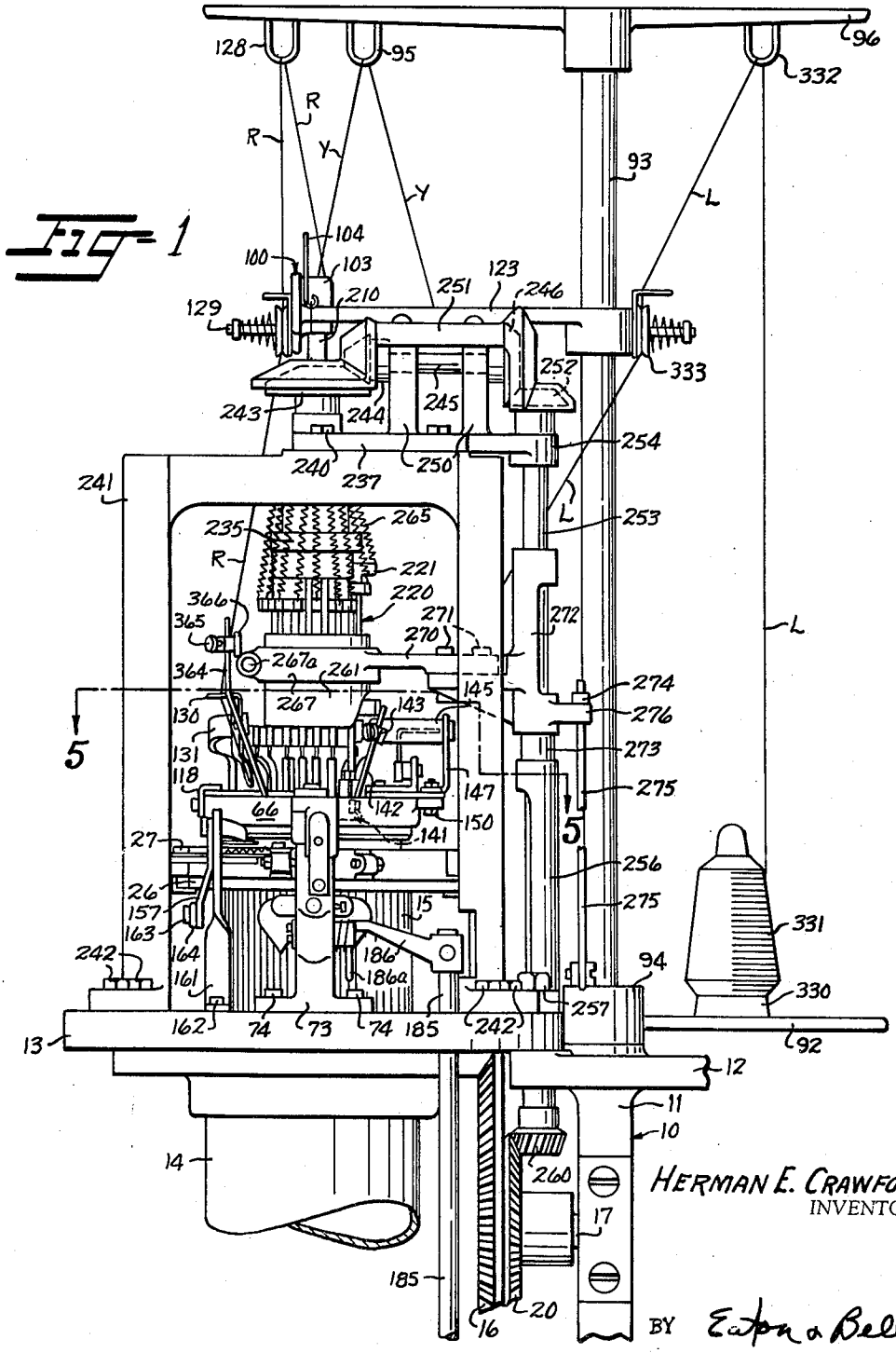
Dec. 8, 1953 H. E. CRAWFORD 2,661,612

MACHINE FOR KNITTING SHAGGY FABRICS

Filed Oct. 19, 1951 18 Sheets-Sheet 1

Fig. 1



HERMAN E. CRAWFORD,
INVENTOR.

BY Eaton & Bell

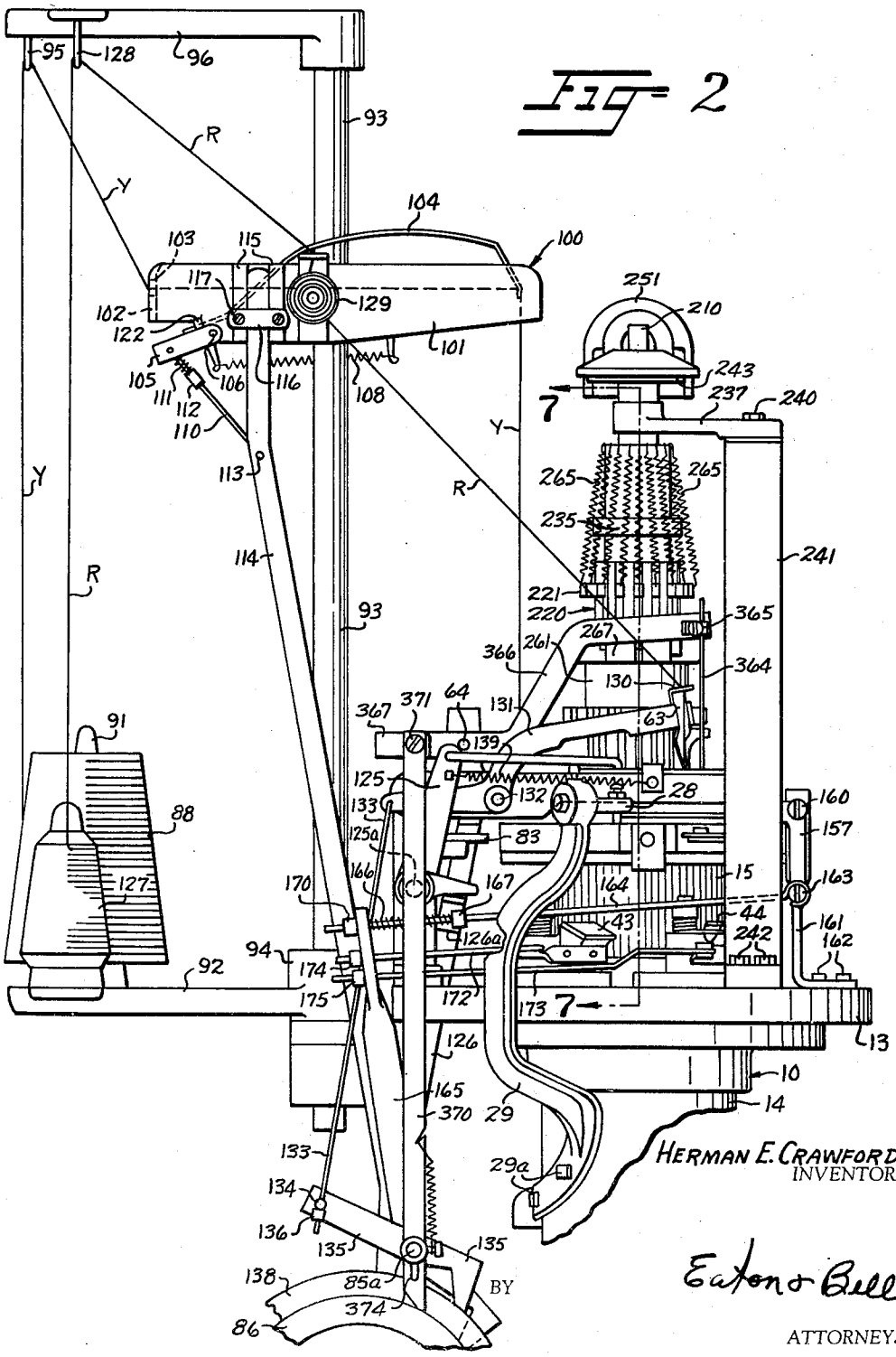
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MACHINE FOR KNITTING SHAGGY FABRICS

Filed Oct. 19, 1951 18 Sheets-Sheet 2

Fig. 2



HERMAN E. CRAWFORD, INVENTOR.

Eaton & Bell

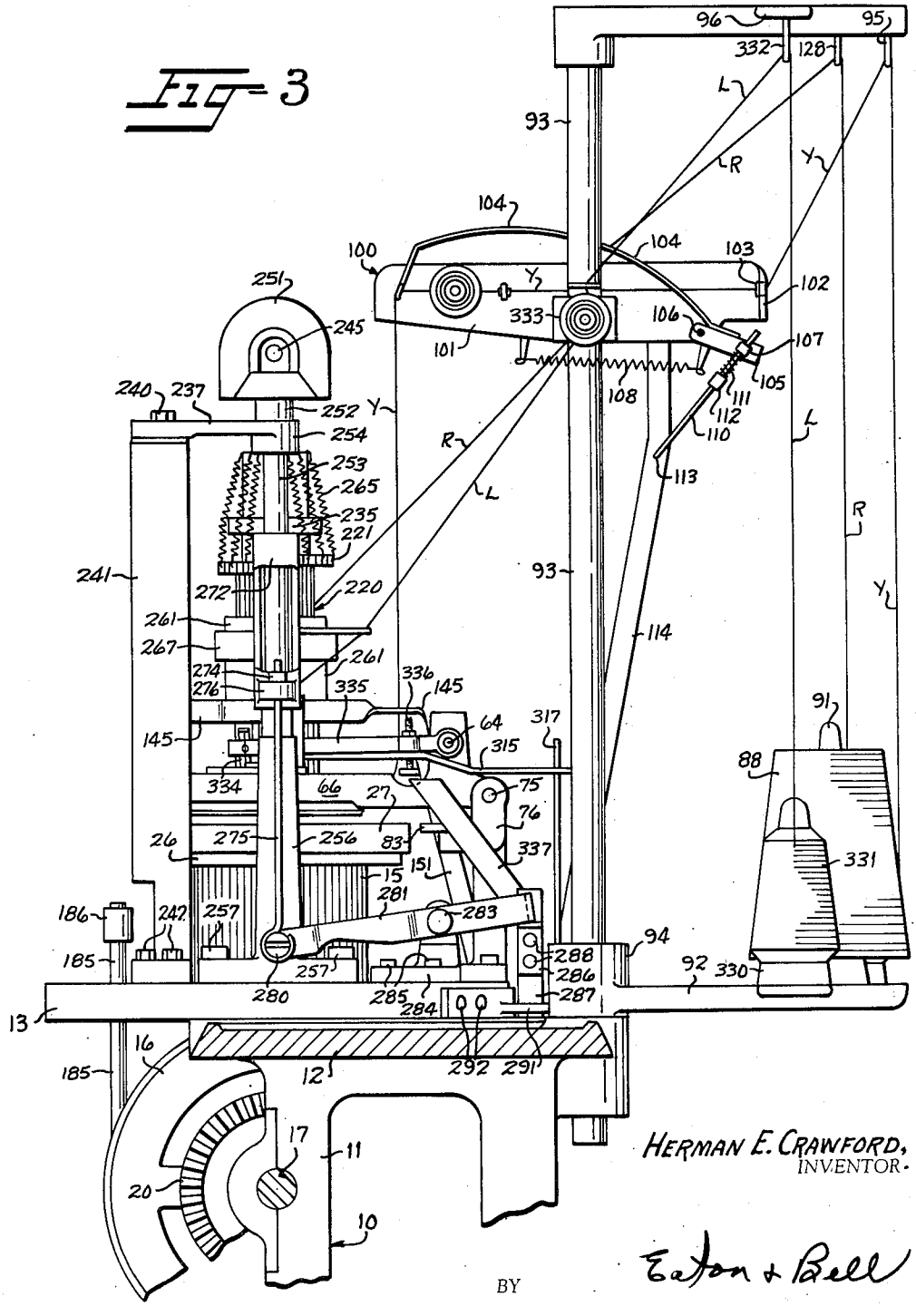
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MACHINE FOR KNITTING SHAGGY FABRICS

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Fig. 3



HERMAN E. CRAWFORD,
INVENTOR.

