May 10, 1966 D. R. YORK ET AL 3,250,092

METHOD OF KNITTING LADIES SEAMLESS SUPPORT STOCKING

Original Filed Dec. 7, 1962 4 Sheets-Sheet 1

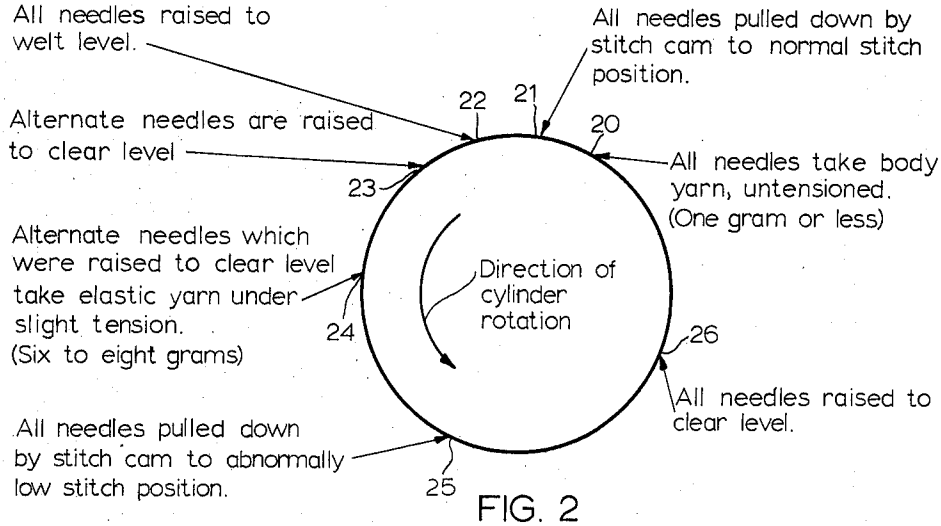

FIG. 2

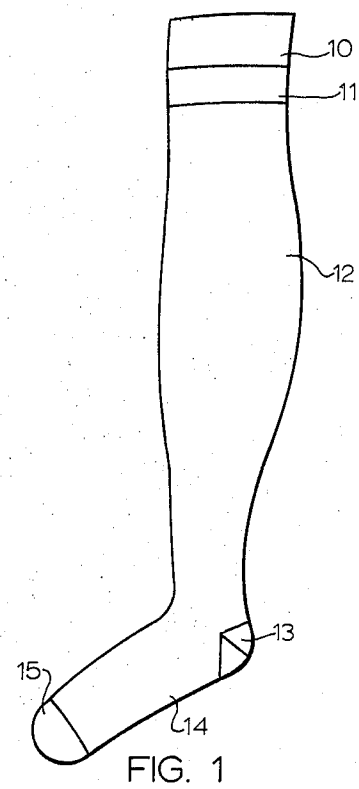

FIG. 1

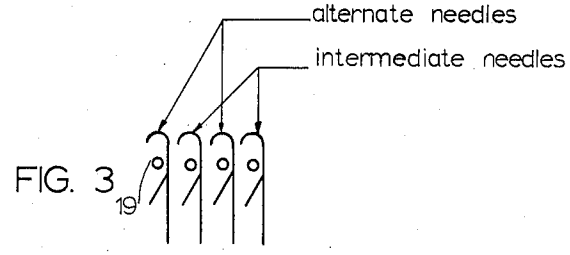

FIG. 3

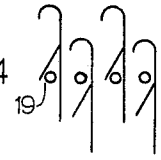

FIG. 4

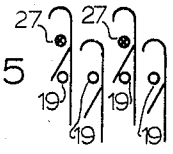

FIG. 5

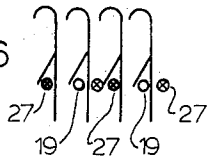

FIG. 6

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METHOD OF KNITTING LADIES SEAMLESS SUPPORT STOCKING

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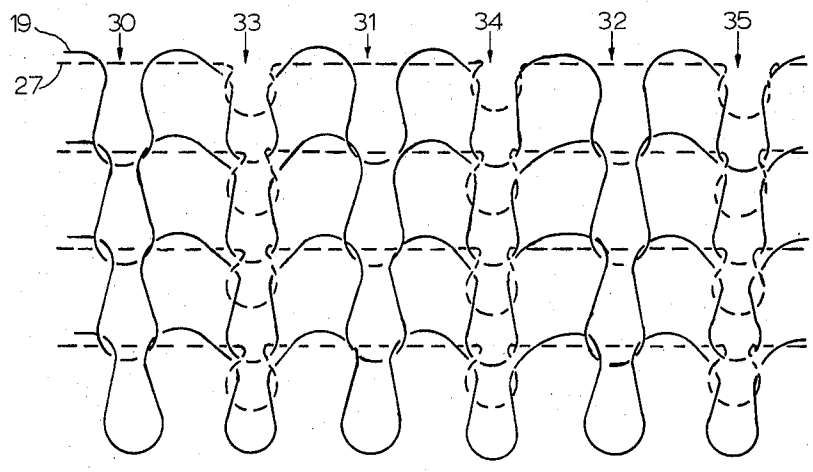

