June 6, 1939. J. L. GETAZ 2,161,250

KNITTING MACHINE

Original Filed Dec. 10, 1935 3 Sheets-Sheet 1

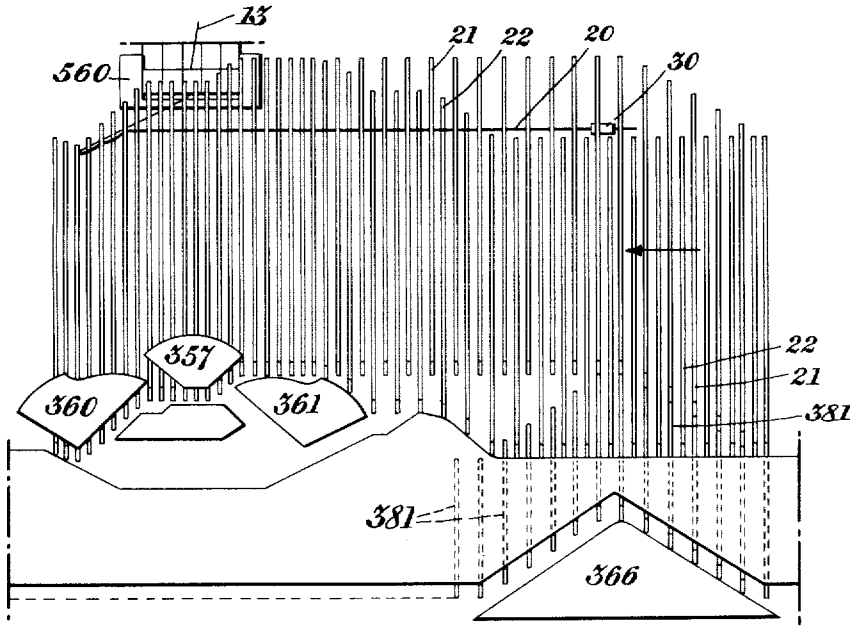


Fig:1.

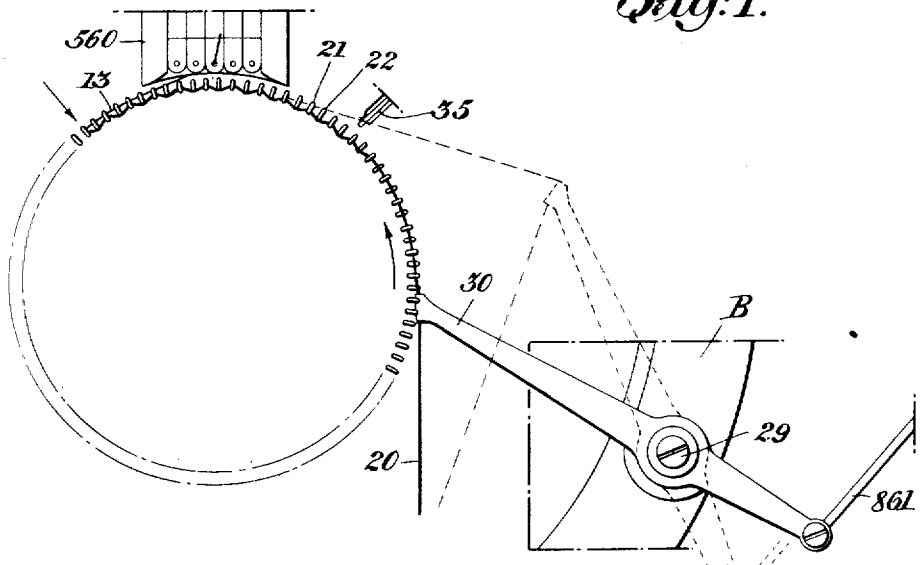


Fig:2.

INVENTOR

James L. Getaz

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KNITTING MACHINE

Original Filed Dec. 10, 1935 3 Sheets-Sheet 2

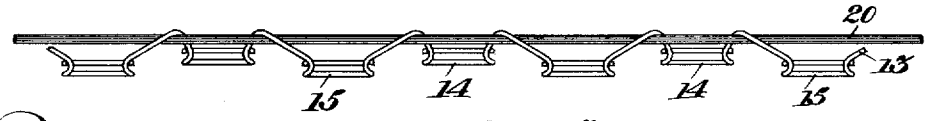


Fig. 3.