BY Eaton & Bell

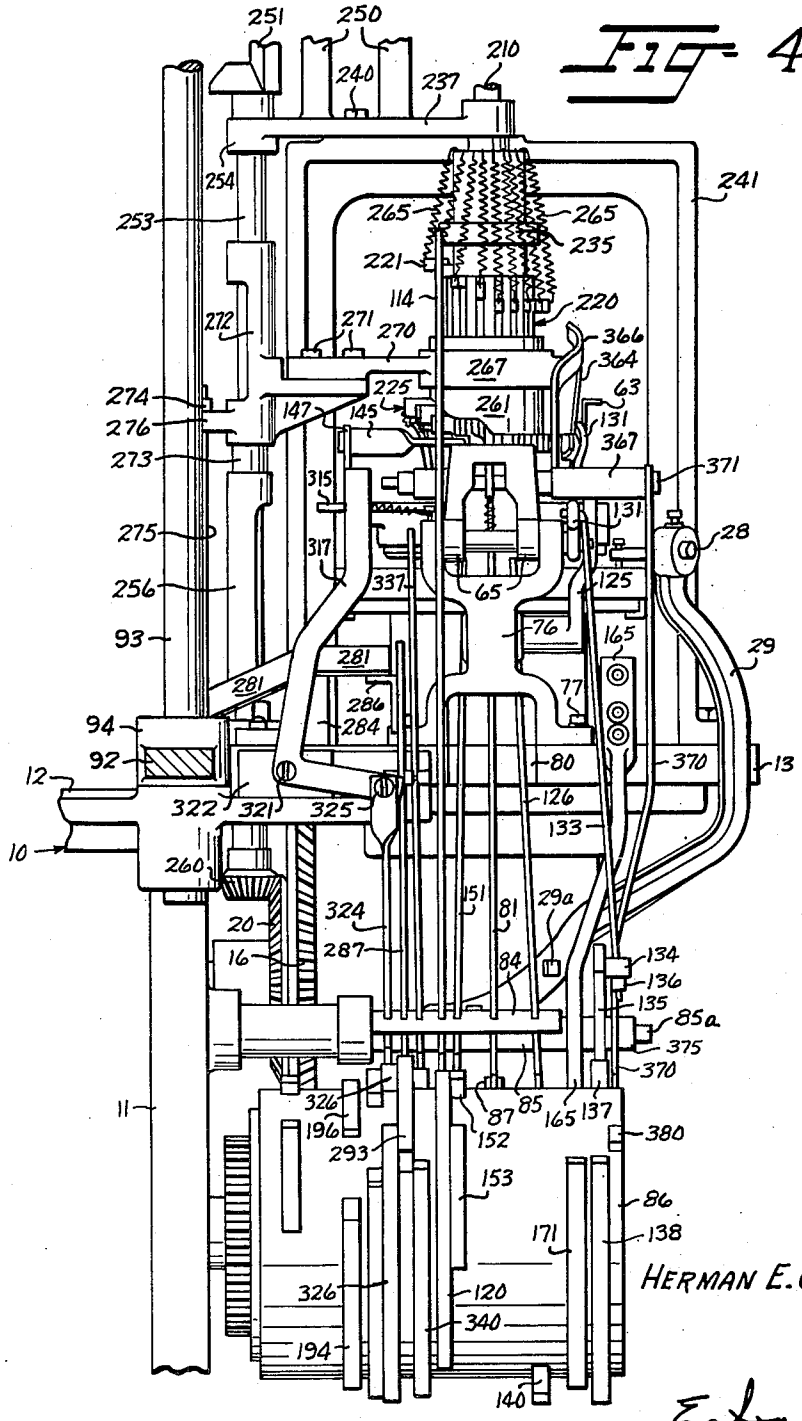
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MACHINE FOR KNITTING SHAGGY FABRICS

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Fig. 4



HERMAN E. CRAWFORD,
INVENTOR.

BY Eaton & Bell

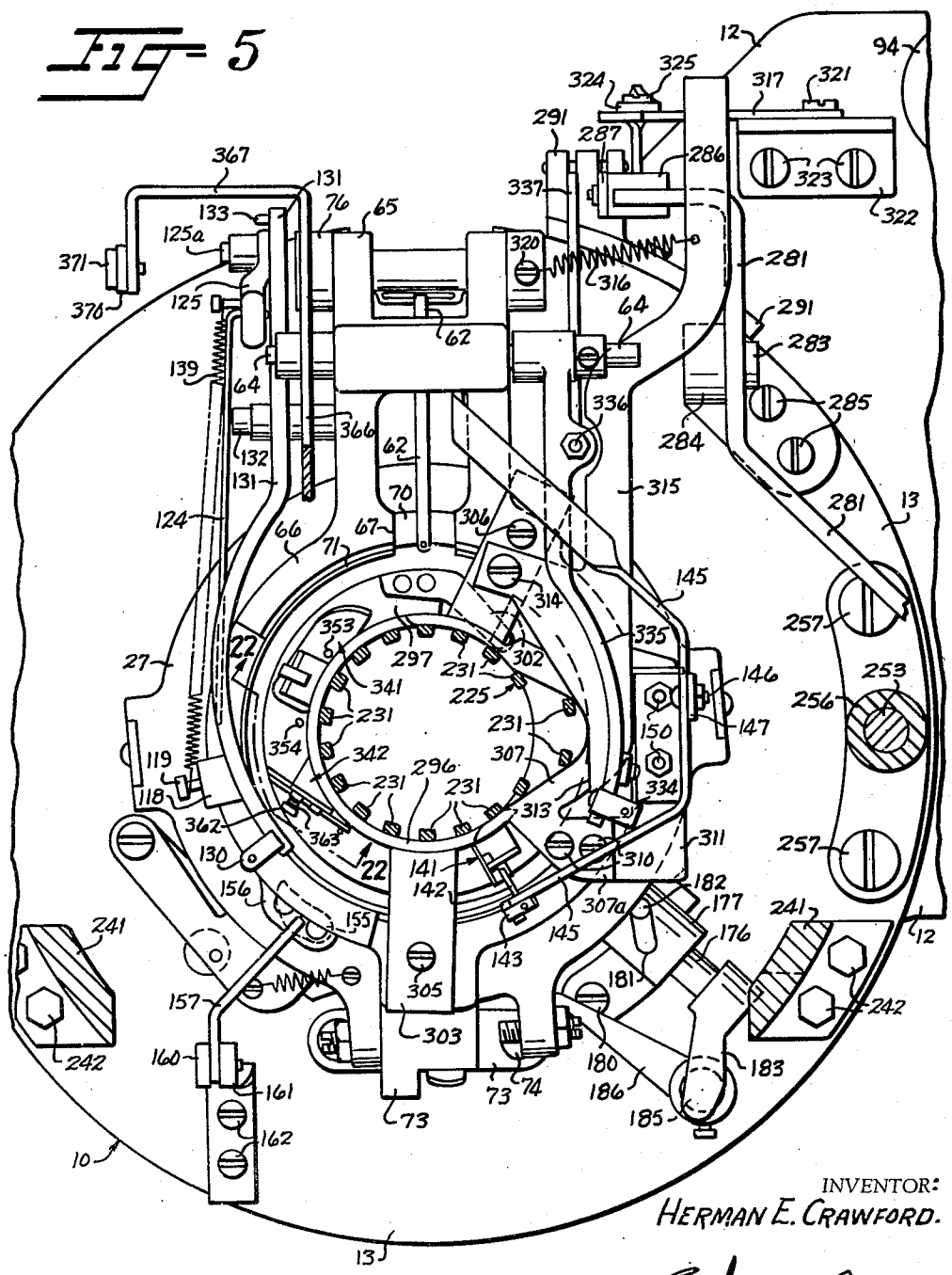
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MACHINE FOR KNITTING SHAGGY FABRICS

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Fig. 5



INVENTOR:
HERMAN E. CRAWFORD.

BY Eaton & Bell

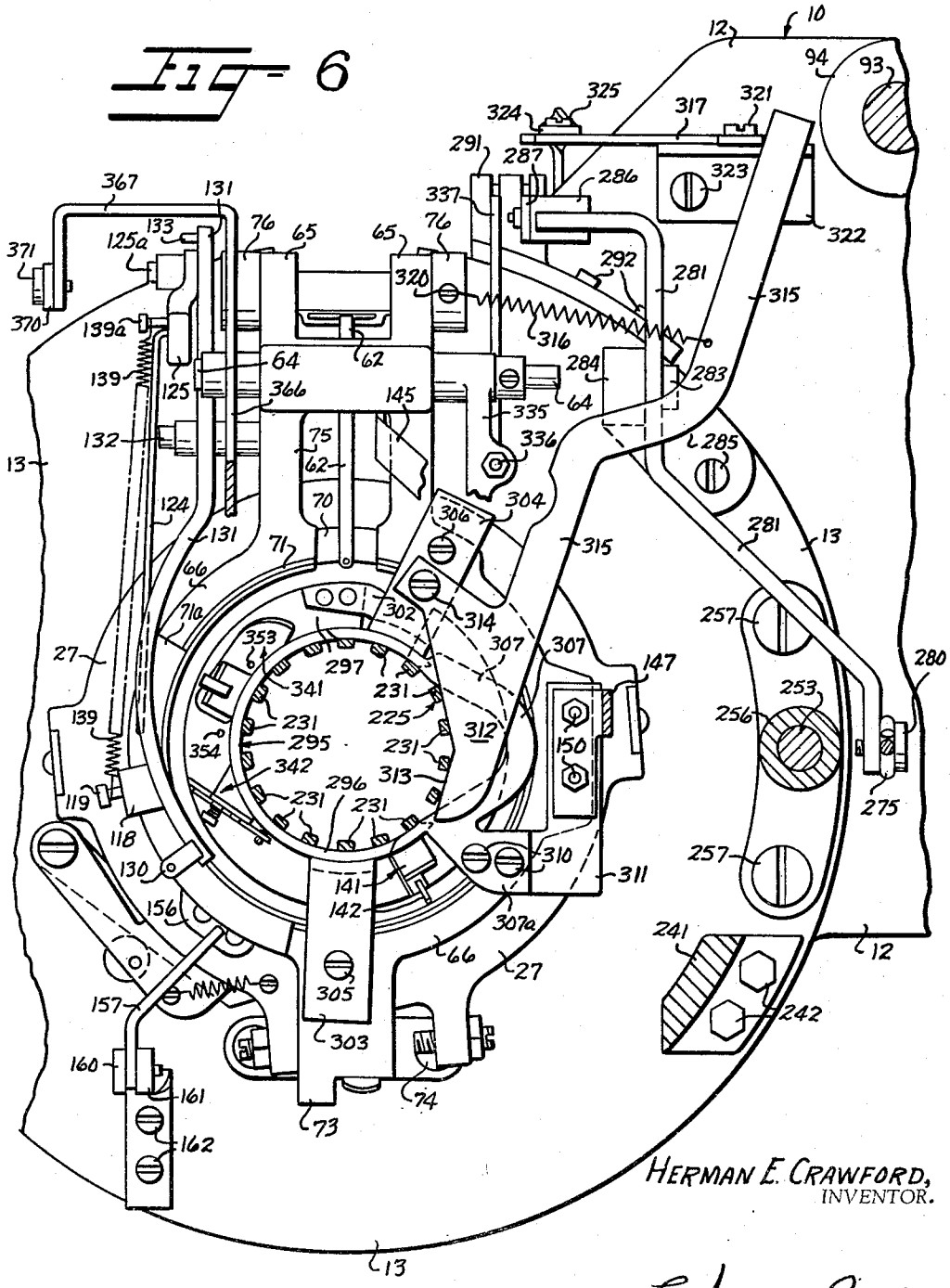
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MACHINE FOR KNITTING SHAGGY FABRICS

Filed Oct. 19, 1951 18 Sheets-Sheet 6

Fig. 6



HERMAN E. CRAWFORD,
INVENTOR.