FIG. 7

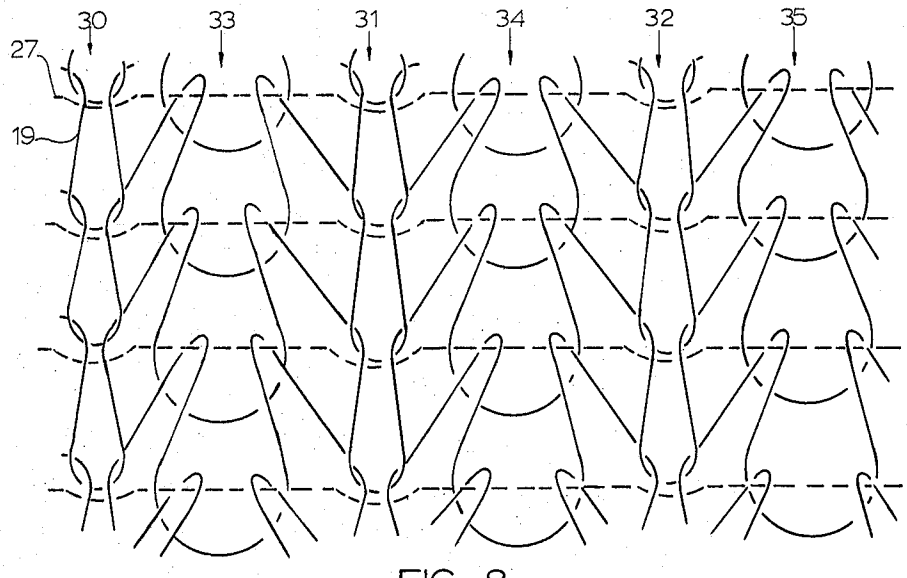

FIG. 8

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METHOD OF KNITTING LADIES SEAMLESS SUPPORT STOCKING

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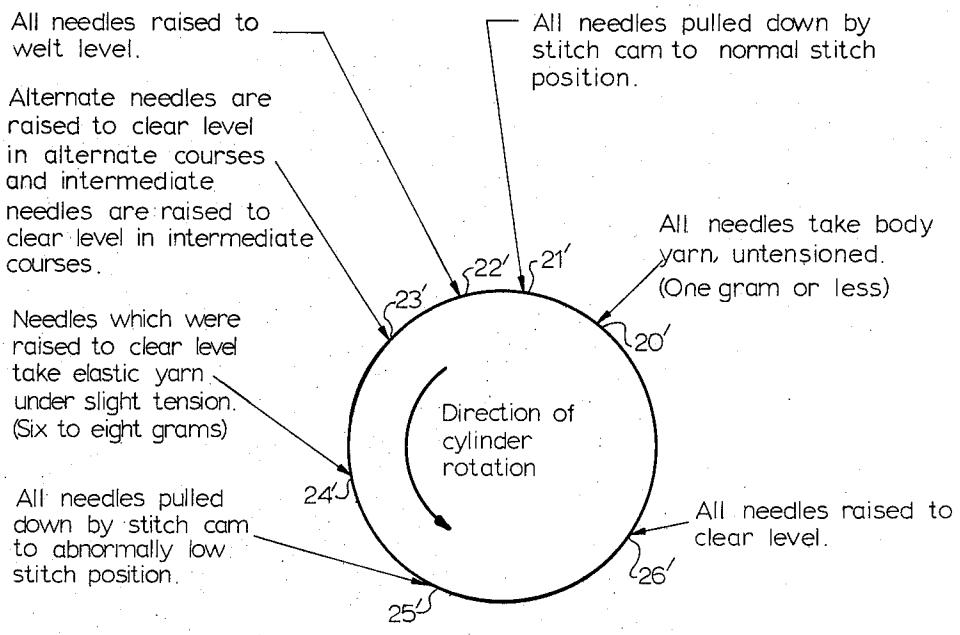

FIG. 9

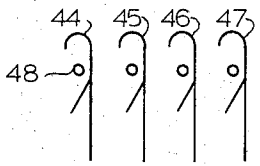

FIG. 10

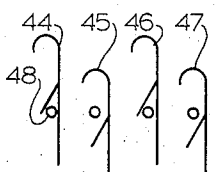

FIG. 11

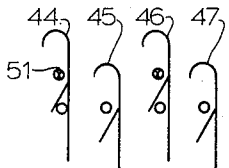

FIG. 12

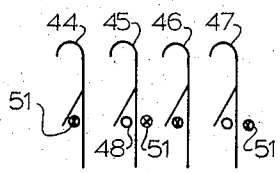

FIG. 13

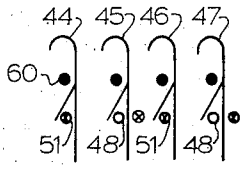

FIG. 14

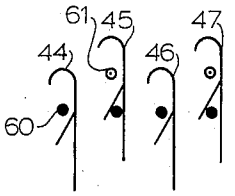

FIG. 15

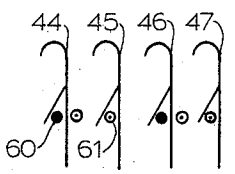

FIG. 16

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METHOD OF KNITTING LADIES SEAMLESS SUPPORT STOCKING

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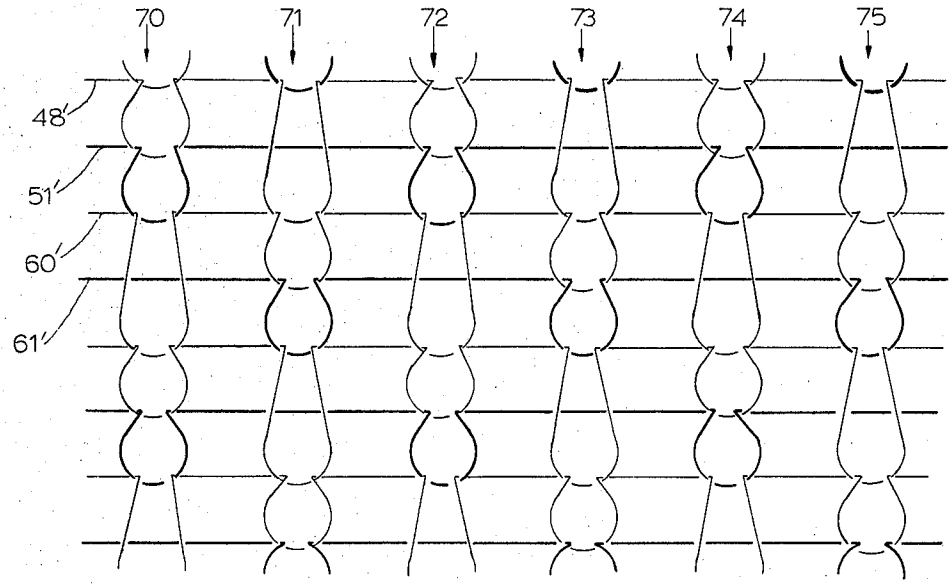

