

April 30, 1940.

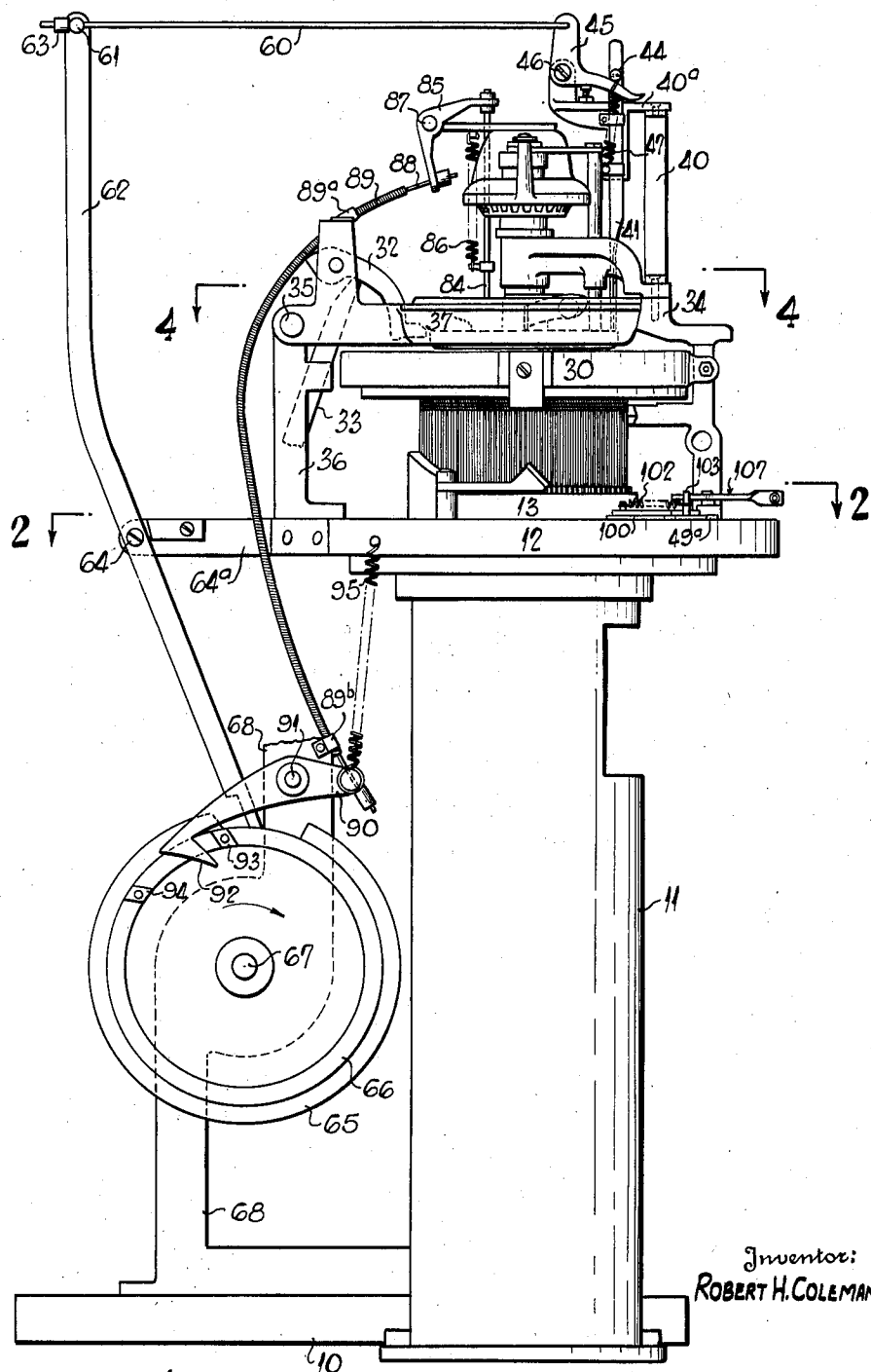
R. H. COLEMAN

2,199,302

KNITTING MACHINE

Filed Nov. 17, 1936

7 Sheets-Sheet 1



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Fig. 1

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KNITTING MACHINE

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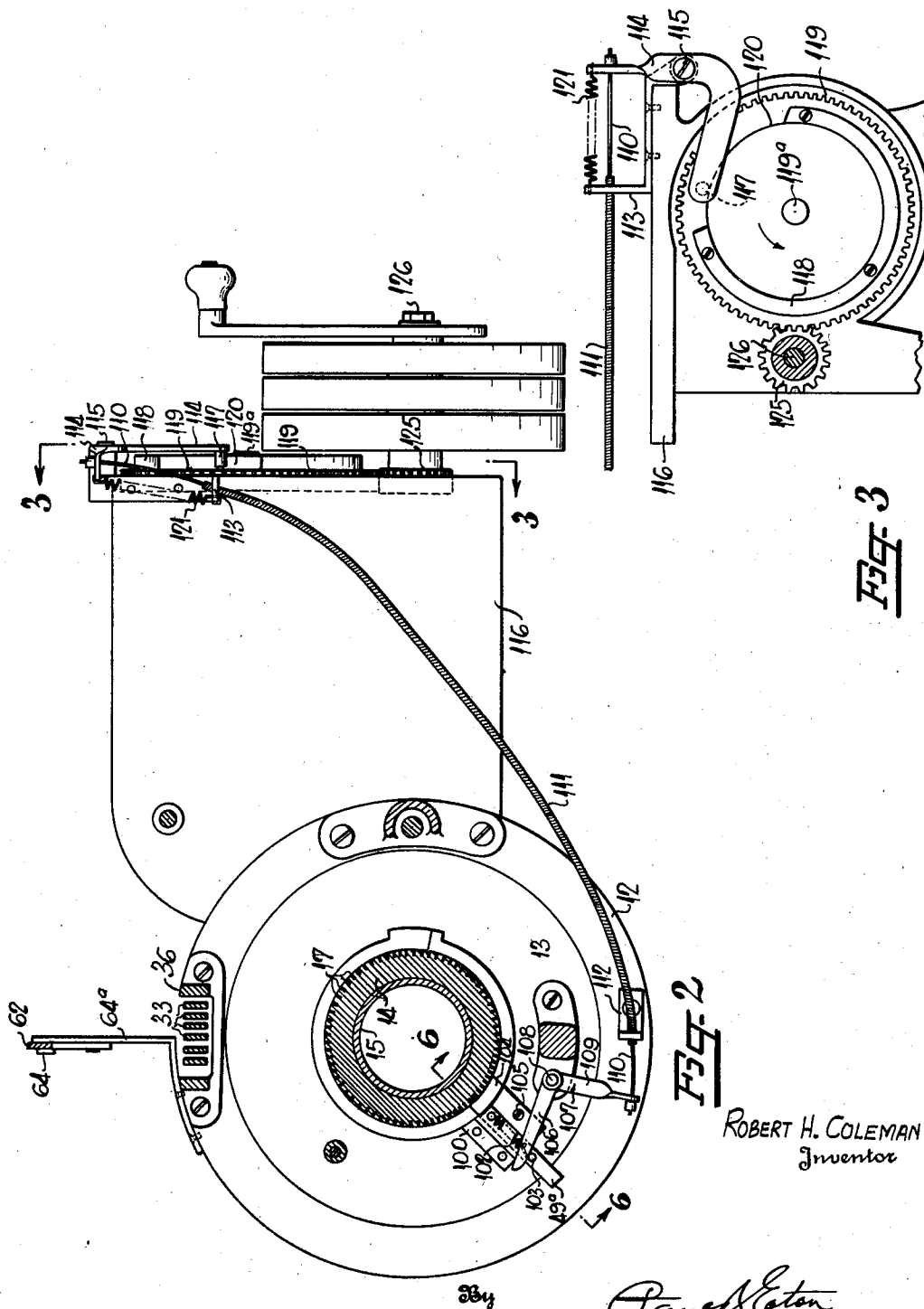