BY Eaton & Bell

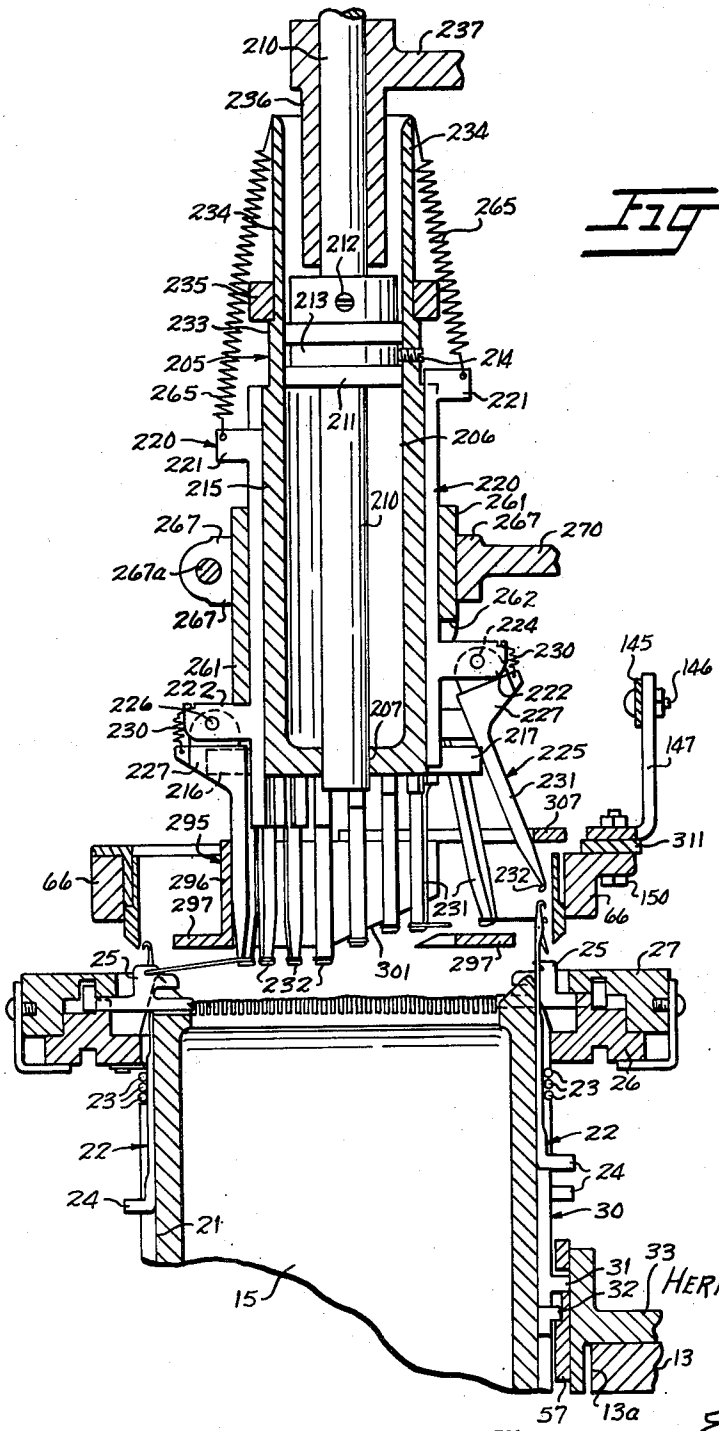
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MACHINE FOR KNITTING SHAGGY FABRICS

Filed Oct. 19, 1951 18 Sheets-Sheet 7

Fig. 7



HERMAN E. CRAWFORD,
INVENTOR.

BY Eaton & Bell

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MACHINE FOR KNITTING SHAGGY FABRICS

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Fig. 8

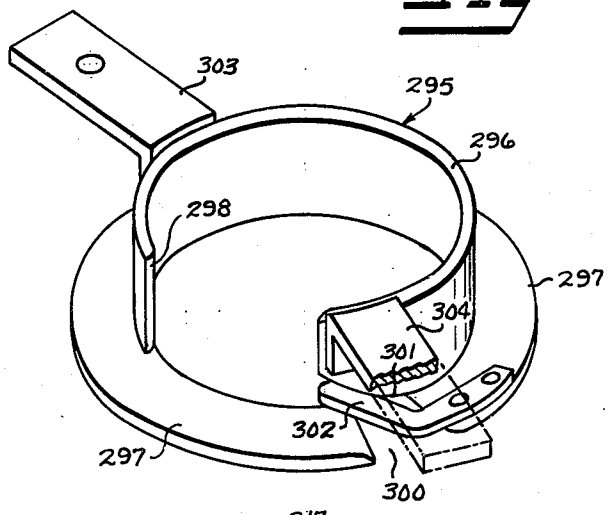


Fig. 10

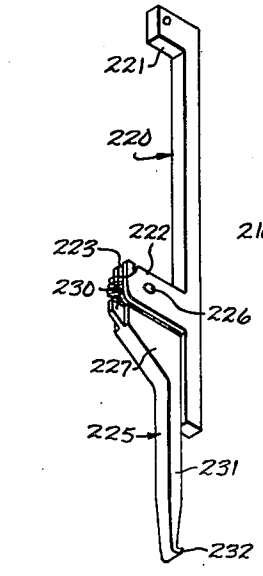
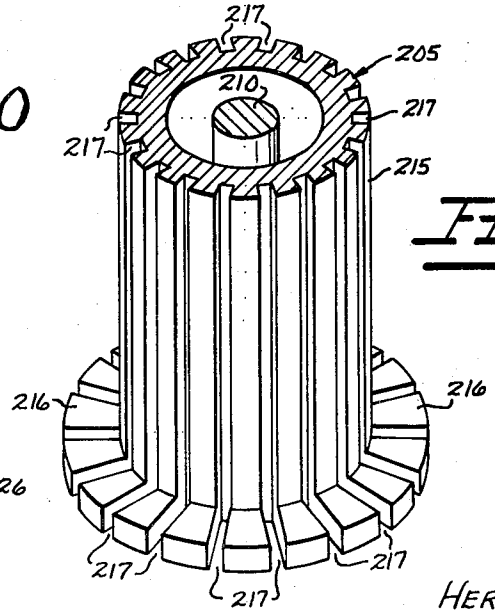


Fig. 9



HERMAN E. CRAWFORD,
INVENTOR.

BY Eaton & Bell

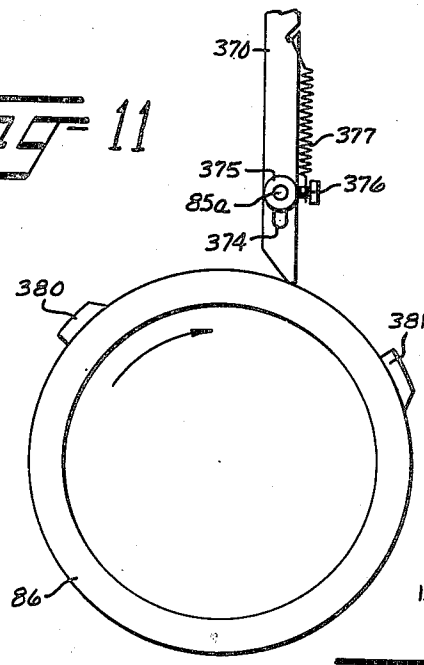
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MACHINE FOR KNITTING SHAGGY FABRICS

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Fig. 11



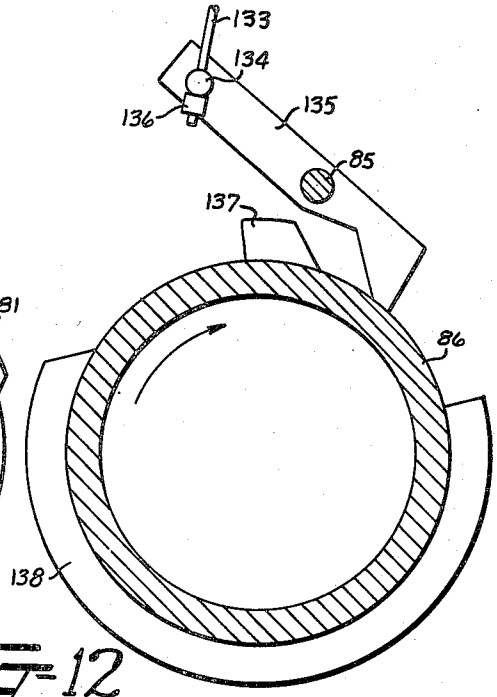
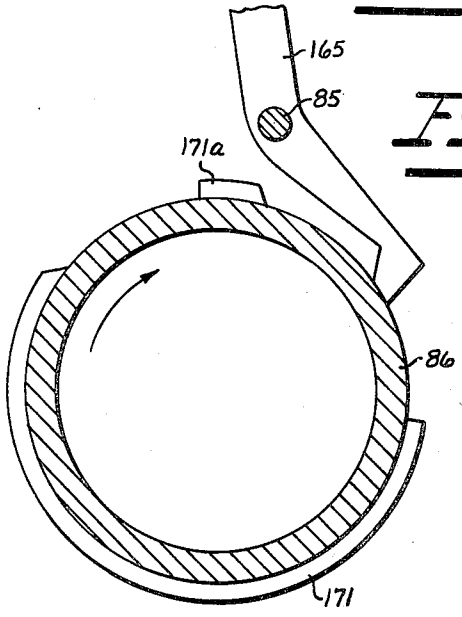


Fig. 12

Fig. 14



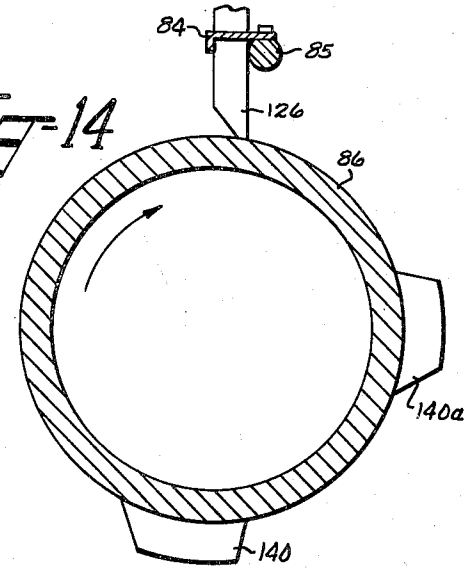


Fig. 13

INVENTOR:
HERMAN E. CRAWFORD.