FIG. 17

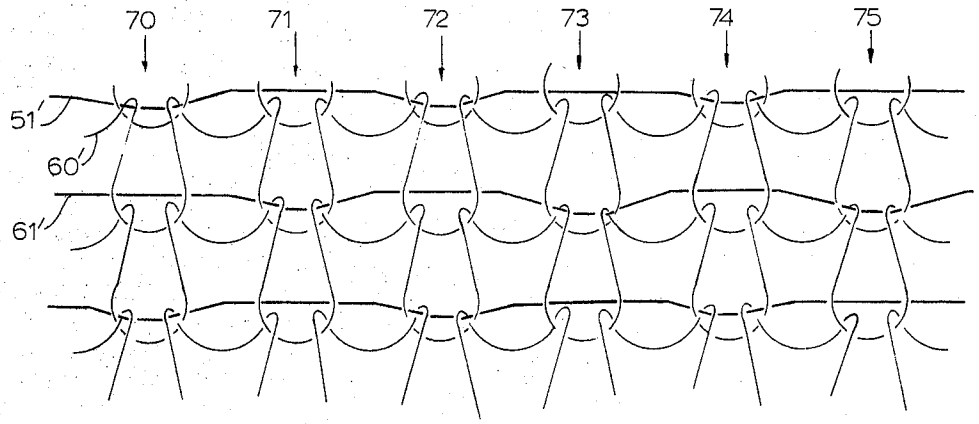

FIG. 18

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3,250,092

METHOD OF KNITTING LADIES SEAMLESS SUPPORT STOCKING

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Continuation of applications Ser. No. 243,072, Dec. 7, 1962 and Ser. No. 278,366, May 6, 1963. This application Jan. 25, 1965, Ser. No. 427,584
7 Claims. (Cl. 66—42)

This invention is concerned with ladies seamless support stockings. More particularly, the invention is concerned with knitting methods employed in the manufacture of ladies nylon seamless support stockings.

This present continuation application combines and is a continuation of a prior application filed December 7, 1962, Serial No. 243,072, entitled "Ladies Seamless Support Stocking and Method" and a prior application filed May 6, 1963, Serial No. 278,366 entitled "Sheer Seamless Support Stocking and Method" both of which applications have become abandoned.

Support stockings have long been employed for relief of varicose veins and other infirmities as well as for the purpose of giving relief to persons whose work requires them to be on their feet for long periods of time. Conventional support stocking for ladies have however given the appearance of being dense, of heavy construction and unfashionable which has led many ladies to avoid their use who might otherwise have enjoyed their benefits. Conventional support stockings tend to fit poorly particularly around the ankles and lack the desired gradually decreasing compression effect from the ankle to the knee. The denseness, heavy construction, loose fit and poor compression which are apparent in most conventional support stockings can be traced to the stitch arrangement, the nature of the body and elastic yarns employed and particularly to the method of knitting the body and elastic yarns. With so many factors involved the ultimate combination is critical particularly where there is a desire to achieve a support stocking which not only gives the support effect but also fits well and is sheer in appearance.

A common practice which leads to a substantially dense and poor fitting stocking structure is to knit with a forty denier nylon body yarn on every needle in every course of the leg and foot and knit in conjunction with the forty denier nylon on every needle but in every other course a heavy spandex yarn, of about 240 gauge, relaxed, covered with two ends of twenty denier nylon. Another common practice is to feed in a spandex yarn in every other course and to every needle in the manner described but use a bare, uncovered spandex that is fed with a thirty denier nylon as a covering substitute. In either case the body yarn in the leg and foot is continuously knit on every needle in every course and the spandex is knit with the body yarn on every needle but in every other course which leads to a substantially dense and unfashionable appearing end product. Furthermore, the methods employed have been conventional which have produced conventional loop formations lacking the desired features.

An object of this invention is therefore to provide a method for producing a ladies seamless support stocking which gives substantial support but which nevertheless gives an appearance of sheerness.

Another object of this invention is to provide a method of knitting a ladies seamless support stocking which produces a substantially sheer fabric but which is nevertheless adaptable to conventional circular women's seamless hosiery knitting machines.

Another object is to provide a method for producing a ladies seamless support stocking having an open mesh, sheer appearance but which also exhibits a highly compressive supporting characteristic.

Another object is to provide a method of producing a ladies seamless support stocking which lends itself to fast production.

An object of this invention is to provide a method for producing an improved nylon ladies seamless support stocking which gives substantial support with an appearance of sheerness but without noticeable wale lines.

Another object of this invention is to provide a method for producing a nylon ladies seamless support stocking which provides a graduated compression effect from the ankle upwards to the top of the stocking.

These and other objects of the invention will become apparent from the drawings and as the description proceeds. In the drawings:

FIGURE 1 is a view of a conventional ladies stocking.