Fig. 3

Fig. 2

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KNITTING MACHINE

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7 Sheets-Sheet 3

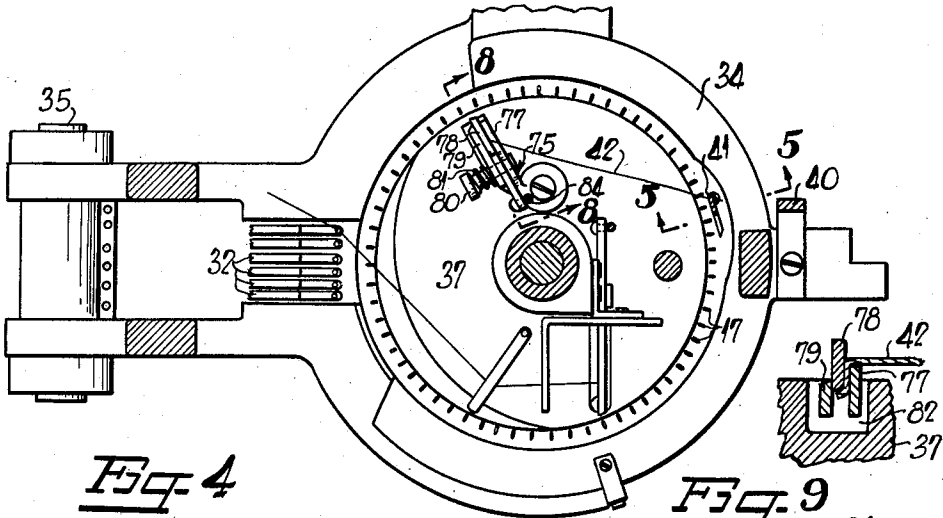


Fig. 4

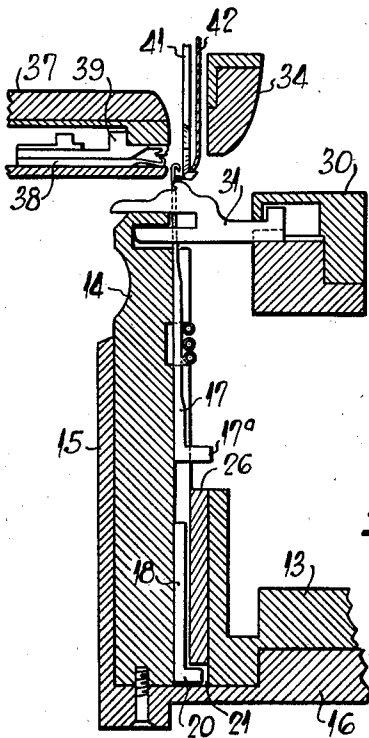


Fig. 5

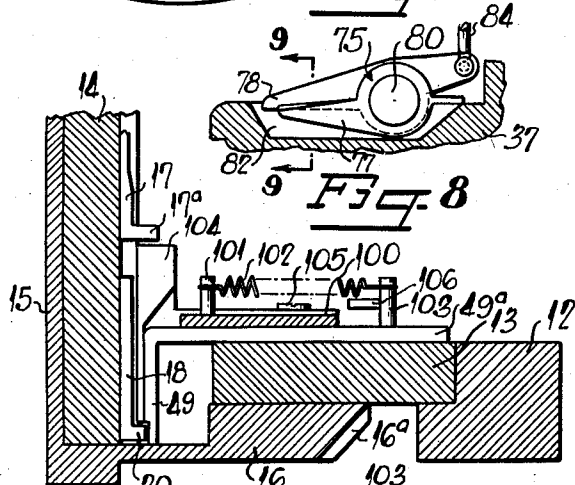


Fig. 6

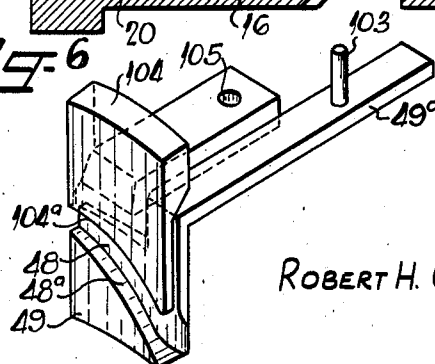


Fig. 7

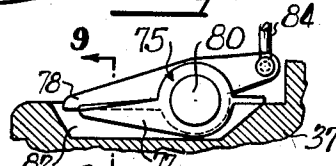


Fig. 8

Fig. 9

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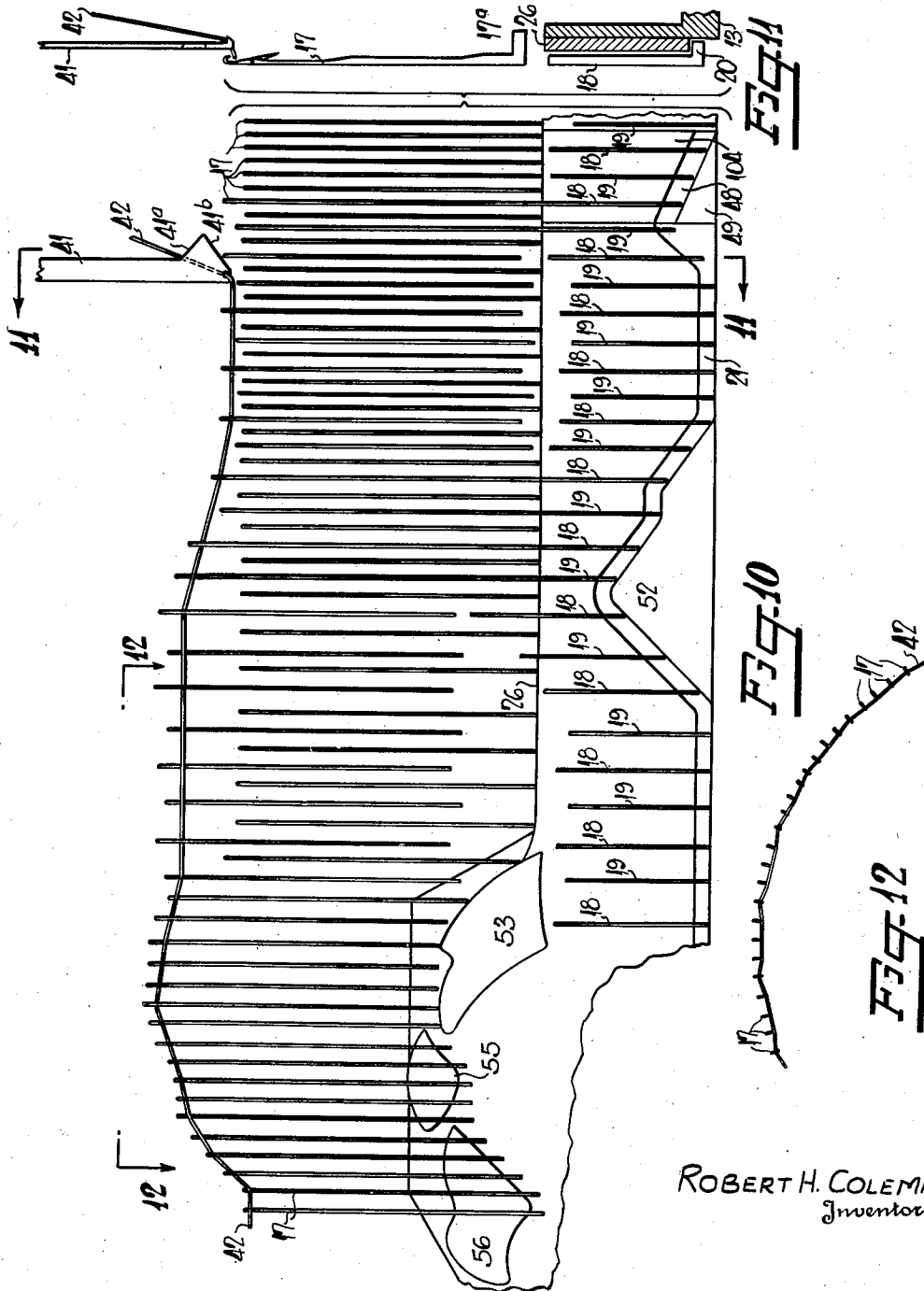
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KNITTING MACHINE