BY Eaton & Bell

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MACHINE FOR KNITTING SHAGGY FABRICS

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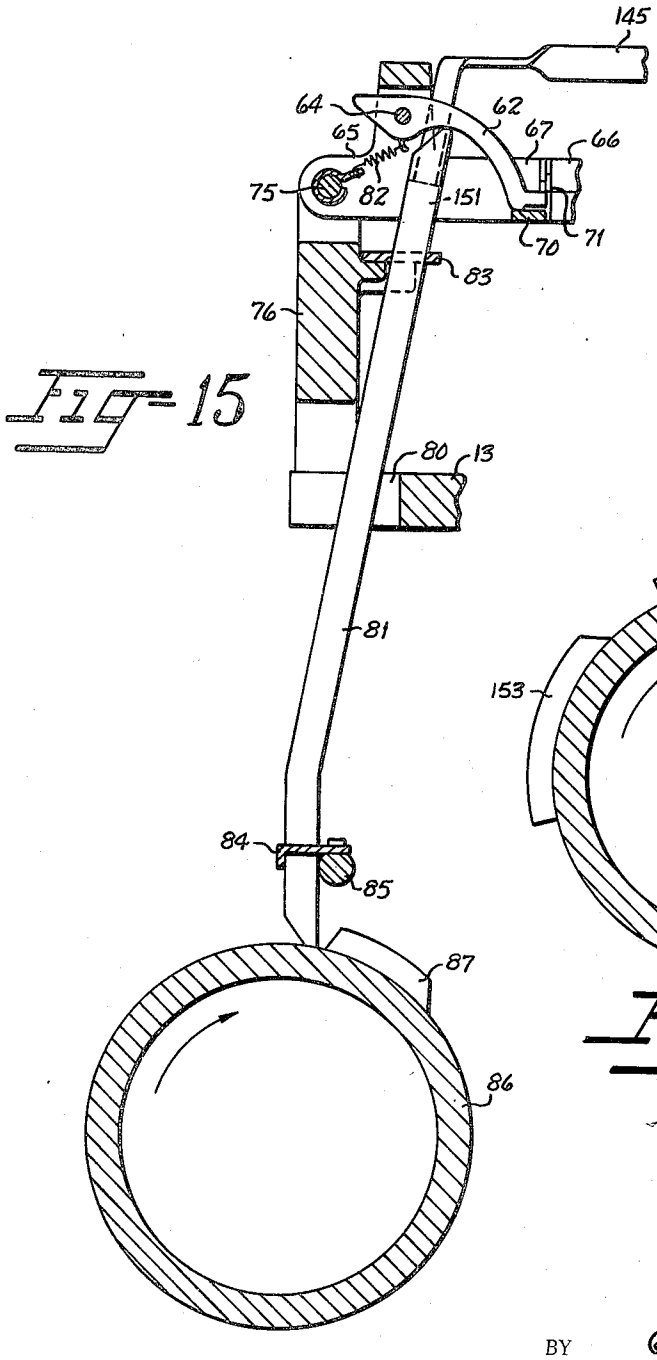


Fig. 15

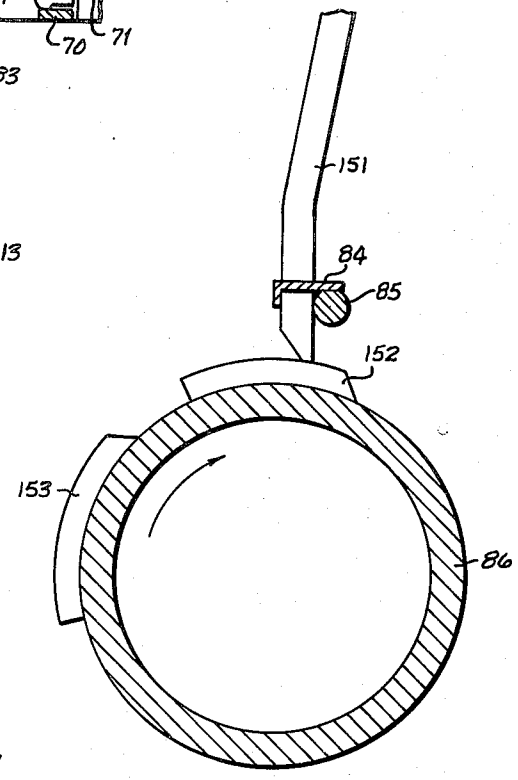


Fig. 16

HERMAN E. CRAWFORD,
INVENTOR.

BY Eaton & Bell

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Dec. 8, 1953 H. E. CRAWFORD 2,661,612

MACHINE FOR KNITTING SHAGGY FABRICS

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Fig-17

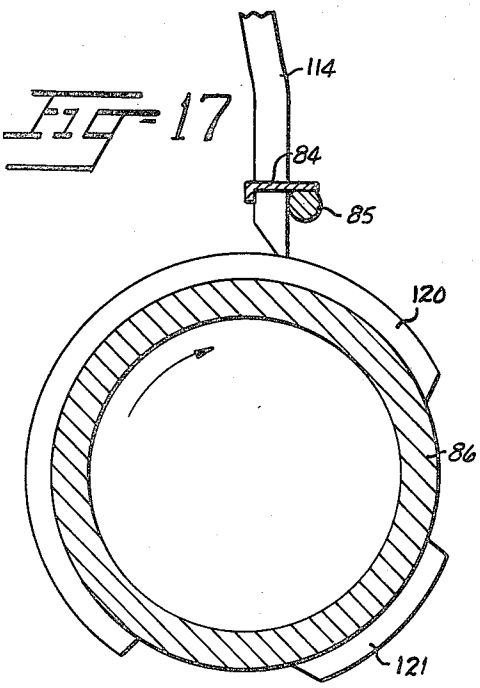


Fig-18

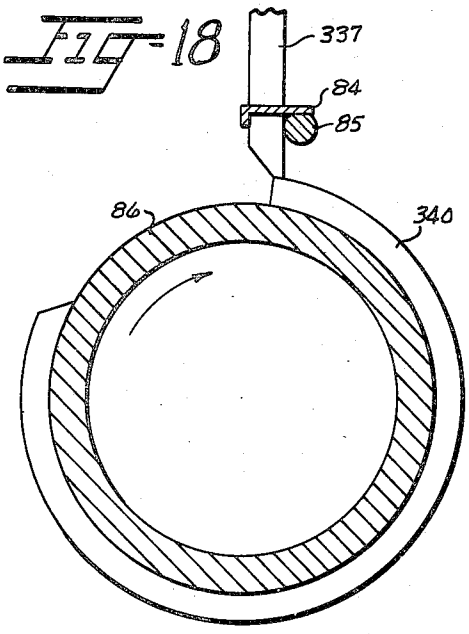


Fig-19

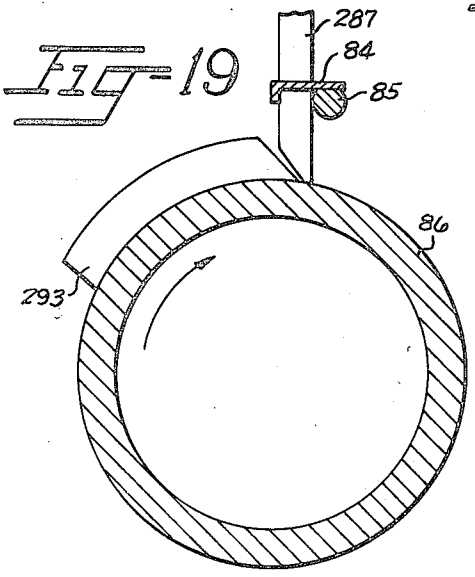
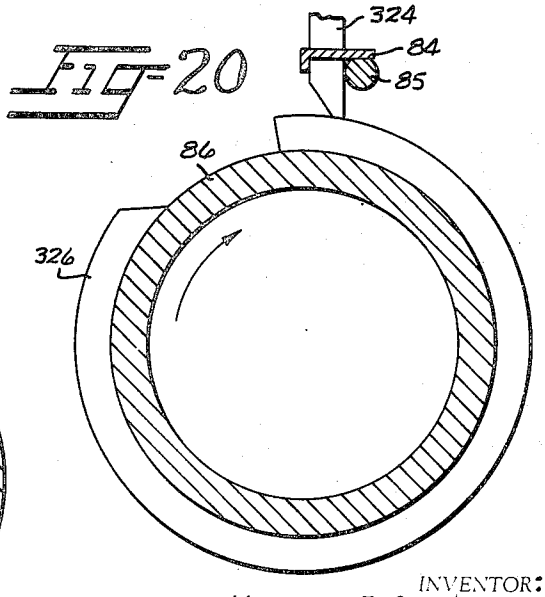


Fig-20



INVENTOR:
HERMAN E. CRAWFORD.

BY Eaton & Bell

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MACHINE FOR KNITTING SHAGGY FABRICS

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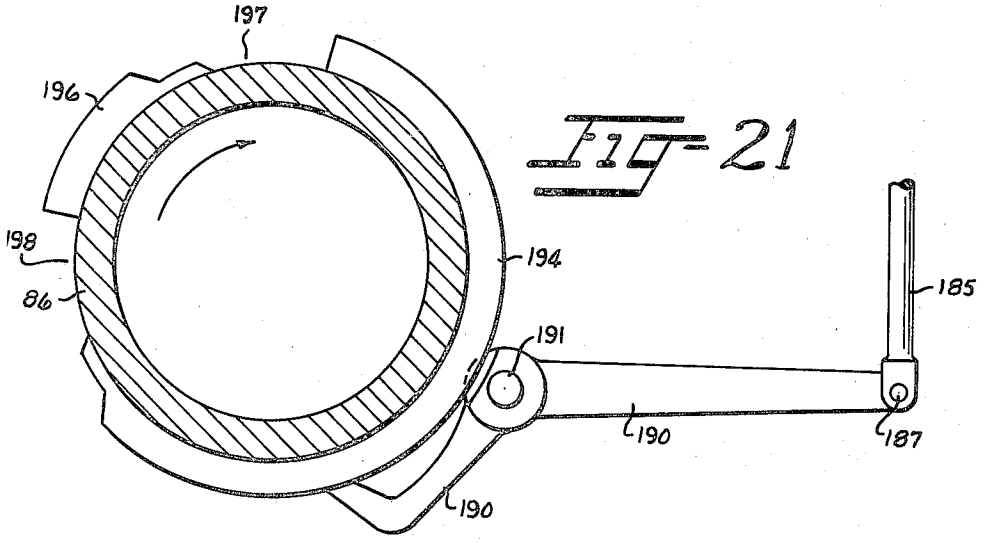


Fig. 21

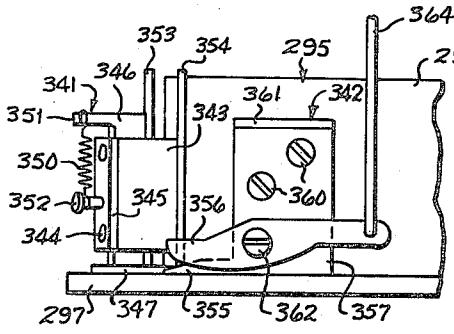


Fig. 22

HERMAN E. CRAWFORD,
INVENTOR.

BY Eaton & Bell

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MACHINE FOR KNITTING SHAGGY FABRICS

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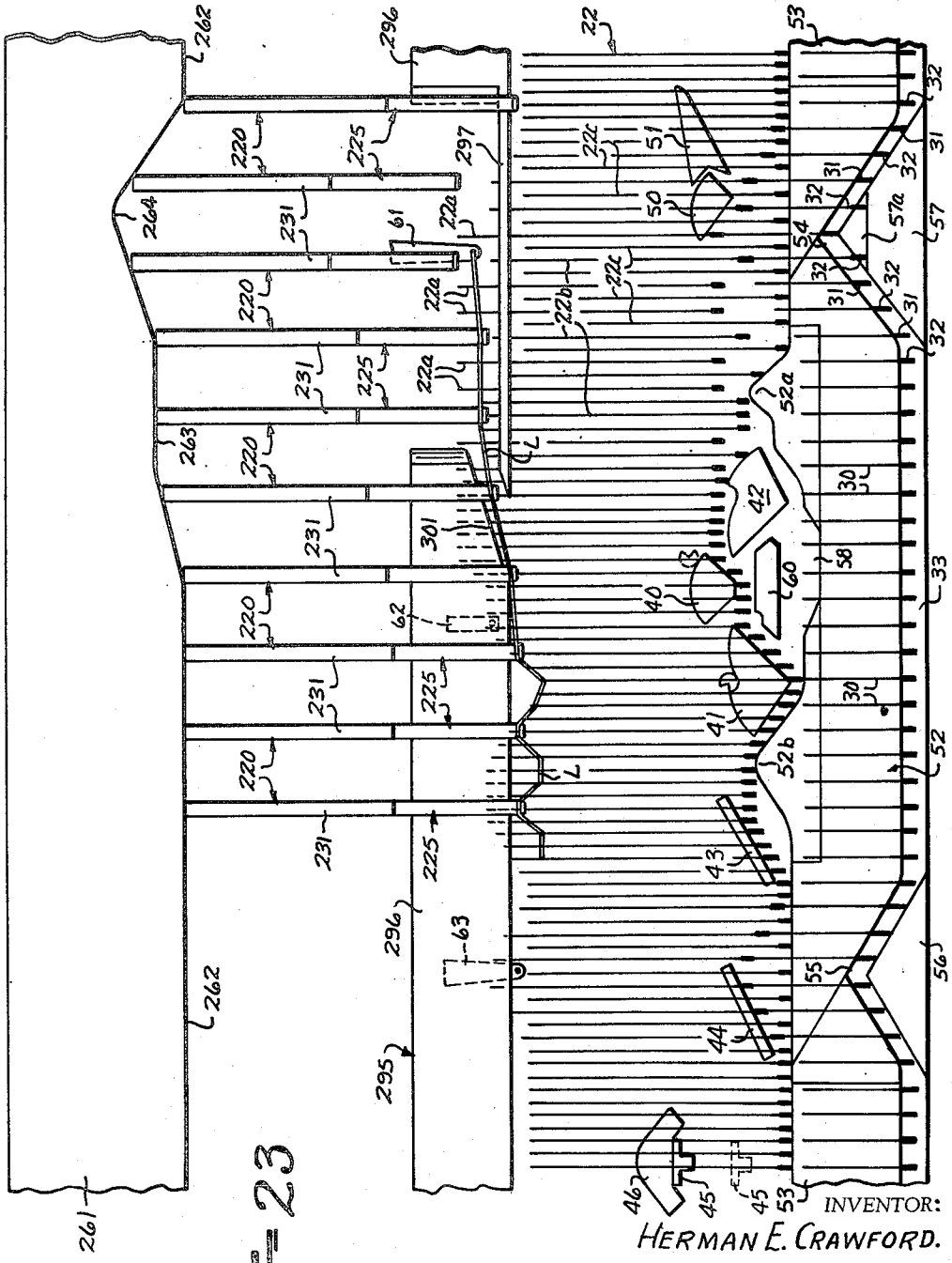


FIG. 23

INVENTOR:
HERMAN E. CRAWFORD.

