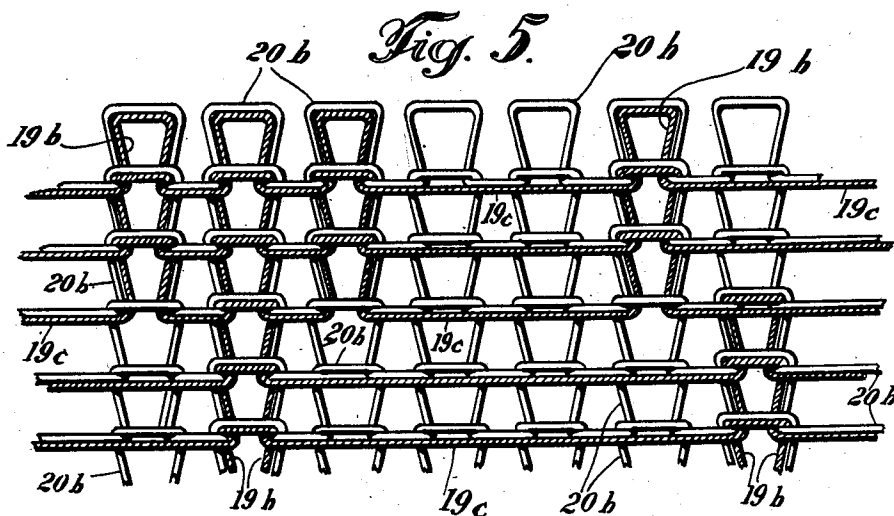
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METHOD AND APPARATUS FOR MAKING KNITTED FABRICS

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METHOD AND APPARATUS FOR MAKING
KNITTED FABRICSJack Markowitz, Brooklyn, N. Y., assignor to Pen-
nant Knitting Mills, Inc., Brooklyn, N. Y.Original application October 29, 1940, Serial No.
363,320. Divided and this application Decem-
ber 18, 1940, Serial No. 370,682

7 Claims. (Cl. 66—8)

This invention relates to a method and apparatus for making knitted fabrics having design patterns thereon, this being a division of my prior application filed October 29, 1940, Serial No. 363,320. Although the invention herein described constitutes a particular method of making the type of stretchable fabric referred to in my said prior application and adapted for use in slip covers and resilient garments, it is also intended for the production of other types of relatively non-stretchable fabrics with multi-color effects.

Among the several methods of producing knitted fabrics containing colored design patterns, interlocking and plating methods have been commonly resorted to, as well as knitting on rib machines. Fabrics produced by these methods have always had the inherent shortcoming of showing the trimming or design yarn through the wales of the body portion, so that such yarn which was intended to be invisible at certain areas was never completely hidden. Fabrics produced by wrap-around devices and warp-stitching methods do not have these disadvantages, but the machines for producing them are very intricate in construction and relatively slow in operation. It is within the contemplation of my invention to produce a knitted fabric with colored design patterns thereon wherein the trimming or design yarn is completely hidden wherever it is not intended to be displayed, thereby producing fabrics of true colors, and containing no areas having unintentional and undesired mixtures of the body and design yarns.

In another method frequently employed to produce knitted fabrics with design patterns, the needle-actuating mechanism is so arranged as to operatively knit a selected color at predetermined intervals, causing long floats to be formed due to the inherent necessity of having a continuous and uninterrupted feed of the selected yarn. The preferred form of float is the "welt" float which is laid in flat, another form being the "tuck" float produced by the needle engaging the yarn and bringing it down short of cast-off position—the latter float being generally wavy in form. Such floats, especially when long, are generally quite loose and unsightly, and are also objectionable because of the fact that they make sewing troublesome and are generally difficult to handle. Furthermore, the long straight floats are practically unstretchable, thereby rendering the fabric lacking in that quality of resiliency which is utterly essential in