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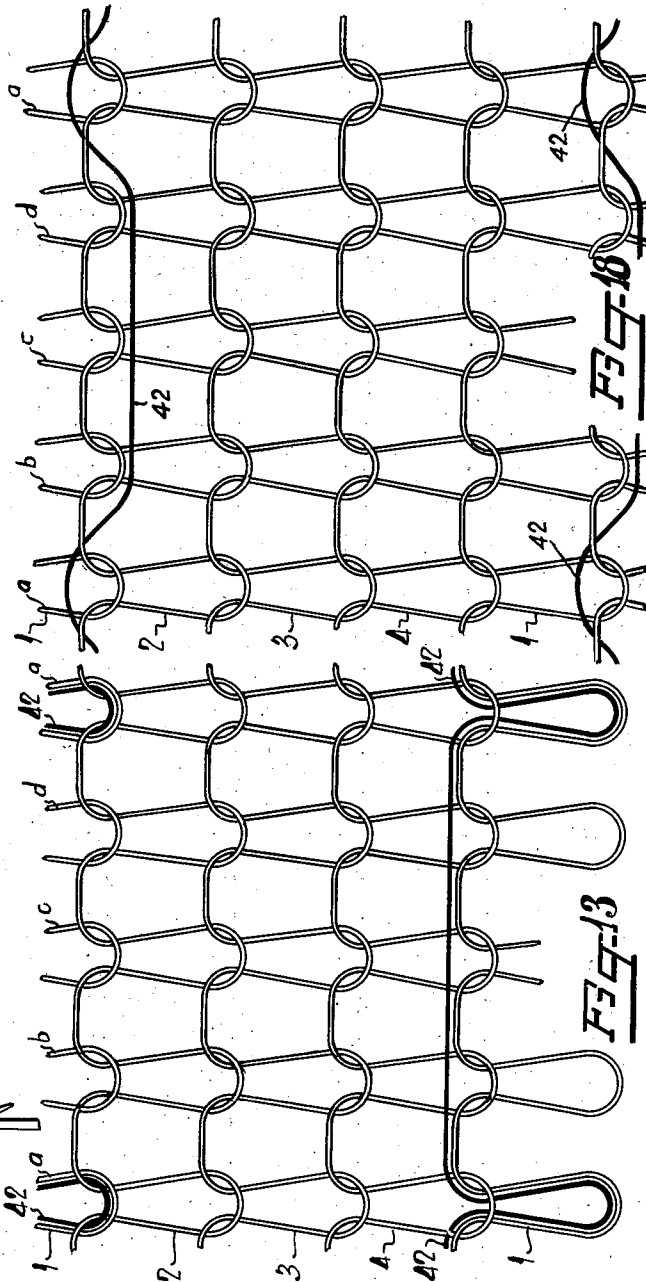
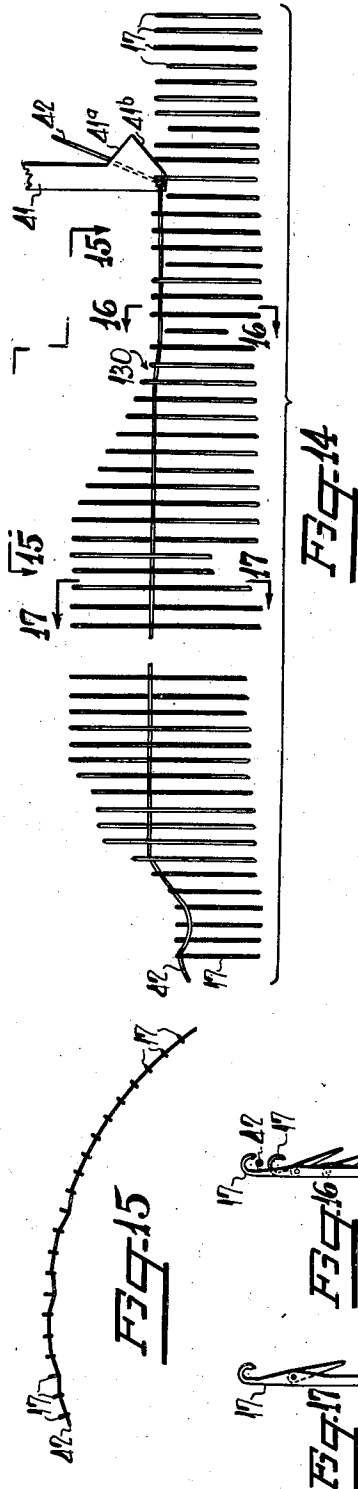
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KNITTING MACHINE