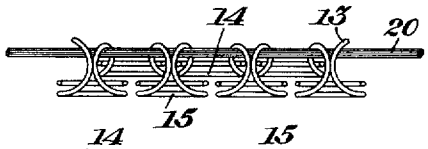


Fig. 4.

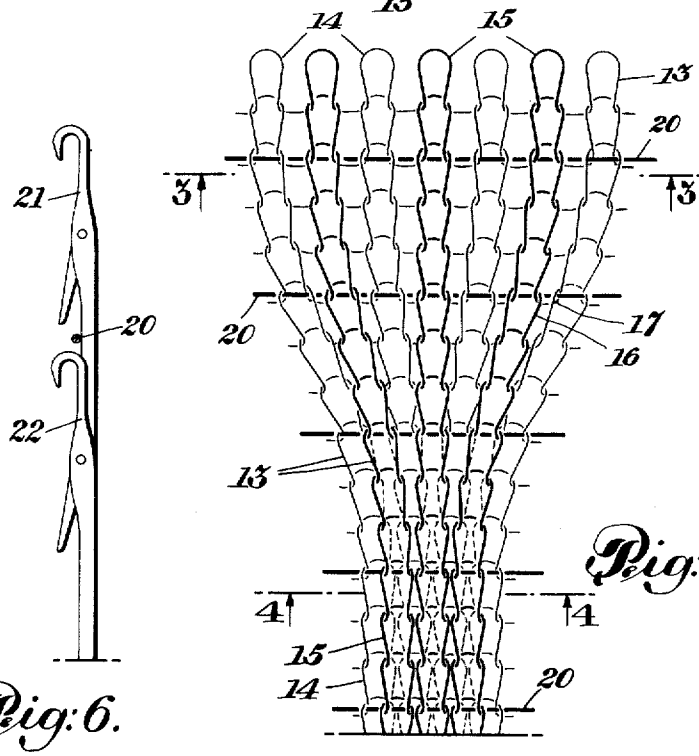


Fig. 5.

Fig. 6.

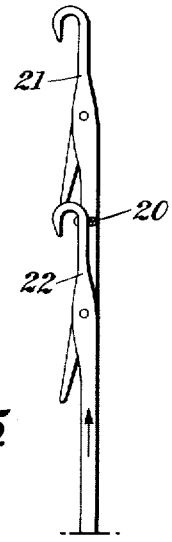


Fig. 7.

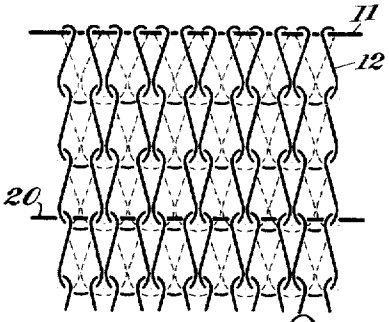


Fig. 8.

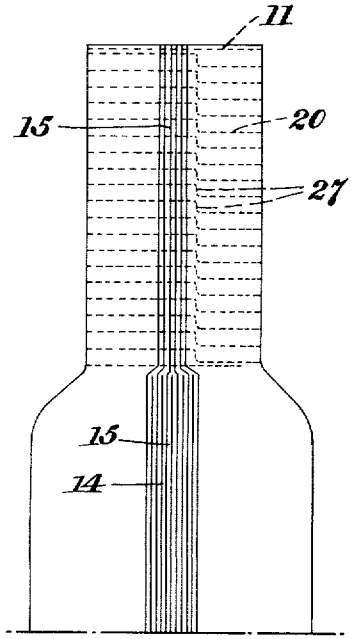
INVENTOR
James L. Getaz
BY
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ATTORNEY

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KNITTING MACHINE

Original Filed Dec. 10, 1935 3 Sheets-Sheet 3

Fig. 10.



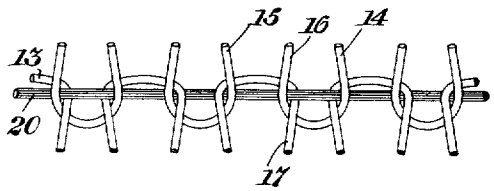


Fig. 11.