slip covers and in certain types of wearing apparel. And also, fabrics produced by the said interlocking method are similarly unstretchable. It is hence a further object of this invention to produce a fabric of multi-colored design, and which is sufficiently stretchable to be particularly adapted for use as slip cover material and wherever also resiliency is a requisite. This I accomplish by employing the process of simultaneously knitting two strands of differently textured or colored yarns, one above the other as in plating, and while one of said yarns is being knitted into the body of the fabric, the companion or trimming yarn is carried in back of the knitted loops of a predetermined number of wales to form a flat horizontal float, and then visibly incorporated into the body at certain selected portions of the fabric; and thereafter the floats so formed are sheared, thereby eliminating them as factors impairing the stretchability of the fabric.

Cognizance is taken of many different types of plating machines for producing multi-colored effects, but many of these are structurally adapted only to produce hosiery and do not contain the knitting mechanisms conveniently employable on the larger circular latch needle knitting machines for manufacturing great lengths of fabric on a production scale. In other types of machines, particularly those adapted for reverse plating, the yarn carriers are moved and certain of the needles are flexed or otherwise movably actuated in order to effect the reversing operation, thereby requiring intricate and delicate mechanisms, and consequently retarding the rate of production. In those machines in which the yarn carriers are moved, there is always the danger of imperfections in the plating results, inasmuch as the trimming and body yarns must always be carefully maintained in predetermined proximate relation for uniformly plated areas. It is an important object of this invention to improve upon the known machines for fabricating this type of work, by conveniently and economically producing on a conventional latch needle circular knitting machine multi-colored fabrics containing floats of the trimming yarn at the back of the fabric, and having design areas of uniform appearance wherever they are so intended to be.

And in the last mentioned aspect of my invention, it is a further object to produce the said multi-colored fabric by employing stationary yarn carriers and an arrangement not necessitating the flexing of the needles or the move-

ment thereof in directions other than along their normal vertical paths for effecting knitting operations.

It is a further object of my invention to produce a fabric of the type hereinabove referred to wherein the danger of runs or drop-stitches is reduced to a minimum.

Another object of this invention is to produce a fabric of the class described with a substantially uniform arrangement of stitches and without any unduly enlarged spaces therebetween, thereby rendering such material substantially dustproof.

Other objects, features and advantages will appear from the drawings and the description hereinafter given.

Referring to the drawings,

Figure 1 is a semi-diagrammatic development of a portion of a knitting machine of the open-top circular type, adapted to perform the steps for producing the fabric according to my invention.

Figure 2 is a fragmentary elevation of a double throat sinker, needle, and trimming yarn, showing the position of these elements during the process of floating said yarn according to one method of practicing my invention.

Figure 3 is a view similar to Figure 2, showing the position of the floated yarn behind the needle after the yarn had been operatively engaged by the sinker.

Figure 4 is a fragmentary semi-diagrammatic plan of a section of the machine employing my invention, showing the cam arrangement for actuating the sinkers to produce the results shown in Figures 2 and 3.

Figure 5 is a diagrammatic representation of a portion of the said fabric made by the knitting machine according to my invention, showing the relationship of the body yarn, the plated trimming yarn and floats before being sheared.

Figure 6 is a diagrammatic elevation of a shearing device, employed in the method of my invention, for removing the floats shown in Figure 5, and

Figure 7 is a view similar to Figure 5 showing the completed fabric with the floats removed.

In the preferred apparatus for practicing this invention, a knitting machine of the circular, latch-needle type is employed, having a conventional cam ring coaxing with a plurality of vertically movable needles. Inasmuch as such a structure is well understood in the art, it is not illustrated in detail, being of the same conventional construction generally employed in circular open-top latch needle machines. Suitably associated with the machine are a plurality of needle elevating and depressing means. According to the structure illustrated the elevating means comprise the approach cams 10, 11 and 12, the rising cam 13, and the selector wheel 14—the depressing elements comprising the separator cam 15, the depressing cam 16 and the stitch cams 17 and 18.