Filed Nov. 17, 1936

7 Sheets-Sheet 5



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KNITTING MACHINE

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7 Sheets-Sheet 6

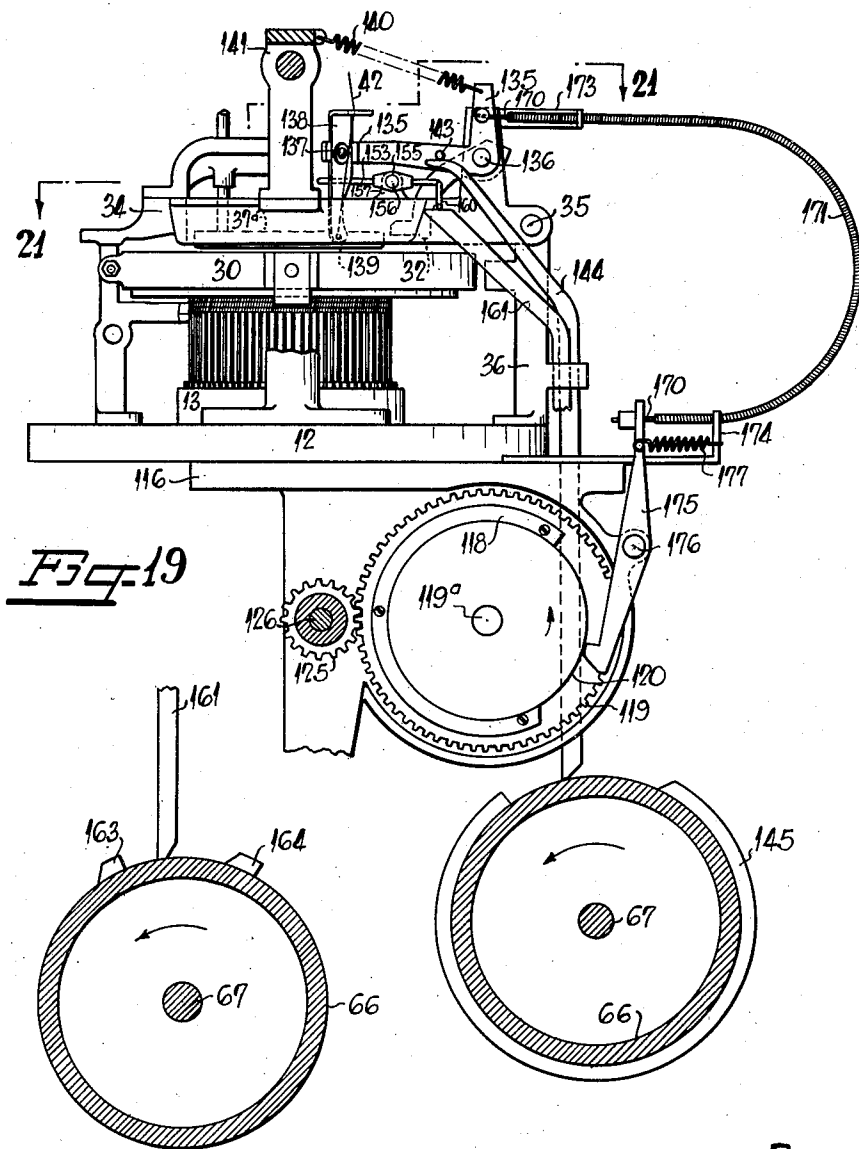


Fig. 19

Fig. 20

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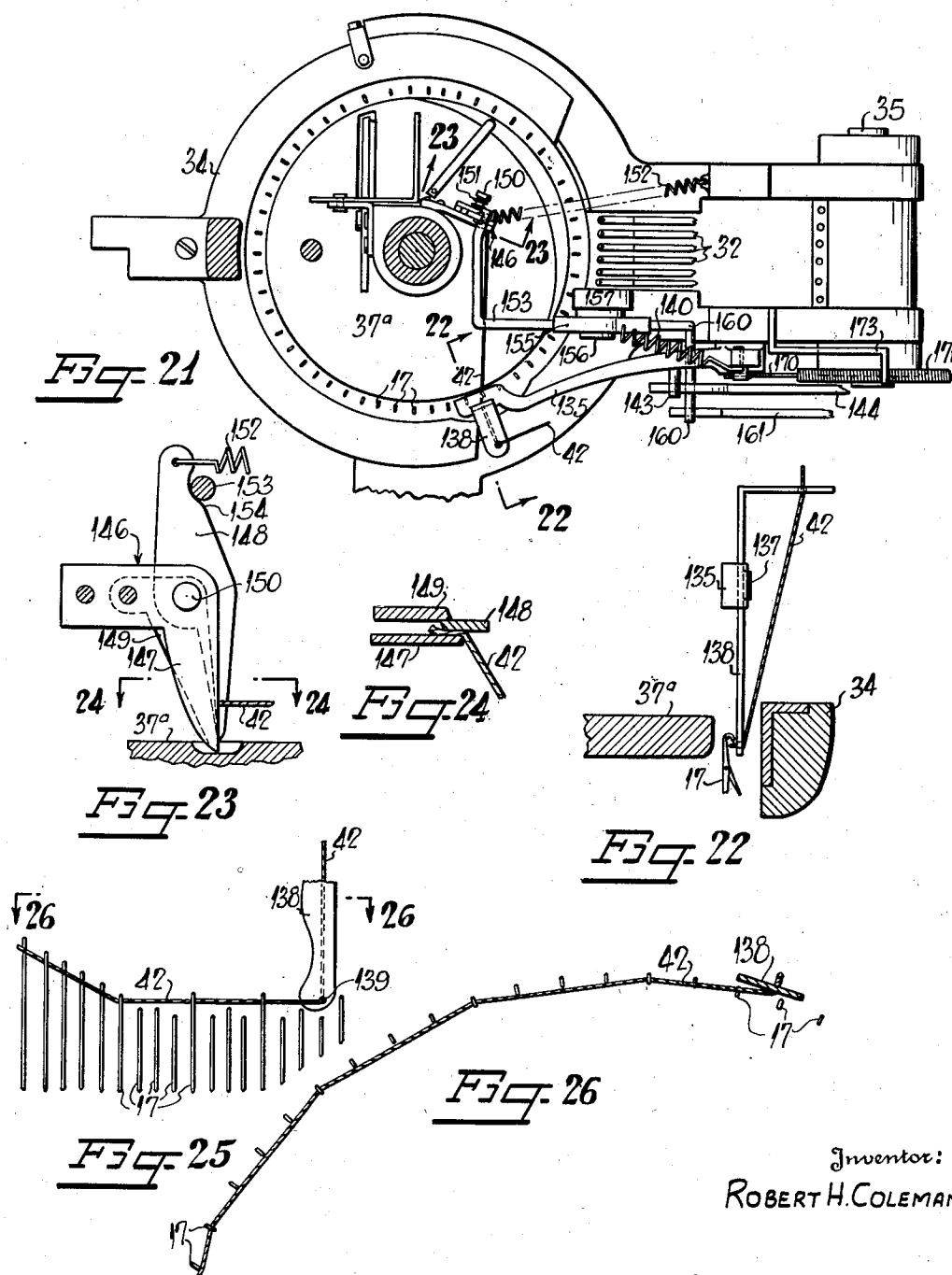
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KNITTING MACHINE

Filed Nov. 17, 1936

7 Sheets-Sheet 7



UNITED STATES PATENT OFFICE

2,199,302

KNITTING MACHINE

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by mesne assignments, to Scott & Williams,
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setts

Application November 17, 1936, Serial No. 111,308

12 Claims. (Cl. 66—8)

This invention relates to a knitting machine and more especially to means for laying in and knitting in an elastic strand in selective courses and wales in the top of a stocking to provide a suitable elastic band whereby the stocking is held in elevated position on the leg of the wearer.

Heretofore, it has been possible to knit an elastic strand in the ribbed top portion with all the needles but this takes a great quantity of strand and also decreases the elasticity of the strand on account of its being knitted into the top portion under tension.

Also, an elastic strand has been laid in the top portion of a stocking and onto the loops held by the dial and alternate cylinder needles as shown in my application, Serial Number 757,521 filed December 14, 1934, which resulted in Patent No. 2,062,208, dated November 24, 1936. In order to produce a construction of this type it is obviously necessary to have a machine equipped with dial and cylinder needles. The present invention contemplates laying in an elastic strand so that it will be pulled through the loops of recurring needles and will be fed to the top portion of the stocking during the knitting of recurring courses. This effect is produced when the dial needles are not in operative position or on a machine which is not equipped with dial needles. As an example, the elastic strand will be floated on the interior of the stocking at three needles or wales and floated on the exterior at the fourth needle or wale. By the term "recurring" where applied to needles, wales, courses and revolutions in the following specification and claims is meant two or more needles, wales, courses or revolutions interspersed among the other needles, wales, courses or revolutions in regular or irregular order.

It is therefore, an object of this invention to provide an attachment for knitting machines having cylinder needles only whereby the elastic strand or thread may be pulled through the loops at selected needles and also fed to the needles on selected courses during the knitting of a stocking.

It is a further object of this invention to provide an attachment for knitting machines which is capable of feeding an elastic strand or thread to selected needles on a knitting machine using only the cylinder needles, with means for knitting in said elastic strand or thread by said selected needles and means for floating the other portions of the strand on the interior of the stocking at the other intermediate needles.

In the drawings, showing the preferred form

of the invention, dial and cylinder needles have been shown, but it is to be understood that the dial needles are not employed while the top portion of the stocking is being knitted with the elastic strand. It frequently occurs, however, that a ribbed stocking is desired to be knitted after the elastic top has been completed, hence the dial and cylinder needles will be necessary in order to complete a stocking of this type.

It is a further object of this invention to provide apparatus on an automatic knitting machine, equipped with cylinder needles and dial needles, whereby an additional strand can be knitted into the stocking being fabricated on the machine, at selected recurring wales and selected recurring courses, the dial needles being inoperative.

This application is a continuation in part of my application, Serial Number 757,521, filed December 14, 1934, maturing on November 24, 1936 into Patent No. 2,062,208.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which:

Figure 1 is an elevation of the upper portion of a knitting machine showing the invention applied thereto;

Figure 2 is a sectional plan view taken along line 2—2 in Figure 1;

Figure 3 is a vertical sectional view taken along line 3—3 in Figure 2;

Figure 4 is a sectional plan view showing the latch ring, dial cap, and cylinder needle circle;

Figure 5 is an enlarged, vertical, sectional view taken along line 5—5 in Figure 4;

Figure 6 is a vertical sectional view taken along line 6—6 in Figure 2;

Figure 7 is an isometric view showing a movable jack cam and its relation to its associated stationary cam;

Figure 8 is an enlarged sectional view taken along line 8—8 in Figure 4 showing the elastic strand cutting and clamping means;

Figure 9 is an enlarged sectional view taken along line 9—9 in Figure 8 and showing an elastic strand cut and clamped therein;

Figure 10 is a developed view looking from the inside of the needle circle showing the arrangement of the needles as the elastic strand is being fed thereto and knitted into the stocking upon every fourth needle;

Figure 11 is a vertical sectional view taken along line 11—11 in Figure 10 showing the rela-

tive position of the needle, the jack and strand feed finger at yarn feeding position;

Figure 12 is a plan view taken along line 12—12 showing the position of the strand prior to the same being knitted in upon every fourth needle;

Figure 13 is an enlarged view looking from the inside of a stocking showing the elastic strand being knit therein upon every fourth wale and upon every fourth course;

Figure 14 is a view similar to Figure 10 but showing a different arrangement of the needles and the elastic strand where the same is being laid in behind the loops of three needles and in front of the loop of every fourth needle;

Figure 15 is a plan view taken along line 15—15 in Figure 14 showing the position of the strand relative to the needles;

Figure 16 is a view taken along line 16—16 in Figure 14 showing the position of the elastic strand of yarn immediately after it has been fed to the needles;

Figure 17 is a view taken along line 17—17 in Figure 14 showing the position of the strand after the needles have raised to a point where the strand is disposed below all of the latches;

Figure 18 is an enlarged view looking from the inside of a stocking and showing the elastic strand after it has been laid in behind the loops of three wales and in front of the loops of every fourth wale and fed to every fourth course of the stocking;

Figure 19 is a view with portions thereof in section, looking at the upper portion of a knitting machine showing a slightly modified form of means for feeding the elastic strand to the needles and knitting the same in at recurring courses and recurring wales;

Figure 20 is a sectional view through the main drum and showing its relation to the push rod which operates the yarn cutting and clamping means;

Figure 21 is a sectional plan view taken along line 21—21 in Figure 19;

Figure 22 is a vertical sectional view taken along line 22—22 in Figure 21;

Figure 23 is a sectional view taken along line 23—23 in Figure 21 showing the cutting and clamping means for the elastic strand.

Figure 24 is a sectional plan view taken along line 24—24 in Figure 23 showing an elastic strand cut and clamped between the cutting and clamping means;

Figure 25 is an elevation looking from the inside of the needle circle showing the position of the needles, the strand feed finger and the elastic strand as it is being fed to the needles so that the strand will be knit upon every fourth needle;

Figure 26 is a sectional plan view taken along line 26—26 in Figure 25.