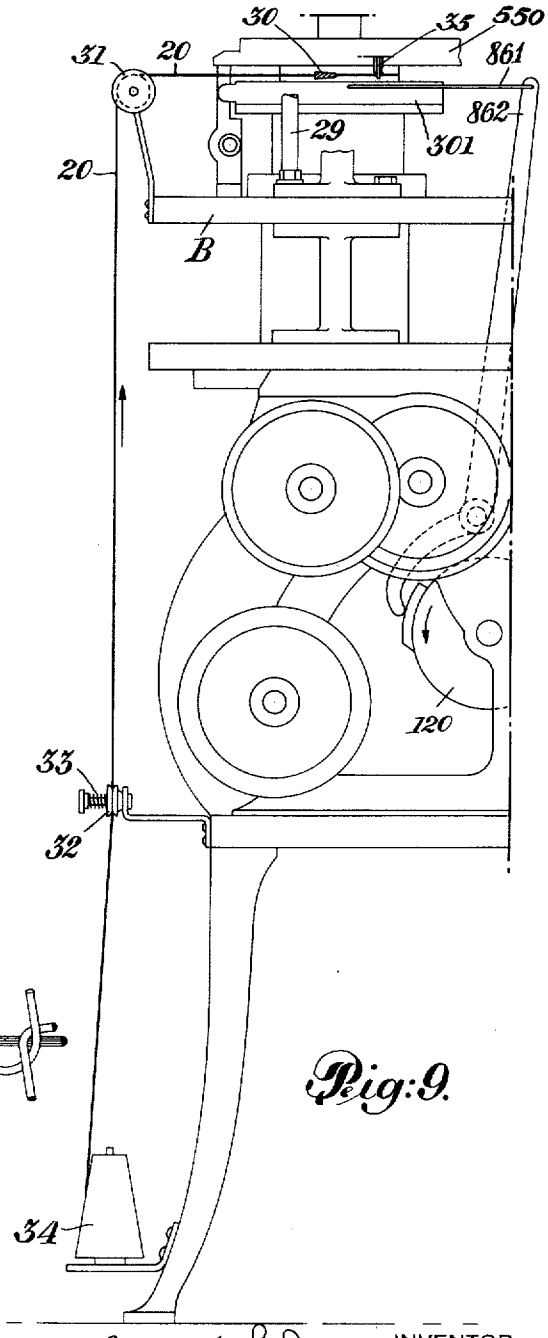


Fig. 9.

INVENTOR

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Patented June 6, 1939 2,161,250

UNITED STATES PATENT OFFICE

2,161,250

KNITTING MACHINE

James L. Getas, Maryville, Tenn.

Original application December 10, 1935, Serial No. 53,824. Divided and this application May 4, 1937, Serial No. 140,587

3 Claims. (Cl. 66—9)

This invention relates to knitting machines for forming seamless hosiery made of plain fabric and more particularly hosiery having elastic threads incorporated in the fabric along with inelastic body threads to support the stocking or sock on the leg. One of the objects of the invention is to produce a smooth flat fabric which will look like rib fabric, and another object is to produce a weltless, seamless stocking which will have a non-curling selvage. Another object is to produce such weltless stocking in an economical manner, starting up from the bare needles. It is characteristic of a stocking made in accordance with this invention that it is contracted by the elastic so that the wales are drawn together alternately on the back and front of the fabric, giving a flat surface similar to one and one rib fabric.

This application is a division of my application for Letters Patent of the United States, Serial Number 53,824, filed December 10, 1935.

In the drawings,

Figure 1 is a development of part of the knitting wave and knitting cams of a circular knitting machine embodying my invention, showing how the two yarns are fed to the needles;

Figure 2 is a plan view corresponding to Figure 1, showing the needle circle and the manner in which the elastic yarn is fed to the needles and drawn out of action, the small arrow indicating the knocking-over point;

Figure 3 is a diagrammatic horizontal section through fabric made in accordance with my invention, taken on the line 3—3 of Figure 5, the fabric being shown in an expanded state;

Figure 4 is a diagrammatic horizontal section on the line 4—4 of Figure 5, showing the fabric in its normal or contracted state;