In performing the preferred method of my invention, I employ groups of two feeds about the cylinder, one feed supplying a trimming or design yarn 19 and the other feed supplying the body yarn 20. The approach cam 10 is operatively brought into engagement with all the needles of the cylinder, elevating them to the points of engagement with the selector wheel 14. This wheel permits certain of the needles 21 to pass horizontally through the slots thereof, and elevates certain other needles 22 to level 23 for tak-

ing the trimming yarn 19. It will be observed that in the needle set-up as illustrated, level 23 to which needles 22 are elevated is at tuck or below the latch-clearing level with respect to the fabric level or normal sinker level 24. In other words, the latches of needles 22 intercept said sinker level 24. It is understood, however, that this is merely a preferred arrangement, inasmuch as the selected needles 22 can be elevated to latch-clearing position if desired, within the scope and intent of this invention. While needles 22 are being elevated by selector wheel 14, the non-selected needles 21 come into engagement with separator cam 15 to be depressed substantially to said normal sinker level 24. The needles 22 are lowered by cam 16 until the yarn 19 is brought substantially to an intermediate level 25, a predetermined distance above level 24. It will be observed that the distance between these two levels is sufficiently great to prevent any accidental engagement of the hooks of needles 21 with the trimming yarn at its lowermost level 25.

As the needles 21 operatively come into engagement with approach cam 11 and are elevated thereby, the trimming yarn 19 is, by some suitable means, pushed to a position behind said rising needles, so that by the time the needles are at level 25, such yarn is disposed in back of said needles to form a float. A preferred method of accomplishing this floating of the yarn at the intermediate level 25 is by employing a double-throated sinker 26 wherein the normal sinker or fabric level is at the lower throat, and the lowermost level 25 of the trimming yarn 19 is at the upper throat. By referring to Figure 2, the needle is shown just below the upper throat 27, with the trimming yarn 19 within the throat and disposed in front of the needle. In Figure 3 the sinker 26 is shown in its projected position, this movement having occurred before the needle was elevated above throat 27. Upon such movement the yarn 19 is brought behind the needle, so that when the needle is elevated substantially to the position shown in full lines in Figure 3, the yarn is disposed therebehind. The movement of the sinker 26 is effected by an actuating cam 52 on sinker cam ring 53, this cam being so arranged as to project the sinkers forwardly substantially at the region B, before the needles 21 reach level 25. The method of actuating the sinkers is not fully described, inasmuch as it is well known in the art. It is to be understood, however, that instead of employing sinkers to operatively engage the trimming yarn 19 at region B by sinker means, any other suitable method may be employed with equal force and effect. Regardless of the method employed, it will be observed that after trimming yarn 19 is engaged at region B as aforesaid, the yarn 19 will remain behind such needles until a complete knitting action occurs at cam 17, as will hereinafter be set forth. In this manner, a float of the trimming yarn 19 is formed.

The cam 11 elevates all the needles to the position where they will be engaged by cam 13 which elevates them further to level 28 for taking the body yarn 20. Although the drawings show a fixed cam 13 elevating all the needles, it is of course understood that a pattern wheel or other selective mechanism can be employed in its place.

It will be observed that level 28 is above latch-clearing position with respect to fabric level 24. At this level all the needles take the body yarn 20, these needles being thereafter depressed by stitch cam 17 to the cast-off level 29. Inasmuch as certain of the needles 22 have within their

hooks, in addition to body yarn 20, the trimming yarn 19, the latter will also be incorporated into the fabric. It is important to observe, however, that in the set-up illustrated the body yarn 20 is slightly above the trimming yarn 19, so that at each wale where both are knitted in, one of these yarns will be exposed on one side of the fabric while the other is exposed on the other side. This is similar to the plating method for producing designs with a trimming yarn. It is to be understood, however, that the relative positions of the trimming and body yarns within the hooks of the needles can be interchanged, provided they are at different levels and in proximate relation. According to the diagram illustrated, the trimming yarn 19 will be visible at the front of the fabric and the body yarn 20 at the rear thereof at each wale where the two are incorporated within the fabric. After the knitting operation has been performed by stitch cam 17, the cycle is repeated when the needles are engaged by the approach cam 12.