BY Eaton & Bell

ATTORNEYS.

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MACHINE FOR KNITTING SHAGGY FABRICS

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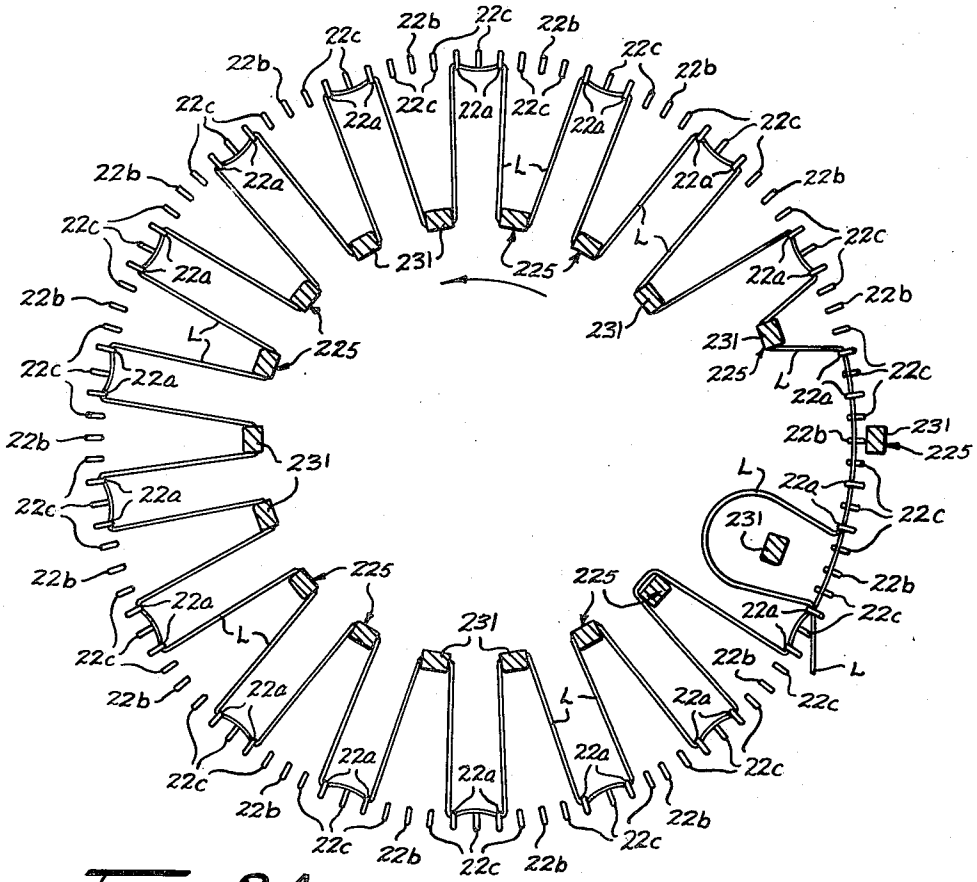


Fig. 24

HERMAN E. CRAWFORD,
INVENTOR.

BY Eaton & Bell

ATTORNEYS.

Dec. 8, 1953 H. E. CRAWFORD 2,661,612

MACHINE FOR KNITTING SHAGGY FABRICS

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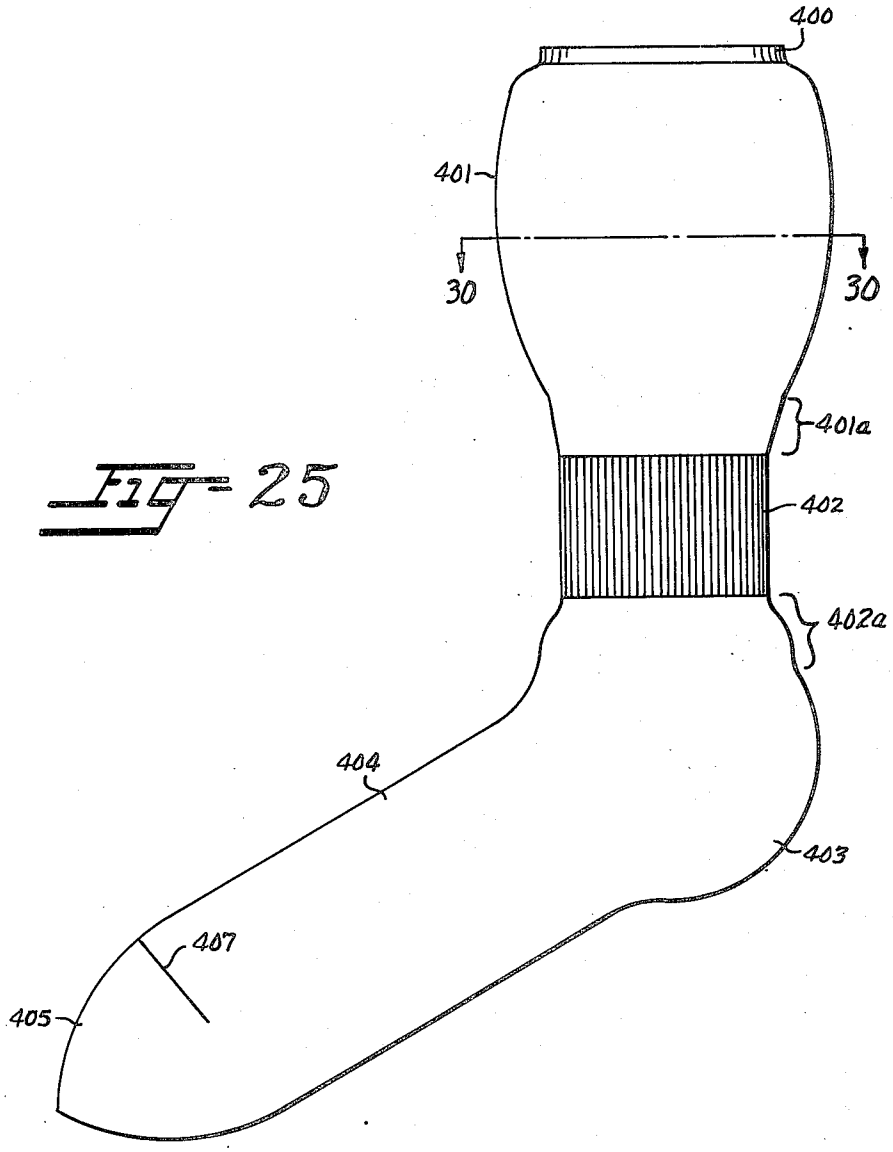


Fig. 25

HERMAN E. CRAWFORD,
INVENTOR.

BY Eaton & Bell

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MACHINE FOR KNITTING SHAGGY FABRICS

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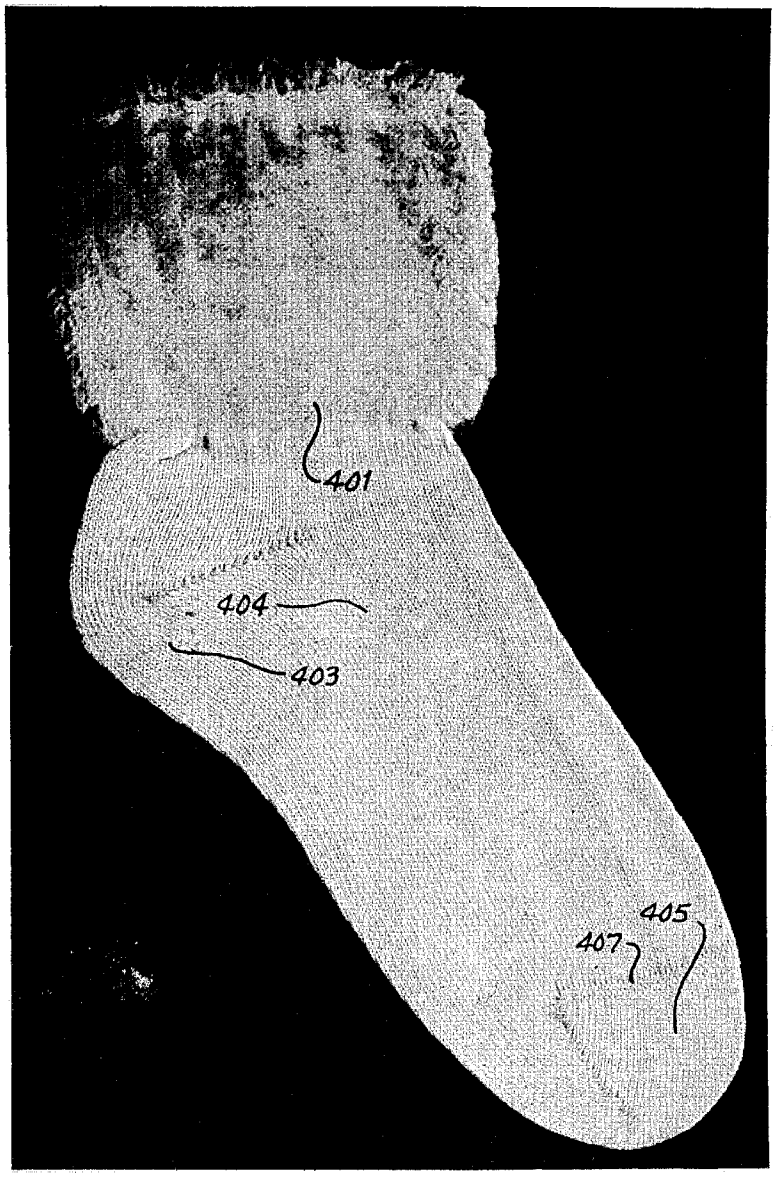


Fig. 26

Inventor:
HERMAN E. CRAWFORD.