Figure 5 is a diagrammatic illustration of the interlooping of the yarns in a fabric made in accordance with my invention, the upper portion of this figure showing the fabric as it lies on the needles, and the lower portion showing the fabric contracted with its normal or one and one rib appearance;

Figure 6 is a side elevation of two needles showing the position of the rubber yarn as it lies against the shank of the elevated needle;

Figure 7 is a view similar to Figure 6 showing the lower needle partly raised so as to drive the elastic yarn behind the hook of the lower needle;

Figure 8 is a diagrammatic view of the interlooping of the yarns in the novel anti-ravel selvage of my stocking;

Figure 9 is a view in elevation of sufficient of the left side of a seamless hosiery knitting machine to show the mechanism for controlling the elastic yarn;

Figure 10 is a diagrammatic outline showing the appearance of the back of the upper portion of a man's hose embodying my invention; while

Figure 11 is an enlarged diagram of the interlooping in part of a course where the elastic yarn is present, the fabric being expanded.

The stocking will be described and shown as a man's half hose, but it should be understood that it is equally applicable to any other kinds of hosiery. In making stockings or socks which have some elastic element incorporated in them to maintain the sock in position on the leg, difficulty is encountered in producing an article having a satisfactory appearance. My novel stocking is a weltless one, that is to say, the top of the sock or stocking is of a single thickness. It is begun on the bare needles, makes an anti-ravel of its own and produces a top or cuff having the appearance of smooth flat one and one rib fabric such as is usually found in a man's sock,—all this being done on a single set of needles.

In the case of my novel stocking there is an interlaced or anti-ravel elastic yarn 11 exercising tension on the fabric and tending to contract it. The actual interloopings of the selvage are somewhat similar to those in the Robert W. Scott Patent No. 1,148,056, dated July 27, 1915, but the fabric is sharply contracted laterally by the elastic tension. The first looped course 12 in the top will preferably be made of inelastic yarn, although it can be made of elastic yarn if desired. The anti-ravel yarn 11 lies in the loops of course 12. In general I find it desirable to use elastic yarn in the top only at intervals. After making the anti-ravel 11 of an elastic yarn, I find it preferable with most elastic yarns in ordinary socks not to insert elastic again until say the second or third course of loops in the top. Thereafter the elastic can be introduced at the same interval repeatedly throughout the portion of the stocking where desired. Thus it can be put in the top, the top and leg, or the top, leg and foot, or any part thereof.

The ordinary inelastic yarn 13 is knit in the regular manner while the elastic yarn is fed in differentiated manner to alternate needles. In no wale is the elastic yarn knitted in as distinguished from laid in, floated, or tied in.

In my invention, I tie in the elastic yarn in every alternate wale 14 on the back of the fabric and float it in the adjacent or intervening wales 15, repeating this procedure all the way around

the stocking. Thus the elastic yarn 20 is incorporated in the fabric by interlacing on the inside of the fabric in every second wale. It is thus attached by catching it in between the legs of the needle wales 16 in successive courses with the tops of the adjacent sinker wales 17 going around the elastic. It might be noted that in Figure 5 the top of the figure is knit last. I am careful to feed the elastic yarn in under a heavy tension sufficient to contract the fabric until it resembles rib fabric. In the absence of sufficiently heavy tension my fabric is not produced. I find that by thus alternately tying in and laying in the elastic yarn under adequate tension, the fabric is contracted so that the wales in which the elastic yarn is free are drawn to the front of the fabric and the wales in which the elastic yarn is tied in are drawn to the back of the fabric and buried out of sight. In this way a neat, smooth and even appearance is given to the fabric without all the difficulties and complexities of a rib knitting machine. I also find that this structure with the elastic yarn alternately tied and floated in successive wales, when combined with the elastic yarn as the anti-ravel yarn at the beginning, produces a structure which is of such a nature that the tendency of the ordinary fabric edge to curl is very much reduced. This may be due partly to the fact that the elastic yarn tends to make the plain fabric assume the wale positions of rib fabric, and partly to the contraction or tension of the elastic yarn itself. It should also be noted that in order to change the fabric from the elastic rib top type of structure to the plain fabric of the ordinary leg or foot, it is necessary merely to withdraw the elastic yarn. In other words, the total number of wales in the fabric is not changed; it is not necessary to make any transfer from one needle to another. It is merely necessary to withdraw the yarn finger which is feeding the elastic yarn. It will be obvious, of course, that if desired the imitation rib fabric containing the elastic yarn in say every third course can be continued throughout the leg until the heel is reached; or if desired it can also be continued down to the foot.