FIGURE 2 is a schematic diagram of the major yarn feed and needle positions and stations and tensioning involved in the method of making the stocking of the invention according to a first embodiment.

FIGURE 3 is a diagrammatic view of a representative group of needles at the beginning of the invention's knitting sequence.

FIGURE 4 is a diagrammatic view of a representative group of needles at another stage in the invention's knitting sequence.

FIGURE 5 is a diagrammatic view of a representative group of needles at another stage in the invention's knitting sequence.

FIGURE 6 is a diagrammatic view of a representative group of needles at another stage in the invention's knitting sequence.

FIGURE 7 is an enlarged stitch diagram of the stocking of the invention as formed on the machine.

FIGURE 8 is an enlarged stitch diagram of the stocking of the invention as it appears after the fabric is cast off the machine.

FIGURE 9 is a schematic diagram similar to FIGURE 2, of the major yarn feed and needle positions and stations and tensioning in the method of the invention according to a second embodiment.

FIGURE 10 is a diagrammatic view of a representative group of needles at the beginning of the knitting sequence according to the second embodiment.

FIGURE 11 is a diagrammatic view of a representative group of needles at another stage in the method according to the second embodiment.

FIGURE 12 is a diagrammatic view of a representative group of needles at another stage in the method according to the second embodiment.

FIGURE 13 is a diagrammatic view of a representative group of needles at another stage in the method according to the second embodiment.

FIGURE 14 is a diagrammatic view of a representative group of needles at another stage in the method according to the second embodiment.

FIGURE 15 is a diagrammatic view of a representative group of needles at another stage in the method according to the second embodiment.

FIGURE 16 is a diagrammatic view of a representative group of needles at another stage in the method according to the second embodiment.

FIGURE 17 is an enlarged stitch diagram of the stocking of the invention as found on the machine according to the second embodiment.

FIGURE 18 is an enlarged stitch diagram of the stock-

ing of the invention as it appears after the fabric is cast off the machine according to the second embodiment.

While various circular knitting machines well known in the art may be employed to practice the method of the invention according to the first embodiment, a suitable machine is the Scott and Williams Company, Laconia, New Hampshire, KN–2, 400 needle, two feed machine, equipped with well known jack and needle butt mechanism appropriate to the needle motions hereinafter described. The following description is therefore made with this machine in mind though it is to be understood that many other types of seamless hosiery machines will be found adaptable to the invention. For example, the Booton Mark III machine is later referred to in connection with the second embodiment of the invention.

Referring to FIGURE 1, there is shown a view of a conventional ladies circular knit support stocking having a folded welt portion **10**, a single thickness shadow welt portion **11**, a leg-ankle portion **12**, a heel portion **13**, a foot portion **14** and a toe portion **15**. This invention is primarily concerned with the leg-ankle portion **12** where the contraction or support effect is most desired and in a fashionable construction. It will also be recalled from prior description that the ankle portion is generally loose and of poor fit in the conventional support stocking. The description is therefore directed primarily to the method of producing the leg-ankle portion **12**, however the stitch which is employed in the leg-ankle portion **12** may also be and preferably is also employed in the foot portion **14** in order to utilize the same mechanism, yarns and the like.

While not directly pertinent to the method of the invention in either of the two embodiments described, it is desirable for the welt, heel and toe stitch constructions to be formed of a fluffy nylon yarn such as the forty denier "Texturlized" nylon sold under the mark "Banlon" by Joseph Bancroft and Sons, Wilmington, Delaware. The inherent fluff and stretch qualities found in such yarn is particularly suited to carrying out in the welt, heel and toe the overall fashionable effects sought by the invention.

Referring to FIGURE 2, there is shown, according to a first embodiment, a somewhat schematic plan diagram of the stations and sequence of needle positioning and yarn feeding and tensioning in the leg-ankle portion **12** during formation of the stitch which follows the method of the invention. It is to be understood that this diagram is not intended to be accurate as to the exact location of the various operations but rather will give a general picture of the knitting sequence such that those who are skilled in the art and are familiar with the knitting machine in question may better understand the invention. For example, according to a first embodiment of the invention knitting may be considered as beginning with the taking of the body yarn by all needles as at position **20**. While up to seventy denier nylon may be employed, a preferred body yarn to be fed at such position and in a substantially relaxed state is a fifteen denier monofilament nylon. This denier is, of course, less than half the denier of the forty denier nylon normally employed in conventional nylon support stockings, however the user of the support stocking of this invention gains substantially the same support effect and also the advantage of sheerness and good ankle fit.

Of particular importance to the present invention is the substantially relaxed and untensioned state of the body yarn which should not exceed about one gram tension. That is, the pull on the body yarn should be as low as practical and should produce no substantial drag. So long as the body yarn tension does not exceed about one gram it is essentially relaxed and untensioned in its behavior and produces the results desired particularly when the elastic yarn tension is between six and eight grams as later described.

After receiving body yarn on all the needles, all the needles form stitches as represented by the stitch cam position **21**. While not shown, we have found it desirable to employ a normal stitch cam at position **21** such that the stitches are drawn within a normal range of size. Following position **21** all needles are raised but to a welt level or less than full shed position as indicated at position **22**. With all needles at such welt level all needles will have body yarn riding in effect on the latch as indicated by the representative four needles in FIGURE 3 showing the position of body yarn **19**. Immediately after raising all needles to welt level at position **22** which step may not be necessary in some machines, alternate needles are raised to clear level and intervening needles remain at welt level as at position **23** by suitable mechanism such as jack butt selectors, not shown, which brings the body yarn **19** below the latch on alternate needles as in FIGURE 4 while maintaining the body yarn **19** above the latch on intervening needles (labeled "intermediate" in FIG. 3).