Referring more specifically to the drawings, the numeral 10 indicates a suitable base portion of the knitting machine which has extending upwardly therefrom a hollow standard 11, said standard having a ring 12 secured to the upper portion thereof. This ring has a cam ring 13 disposed therein, (Figures 2, 5 and 6), in which is adapted to be rotatably mounted a needle and jack cylinder 14. The needle and jack cylinder 14 has the interior portion thereof fixedly secured around an upstanding collar 15 which collar has a gear 16 integral with its lower end having gear teeth 16a, (Fig. 6), for turning the cylinder along with the needles 17 which are disposed therein.

By referring to Figures 5 and 10, it will be seen that the needles 17 are raised or lowered within

the cylinder by means of jacks 18 and 19, the jacks 18 being slightly longer than the jacks 19. Each of these jacks has outstanding butts 20, (Fig. 5), which fit into a suitable groove 21 on the interior of the cam ring 13. It has been common practice heretofore to provide these jacks with short, medium or long butts, depending upon which jacks are desired to be operated by certain movable cams which are adapted to engage these butts at certain intervals in the course of the knitting of a stocking to raise their respective needles. The elevation of the top of the needles 17 is also controlled at certain intervals by means of cams such as 26 which are secured on the interior of the cam ring 13, the top edge of said cams being adapted to be engaged by outstanding butts 17a of the needles 17. As will be seen in the drawings, (Fig. 10) these cams, such as 26, 53, 55 and 56, vary in elevation thereby varying the elevation of the tops of the needles 17, because the butts of these needles will slide along the top edge of these cams.

It is therefore, seen that as the cylinder 14 rotates, the elevation of the tops of the needles 17 will assume various positions depending upon which needles have jacks thereunder and also depending upon the type of cams used within the cam ring 13 for engaging butts 17a. The apparatus is also provided with a conventional sinker ring 30 which has sinkers 31 disposed therein for cooperating with the needles 17 to cause the loops thereon to be shed at the proper time. A latch ring 34 is adapted to rest directly above the sinker ring 30, (Figs. 4 and 6), and this ring is pivoted as at 35 to the bracket 36, said bracket having the lower end thereof secured to the upper portion of ring 12. This ring 34 is adapted to support a conventional dial, such as 37, (Fig. 5), which has dial needles 38 and castoff needles 39 therein; however, it is to be understood that the present invention does not operate while these needles are in operation. It frequently occurs that the dial and cylinder needles are used subsequent to the discontinuance of the feeding of the elastic strand or thread and therefore, are necessary to completely knit the stocking.

Furthermore, a standard automatic knitting machine may be equipped with this apparatus, thus enabling a full automatic machine to be employed for knitting a stocking having the elastic strand knitted at recurring wales and recurring courses. The dial needles are rendered inoperative during the introduction of the elastic strand, by disconnecting the driving mechanism between the machine and the dial needle actuating mechanism.

Latch ring 34 has extending upwardly therefrom a bracket 40 which is adapted to support a second bracket 40a. The bracket 40a has slidably mounted therein a feed finger 41 which introduces an elastic strand or non-elastic strand 42 beneath the hooks of certain needles 17 so that it will be knit in or laid in, depending upon the arrangement of the needles at the time of or after the introduction of the strand. The lower trailing end of feed finger 41 has a heel integral therewith, said heel having beveled surfaces 41a and 41b. These surfaces are provided so as to either completely open or close the latches of any needles which might pass by this finger in an elevated position, since it is evident that any outstanding latch of an elevated needle will engage this heel. This finger is shown and described in my Patent No. 2,062,208 of November 24, 1936.

The upper end of strand feed finger 41 has a pin 44 extending outwardly therefrom, the lower side of which is engaged by the upper cam surface of bell crank member 45, said bell crank member being pivoted as at 46 to the bracket 40a. A tension spring 47 has one end thereof secured to the pin 44 and the other end thereof secured to the lower portion of bracket 40a to normally tend to move the strand feed finger 41 to a lowered feeding position, as shown in Figures 1 and 5. When in this lowered position, (Figs. 10 and 11), the elastic strand 42 is fed beneath the hooks of every fourth needle and above the tops of the three intermediate needles.

As has been previously stated, the high needles or every fourth needle 17 has been raised slightly higher than the other needles by long jacks 18 which are placed thereunder. When the outstanding butt of the long jack 18 passes into the inclined groove 48 on the movable jack cam 49 formed by cam surface 48a and the lower cam surface 104a of member 104 which will be described later, the long jack 18 raised, thereby moving upwardly against the lower end of a needle 17 and forcing the needle to an elevated position, (Figs. 2 and 7). The other jacks 19 which are slightly shorter than the jacks 18 also are forced upwardly, but due to the shorter length, their respective needles are not forced up as high as the needles which are disposed above the long jacks 18.

It will also be noted that the remaining needles do not have jacks therebeneath consequently, the butts of these needles will slide directly upon the top of cams 26 or 53 and these needles will not be elevated until a high place in these cams is encountered. As the needles 17 and jacks 18 and 19 move to the left in Figure 10, the outstanding butts of these jacks move along in the groove 21 and when a jack cam 52 is reached, groove 21 ranges upwardly to cause the jacks to move their corresponding needles to an elevated position.

By referring to Figures 10 and 11, it is seen that every fourth high needle receives the strand or thread from finger 41 and holds the same under the hook and above the latch. Before the needles reach the knitting point the intermediate low needles are raised by various cams to the same elevation. When the intermediate needles are pushed upwardly from beneath the strand 42, which is under hooks of every fourth needle 17, the strand is caused to slide over onto the back side of the intermediate needles or to a position toward the interior of the needle circle. In the meantime, the strand is also pushed upwardly to a point so that it will not fall below the latches of the high needles which originally took the strand from the feed finger 41. In other words, after the needles have passed the jack cam 52, the strand 42 is disposed on the outside and beneath the hooks of the high needles which originally received the strand from the feed finger 41 and also behind the needles which are disposed above the short jacks 19. When the needles reach the stitch cam 53, the butts 17a of all of the needles engage this cam and are moved upwardly to the same elevation. This will cause the remaining low needles 17 to move upwardly so that the strand will be disposed at the back of these needles or inside of the needle circle. It should be noted that three of the needles move upwardly from beneath the strand and to a position on the outside thereof, whereas, only one

of the needles is disposed on the inside of the strand.

This upward movement of the three intermediate needles between the high fourth needles which has the strand under their hooks, maintains the strand in an elevated position at a point beneath the hooks and above the latches of the fourth needles which originally received the strand from feed finger 41. The butts 17a of needles 17 then move beneath the cam 55 and then downwardly beneath the knitting cam 56 so as to knit the strand upon every fourth needle and to cause the remaining portion of the strand to float on the inside of the fabric behind the loops formed by the intermediate needles of the body yarn.

Figure 13 shows an enlarged view looking from the interior of a portion of stocking which is knit in accordance with the invention. In this view, the wales a, b, c, and d, are shown and also the courses 1, 2, 3 and 4. The elastic strand 42 is fed from a feed finger 41 to the high needles which knit the wales a. The intermediate low needles are adapted to knit the wales b, c and d, which are disposed between the wales a. Since the elastic strand is located beneath the hooks of the needles knitting the wale a when these needles reach the knitting point, and behind the needles knitting the wales b, c and d, at the knitting point, it is quite evident that the elastic strand will be knitted in together with the conventional top yarn at the wales a, whereas, the elastic strand will be floated behind the loops knit by the needles which knit the wales b, c and d.

In order to provide means for raising and lowering finger 41 to inoperative and operative positions respectively, a suitable link 60 has been secured to the upstanding leg of bell crank member 45 and this link has its other end slidably mounted as at 61 in a pin in the upper portion of lever 62. Collar 63 is fixedly secured on the end of link in order to prevent it from sliding out of pin 61. The lever 62 extends downwardly and is pivoted intermediate its ends as at 64 to bracket 64a, which bracket extends outwardly from the ring 12. The lower end of lever 62 normally contacts the cam 65 of main drum 66 of the knitting machine or the surface of the drum 66, depending upon whether or not the strand feed finger is in strand feeding or non-strand feeding position. This drum is rotatably mounted as at 67 on bracket 68 which is supported by base member 10.