Any circular knitting machine having cylinder needles with selectivity as between successive needles can be adapted to make this sock or stocking. Thus the well-known Scott & Williams type of revolving needle cylinder machine, such as shown for instance in the United States Letters Patent to Robert W. Scott 1,152,850, dated September 7, 1915, can be adapted to do this work by the addition of mechanism for feeding and tensioning the rubber yarn and adjusting the knitting cams properly.

The preferred method of feeding the elastic yarn is by means of a finger 30 pivoted on a post 29 on the bedplate B to move in a horizontal plane just above the sinker cap 301 below the latch ring 550 (Fig. 9) into and out of operative relation with the cylinder needles 21, 22. In this case the delivery end of the rubber yarn finger 30 passes between the latch ring and sinker ring, and applies the rubber yarn 20 at a point on the needle circle which is just after the crest of the cam 366 raising the jacks 381 which lie under alternate needles. It will be the needles 21 with jacks which have the rubber yarn laid against their shanks. The elevation of the rubber yarn feeding finger is such that the needles 21 with jacks are raised until their latches are above the rubber yarn, so that as those needles are drawn down the yarn will be laid in but not knit in. If desired, this raising of the jack needles 21 can take place prior to passage by the switch cam (not shown), that is to say, between the customary widening pick and the stitch cam. Shortly after the elastic yarn is laid against the raised needles 21, below their latches, the jackless needles 22 rise on the camming edge of the leading stitch cam 361 and interlace the rubber yarn by passing in front thereof. With this manipulation all the needles reach the drawdown cam 360 at the same level.

In starting up the sock from the bare needles with the elastic yarn laid in front of and behind the needles alternately in advance of the throat plate 560 as above described, the feeding of the rubber yarn commences slightly before the feeding of the non-elastic yarn in the throat plate in order that the first needle to which the elastic yarn is fed may reach the throat plate before the non-elastic yarn begins to feed. In starting up the sock from the bare needles, the elastic yarn will ordinarily be held in the clamp, indicated at 35, which is located between the feeding point of the yarn finger 30 and the throat and sufficiently in advance of the yarn finger so that when the yarn finger is in feeding position the yarn will be laid against the shanks of the raised needles below their latches, as above described, and the jackless needles rise and interlace the elastic yarn by passing in front thereof. The friction of the needles with the interlaced yarn will carry the yarn along toward the throat and remove the end from the clamp 35, thus enabling the starting up to be effected automatically, as will be readily understood. In order to get this advanced action of one of the yarn feeds, special movements can be obtained from either the main pattern drum or an auxiliary drum. In the drawings the abnormally early movement of the rubber yarn finger 30 is obtained by means of a link 861 connected to a pivoted lever 862 operated by a cam surface on the main pattern drum 120. By feeding the elastic yarn 20 to the needles as described and simultaneously feeding the non-elastic yarn 13 to the hooks of the needles in a normal manner—all in one and the same course—the anti-ravel startup construction described is obtained. This quick and simple manner of obtaining an anti-ravel elastic edge at the upper end of a weltless stocking is not per se claimed herein, as it forms the subject matter of Letters Patent of the United States No. 2,054,217, granted to me September 15, 1936, upon an application Serial No. 59,125, filed January 14, 1936, which is a division of my original application Serial No. 53,824, filed December 10, 1935.

The use of elastic yarn for the anti-ravel, in combination with the use of elastic yarn in subsequent courses, as will now be described, produces the much constricted fabric of my novel top. However, it should be noted that in order to produce this novel top it is necessary that the tension on the elastic yarn as it is fed into the machine be above a certain minimum and that the elastic be incorporated in a special manner. The tension must be great enough to pull the wales together till they give the appearance of rib fabric.