Continuing the knitting sequence, the raised alternate needles are now fed an elastic yarn at position **24** at slight tension such that the elastic yarn **27** goes on the alternate needles under slight tension and above the latches as illustrated in FIGURE 5. The choice of type of elastic yarn has been found to be important and an elastic yarn that has been found to be especially suited to the invention is a two end nylon covered spandex yarn. The composite yarn is formed from a spandex yarn of 200 gauge, relaxed, which is then covered in a stretched condition with top and bottom ends of 15 denier nylon. One such elastic yarn may be purchased under the mark "Vyrene" from the United States Rubber Company, Rockefeller Center, New York, New York,

It is important that the elastic yarn be fed to the needles under a slight tension. The tension in the elastic yarn should be from six to eight grams. That is, according to the method of the invention the body yarn **19** is held substantially untensioned up to about one gram tension, and the elastic yarn **27** is held slightly tensioned between six and eight grams. While tensioning, per se, is not new either as to body or elastic yarns, the step of maintaining a wide difference in tensioning of the body and elastic yarns within the ranges described when combined with the other method steps disclosed herein is unknown and has in fact in such unique combination of method steps produced a vastly superior and widely accepted seamless support stocking.

In further reference to the elastic yarn and as will be better understood later on in the description, stitches are actually formed with the elastic yarn but due to the inherent elasticity of the elastic yarn and the fact of the elastic yarn being under the mentioned slight tension, the elastic yarn stitches are pulled out and do not in fact appear in the end product.

Referring further to the knitting sequence, the needles after leaving position **24**, rotate to a position **25** where all of the needles are drawn down to an abnormally low stitch position so as to draw stitch loops about twice as long as those that were drawn at position **21**. This is accomplished by employing a stitch cam, not shown, at position **25** having a throw about one and a half to twice the throw of the stitch cam located at position **21**. The exact throw required at the second stitching station will be found to vary both with type of elastic yarn and machine. As with the question of determining the exact tension to be applied to the elastic yarn, the throw of the stitch cam at position **25** should be regulated to achieve relatively long loops at position **25** so that when the elastic yarn loops are cast off and released and allowed to distort the end fabric, there still remains the desired open mesh construction into which the elastic yarn is locked. In other words, the elastic yarn tension and the stitch cam throw at position **25** work together in controlling the extent to which the elastic yarn distorts and closes the end fabric.

This will be seen more clearly as the description proceeds. For the moment, it should be noted that the stitch cam following the elastic yarn feed is substantially lower than the stitch cam following the body yarn feed so as to form elastic yarn loops of substantially larger size than the body yarn loops.

Following position **25**, all of the needles are brought to a clear level position as at position **26** preparatory to repeating the described sequence. Of interest at this point is the fact that when the needles are leaving position **26** and are approaching position **20** to again receive body yarn **19**, alternate needles will have the elastic yarn **27** below the latch and in front of the needle while intervening needles will be found to have the body yarn **19** below the latch in front of the needle and elastic yarn **27** below the latch and behind the needle. This is illustrated in FIGURE 6 where the elastic yarn **27** is represented by a crossed circle and the inelastic yarn **19** by a circle.

In accordance with conventional practice, it may be mentioned that shaping of the leg may be accomplished during carrying out of the previously described method by gradually varying the stitch size through any of the conventional mechanisms suitable to this purpose. Further shaping may be accomplished by boarding according to conventional practices.

To relate the previously described knitting sequence to the fabric produced, reference is next made to FIGURE 7 which is a stitch diagram showing how the loops are actually formed on the machine. Using wales **30, 31,** and **32** as examples, it can be seen that all of the loops in each of those wales are formed solely of the body yarn **19** which is represented by a solid line in FIGURE 7. Referring back to FIGURE 2, it will further be recognized that wales **30, 31,** and **32** are formed by those previously mentioned "intervening" needles which take body yarn **19** only but on every needle and on every rotation of the cylinder. On the needles forming wales **30, 31, 32,** therefore, it can be said that one course of body yarn **19** is formed on each rotation of the cylinder.

Looking next at wales **33, 34, 35** in FIGURE 7 it will be noted that loops of body yarn **19** alternate with loops of the elastic yarn **27** shown in dotted lines. Again going back to FIGURE 2, it will be seen that wales **33, 34, 35** can be attributed to operation of the previously mentioned "alternate" needles. That is, the needles forming wales **33, 34, 35** take and knit body yarn **19** and also take and knit elastic yarn **27** on each rotation of the cylinder. In effect then, the referred to alternate needles knit and shed both body yarn and elastic yarn stitches on each rotation.

It will be recalled at this point that mention was made of the elastic yarn **27** being fed under tension of six to eight grams and also of abnormally long loops being drawn after the elastic yarn was placed on the alternate needles. This results in the stitches being "theoretically" formed substantially as diagrammed in FIGURE 7. That is, the stitch arrangement and fabric of FIGURE 7 according to the method of the invention never in fact actually exists since the elastic yarn stitches are pulled out as rapidly as they are made. The stitch arrangement of FIGURE 7 does however represent how the end fabric is formed.

Immediately after being cast off, the elastic yarn **27** once freed of tension assumes a sort of wavy or undulating form running coursewise in each course and in the final fabric the elastic yarn appears to be caught in the body yarn stitches rather than appearing as separate elastic yarn stitches as in FIGURE 7. Thus, in FIGURE 8, there is shown a diagram of the final stitch arrangement substantially as it appears to the eye when highly enlarged.