It will be noted that the trimming and body yarns 19 and 20 converge towards each other at a fixed angle, the relative positions of the two said yarns remaining unchanged. The trimming and body yarn guides 50 and 51, which determine the paths of the trimming and body yarns before being knit, are stationary, and the needles are movable only in vertical directions in the performance of their respective knitting operations. The floating of the trimming yarn behind the needles is effected by the simple expedient of engaging said yarn at region B (as indicated in Figures 2 and 3), and not by any actuation of the yarn guides or carriers, or by a flexing of the needles as is necessary in other commonly employed devices. The method constituting my invention is thus obviously relatively simple, and adapted to produce uniform design areas where the trimming yarn is operatively incorporated into the fabric.

Figure 1 diagrammatically shows certain of the previously formed stitches incorporated into the fabric during the preceding cycle, illustrating the relationship between these stitches and certain of the knitting elements. The stitches 19a and 20a represent the trimming and body yarn stitches respectively. Wherever two stitches 19a and 20a are shown one above the other, the fabric at such points contain at the front thereof visible positions of the trimming yarn. Wherever a single stitch 20a is shown, the trimming yarn is floated at the rear of the fabric. Thus, within the region A the trimming yarn is disposed behind the fabric in the form of a float.

By the method above described, a fabric such as is illustrated in Figure 5 is produced. It will be observed that the body yarn 20b is present in all portions of the fabric. The trimming yarn 19b, however, is visible only where it is actually incorporated into the fabric; at other regions the floats 19c are disposed behind the fabric in horizontal formations. It is of course apparent that various designs can be produced with trimming yarn 19b incorporated into the fabric at selected wales and courses in accordance with the setting of pattern wheel 14. However, in a fabric of this nature, the floats 19c not only present an unsightly appearance and make handling of the material difficult, but they also impair the stretchability thereof particularly in a lateral direction, in view of the comparative longitudinal unstretchability of the yarn. I therefore elimi-

nate these floats by another step in the process of my invention which will now be described.

The fabric 32 (see Figure 6) containing floats 19c thereon, is passed over mandrel 33 disposed below shearing drum 34 with blades 35 thereon. Disposed between the upper edge of mandrel 33 and lowermost position of blades 35 is the guard 36. By suitable conveying means not shown, the material is passed between mandrel 33 and guard 36, the elements being arranged so that the floats will be operatively intercepted and sheared by said blades 35 during the rotation of drum 34. In this manner the floats are removed whereby the fabric illustrated in Figure 7 is produced.

In the finished fabric as illustrated in Figure 7, the floats are shown to be sheared off at points adjacent the wales into which the floats are incorporated, the particular point of shearing depending upon the properties of the yarn and the type of shearing apparatus employed. Thus the terminals 41 of the trimming yarn sections in course 42 end adjacent wales 30 and 31, respectively. The trimming yarn may be incorporated at a single wale in short loops as at 43, or may be knit in with the body yarn along several consecutively adjacent wales as indicated by the section C. In either case the trimming yarn is incorporated into the fabric in the form of independent and detached sections along certain courses.

The shearing step above described thus entirely removes the floats as elements impairing the stretchability of the fabric, and also leaves the reverse side of the fabric free of unsightly and loose yarn elements. And all this is accomplished without in any way affecting the design characteristics of the fabric. It is of course apparent that no portion of the trimming yarn is visible except where it is deliberately incorporated into the fabric, thereby producing true colors and well defined designs.