Turning now to the manipulation of the machine for the courses subsequent to the anti-ravel startup on the bare needles, I have discovered that by using in subsequent courses the same manipulation of the needles and the yarns referred to above in connection with the starting-up course, and maintaining the high tension on

the elastic yarn already referred to, unexpected advantages result. I have discovered that when the elastic yarn is introduced in this manner in a course subsequent to the anti-ravel course, the elastic yarn is entirely hidden on the face of the fabric except when the fabric is stretched to an extreme degree. Thus in the alternate wales 15 knit on those needles 21 where the elastic yarn 20 is laid in front of the shanks, the elastic yarn is floated and as the fabric turns over down into the fabric tube of the machine the elastic yarn floats lie inside the fabric and cover entirely the alternate wales 16 of non-elastic yarn. In those wales 14 where the elastic yarn was laid behind the needles 22, the entire structure is outside the elastic yarn except for the adjacent sinker wales 17 of the wale 14 which go around in back of the elastic yarn, thus tying it in the fabric with the assistance of the adjacent sinker wales 17 of the preceding course. This construction can be seen in Fig. 11 which is a diagram of the interlooping and interlacing in one course as seen from the front of the fabric while it is extended.

The elastic yarn is fed into the machine with a high tension such that as the fabric moves away from the needles down the fabric tube the fabric contracts to a normal state in which the one and one rib appearance already described occurs. In this normal contracted condition it is the alternate wales 15 which were knit on the needles where the elastic yarn was laid in front of the needles, which will form the face of the fabric, and the intervening wales 14 knit on the needles where the elastic yarn was laid in back of the shanks lie buried in the rear of the fabric.

The elastic yarn can if desired be floated from course to course until it is time for its re-introduction, thus making the elastic yarn continuous throughout the portion of the fabric where it is present. This is indicated at 27 in Fig. 10. In this case the periodic introduction of the elastic yarn is obtained by manipulation of the needles. The elastic yarn finger 30 is kept in its operative position. Thus in a course where the elastic yarn is to be present, every jack needle 21 is raised before reaching the elastic yarn finger 30, and in courses where the elastic yarn is not to be present, no needles are raised until a point subsequent to the position of the elastic yarn finger is reached. In this connection it should be noted that the normal level for the tops of the needles at a point opposite the elastic yarn finger is below such finger so that unless a needle is specially raised by a jack it will pass the rubber yarn finger without taking the yarn.

In view of the great amount of the tension, it is very important that the tension be uniform at all times while the rubber yarn is being introduced and particularly so at the time that the stocking is being started. In some cases it is desirable for more tension to be used in the starting-up of the stocking than in the subsequent courses where the elastic yarn is present, but in any case the tension must be absolutely controlled. Under ordinary practice, the tension is maintained uniform at all times, and since it is important that the tension in the first course of the stocking be approximately the same as the tension on the elastic yarn in the last course in which it is present, it is important that there be no "creeping" of the rubber yarn toward the finger while the yarn is not feeding. The slightest variation therein will either cause a lack of uniformity in the stocking or a change in the width of the stocking. To minimize any such variations in tension, I prefer to place the tensioning means a considerable distance from the point at which the elastic yarn is fed to the needles. For this purpose, I lead the elastic yarn to a point near the floor when using an elastic yarn which is covered, i. e., lastex or any other elastic yarn which has an inelastic covering. To reach this position near the floor, the elastic yarn, shortly after leaving the elastic yarn finger, crosses over a roller 31. One kind of tensioning means which I find suitable for this work is the so-called "button" or "disk" tension. This consists of two disks 32 pressed together lightly by an adjustable compression spring 33. Slight changes in the pressure on the disks by this compression spring make a considerable difference in the width of the stocking or sock being knit by the machine. I also find it essential that there be substantialy no tension on the elastic yarn between this disk tension and the elastic yarn supply 34. In order to insure this I can use a ballooner, to be sure that the elastic yarn will not hang or stick on the comb or bobbin from which it is coming.