By Eaton & Bell

Attorneys

Dec. 8, 1953 H. E. CRAWFORD 2,661,612

MACHINE FOR KNITTING SHAGGY FABRICS

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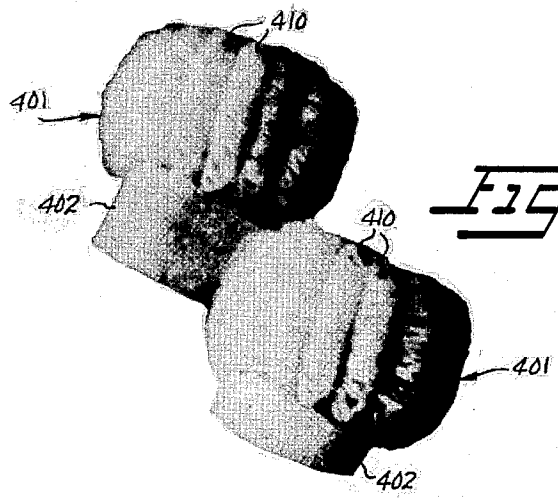


Fig. 28

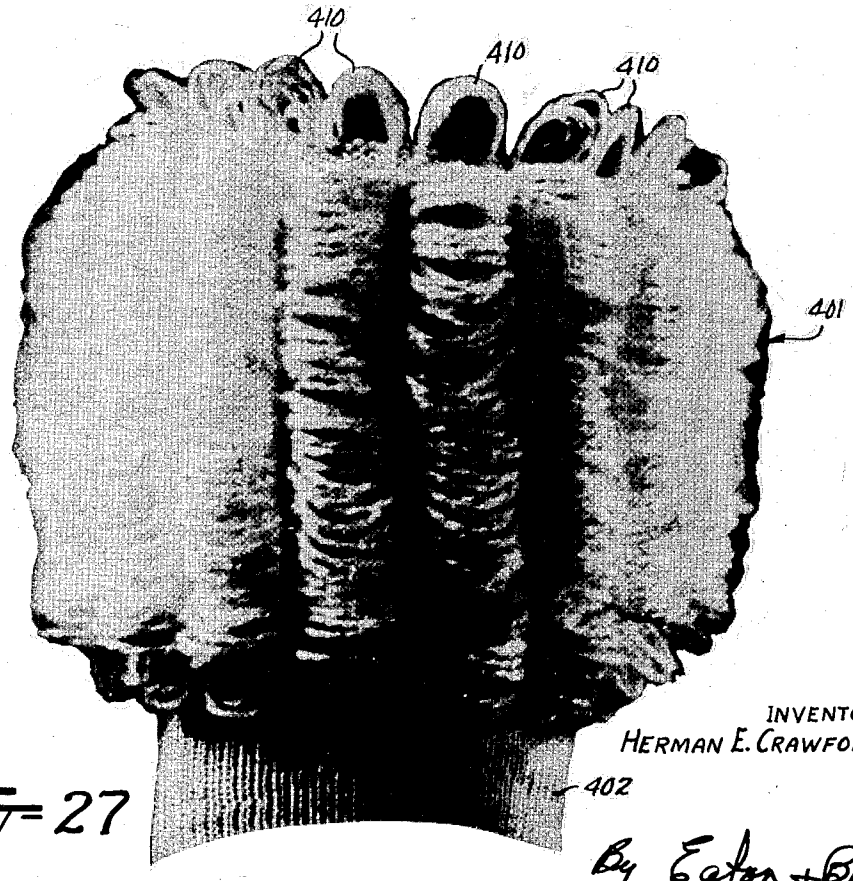


Fig. 27

INVENTOR:
HERMAN E. CRAWFORD.

By Eaton & Bell

Attorneys

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MACHINE FOR KNITTING SHAGGY FABRICS

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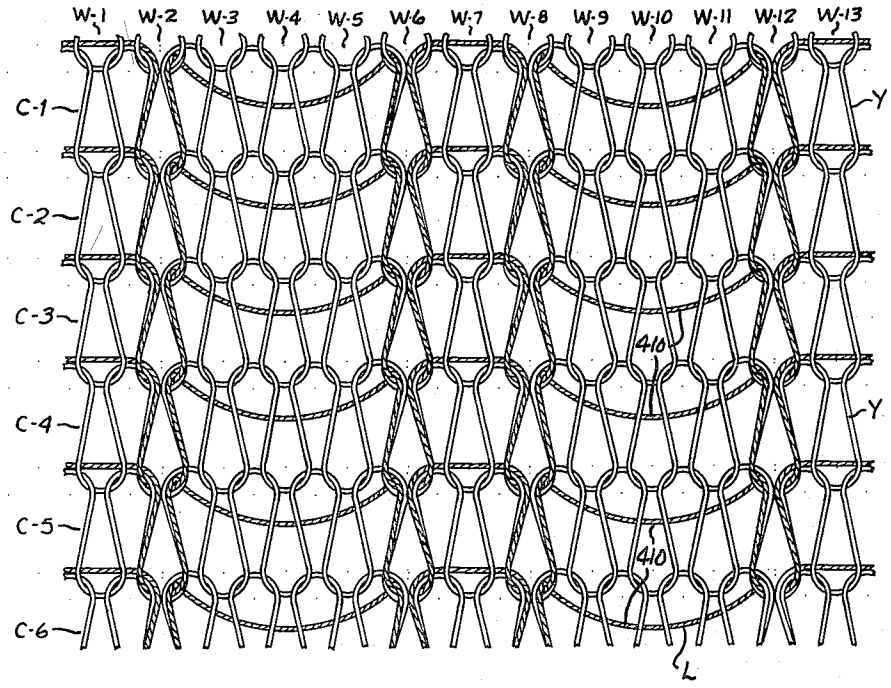


Fig 29

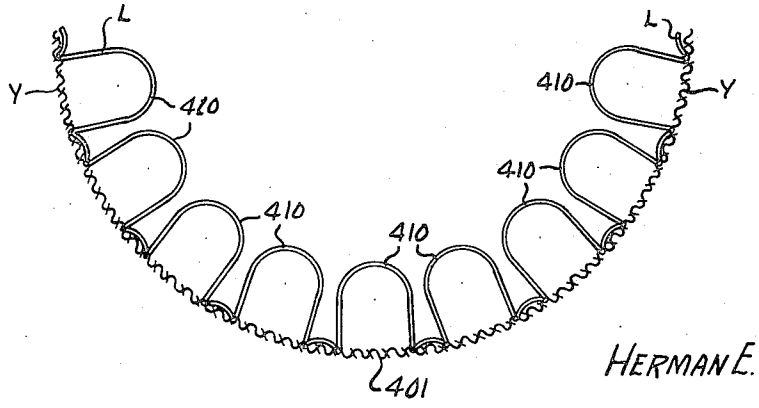


Fig 30

HERMAN E. CRAWFORD,
INVENTOR.

BY Eaton & Bell

ATTORNEYS.

Patented Dec. 8, 1953

2,661,612

UNITED STATES PATENT OFFICE

2,661,612

MACHINE FOR KNITTING SHAGGY FABRICS

Herman E. Crawford, Kernersville, N. C.

Application October 19, 1951, Serial No. 252,082

9 Claims. (Cl. 66—9)

1

This invention relates to circular independent needle knitting machines and more especially to a machine for knitting socks, such as anklets and the like, wherein the fabric knitted has a shaggy texture and appearance which is pleasing to the eye when the top of the sock is formed of this type of fabric and then turned down upon itself to form a cuff at the upper portion of the anklet.

It is the primary object of this invention to provide a circular knitting machine having the usual knitting instrumentalities thereon and, in addition, being provided with a plurality of loop fingers which cooperate with the needles in such a manner as to form enlarged loops from one of at least two yarns employed in knitting a particular sock or stocking, these enlarged loops being anchored or interknitted with the body yarn at spaced intervals so as to cause a single loop to embrace a plurality of wales knitted of the body yarn.

It is another object of this invention to provide a circular independent needle knitting machine having pattern controlled means for knitting courses of normal stitches throughout a portion of a stocking as in the toe, foot, heel and ring heel portions of a stocking and also having pattern controlled means for knitting a ribbed elastic portion of a stocking such as the intermediate portion of the leg thereof and also having means for knitting a top or cuff portion of a stocking wherein an additional yarn, preferably of less twist and of a softer texture than the body yarns of the stocking, is introduced to certain spaced single needles or spaced groups of needles and means being provided for engaging the relatively soft yarn and pulling the same inwardly through the hooks of the needles as they take the yarn and before the needles pass through the stitch cams to thus form enlarged loops on the inner face of the fabric, each of which embraces a plurality of wales formed of the body yarns and whereby the length of the yarn included in each loop is substantially greater than the distance between the points at which the loop is interknitted with the body yarns of the fabric to thus produce a fabric having a shaggy interior which may be included in the top of a stocking and thus may be turned outwardly and downwardly upon itself to form a shaggy cuff on the finished stocking.

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 a front elevation of the upper portion of a knitting machine showing the improved

2

mechanisms in association therewith, the lower portion of the machine being omitted since the parts thereon are conventional;

Figure 2 is a view with parts broken away looking at the left-hand side of Figure 1;

Figure 3 is another view with parts broken away looking at the right-hand side of Figure 1;

Figure 4 is a view looking at the rear of the machine or at the opposite side of Figure 1 but omitting the upper portion thereof and showing, in addition, a lower portion of the knitting machine;

Figure 5 is an enlarged top plan view, with parts in section, taken substantially along the line 5—5 in Figure 1;

Figure 6 is a plan view similar to Figure 5 but showing some of the parts in a different position;

Figure 7 is an enlarged vertical section taken substantially along the line 7—7 in Figure 2 and showing the loop jack cylinder, the loop jacks and their associated loop fingers in association with the needle cylinder;

Figure 8 is an isometric view of the constrictor ring, shown in the central portion of Figure 7, which assists in guiding the lower portions of the loop fingers after the loops have been formed thereby;

Figure 9 is an isometric view showing the loop jack cylinder removed from the machine and also omitting the loop jacks and the loop jack cam and with the upper portion of the loop jack cylinder being broken away;

Figure 10 is an isometric view showing one of the jacks and the corresponding loop finger removed from the loop jack cylinder;

Figure 11 is an enlarged view looking at the right-hand end of the main pattern drum shown in the lower portion of Figure 4 and showing a part of the means for severing the body yarn and the auxiliary yarn from which the enlarged loops are made;

Figure 12 is a vertical sectional view through the main pattern drum showing the arrangement of the second row of circularly arranged cams on the main pattern drum from the right in Figure 4, these cams being instrumental in effecting operation of the elastic yarn feed finger;

Figure 13 is a view similar to Figure 12 but showing the next adjacent or third set of circularly arranged cams on the main pattern drum in Figure 3, the particular cams shown being instrumental in controlling the first and second needle lowering cams;

Figure 14 is a view similar to Figure 13 but showing the fourth circularly arranged set of

cams on the main pattern drum from the right in Figure 4 for controlling the conventional gap closer;

Figure 15 shows the fifth circularly arranged cam and also showing some of the intervening connections between the main pattern drum and the body yarn feed finger;

Figure 16 is a view similar to the lower portion of Figure 15 showing the sixth set of circularly spaced cams on the main pattern drum shown in Figure 4 on the right-hand end thereof and these cams being instrumental in controlling the cutting and clamping of the elastic yarn;

Figures 17, 18, 19, 20 and 21 show the successive sets of circularly arranged cams on the main pattern drum in the lower portion of Figure 4 including the seventh, eighth, ninth, tenth and eleventh sets of cams from the right-hand end of the main pattern drum;

Figure 22 is an enlarged fragmentary elevation with parts broken away looking substantially along the line 22—22 in Figure 5 and showing the particular manner in which the clamping and cutting means for the body yarn and auxiliary or loop yarns are arranged;

Figure 23 is a developed schematic diagram looking at the inner surfaces of the various needle and jack control cams and illustrating the relative positions of the needles and the loop fingers as they move with the needle cylinder;

Figure 24 is a schematic top plan view showing the arrangement of the loop forming fingers relative to the needles and illustrating the manner in which the loop yarn is drawn through the hooks of the needles to control the lengths of the enlarged loops;

Figure 25 is a view looking at one side of a stocking such as is manufactured on a knitting machine employing the principles of the present invention and showing the top of the stocking as it is discharged from the machine;

Figure 26 is a side view of the stocking looking at the opposite side from that shown in Figure 25 but showing the top of the stocking turned down to form a cuff thereon;

Figure 27 is an enlarged fragmentary elevation showing the turned-down cuff at the top portion of a stocking and looking at the right-hand end of the upper portion of Figure 26;

Figure 28 is a view looking at the sides of an adjacent pair of stockings made on a machine embodying the features of the present invention and omitting the bottom portions of a stocking since the portions shown in Figure 28 are the only portions that would normally be visible when the stockings are actually being worn;

Figure 29 is a greatly enlarged fragmentary elevation showing the manner in which the enlarged inwardly facing loops are interknitted with the body yarns and this view indicates the appearance of the exterior of the cuff of the stocking before it is turned-down or as it is in the position that it will occupy during the knitting thereof;

Figure 30 is a fragmentary schematic sectional plan view showing the general appearance of the enlarged loops formed of the loop yarn relative to the base knitted fabric and omitting substantially half of the stocking, this view being taken substantially along the line 30—30 in Figure 25.