In order to enhance the stretchability of the fabric, I prefer to space the sections of trimming yarn in each course no less than two wales apart, and preferably more, so as to present extended areas containing only knitted loops of body yarn. The limit of stretchability of the fabric will hence to a large measure depend upon the stretchability of such free areas of body yarn, and will not be adversely affected by knitted in or floated sections of trimming yarn.

It will be observed that the sheared portions of the trimming yarn sections are frictionally retained within the fabric inasmuch as they are incorporated therein together with the body yarn. However, in the event one end of a sheared yarn should, due to a stretching of the fabric, be pulled out, no run will occur in the material in view of the fact that the body yarn 20 is incorporated in the form of knitted loops without interruption throughout the entire fabric. This has the further advantage of preventing the appearance of holes or gaps in the fabric at points where the sheared ends may be pulled out. This last mentioned feature is of particular importance in slip cover fabrics, inasmuch as the absence of holes renders such fabric practically dust-proof.

It is of course understood that other additional forms and modifications of the apparatus and adaptation of the method constituting this invention can be employed beyond and in addition to those hereinbefore described, all within the scope of the appended claims.

What I claim is:

1. In a method of producing on a circular latch

needle knitting machine a fabric with a design portion of trimming yarn incorporated therein, the steps of successively elevating selected needles to a level for taking trimming yarn, operatively supplying said trimming yarn to said selected needles, lowering the selected needles to a predetermined position above normal sinker level, elevating the said selected and the non-selected needles to a latch-clearing position for taking body yarn and simultaneously pushing said trimming yarn to a position behind the non-selected needles before they reach the trimming yarn, whereby a float will be formed, supplying a body yarn to said elevated needles at a level other than but in proximate relation to that of the trimming yarn operatively engaged by the needles, and lowering all the needles to below the sinker level for casting off and operatively knitting and tying in the previously formed stitches and float.

2. In a method of producing on a circular latch needle knitting machine a fabric with a design portion of trimming yarn incorporated therein, the steps of successively elevating selected needles to a level for taking trimming yarn, lowering the non-selected needles substantially to normal sinker level, operatively supplying said trimming yarn to said selected needles, lowering the selected needles to a predetermined position above said sinker level, maintaining the trimming yarn taken by said selected needles at a predetermined level above normal sinker level, elevating the said selected and the non-selected needles to a latch-clearing position for taking body yarn and simultaneously pushing said trimming yarn to a position behind the non-selected needles before they reach the said level of the trimming yarn, whereby a float will be formed, supplying a body yarn to all said elevated needles at a level slightly above that of the trimming yarn operatively engaged by the needles, and lowering all the needles to below the sinker level for casting off and operatively knitting and tying in the previously formed stitches and float.

3. In a method of producing on a circular latch needle knitting machine a fabric with a design portion of trimming yarn incorporated therein, the steps of successively elevating selected needles to a level for taking trimming yarn, operatively supplying said trimming yarn to said selected needles, lowering the selected needles to a predetermined position above normal sinker level, maintaining the trimming yarn taken by said selected needles at a predetermined substantially horizontal level, elevating the said selected and the non-selected needles to a latch-clearing position for taking body yarn and simultaneously pushing said trimming yarn to a position behind the non-selected needles before they reach the trimming yarn, whereby a float will be formed, feeding a body yarn to all said elevated needles along a path making a predetermined and fixed angle with the said level at which the trimming yarn is maintained and operatively supplying said body yarn to the needles at a level other than but in proximate relation to that of the trimming yarn operatively engaged by the needles, and lowering all the needles to below the sinker level for casting off and operatively knitting and tying in the previously formed stitches and float.