In examining FIGURE 8, it will be seen that the stitch formed by the method of the invention even though it employs covered retractive yarn in every course is characterized by a substantially open mesh, sheer appearance in which wales of relatively small body yarn loops alternate with wales of relatively large body yarn loops with the elastic yarn being caught in the loop intersections of those wales having the large loops. In the greige, the fabric exhibits a very evident transparency which transparency is lessened but retained even after dyeing with conventional shades. Because of the fact that alternate stitches in the alternate wales are actually formed solely with the elastic yarn during knitting it can also be said that the fabric made by the method of the invention is further characterized by the fact that the fabric is held together at the large loop intersections solely by the elastic yarn which gives the fabric a unique walewise and coursewise stretch characteristic. Such stretch characteristic is markedly absent in the conventional stocking where a relatively heavy elastic yarn is combined with the body yarn and is knit on every needle in those courses in which the elastic yarn appears. Furthermore, the stocking formed by the method of the invention gives an excellent fit around the ankle and the desired graduated compression effect from the ankle up the leg.

A second embodiment of the method of the invention is illustrated by FIGURES 9 through 18. Like the first embodiment, the method of the second embodiment produces a support stocking which exhibits both sheerness and graduated compression in the ankle and leg. The fabric produced by the second embodiment is, like the first embodiment, characterized by larger elastic loops relative to the inelastic loops. Certain combinations of elastic and inelastic yarns when knit according to the first embodiment may however exhibit noticeable wale lines which are eliminated in the stocking which follows the second embodiment. In particular, in the second embodiment the needles which take the elastic yarn are periodically shifted as hereafter explained and such shifting tends to eliminate noticeable wale lines.

As with the first embodiment, various circular knitting machines well known in the art may be employed in the practice of the method of the second embodiment of the invention. An example of a machine suitable to the purposes of the second embodiment is the Booton Mark III, two feed, 403 latch needle, circular knitting machine made by Textile Machine Works of Reading, Pennsylvania, and equipped with the necessary needle positioning mechanism appropriate to the needle motions hereinafter described. With particular reference to the Booton Mark III machine for example, it has been found necessary only to place the retractive yarn holder and cutter closer to the retractive yarn feed than it would otherwise be, the float finger feed being employed for this purpose on this particular machine, otherwise the machine has been found immediately adaptable to being set up for the method of the present invention. As contrasted to the 400 needle and other well known even number needle machines, an odd needle number machine such as the mentioned 403 needle machine eliminates the fault line which would otherwise develop in stockings produced by the method of the second embodiment now to be described.

FIGURE 9 is similar to FIGURE 2 for the first embodiment and shows a somewhat schematic plan diagram of the stations and sequence of needle positioning and yarn feeding in the leg portion **12** during formation of the stocking according to the second embodiment of the invention. As with the first embodiment, it is to be understood that this diagram is not intended to be accurate as to the exact location of the various operations but rather will give a general picture of the knitting sequence such that those who are skilled in the art and are familiar with the knitting machine in question may better understand the invention. For example, knitting may be considered as beginning in the same manner as in the first embodiment namely with the taking of the body yarn by all needles as at position **20'**. As with the first embodiment, a preferred body yarn to be fed at such position

and in a substantially relaxed or untensioned state, not exceeding one gram tension, is a fifteen denier nylon.

After receiving body yarn on all the needles, all the needles form stitches the same as in the first embodiment and as represented by the stitch cam position 21'. That is, a course of body yarn is formed in which every needle knits. While not shown, a normal stitch cam is employed at position 21' such that the stitches are drawn within a normal range of size as in the first embodiment. Following position 21' all needles are raised but to a welt level or less than full shed position as indicated at position 22'. With all needles at the welt level, all needles will have body yarn riding in effect on the latch as indicated by a representative group of four needles 44, 45, 46, 47 in FIGURE 10 showing the position of the body yarn represented by the circle symbol 48. Immediately after raising all needles to welt level at position 22' which step may not be necessary in some machines, alternate needles 44, 46 are raised to a clear level or full shed position and intermediate needles 45, 47 are held to a welt level at position 23' by suitable mechanism such as jack butt selectors, not shown, which brings the body yarn 48 below the latch on alternate needles 44, 46 as in FIGURE 11 while maintaining the body yarn 48 above the latch on intermediate needles 45, 47.

Continuing the knitting sequence, the raised alternate needles 44, 46 are now fed an elastic yarn, indicated by the crossed circle symbol 51, at position 24' such that the elastic yarn 51 goes on the alternate needles 44, 46 above the latches as illustrated in FIGURE 12.

Referring further to the knitting sequence, the needles after leaving position 24', rotate to a position 25' where all of the needles are preferably drawn down to an abnormally low stitch position so as to draw stitch loops about twice as long as those that were drawn at position 21'. This is accomplished by employing a stitch cam, not shown, at position 25' having a throw about one and a half to twice the throw of the stitch cam located at position 21'. As in the first embodiment, the exact throw required at the second stitching station will be found to vary both with type of elastic yarn and machine.

Following position 25', all of the needles are brought to a clear level position as at position 26' preparatory to forming the next course of body yarn. In being raised the intermediate needles 45, 47 will pass forward of the elastic yarn 51. When the needles 44, 45, 46 and 47 leave position 26' and again approach position 20' to again receive body yarn 48, alternate needles 44, 46 will have the elastic yarn 41 below the latch while intervening needles 45, 47 will have the body yarn 48 below the latch. This is illustrated in FIGURE 13.