Referring more specifically to the drawings, the numeral 10 broadly designates the frame of a knitting machine, the particular knitting machine shown in the drawings being substantially of a type manufactured by Scott and Williams

and commonly known as their Model B–5 knitting machine. It is to be understood, however, that the present invention may be associated with any type of circular knitting machine. The frame of the conventional machine includes a vertically disposed standard 11. The standard 11 supports a main base plate 12 which, in turn, supports a substantially circular bed plate 13 from which the usual sock horn 14 depends.

The standard 11 and the base plate 12 comprise a part of a conventional housing in which the usual driving mechanisms for the knitting machine are disposed, this driving mechanism being of a type substantially as shown in Scott Patent No. 1,152,850 of November 7, 1915. This driving mechanism includes means for transmitting rotary and reciprocatory motion to a conventional needle cylinder 15, according to a desired pattern, and through an intervening beveled gear 16 fixed on a conventionally driven shaft 17 (Figure 1) on which a second bevel gear 20 of smaller diameter than the gear 16 is also fixedly mounted. This beveled gear 20 is instrumental in driving the usual dial mechanism adapted to be associated with a knitting machine of this type in lieu of which a loop jack cylinder to be later described is adapted to be employed.

As is clearly shown in Figure 7, the needle cylinder 15 is provided with the usual vertically extending circularly spaced grooves 21 in which a plurality of conventional latch needles, generally designated at 22, are mounted for vertical sliding movement, these needles being retained in the grooves 21 by the usual circular springs 23. The latch needles 22 are provided with the usual needle butts 24 which, as is well known to those familiar with the art, are made in different lengths so that approximately half of the needles are provided with short butts and the other half of the needles are provided with long butts for the well known purpose of knitting the heel and toe pockets of a stocking.

The needles 22 cooperate with conventional sinkers 25 mounted in a sinker head 26 and sinker cap 27 for drawing stitches in the usual manner. Since it is well known that the sinker cap and sinker head must oscillate slightly with reciprocatory movement of the needle cylinder during the knitting of the heel and toe pockets, this sinker cap is held down against the upper portion of the needle cylinder and is supported thereby in a conventional manner. The sinker cap is engaged by a projection or an arm 28 extending from a sinker cap hold down bracket 29 which is irregularly shaped as shown in Figures 2 and 4 and extends downwardly and is suitably secured, as by screws 29*a*, to the conventional sock horn 14.

Certain needles 22 are controlled as to up and down movement through the medium of conventional needle jacks, generally designated at 30, and wherein certain spaced jacks 30 are provided with relatively long butts 31 while the jacks therebetween are provided with short butts indicated at 32. The length of these butts on the needle jacks 30 are instrumental in determining the needles which shall be elevated adjacent opposed sides of the loop fingers, to be later described, and are considered as parts of the present invention.

It will be observed in Figure 7 that the bed plate 13 is provided with the usual opening, the wall of which is indicated at 13*a*, through which the needle cylinder 15 extends. This bed plate 13 supports a conventional cam ring 33 to which

some of the usual needle and jack operating cams are suitably secured, these cams being shown diagrammatically in Figure 23.

The needle cams include the usual group of stitch cams, namely, a top center cam 40 and left-hand and right-hand stitch cams 41 and 42, respectively, which are inclined, as shown in Figure 23, to engage the butts of all of the needles for directing any of the needles downwardly which may have been directed thereto. The cams 43 and 44 are controlled, in a manner to be later described, as to their position radially of the needle cylinder 15 and are particularly provided for positioning alternate needles so as to take the elastic yarn from the feed finger provided therefor to be later described.

Also, disposed to the left of and at a higher elevation than the second needle lowering cam 44 is a widening pick 45 which is oscillatable in the usual manner, as shown in said Patent No. 1,152,850, for lowering the needles in knitting the heel and toe pockets. A conventional stationary leveling cam 46 is disposed immediately above the widening pick 45.

Spaced substantially to the right of the top center cam 40 (Figure 23) is a leveling cam 50 and a switch cam 51 which are instrumental in knitting the heel and toe of the stocking and which do not constitute any part of the present invention and a further description thereof is deemed unnecessary.

The cam ring 33 has a pair of substantially semi-circular cam members 52 and 53 suitably secured thereto, the lower edges of which are spaced from the lower edge of the cam ring 33 and the junctures of which are beveled to provide inverted substantially V-shaped notches 54 and 55 in which notches substantially triangularly-shaped first and second jack raising cams 56 and 57, respectively, are disposed. These cams are suitably secured to the inner face of the cam ring 33 and extend substantially below the lower edges of the segmental cam members 52 and 53 so as to direct the butts of any jacks engaged thereby upwardly with movement of the needle cylinder in either direction. It will be noted that the upper portion of the substantially triangularly-shaped second jack raising cam 57 is partially cut away to provide a notch 57*a* therein (Figures 7 and 23). The depth of this notch 57*a* is such that the jacks having the relatively short butts 32 thereon will only be elevated to the level of the lower surface of this notch and will pass by the remaining portion of the second jack raising cam 57 while the remaining jacks having the relatively long butts 31 thereon will be elevated to the apex of the cam 57.

It will be observed in Figure 23 that the jacks 30 are disposed under alternate needles only, although it is to be understood that the jacks 30 may be spaced differently according to a desired pattern. In the particular cam arrangement shown in Figure 23, it is preferable that the jacks 30 be positioned beneath alternate needles, not only for the purpose of cooperating with the loop forming fingers, to be later described, but to cause the elastic yarn to be taken from the yarn feed finger provided therefor by alternate needles, since, by referring to the cam 56 in the left-hand portion of Figure 23, it will be observed that the butts 31 and 32 on the jacks 30 engage and ride up the cam 56 as they move from right to left in Figure 23 and after the corresponding or alternate needles have taken the elastic yarn, they ride down the lower surface of the second needle

lowering cam 44 so as to be at the same level as the needles therebetween.

The upper surface of the segmental cam member 53 is of the same elevation throughout its length while the upper surface of the segmental cam 52 therebetween is provided with upwardly projecting cam portions 52*a* and 52*b* which provide a cavity 58 therebetween into which the butts of the needles pass as they engage the lower surfaces of the respective stitch cams 42 and 41 depending upon the direction of rotation of the needle cylinder 15. This cavity 58 also provides an opening in which a conventional lower or bottom center cam 60 is disposed and which is also instrumental in controlling the needles to form stitches thereby.

It might be stated that all of the needle and jack control cams shown in the lower portion of Figure 23 are conventional substantially as shown in said Patent No. 1,152,350 with the exception of the cam 57 which is shown as occupying the position usually occupied by a similar cam for taking the elastic yarn from a corresponding elastic yarn feed finger disposed thereabove. However, in this instance, the elastic yarn feed finger occupies a different position from that which is usually disposed and the cam 56 is provided for the purpose of directing alternate needles to this elastic yarn feed finger. The cam 57 differs from that usual cam which occupies this position only in the fact that it is provided with the notch 57*a* at the upper portion thereof for the purpose heretofore described. Although, the first and second needle lowering cams 43 and 44 are conventional, they are controlled in a manner peculiar to the present invention.

In Figure 23, there are shown three yarn feed stations exemplified by respective yarn feed fingers 61, 62 and 63 which may be termed as first, second and third yarn feeding stations. The first yarn feed finger 61 may also be termed an auxiliary or loop yarn feed finger, the second yarn feed finger 62 may be termed a main or body yarn feed finger and the third yarn feed finger 63 may be termed an elastic or rubber yarn feed finger, for purposes of description and for purposes of demarcation in the claims.

Although, a single main or body yarn feed finger 62 is shown in Figures 5, 6, 15 and 23, it is to be understood that any reasonable number of body yarn feed fingers may be employed in accordance with the number of yarns which may be desired in the basic fabric being knitted. The main yarn feed finger 62 is controlled in a conventional manner but since its cooperation with the auxiliary yarn feed finger 61 is necessary to clear understanding of the present invention, the conventional means for controlling this yarn feed finger 62 is clearly shown in Figure 15.

Referring to Figure 15, it will be observed that the body yarn feed finger 62 is pivoted on a shaft 64, oscillatably mounted in a rearwardly extending portion 65 of a conventional latch ring 66 which, as shown in Figure 5, is provided with a gap or throat 67 in which the free or front end of the yarn feed finger 62 is adapted to have vertical movement. The lower free end of the yarn feed finger 62 normally rests upon a conventional throat plate 70 which spans the throat 67. This latch spring 66 also has a conventional gap closer 71 therein which may be of a type such as is shown in United States Patent No. 1,859,137. The manner in which this gap closer 71 is controlled is also conventional but a brief

description will be given of the same later in this context.

The front end of the latch ring 66 (Figures 1, 5 and 6) is supported in a conventional manner on the upper end of a front post 73 suitably secured, as by screws 74, to the upper surface of the bed plate 13. The rear end of the rearwardly extending portion 65 of the latch ring 66 is pivotally mounted, as at 75 (Figure 15), in the bifurcated upper end of a rear post 76 which extends downwardly (Figure 4) and is suitably secured, as by screws 77, to the upper surface of the bed plate 13. The lower end of the rear post 76 and the adjacent portion of the bed plate 13 are cut away to form an opening 80 therein through which a thrust rod 81 extends in addition to other thrust rods to be later described. The yarn feed finger 62, in Figure 15, is normally biased downwardly against the throat plate 70 and the upper end of the corresponding thrust rod 81 by a tension spring 82 which is suitably connected at one end thereof to the yarn feed finger 62 and at its other end to the pivot shaft 75 on which the rearwardly extending portion 65 of the latch ring 66 is pivotally mounted.

The upper portion of the thrust rod 81 slidably penetrates a suitable first thrust rod guide plate 83 projecting forwardly from the post 76. The thrust rod 81 extends downwardly and also penetrates a second guide plate 84 which is suitably supported on a horizontally disposed rod 85 which extends transversely of the machine and is suitably secured at its left-hand end in Figure 4 to the standard 11 of the frame 10.

The lower end of the thrust rod 81 is adapted to normally engage the periphery of a conventional main pattern drum 86 which is driven in a conventional manner as is clearly shown in said Patent No. 1,152,850. This pattern drum has a plurality of longitudinally spaced circularly arranged cams thereon which coincide with the respective thrust rods and it will be observed in Figure 15 that there is a cam member 87, suitably secured to the periphery of the main pattern drum 86, which engages the lower end of the thrust rod 81 urging the same upwardly, to elevate the free end of the corresponding body yarn feed finger 62 to clear the body yarns from the needles following the knitting of a stocking and preparatory to knitting a subsequent stocking at which time the cam 87 moves out of engagement with the thrust rod 81 permitting the yarn feed finger 62 to again move into operative position as shown in Figure 15.

Referring to Figure 2, it will be observed that the body yarn, indicated at Y, extends from a package of yarn 88 wound about a cone 91 which is suitably supported on a yarn stand 92 which extends inwardly in Figure 2 and is fixedly mounted on a creel post 93. The lower end of this post 93 is suitably secured in a boss portion 94 integral with the base plate 12 of the frame 10 as is clearly shown in Figure 1.