Where the elastic yarn is an uncovered one it is sometimes desirable to provide the tension by leading the elastic yarn around a reel or circular disk and putting a frictional brake on this reel. In this case, I also prefer to use a takeup similar to that used for the heel and toe of the stocking in order to take up the slack in the elastic yarn when it is not being fed into the machine. By the use of this takeup, in addition to the reel with the friction brake thereon, the tension of the elastic yarn when first introduced at the beginning of the stocking is uniform with the tension of the yarn as it is fed in in subsequent courses. The reel with the brake thereon prevents the rubber from crawling while the elastic yarn is not feeding to the machine, the crawling of course tending to reduce the tension on the yarn when it is first fed into the stocking. When that portion of the stocking or sock is completed where the elastic yarn is used, the elastic yarn is thrown out of action by withdrawing the yarn finger radially. This radial withdrawal throws the rubber yarn into a clamp 35 carried on the head of the machine and lying above the sinker cap between the throat plate and the yarn finger 30, this clamp holding the thread until the next stocking is started. If desired, and I find it preferable, the clamp may include a knife for cutting the elastic thread between the clamp and the needle cylinder, or if desired the clamp may hold the elastic yarn and allow it to break as the subsequent knitting operations increase the tension on the elastic yarn.

As already mentioned, the elastic yarn may be fed in every course, or upon the completion of the first course may be omitted and introduced in the second, third or any other desired number of courses in regular sequence or order. It is essential, however, that its introduction be at every other needle so that it lies in one wale and is floated in the next, so that owing to the tension of the elastic yarn the wales are pushed laterally and brought to the position that they would assume if the fabric was rib. It will be seen that the yarn feeding finger 30 is located entirely outside of the needle cylinder, and that the feeding portion thereof is movable toward and from the cylinder with a radial component of movement, thus avoiding any interference with the location of additional yarn feeding mechanism on the interior of the cylinder, which is customary in many types of

circular knitting machines. Furthermore, the yarn feeding portion of the finger 30, when in operative position, delivers the yarn against the shanks of the raised needles just above the sinker ring 301 and between it and the latch ring 550, at which point the shanks of the needles below the latches of the raised needles will be exposed, thus facilitating the interlacing of the elastic yarn in the manner described and the removal of the end of the yarn held in the clamp 35 in starting up on bare needles.

Where in this specification the words "elastic yarn" are used, it should be understood that they include any resilient yarn, such for instance as rubber, lastex, etc. Where the specification refers to "alternate needles", every other needle is meant.

The fabric and articles of hosiery herein described are not claimed herein, as they form the subject matter of my aforesaid original application Serial No. 53,824, filed December 10, 1935.

The improvements in process of knitting herein described for the production of the fabric and articles of hosiery herein described are not herein claimed as they form the subject matter of a separate application for Letters Patent of the United States, filed July 13, 1937, Serial No. 153,329, which said application is also a division of my application Serial No. 53,824, filed December 10, 1935, hereinbefore referred to.

What I claim is:

1. A seamless knitting machine having a single circular series of independently operable needles, knitting cam mechanism for knitting plain knit fabric on all the needles of the machine, a throat plate provided with means for feeding inelastic yarn to the hooks of all the needles, a feeding finger having a yarn feeding part located in advance of the throat plate and movable into and out of operative position, for feeding an elastic yarn to the needles, means for raising selected needles adjacent to said finger to receive the elastic yarn below the latches thereof, means located between said yarn finger and the throat for raising the remaining needles in front of the yarn fed by said finger and interlacing said yarn with the needles, the friction of the needles with the interlaced portions of the elastic yarn enabling the needles to carry said yarn past the throat plate and knitting cam mechanism, and permitting the starting of knitting on bare needles, and means for moving said finger into and out of operative position.

2. A seamless knitting machine having a single circular series of independently operable needles, knitting cam mechanism for knitting plain knit fabric on all the needles of the machine, a throat plate provided with means for feeding inelastic yarn to the hooks of all the needles, a feeding finger having a yarn feeding part located in advance of the throat plate and movable into and out of operative position, for feeding an elastic yarn, means for raising selected needles adjacent to said last mentioned finger to receive the elastic yarn below the latches thereof, tension means for applying tension to said elastic yarn sufficient to force alternate wales of the fabric to one face thereof and intervening wales to the opposite face thereof, means located between the yarn finger and the throat for raising the remaining needles in front of the elastic yarn fed by said finger, and interlacing it with the needles, the friction of the needles with the interlaced portions of the elastic yarn enabling the needles to carry said yarn past the throat plate and knitting cam mechanism, against the retarding action of said tension means.