By referring to Figure 1, it is seen that as the main drum 66 rotates in a clockwise manner, the lower portion of lever 62 must either contact cam portion 65 or the exterior of drum 66. When it is in the position shown in Figure 1, the strand feed finger is in a lowered position and the elastic strand is being introduced to the high fourth needles. As this drum continues to rotate the lower end of lever 62 will ride upon cam 65 and be caused to rotate slightly in a counter-clockwise manner about pivot point 64, (Fig. 1). This movement of lever 62 will cause bell crank lever 45 to rotate in a counter-clockwise manner thereby raising the feed finger 41 to a position where the hooks of the elevated fourth needles 17 will not engage the elastic strand. While the lower end of lever 62 is disposed on cam 65, the body, heel, foot and toe portions of the stocking are being knitted. When it is off and resting on the exterior surface of the drum, only the top portion of the stocking

is being knitted in which the elastic strand is desired to be placed.

Prior to the beginning of the knitting of the top portion of a sock in which an elastic strand is desired to be placed, the end of the elastic strand 42 is clamped between a combination clamp and cutting device 75, (Figs. 4, 8 and 9). This device is secured to dial 37 and comprises members 77, 78 and 79, all of which are pivoted together by means of a pin 80 which has a compression spring 81 secured therearound and normally forcing these members together.

Figure 9 shows these members with the strand 42 cut and clamped in position. The members 77 and 78, forming the clamping means, and members 78 and 79 forming the shearing or cutting means. The combination cutting and clamping means has the lower portion thereof disposed in a suitable slot 82 which is cut in the top of dial 37. The movable member 78 extends to the right of pin 80 in Figure 8, and has pivotally secured to the inner end thereof a vertically disposed link 84 which has its upper end secured to one leg of a bell crank 85, (Fig. 1). A tension spring 86 normally tends to hold this member in the position shown in Figures 8 and 9, to cause member 78 to be closed and the strand 42 to be cut and clamped in position.

The lever 85 is pivoted as at 87 and has a down-standing leg which is slidably penetrated by wire 88, said wire being slidably disposed within a tube 89, which tube is supported as at 89a. This tube gives the wire 88 the desired rigidity so that there will be no lost motion in the wire 88 due to deflection or lateral bending. The lower end of wire 88 is secured to one end of a lever 90 which is pivoted as at 91 to the bracket 68. The left-hand end of lever 90 has a cam surface 92 thereon which is adapted to engage cam 93 for releasing the end of the elastic strand after it has once been introduced by the feed finger 41 and also by another cam 94 for opening the combination cutting and clamping means to cut and clamp the strand after the finger 41 has withdrawn the strand from feeding position. A spring 95 has one end thereof secured to the right-hand end of the lever 90 and the other end thereof secured to the ring 12 to normally hold the lever 90 in the position shown in Figure 1.

It is quite evident that when the cam surface 92 engages either the cam 93 or 94 that the lever 90 will be rotated momentarily a slight amount in a clockwise direction in Figure 1, thereby pulling wire 88 downwardly and causing the bell crank lever 85 to rotate in a clockwise manner and thereby force the rod 84 downwardly to open the blade 78. In other words, when the cam surface 92 is disposed upon cam 93 or 94, the blade 78 will be in an open position but immediately when the cam surfaces are moved from engagement with each other, the rod 84 will snap upwardly under the tension of the spring 86 thereby causing the parts of clamp 75 to assume a closed position as shown in Figures 8 and 9.

Means for introducing the strand 42 to the needles has been described as well as means for releasing and clamping the ends thereof at the introduction and withdrawal of the strand. Now the means for elevating every fourth needle upon every fourth course will be described.

Again referring to Figures 10 and 11, it will be seen that if the butts of the jacks 18 did not engage the groove 48, every fourth needle 17

would not be raised to a position where it would engage the elastic strand 42. As has been shown after the strand feed finger 41 has been lowered to operative position it remains in this position while the top of the stocking is knitted and in which the elastic strand is introduced. Since it is only desired to introduce this strand at recurring courses, which, in this instance, is every fourth course, means must be provided whereby these needles will only be elevated by their respective jacks 19 on every fourth course.

In order to accomplish the above result, the movable jack cam 49, (Figures 2, 6 and 7), has been provided with an outstanding leg 49a which leg is slidably mounted within a bracket 100, 15 said bracket being disposed on top of the cam ring 13. Bracket 100 has a pin 101 extending upwardly therefrom to which is secured a tension spring 102, the other end of said spring being secured to a pin 103 extending upwardly 20 from the outstanding leg 49a.

The spring 102 normally holds the movable jack cam 29 in the position shown in Figures 6 and 7, at which time the outstanding butts of the jacks 18 or 19 will ride into groove 48 to cause the jacks 18 or 19 and their corresponding needles to be elevated. A member 104 is fixedly secured to the cam ring 13 as at 105, and the interior lower edge thereof is cut in such a manner that this edge will be substantially parallel 30 to the groove 48 cut within the movable jack cam 49, thereby forming the other side of the groove.

Pin 103, which is disposed in leg 49a, also is engaged by leg 106 of bell crank 107, (Figs. 2 and 6). This bell crank is pivoted as at 108 to the cam plate 13 and has its other leg 109 secured to wire 110, said wire 110 passing through a tube 111. This tube 111 is fixed at each end to brackets 112 and 113 so that the wire 110, which is slidably mounted therein, will have the same rigidity as the tube, thereby causing the wire to act substantially the same as if it were a rigid link.

The other end of wire 110 is secured to the upper portion of lever 114, which lever is pivoted as at 115 to the framework 116 of the knitting machine, (Figs. 2 and 3). The lower end of lever 114 has a pin 117 extending therefrom which is adapted to contact either the cam 118, which is secured to the quartering gear 119, or to contact the arcuate surface 120 which is formed as a part of the quartering gear. A tension spring 121 has one end thereof secured to the upper end of lever 114 and its other end secured to bracket 113 which spring normally holds lever 114 in a position where the pin 117 will either contact the cam ring 118 or the arcuate surface 120.

The quartering gear 119, which is mounted on crank shaft 119a, is adapted to mesh with gear 125 which, in turn, is fixedly secured on main drive shaft 126. Since main drive shaft 126 causes the cylinder of the knitting machine to rotate once for each revolution thereof, or for every course knitted in the stocking, it is necessary for the gear 125 to be exactly one-fourth the diameter of the quartering gear 119, so that during four revolutions of the cylinder, which is equivalent to every four courses of yarn knitted, the quartering gear 119 will rotate exactly one revolution. During this revolution, pin 117 is disposed on top of cam 118 three-fourths of the time, and upon the arcuate portion 120 the other fourth of the time. This means that during the time the three courses are knit, while pin 117 is disposed upon

cam 118, the movable jack cam 49 will be moved to the right in Figures 6 and 7, so that cam face 48a will not engage the butts of the needles jacks 19. However, upon the fourth course, while the pin 117 is resting upon arcuate surface 120 the jack cam 49 will be allowed to move inwardly under the tension of spring 102 so that the groove 48 will be formed. The face 48a of groove 48 will engage the butts of jacks 18 and cause the needles thereabove to be raised to yarn receiving position. In other words, when the pin 117 rides upon the cam ring 118 lever 114 is rotated in a clockwise manner thereby moving the wire 110 to the right in Figures 2 and 3, and at the same time rotating bell crank 107 in a counter-clockwise manner, Figure 2. This, of course, will move the jack cam arm 49a toward the observer in Figure 2, and withdraw cam 48a away from the jacks which are disposed in the cylinder 14 so that the butts of these jacks will not be engaged but will be allowed to move past this point at their normal elevation.