4. In a method of producing stretchable knitted fabric with a design portion of trimming yarn incorporated therein, the operations of knitting on a circular latch needle machine and shearing, the knitting operation comprising the steps of successively elevating selected needles to a level

for taking trimming yarn, operatively supplying said trimming yarn to said selected needles, lowering the selected needles to a predetermined position above normal sinker level, elevating the said selected and the non-selected needles to a latch-clearing position for taking body yarn and simultaneously pushing said trimming yarn to a position behind the non-selected needles before they reach the trimming yarn, whereby a float will be formed, supplying a body yarn to said elevated needles at a level other than but in proximate relation to that of the trimming yarn operatively engaged by the needles, lowering all the needles to below the sinker level for casting off and operatively knitting and tying in the previously formed stitches and float; the shearing operation comprising the steps of cutting off the floats formed by the aforesaid knitting steps at points adjacent the wales into which the said floats were incorporated.

5. In a method of producing stretchable knitted fabric with a design portion of trimming yarn incorporated therein, the operations of knitting on a circular latch needle machine and shearing, the knitting operation comprising the steps of successively elevating selected needles to a level for taking trimming yarn, operatively supplying said yarn to said needle, lowering the non-selected needles substantially to normal sinker level, lowering the selected needles to a predetermined position above said sinker level, elevating all the needles to a latch-clearing position for taking body yarn and simultaneously pushing said trimming yarn to a position behind the non-selected needles before they reach the lowermost level of the trimming yarn, whereby a float will be formed, supplying a body yarn to said elevated needles at a level sufficiently above that of the trimming yarn within the hooks of the said selected needles for producing a plated effect, lowering all the needles to below the sinker level for casting off and operatively knitting and tying in the previously formed stitches and float; the shearing operation comprising the steps of cutting off the floats formed by the aforesaid knitting steps at points adjacent the wales into which the said floats were incorporated.

6. In a circular vertically movable latch-needle knitting machine, a plurality of spaced yarn feeds including two successive feeds for supplying a trimming yarn and a body yarn, needle elevating and depressing means associated with each of said feeds, the said needle elevating means being adapted to raise coacting needles at said trimming yarn feed to a level for operatively taking the trimming yarn, and at the body yarn feed to a level for operatively taking the body yarn, the said needle depressing means being adapted to lower the coacting needles at the said trimming yarn feed to a level above cast-off position, and at the body yarn feed to a cast-off position for effecting a knitting operation, stationary trimming yarn and body yarn guides at the corresponding feeds for holding said yarns along predetermined fixed paths, said paths being so disposed as to cause the trimming and body yarns to be taken by the needles at the body yarn feed at slightly different levels such as to produce a plating effect, and yarn-actuating means engageable with the trimming yarn operatively held by the said trimming yarn guide, said yarn-actuating means being adapted to move the trimming yarn behind the needles being raised by the said needle-elevating means

operatively associated with the body yarn feed, whereby a float will be formed.

7. In a circular vertically movable latch-needle knitting machine, a plurality of spaced yarn feeds including two successive feeds for supplying a trimming yarn and a body yarn, needle elevating and depressing means associated with each of said feeds; the said needle elevating means containing at the said trimming yarn feed a selector wheel adapted to selectively raise coacting needles to a level for operatively taking the trimming yarn, and at the body yarn feed a raising cam for raising all the needles to a latch-clearing level for operatively taking the body yarn; the said needle depressing means containing a separator cam for lowering the non-selected needles leaving said selector wheel substantially to sinker level, a depressing cam for lowering the selected needles to a predetermined intermediate level above the sinker level, and at the body yarn

5 feed a stitch cam for lowering all the needles to cast-off position below the sinker level; stationary trimming yarn and body yarn guides for holding said yarns along fixed predetermined feeding paths, said paths being so disposed as to cause the trimming and body yarns to be taken by the needles at the body yarn feed at slightly different levels, the said feeding path of the trimming yarn being a sufficient distance above the sinker level so as not to clear the latches of the needles when at their uppermost positions at the body yarn feed, and yarn actuating means engageable with the trimming yarn operatively held by the said trimming yarn guide at its said feeding path, said yarn actuating means being adapted to move the trimming yarn behind the needles being raised by the said raising cam, whereby a float will be formed.

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