3. A seamless knitting machine having a single circular series of independently operable needles, knitting cam mechanism for knitting plain knit fabric on all the needles of the machine, a throat plate provided with means for feeding inelastic yarn to the hooks of all the needles, a feeding finger having a yarn feeding part located in advance of the throat plate and movable into and out of operative position, for feeding an elastic yarn, means for raising selected needles adjacent to said last mentioned finger to receive the elastic yarn below the latches thereof, tension means for applying tension to said elastic yarn sufficient to force alternate wales of the fabric to one face thereof and intervening wales to the opposite face thereof, means located between the yarn finger and the throat for raising the remaining needles in front of the elastic yarn fed by said finger, and interlacing it with the needles, the friction of the needles with the interlaced portions of the elastic yarn enabling the needles to carry said yarn past the throat plate and knitting cam mechanism, against the retarding action of said tension means, and a yarn clamp located at a sufficient distance in a direction towards the throat plate from the position of said finger when in operative position to lay the elastic yarn between it and said finger around the outside of a sufficient number of said selected raised needles to provide sufficient friction on the interlaced portions of the needles when the remaining needles are raised to overcome the tension on the elastic yarn and insure its removal from the yarn clamp when held therein.

JAMES L. GETAZ.

Disclaimer

2,161,250.—*James L. Getaz*, Maryville, Tenn. KNITTING MACHINE. Patent dated June 6, 1939. Disclaimer filed July 13, 1950, by the assignee, *The Davis Company*.

Hereby enters this disclaimer to claims 1 to 3, inclusive, of said patent.

[*Official Gazette August 8, 1950.*]

circular knitting machines. Furthermore, the yarn feeding portion of the finger 30, when in operative position, delivers the yarn against the shanks of the raised needles just above the sinker ring 301 and between it and the latch ring 550, at which point the shanks of the needles below the latches of the raised needles will be exposed, thus facilitating the interlacing of the elastic yarn in the manner described and the removal of the end of the yarn held in the clamp 35 in starting up on bare needles.

Where in this specification the words "elastic yarn" are used, it should be understood that they include any resilient yarn, such for instance as rubber, lastex, etc. Where the specification refers to "alternate needles", every other needle is meant.

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2. A seamless knitting machine having a single circular series of independently operable needles, knitting cam mechanism for knitting plain knit fabric on all the needles of the machine, a throat plate provided with means for feeding inelastic yarn to the hooks of all the needles, a feeding finger having a yarn feeding part located in advance of the throat plate and movable into and out of operative position, for feeding an elastic yarn, means for raising selected needles adjacent to said last mentioned finger to receive the elastic yarn below the latches thereof, tension means for applying tension to said elastic yarn sufficient to force alternate wales of the fabric to one face thereof and intervening wales to the opposite face thereof, means located between the yarn finger and the throat for raising the remaining needles in front of the elastic yarn fed by said finger, and interlacing it with the needles, the friction of the needles with the interlaced portions of the elastic yarn enabling the needles to carry said yarn past the throat plate and knitting cam mechanism, against the retarding action of said tension means.

3. A seamless knitting machine having a single circular series of independently operable needles, knitting cam mechanism for knitting plain knit fabric on all the needles of the machine, a throat plate provided with means for feeding inelastic yarn to the hooks of all the needles, a feeding finger having a yarn feeding part located in advance of the throat plate and movable into and out of operative position, for feeding an elastic yarn, means for raising selected needles adjacent to said last mentioned finger to receive the elastic yarn below the latches thereof, tension means for applying tension to said elastic yarn sufficient to force alternate wales of the fabric to one face thereof and intervening wales to the opposite face thereof, means located between the yarn finger and the throat for raising the remaining needles in front of the elastic yarn fed by said finger, and interlacing it with the needles, the friction of the needles with the interlaced portions of the elastic yarn enabling the needles to carry said yarn past the throat plate and knitting cam mechanism, against the retarding action of said tension means, and a yarn clamp located at a sufficient distance in a direction towards the throat plate from the position of said finger when in operative position to lay the elastic yarn between it and said finger around the outside of a sufficient number of said selected raised needles to provide sufficient friction on the interlaced portions of the needles when the remaining needles are raised to overcome the tension on the elastic yarn and insure its removal from the yarn clamp when held therein.

JAMES L. GETAZ.

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