Figures 14 to 18 inclusive, show a slightly modified form of the invention in which the elastic strand is floated on the inside of the loops formed by every fourth needle and at every fourth course and on the inside of the loops formed by the other needles, without its being knitted in by any of the needles. This effect is produced primarily by the arrangement of the needles, but produced with the same feeding apparatus. The strand 42 is introduced by the strand feeding finger 41 as in the preceding form, but the needles 17 have their hooks arranged at slightly different elevations. In other words, high jacks are disposed beneath three of the needles 17 and a low jack is disposed beneath the fourth needle. This means that the strand, as it is fed from feed finger 41, will be engaged by the hooks of the three high needles, whereas, the low needles will not engage this yarn. As the cylinder continues to revolve toward the knitting point, the low fourth needles engage suitable cams and are raised thereby assuming a position on the exterior of the elastic strand as shown in Figure 15. At this time the elastic strand is on the outside of three needles and on the inside of the fourth needle. Due to the fact that four needles are engaging the strand with their exterior surfaces, and only one needle rises upwardly to cause the strand to pass behind the same, the strand 42 is not forced upwardly as in the preceding form, since the upward movement of this fourth needle does not produce sufficient friction to force the strand an appreciable elevation above that at which it was introduced to the needles, consequently, after the needles pass the point 130, in Figure 14, and are caused to rise upwardly by cam means disposed therebelow, the strand 42 will fall beneath the latches of the three needles which originally engaged the strand, (Fig. 17). At the same time the strand will be behind the fourth needle. When the needles reach the knitting point and are lowered below the normal elevation of the strand, it is quite evident that the strand will then close the latches and pass over the top of the three needles which are disposed inside the strand 42 so that the strand will be allowed to move over the tops of the needles and floated on the inside portion of the stocking at these three needles; whereas, the strand which is disposed behind the fourth needle will be disposed on the outside of the loop formed by this particular needle. In other words, the strand will be floated on the inside of the fabric at the wale a of course 1, in

Figure 18 and it will be floated on the inside of the stocking in wales b, c and d, of course 2.

It is quite evident that in case it should be desired to insert the strand 42 into the fabric every other course, then, the quartering gear 119 would have two cams thereon of approximately 90 degrees in length with two spaces of approximately 90 degrees in length between them, and thus the strand would be inserted in the fabric every other course.

Figures 19 to 26 inclusive, show a slightly modified form of attachment for introducing an elastic strand to selected high needles whereby the same is knitted by these high needles and floated on the interior of the stocking at the intermediate needles.

The elastic strand or thread feeding means comprises a bell crank lever 135 which is pivoted as at 136 to the latch ring 34. The horizontally disposed leg of this bell crank has secured thereto as at 137 a feed finger 138, the lower end of said finger having a hole 139 therein through which the elastic strand or thread passes, immediately before it is introduced to the needles. The upper end of member 138 has an outstanding leg which also has a hole therein through which the strand passes after it leaves a cone. The vertical leg of bell crank 135 has a tension spring 140 secured thereto, the other end of this spring being secured to bracket 141 which rises from latch ring 34 to support various attachments of the machine. This spring normally tends to hold the lever 135 and the finger 138 in the feeding position shown in Figures 19, 22 and 25.

By referring to Figure 25 it will be seen that every fourth needle 17 is elevated slightly above the top of the intermediate three needles. The lower portion of the finger 138 is lowered to a position where the eyelet 139 will allow the strand 42 to pass directly beneath the hooks of the high needles. When the intermediate needles rise, the strand will fall behind these needles and be pushed upwardly under the hooks of the original high needles to which the strand 42 was fed. Consequently, when the strand reaches the knitting position the strand 42 will be knit into the fabric at every fourth needle, that is, at the high needles to which the strand was fed, and at the intermediate needles the strand will be floated over behind to the interior of the fabric. In other words, the fabric knitted will be identical in all respects to that shown in Figure 13.

The horizontal leg of bell crank lever 135 has extending therefrom a pin 143, which normally rests upon the upper end of push rod 144. This push rod extends downwardly and has the lower end thereof resting upon the periphery of main drum 66 or upon the cam 145, depending upon whether the finger 138 is lowered to feeding position or elevated to an inoperative position. As the main drum 66 rotates in a counter-clockwise manner in Figure 20, the push rod 144 will rise upwardly when the cam 145 engages its lower end thereby moving the push rod upwardly and rotating the lever 135 in a clockwise manner to raise the lower end of feed finger 138 to a position where the hooks of the elevated needles will not engage the strand passing therefrom.

While the strand feed finger 138 is in an inoperative position the end of strand 42 is clamped in the combination cutting and clamping means 146. This cutting and clamping means is formed of three plates namely, 147, 148 and 149; the portions 147 and 148 constituting the clamping means, whereas, the portions 148 and 149 con-

stituting the shearing or cutting means. These three members are pivoted together by suitable means such as a pin 150 which pin has a compression spring 151 therearound for normally pressing these three plates together. Members 147 and 149 are held in a stationary position, whereas, member 148 is movable and is pivotally mounted around pin 150. The upper end of member 148 has secured thereto one end of tension spring 152 which spring has the other end thereof secured to a portion of latch ring 34. This spring normally tends to hold the clamping and cutting means in closed position as shown in Figures 23 and 24.

The means for opening this cutting and clamping means 146 comprises a rod 153 which is adapted to rest against a suitable cam surface 154 in the right-hand upper portion of member 148. This rod is substantially L-shaped and is secured into block 155, said block being pivoted as at 156 to projection 157 extending upwardly from latch ring bracket 34. Extending from the other end of member 155 is another rod 160 which projects laterally, downwardly, and forwardly so that the lower portion thereof may be engaged by the upper end of push rod 161. This push rod 161 extends downwardly in a similar manner to push rod 144, previously described, and has its lower end normally contacting either the periphery of main drum 66 or the cams 163 or 164, (Figs. 10 and 20). When the top of a stocking, in which elastic strand is placed, is started, the push rod 144 drops downwardly off of cam 145 onto the surface of drum 66. Immediately after this rod falls downwardly, to lower the finger 138 to feeding position, the push rod 161 is allowed to ride upon cam 163 thereby raising this rod and rotating the members 160 and 155 and 153 in a counter-clockwise manner about pivot point 156. This will move rod 153 downwardly on cam surface 148 in Figure 23 to cause the members 148 to rotate slightly in a counter-clockwise manner to release the end of the elastic strand 42. When the push rod 161 falls off of projection 163, the clamp 146 is pulled to closed position by tension spring 152. When it is desired to withdraw the elastic strand, then the push rod 144 will ride onto cam 145 to raise finger 138. Shortly before this operation takes place, the push rod 161 will ride upon cam 164 to cause the clamp 146 to open to a position where it will receive the strand as it is withdrawn. Upon further movement of the main drum 66, the push rod 161 will fall off from cam 164 thereby allowing the clamp to close to the position shown in Figures 23 and 24 to sever and clamp the elastic strand.

In order that the strand will be introduced in only every fourth course it is necessary to provide means whereby this finger will be lowered to the position shown in Figure 19 for one course, and then raised to inoperative position, where the high needles will not engage the strand, for the other three courses. Hence, a suitable wire 170 has been secured to the vertical leg of bell crank 135, said wire being slidably mounted in a tube 171, said tube being fixed at its ends by means of brackets 173 and 174. The lower end of the wire 170 is secured to the upper end of lever 175, which lever is pivoted as at 176 to framework 116. The lower end of the lever 175 normally contacts, either the arcuate surface 120 of quartering gear 119, or it contacts cam ring 118. In the above construction, it is evident that during the revolution of quartering gear 119, the lower end of lever 175 will contact the arcuate surface

120 for one revolution, of the cylinder 14 of the knitting machine, whereas, it will contact the cam 118 for the next succeeding three revolutions; consequently, the feed finger will be held in a raised inoperative position for three revolutions and in a lowered operative position for one revolution, thereby causing the strand to be fed to the stocking upon every fourth course. A suitable tension spring 177 having one end thereof secured to the upper end of lever 175 and its other end secured to bracket 174, normally tends to hold the lower end of lever 175 in contact with arcuate surface 120 or the cam ring 118.

It is evident that in case it should be desired to insert the elastic strand at every second course, then the quartering gear 119 would have two cams thereon, each extending approximately 90 degrees with two spaces between the cams, each of approximately 90 degrees, so that the strand would be fed to the needles every other course.

It is evident that the jack arrangement shown in Figures 10 and 11 could be employed in one portion or portions of the cylinder for knitting the strand at recurring wales, while the jack arrangement illustrated in Figure 14 could be employed in another portion or portions of the cylinder to lay the strand behind the loops formed by some of the needles and in front of the loops formed by the other needles thereby knitting the strand at recurring wales in one portion or portions of a course and at the same time laying the strand in front of the loops formed by recurring needles in another portion or portions of a course, as the jack arrangement can be varied to bring about this result, as will readily appear to any one skilled in the art of knitting.

In the drawings and specification there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only, and not for purposes of limitation, the scope of the invention being set forth in the appended claims.

I claim:

1. In a knitting machine for knitting a fabric and having a revolving cylinder equipped with cylinder needles and jacks for raising the needles, selected needles having high jacks for raising their needles higher than the other needles, a cam shaft having a gear thereon, a strand feeding finger, means for lowering said strand feeding finger immediately outside the needle circle defined by the cylinder needles, means for clamping the strand on the inside of the needle circle, a movable cam for engaging said high jacks, and means controlled by the gear on the cam shaft for moving said movable cam for raising the needles associated with the long jacks at recurring courses of knitting to raise their respective needles to an elevation to where their hooks will engage said strand and knit the same and lay the strand behind the loops of the fabric formed by the other needles.