As the needle group next pass position 20' all needles take and form a second course of body yarn represented by the solid circle symbol 60 which arranges the respective yarns 60, 51 and 48 as in FIGURE 14. The needles now pass through position 21' where they form stitches and at position 22' all needles are again raised to welt level. As the needles continue to move and as the leading needle 44 of the group, which is also assumed as being the leading needle in the group of 403 needles of the machine being discussed, again approaches the position 23' a jack butt or other suitable needle position selection is made by the appropriate mechanism, not shown, such that as the needle group comprising needles 44, 45, 46 and 47 again goes through the position 23', alternate needles 44, 46 remain at the welt level while the intermediate needles 45, 47 are raised to clear level and in such respective positions the needles continue through position 24'. At position 24', the raised intermediate needles receive the second course of elastic yarn, represented by the dot in circle symbol 61, on the intermediate needles 45, 47 as represented in FIGURE 15 after which all needles go through the stitching position 25' followed by all needles being raised to clear level at position 26' and which places the elastic and body yarns on the needles as represented in FIGURE 16.

At this stage in the second embodiment of the method having installed two courses of body yarn and two courses of elastic yarn, the sequence is ready to repeat with a further course of body yarn being cast on all the needles and a further course of elastic yarn being cast on the alternate needles as was the described yarn 51. Considering the sequence of knitting which repeats every four courses and evary two wales and taking station 20' as a starting point, in the first course body yarn can be said to be knit on every needle. On alternate needles the body yarn can be said to be knit with the elastic yarn and on intermediate needles with the body yarn. The second course is formed to the elastic yarn which can be said to be knit only in intermediate wales with the body yarn. The third course is formed of the body yarn which is knit on all needles but which is knit with the body yarn on alternates needles and with the elastic yarn on intermediate needles. That is, in each successive course of body yarn the body yarn loops which knit with the elastic yarn are offset one wale. Continuing the sequence, the fourth course in the selected sequence will comprise the elastic yarn knit only in alternate wales with the body yarn.

Reference is next made to FIGURE 17 which shows in stitch diagram form the loop formation on the machine and FIGURE 18 which shows also in stitch diagram form the loop formation after the fabric leaves the machine and the tensioned elastic yarn is given an opportunity to draw the body yarn loops together. In the diagrams, FIGURES 17 and 18, wale 70 is assumed to represent the wale formed by needle 44, wale 71 the wale formed by needle 45, wale 72 the wale formed by needle 46, and wale 73 the wale formed by needle 47. Also in the diagrams the first reference course of body yarn is indicated by 48', the second reference course of elastic yarn by 51', the third reference course of body yarn by 60' and the fourth reference course of elastic yarn by 61'. In the diagrams the heavy lines represent the elastic yarns and the light lines represent the body yarns.

Referring to wale 70, FIGURE 17, it will be noted that a characteristic of the loop formation is that elastic yarn loops alternate walewise with pairs of body yarn loops. It will also be noted that unlike conventional support stockings the fabric is actually held together by the elastic yarn at those points where the elastic yarn loops are formed. Thus, at these points compression and retraction depends solely on the elastic yarn. Another characteristic illustrated by the diagram of FIGURE 17 is that the elastic yarn forms loops in alternate wales in alternate elastic yarn courses and forms loops in intermediate wales in intermediate elastic yarn courses. For example, treating elastic yarn course 51' as an alternate elastic yarn course, the elastic yarn loops are formed in what we may refer to as alternate wales 70, 72, 74 and treating elastic yarn course 61' as an intermediate elastic yarn course, the elastic yarn loops are formed in what we may refer to as intermediate wales 71, 73, 75.

In view of the nature of the elastic yarn, such as the mentioned nylon covered spandex, and because of its being fed under tension the elastic yarn loops tend to pull out from the position in which they were formed as in FIGURE 17 and assume the position shown in FIGURE 18. In FIGURE 18, it will be particularly noticed that the elastic yarn is caught both coursewise and walewise in alternate body yarn loop intersections but the places of being caught are offset from course to course. It will also be noticed that the elastic yarn is laid behind the body yarn stitches between the body yarn loop intersections wherein it is caught.

Shaping of the fabric made according to the second embodiment may be controlled as with the first embodiment fabric through gradual stitch variation from leg

to ankle or by boarding or by a combination of both procedures. In the course of shaping, however, it is desirable to recognize the need for producing a support stocking whose compressive effect is maximum in the ankle area, somewhat less in the calf area and least in the knee area. The method of the invention as expressed in the two embodiments previously discussed has been found to be especially adapted to producing stockings exhibiting such characteristic on a consistent production basis whereas stockings made according to prior art methods have been found to be difficult to control so far as producing stockings showing any degree of uniformity in the matter of having a graduated compressive effect from ankle to knee portions. In a typical case with the second embodiment of the method, ladies nylon seamless support stockings were made on a Booton Mark III machine in quantity using a 20 denier monofilament nylon as the body and a 200 gauge, relaxed, "Vyrene" elastic yarn with two ends of 15 denier nylon cover knitted throughout the leg and foot. Such stockings were held to a substantially uniform compressive effect and with samples selected at random the pressure at the ankle measured 18 millimeters of mercury, at the calf it measured 16 millimeters of mercury and at the knee it measured 14 millimeters of mercury, the measurements being taken with the kind of measuring apparatus described in Patent 2,962,885. Furthermore on a "standard leg" there was excellent fit in the ankle area and on overall highly sheer appearance.

It is to be understood that the foregoing description and drawings are for illustrative purposes only, the scope of the invention being defined by the claims.

Having described the invention, what is claimed is:

1. The method of knitting on a rotating circular cylinder latch needle seamless hosiery knitting machine a ladies nylon seamless support stocking characterized by a substantial and upwardly gradually deceasing compression effect, an open mesh appearance and a sheerness rendering the stocking fabric as worn substantially transparent which includes during each rotation of the cylinder, in successive knitting sequence, the steps of raising all the needles to a clear level position; feeding under a tension not exceeding one gram a nylon body yarn to all said needles while in said clear level position; lowering all said needles while in said clear level position; lowering all said needles down to a normal stitch forming position whereby to form stitches on all said needles; raising alternate needles to a clear level position while maintaining intervening needles in a welt level position; feeding under a tension of between six and eight grams a covered elastic yarn to said alternate needles only; lowering all said needles down to an abnormally low stitch forming position whereby to form stitches only on said alternate needles but to draw out substaantially long loops on each of said needles and then repeating said first mentioned step of raising all of said needles to a clear level position, said tension of said yarns and the draw of said abnormally low stitch position being regulated during the practicing of said method such that stocking as cast off said machine shows stitches only of said body yarn and alternating wales of relatively small and large loops with said elastic yarn being caught only in each successive intersection of said large loops.

2. The method of knitting as claimed in claim **1** including immediately after said normal stitch forming step the additional step of raising all said needles to welt level position while maintaining said body yarn just previously taken above the latches of all said needles.

3. A method of knitting an elastic support fabric, with an open mesh and highly sheer appearance and upwardly gradually decreasing compression effect, on a multi-feed circular knitting machine having a complement of stitch forming instrumentalities, including needles, which method comprises the steps of feeding under a tension not exceeding one gram an inelastic yarn to all the needles at one yarn feed and forming said inelastic yarn into knitted stitches of a selected size; and feeding under a tension of between six and eight grams an elastic yarn to selected needles at the next successive yarn feed and forming said elastic yarn into knitted stitches of a substantially larger size than said inelastic yarn stitches, the difference in tension of said yarns and the sizes of said stitches being such that the fabric as cast off said machine shows stitches only of said inelastic yarn and alternating wales of relatively small and large stitches with said elastic yarn being caught only in each successive intersection of said large stitches.

4. The method of knitting on a rotating circular cylinder latch needle seamless hosiery knitting machine the leg portion of a ladies' nylon seamless support stocking characterized by a substantial and gradual upwardly decreasing compression effect, an open mesh appearance and a sheerness rendering the stocking fabric as worn substantially transparent which includes during a first rotation of the cylinder, in successive knitting sequence, the steps of first, raising all the needles to a clear level position; second, feeding under a tension not exceeding one gram a nylon body yarn to all said needles while in said clear level position; third, lowering all said needles down to a stitch forming position whereby to draw out substantially normal size loops on all said needles; fourth, raising alternate needles to a clear level position while maintaining intervening needles in a welt level position; fifth, feeding under a tension of between six and eight grams a nylon covered elastic yarn to said alternate needles only; sixth, lowering all said needles down to a stitch forming position whereby to form stitches only on said alternate needles but to draw out substantially long loops on each of said needles; seventh, raising all of said needles to a clear level position; then, during a second rotation of said cylinder repeating each of the aforementioned seven steps except for the fourth step being changed to raising intervening needles to a clear level position while maintaining alternate needles in a welt level position; then allowing the aforesaid first and second cylinder rotation sequence to repeat until said leg portion has been completed; said difference in tension of said yarns and difference in draw of said stitch forming positions being regulated during said steps such that said leg portion as cast off has stitch loops solely of said body yarn with said elastic yarn being caught both coursewise and walewise in alternate body yarn loop intersections.

5. The method knitting as claimed in claim **4** including on each cylinder rotation immediately after said third stitch forming step the additional step of raising all said needles to welt level position while maintaining said body yarn just previously taken above the latches of all said needles.

6. A method of knitting an elastic support fabric, with an open mesh and highly sheer appearance and gradual upwardly decreasing compression effect, on a multi-feed circular knitting machine having a complement of stitch forming instrumentalities, including needles, which method comprises the steps of feeding under a substantially small tension an inelastic yarn to all the needles at one yarn feed and forming said inelastic yarn into knitted stitches of a selected size; and feeding under a tension at least six times as much as said small tension an elastic yarn to selected needles at the next successive yarn feed and forming said elastic yarn into knitted stitches of a substantially larger size than said inelastic yarn stitches, the tension of said yarns and the difference in sizes of said stitches being such that the fabric as cast off said machine shows stitches only of said inelastic yarn and alternating wales of relatively small and large stitches with said elastic yarn being caught only in each successive intersection of said large stitches, said selected needles in each course being staggered in relation to the selected needles of the immediately preceding course.

7. A method of knitting the leg portion of a ladies' seamless support stocking on a multi-feed circular knitting

machine having a cylinder with a complement of independent needles and a stitch cam at each feed which method comprises the steps during the knitting of said leg portion of selectively positioning the stitch cams at each feed relative to the needle cylinder to draw the needles to form yarn into knitted stitches of selected size; rotating the needle cylinder relative to the stitch cams; feeding and knitting an inelastic yarn of selected character on all of the needles at one feed in as tension-free a condition as practicable; and feeding and knitting an elastic yarn of selected character on selected needles only at the next successive feed under a tension maintained at an amount at least six times greater than any tension imposed on the inelastic yarn, said selective positioning of said stitch cams, said selective character yarns, said needle selection and said feeding tension of said inelastic and elastic yarns being selected and coordinated to produce in said leg portion an open mesh and highly sheer fabric exhibiting an upwardly gradually decreasing compression effect.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,250,092 May 10, 196(

Dennis R. York et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 8, line 10, for "evary" read -- every --; line 15 for "to" read -- of --; column 9, lines 44 and 45, strike out "lowering all said needles while in said clear level position line 54, for "substaantially" read -- substantially --; line ! after "that" insert -- said --.

Signed and sealed this 19th day of July 1966.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNEI
Commissioner of Patents