2. A knitting machine having a revolving cylinder equipped with cylinder and needles having jacks and a cam ring for operating said needles to knit a fabric, certain of the needles having long jacks for raising the same, means for feeding yarn to the needles, means for clamping a strand on the inside of the circle defined by the needles, means for lowering said strand immediately outside the cylinder needles to where it will be engaged by only the hooks of the needles associated with the long jacks, a movable cam for engaging the jacks and raising the needles, a

rotatable shaft in said machine, means on said shaft for moving said movable cam at recurring revolutions only of the cylinder to raise the long jack needles above the edge of the fabric to engage the said strand to be engaged in the fabric when the needles are lowered in a knitting operation.

3. In a knitting machine for knitting a fabric and having a revolving cylinder equipped with cylinder needles, a cam ring, a cam shaft provided with a gear, a main drum, jacks for raising some of said needles, a plurality of yarn feed fingers for feeding yarn to the needles to be knitted into a fabric, a strand feeding finger movable vertically immediately outside the needles, means controlled by the main drum for lowering said finger, a movable cam, means controlled by the gear for moving said cam to cause it to engage the jacks and raise some of the needles at recurring revolutions of said cylinder to engage the strand and means for subsequently raising the remaining needles on the outside of said strand to thereby lay the strand on the inside of the loops formed by the needles whose hooks initially engaged the strand and on the outside of the other needles, when the needles are lowered in a knitting operation, and means for lowering all of the needles at the knitting point in the machine.

4. In a knitting machine having a revolving cylinder equipped with cylinder needles for knitting a fabric, jacks for raising needles, occasional ones of said jacks being longer than the other jacks, means for feeding yarn to the needles, means for clamping a strand on the inside of the needle circle, means for lowering said strand immediately outside the needle circle to where it will be engaged only by the needles having long jacks, said machine having a cam shaft equipped with a gear and means controlled by said gear for engaging the long jacks upon recurring revolutions of said cylinder to raise said needles associated with said long jacks to take the strand, means for operating all of the needles in a knitting operation whereby the needles having the long jacks will knit the strand into the fabric, and the strand will pass behind the other needles and will be laid inside the loops of the fabric held thereon.

5. In a knitting machine for knitting a fabric and having a revolving cylinder equipped with cylinder needles, jacks and a cam ring for raising said needles and a knitting cam for lowering said needles in a knitting operation, selected needles having longer jacks thereunder than the other needles, means for feeding a knitting yarn to said needles, means for clamping a strand on the inside of the needle circle, means for lowering the strand immediately outside the needle circle at a point in advance of the knitting cam, a movable cam operable upon recurring revolutions of the cylinder for engaging said jacks and raising the needles associated therewith before they reach knitting position whereby the longer jacks associated with alternate needles will raise their needles high enough to engage the strand to knit the same into the fabric when the knitting cam lowers the needles but which will not raise the other needles high enough to engage said strand, said machine having a shaft driven a complete revolution upon each four revolutions of the cylinder, and means controlled by said shaft for controlling said movable cam to raise the needles only upon recurring courses.

6. In a knitting machine having a revolving cylinder equipped with pivoted latch needles, means for feeding yarn to said needles, a clamp for a strand disposed within the needle circle, a strand feeding finger disposed for vertical movement immediately outside the tops of the cylinder needles, selected ones of said needles having long jacks thereunder, a movable cam for engaging said long jacks for raising said long jack needles higher than the other needles, means for lowering said strand feeding finger to where the raised long jack needles will engage the strand with their hooks as they pass the strand feeding finger, cam means for raising all of the needles after said long jack needles have been raised whereby the strand, when the needles are all raised, will rest in front of the long jack needles and on the back of the other needles when they reach the knitting point to be knitted into the fabric with the loops of yarn formed on the long jack needles and laid behind the loops of yarn formed on the other needles.

7. In a knitting machine having a revolving cylinder equipped with pivoted latch needles, means for feeding yarn to said needles, a clamp for a strand disposed within the needle circle, a strand feeding finger disposed for vertical movement immediately outside the tops of the cylinder needles, selected ones of said needles having long jacks thereunder, a movable cam for engaging said long jacks for raising said long jack needles to a higher elevation than the other needles, means for lowering said strand feeding finger to where the raised long jack needles will engage the strand with their hooks as they pass the strand feeding finger, means for raising all of the needles so that the strand when the needles are all raised will rest in front of the long jack needles and on the back of the other needles, a knitting cam for lowering all of the needles when they reach the knitting point, whereby the strand will be knitted in the fabric with the loops formed on the long jack needles and laid behind the loops formed on the other needles, said machine having a cam shaft, and means controlled by said cam shaft for moving said movable cam to engage said long jacks upon recurring revolutions of the cylinder.

8. In a knitting machine having a revolving cylinder equipped with pivoted latch needles, means for feeding yarn to the needles, a clamp for a strand disposed within the needle circle, a strand feeding finger disposed for vertical movement immediately outside the tops of the cylinder needles, selected ones of said needles having long jacks thereunder, a movable cam for engaging said long jacks for raising said long jack needles to a higher elevation than the other needles, means for lowering said strand feeding finger to where the raised long jack needles will engage the strand with their hooks as they pass the strand feeding finger, means for further raising all of the needles whereby the strand when the needles are all raised will rest in front of the long jack needles and on the back of the other needles when they reach the knitting point, cam means for lowering all of the needles at the knitting point to cause the strand to be knitted in with the loops of the fabric formed on the long jack needles and laid behind the loops formed on the other needles, said machine having a cam shaft, means controlled by said cam shaft for moving said movable cam to engage said long jacks upon recurring revolutions of the cylinder, said machine also having a main drum, and means op-

erable by the drum for lowering said strand feeding finger.

9. In a knitting machine having a revolving cylinder equipped with pivoted latch needles, means for feeding yarn to the needles, a clamp for a strand disposed within the needle circle, a strand feeding finger disposed outside the needle circle, selected ones of said needles having long jacks thereunder, means for lowering said strand feeding finger, means for engaging said long jacks and raising the long jack needles so that the strand fed by said finger will be engaged by the hooks of said long jack needles, means for raising all of the needles after the long jack needles have received the strand and before they reach the knitting point of the machine, so that the strand will remain in front of the long jack needles and pass behind the other needles in a knitting operation whereby the strand will be knitted in the loops in the fabric formed by the long jack needles and will be laid behind the loops formed by the other needles.
10. In a knitting machine having a revolving cylinder equipped with pivoted latch needles, means for feeding yarn to the needles, a clamp for a strand disposed within the needle circle, a strand feeding finger disposed outside the needle circle, selected ones of said needles having long jacks thereunder, means for lowering said strand feeding finger, means for engaging said long jacks and raising the long jack needles so that the strand fed by said finger will be engaged by the hooks of said long jack needles, means for raising all of the needles after the long jack needles have received the strand and before they reach the knitting point of the machine so that the strand will remain in front of the long jack needles and pass behind the other needles and

cam means for lowering all of the needles at their knitting point so that the strand will be knitted in the loops of the fabric formed by the long jack needles and laid behind the loops formed by the other needles, and means for preventing engagement between the strand and the hooks of said long jack needles except upon recurring revolutions of the cylinder.

11. In a circular knitting machine having independent needles, body yarn feeding means and jacks for raising cylinder needles, selected cylinder needles having longer jacks for raising their needles higher than other needles, means for feeding a thread in advance of the usual knitting point, a movable cam for operating said longer jacks to raise their associated needles to take the thread, means for operating said movable cam for operating said longer jacks in the knitting of recurring courses and means for operating the cylinder needles to take and knit a body yarn in all courses.

12. A circular knitting machine having independent needles, jacks for raising cylinder needles and cams for operating said needles to take and knit a body yarn, selected cylinder needles having longer jacks for raising their needles higher than other needles, means for feeding body yarn to the needles, means for feeding a strand in a position where it will be engaged only by the hooks of the needles associated with the longer jacks, a movable cam for operating the jacks to raise the needles, a rotatable cam shaft, means for operating said movable cam from said cam shaft at recurring revolutions of the needle cylinder to raise the longer jack needles to take said strand for engaging said strand in the fabric when all of the needles are lowered in the knitting operation.

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