The yarn Y extends upwardly in Figures 2 and 3 and passes through a suitable thread eye or guide 95 depending for a horizontally disposed bar 96 which is suitably secured intermediate its ends on the upper end of the creel post 93. The yarn Y then extends downwardly and through a suitable yarn tensioning device 100 which does not necessarily constitute a part of the present invention but a description of which is deemed necessary so as to clarify the operation of this machine.

This yarn tensioning device 100 comprises a horizontally disposed bracket 101 having a rightangularly turned portion 102 thereon which is provided with an eye or opening 103 through which the yarn Y extends and from whence the yarn Y extends through the free end of a wand or yarn take-up arm 104. The yarn take-up arm extends rearwardly from the free end thereof and is suitably secured to a block 105 which is pivotally mounted at one end thereof, as at 106, on the bracket 101. This block 105 has a sleeve 107 pivotally mounted thereon which is slidably penetrated by the upper end of a connecting rod 110 which is encircled by a compression spring 111, one end of which engages a collar 112 fixedly secured on the intermediate portion of the shaft or rod 110 and the other end of which engages the collar 107 to normally urge the tension arm 104 downwardly at its free end or in a counter-clockwise direction in Figure 3, when a corresponding thrust rod 114 is in a raised position. When the thrust rod 114 is lowered the spring 111 moves away from the collar 107 and the take-up arm 104 is then urged in a clockwise direction by a tension spring 108 (Figure 3). It is evident that the body yarn Y then extends downwardly from the free end of the tension arm 104 and passes through the usual eye in the free end of the yarn feed finger 62.

Referring to Figures 2 and 3, it will be observed that the lower end of the rod 110 is pivotally connected, as at 113, intermediate the ends of the thrust rod 114. The upper end of the thrust rod 114, in Figure 2, is mounted for vertical sliding movement between a pair of projections 115 on the outer surface of the bracket 101 and is confined therebetween by a suitable plate 116 which is suitably secured to the projections 115 as by screws 117.

This thrust rod 114 extends downwardly in Figures 2 and 17 and also slidably penetrates the second thrust rod guide plate 84 and is adapted to successively engage the periphery of the main pattern drum 86 and circularly spaced cam members 120 and 121 suitably secured to the periphery of the main pattern drum 86. The weight of the thrust rod 114 is sufficient to normally urge the same against the main pattern drum 86 and the respective cams 120 and 121 (Figure 17).

As is well known to those familiar with the art, it is necessary that the free end of the yarn take-up arm 104 be permitted to oscillate to take up the slack in the yarn Y during reciprocatory knitting of the heel and toe pockets of a stocking. Therefore, during the knitting of the heel and toe pockets, the lower end of the thrust rod 114 in Figure 17 rests upon the periphery of the main pattern drum 86. Thus, the thrust rod 114 assumes a relatively lowered position which, in turn, relaxes the tension spring 108 and the tension spring 108 will then urge the free end of the yarn tension finger 104 upwardly.

Thus, as the yarn is fed to the needles during reciprocation of the needle cylinder, the tension in the yarn will be maintained. However, during the knitting of the leg and the foot portions of the stocking, that is, during all circular knitting, the lower end of the thrust rod 114 is engaged by one or the other of the cams 120 and 121 to move the same upwardly and to thus place the tension spring 108 under stress whereupon the free end of the yarn take-up arm will remain in a lowered position. In this instance, the yarn take-up arm 104 is prevented from mov-

ing below a predetermined point at the outer end thereof by a suitable projection 122 on the bracket 101 which engages the block 105 adjacent the pivot point 106 thereof as is clearly shown in Figure 2. Referring to Figure 1, it will be observed that the bracket 101 has an outwardly extending portion 123 integral therewith which is fixedly mounted on an intermediate portion of the creel post 93.

Control means for gap closer

The gap closer 71 has a plate portion 71*a* integral therewith which is adapted to move in sliding engagement with the upper surface of the latch ring 66 and which is held thereagainst by an angle clip 118 which is secured to the side surface of the latch ring 66 by any suitable means such as a screw 119. One end of a horizontally disposed connecting rod 124 is pivotally connected intermediate the ends of the plate 71*a*, the other end of the connecting rod 124 being pivotally connected to the upper end of a lever arm or bell crank 125 (Figures 2 and 6). The lever arm or bell crank 125 is oscillatably mounted on a stub shaft 125*a* (Figures 2, 4 and 6) which is fixedly mounted in the rear post 76.

It will be observed in Figure 2 that the lower surface of the horizontal leg of the bell crank 125 is engaged by an angle clip 126*a* which is suitably secured to one side of a thrust rod 126. The upper portion of the thrust rod 126, that is the portion disposed above the angle clip 126*a* in Figure 2, is mounted for vertical sliding movement in the upper thrust rod guide plate 83. The thrust rod 126 extends downwardly and is also mounted for vertical sliding movement in the lower thrust rod guide plate 84 and is normally urged against the upper surface of the main pattern drum 86 by a tension spring 139 which is suitably connected at its rear end, as at 139*a* (Figure 6) adjacent the upper end of the tension spring 139 is mounted on the screw 119 heretofore described which secures the angle clip 118 to the latch ring 66. It is thus seen that the tension spring 139 also normally urges the gap closer 71 to inoperative or open position.

It will be observed in Figure 14 that the gap closer thrust rod 126 is adapted to be successively engaged by circular spaced cam members 140 and 140*a* which are suitably secured to the periphery of the main pattern drum 86 and, upon the lower end of the thrust rod 126 in Figures 2 and 14 being engaged by the cam members 140 and 140*a*, the bell crank 125 in Figure 22 is caused to move in a counterclockwise direction to thus move the gap closer to operative position during the knitting of the heel and toe pockets. This gap closer and the manner in which it is operated is conventional and therefore does not constitute any part of the present invention and is merely shown to illustrate the manner of its operation relative to the manner of operation of the various other movable parts of the knitting machine.

Elastic yarn feeding means

Referring to Figure 2, there will be observed a yarn package 127 suitably supported on the yarn stand 92 and from which an elastic or rubber yarn R extends upwardly and passes through a suitable thread eye or guide 128. The elastic yarn R then extends downwardly and forwardly at an angle and passes through the usual friction disk-type of yarn tension device indicated at 129. The yarn R then passes downwardly through a substantially right-angularly bent portion 130 of the elastic yarn feed finger 63 (Figures 2 and 23). The elastic yarn R then extends downwardly from the right-angularly bent portion 130 of the elastic yarn feed finger 63 and passes through the usual eye at the lower end thereof to be directed to the needles or to the elastic yarn clamping and cutting apparatus to be later described.

The free front end of a lever 131 is oscillatably mounted intermediate its ends, as at 132, on the rearwardly extending portion 65 of the latch ring 66. The lever 131 extends rearwardly (Figures 2, 4, 5 and 6) and has the upper end of a connecting rod 133 pivotally connected to the rear end thereof and extending downwardly and slidably penetrating a pin 134 (Figures 2 and 12) which is oscillatably mounted on the free end of a control finger 135. The connecting rod 133 has a suitable collar 136 fixed on the lower end thereof which is normally urged against the lower surface of the pin 134 by virtue of the weight of the elastic yarn feed finger 63 on the front end of the lever 131.

This control finger 135 is oscillatably mounted intermediate its ends on the rod 85 and the free end thereof is adapted to successively engage the periphery of the main pattern drum 86 and circularly spaced cams 137 and 138 which are suitably secured to the periphery of the main pattern drum 86.

The clamp and cutter mechanism for the elastic yarn R is indicated generally at 141 (Figures 1, 5 and 6). Inasmuch as this clamping and cutting mechanism 141 may be constructed in a conventional manner and is not pertinent to the present invention, except in the order in which it is controlled relative to the various other controlling devices for controlling the needle cams and other parts of the machine, a detailed description thereof is deemed unnecessary, it being deemed sufficient to state that this clamping and cutting mechanism 141 may be substantially of the type shown in Figures 32, 33 and 34 of my co-pending application entitled Improved Knitting Machine and Method, Serial No. 192,935, filed October 30, 1950.

The usual movable clamp and cutter blade of the clamping and cutting mechanism 141 has pivotally connected thereto the lower end of a connecting rod 142 (Figures 1, 5 and 6) which extends upwardly and is pivotally connected, as at 143 (Figure 5), to the free end of an irregularly shaped lever arm 145 which is pivotally mounted intermediate its ends, as at 146, on a bracket 147. Referring to Figure 6, it will be observed that the bracket 147 is substantially L-shaped and is suitably secured, as by bolts 150, to the upper surface of the latch ring 66.

The usual elastic yarn clamping and cutting mechanism 141 has conventional spring means, not shown, associated therewith which will normally urge the connecting rod 142 and the front end of the irregularly shaped lever arm 145 upwardly thus urging the rear portion thereof in Figure 15 downwardly against the upper end of a thrust rod 151 which is shown in Figure 15 disposed in back of the thrust rod 81 and the lower portion of which is shown in Figure 16 extending through the thrust rod guide plate 84. This thrust rod 151 is adapted to be successively engaged by the main pattern drum 86 and spaced circularly arranged cam members 152 and 153 suitably secured to the periphery of the main pattern drum 86.

Contrary to the usual practice, an intermediate portion of the leg of a stocking, such as the stocking shown in Figures 25 and 26, has a ribbed effect therein knitted in the usual manner in which the rubber or elastic top is formed in a stocking constructed in the usual manner. Therefore, although it need not be construed as being a part of the present invention nor a necessary part of this machine, I have included in the sinker cap 27 an attachment for producing a ribbed effect in the stocking as the rubber yarn is fed to the needles, this attachment being substantially as shown in my Patent No. 2,420,771 of May 21, 1947.

Since this attachment is clearly shown in said patent, a detailed illustration and description thereof is deemed unnecessary, it being deemed sufficient to state that the rib attachment includes a special sinker cam 155 which is shown in broken lines in Figures 5 and which is normally urged upwardly to inoperative position by a leaf spring member 156. The sinker cam 155 and its associated leaf spring member 156 are shown merely to illustrate the manner in which this cam 155 is controlled relative to the various other parts which are controlled through the medium of the main pattern drum 86.

The leaf spring member 156 normally urges the horizontal leg of a bell crank 157 (Figure 2) upwardly or in a clockwise direction in Figure 2, this bell crank 157 being pivotally mounted, as at 160, on a substantially L-shaped support 161. The L-shaped support extends downwardly and is suitably secured, as by screws 162 (Figures 2 and 5) to the upper surface of the bed plate 13. Pivotally connected, as at 163, to the lower end of the vertical leg of the bell crank 157 is the front end of a connecting rod 164 which extends rearwardly and slidably penetrates the upper end of a control finger 165.

A safety compression spring 166 surrounds the connecting rod 164 and one end thereof bears against the upper end of the control finger 165, the other end thereof bearing against a suitable collar 167 fixed on an intermediate portion of the control or connecting rod 164.

The connecting rod 164 also has a collar 170 fixed on the outer or rear end thereof which is urged against the rear surface of the control finger 165 by the compression spring 166. The control finger 165 extends downwardly and is oscillatably mounted on the rod 85 heretofore described (Figure 13) and is normally urged against the periphery of the main pattern drum 86 or against a pair of circularly spaced cam members 171 and 171*a* suitably secured to the periphery of the main pattern drum 86. The first and second needle lowering cams 43 and 44 are also controlled as to their position radially of the needle cylinder by the cam member 171 in Figure 13 and the control finger 165.

The needle cams 43 and 44 (Figures 2 and 23) may be constructed in the identical manner in which the respective cams 8 and 145 of Scholz Patent No. 2,139,606 of December 6, 1938, are constructed, if so desired. Inasmuch as the structure of the cams 43 and 44 may be identical to that of said patent, a detailed description thereof is deemed unnecessary since the means for controlling the position of these cams 43 and 44 relative to the needle cylinder 15 is the only feature relative to these cams that may be considered pertinent to the present invention.

Since the first and second needle lowering cams 43 and 44 are normally biased inwardly to operative position, these cams are controlled by respective connecting rods 172 and 173 which extend rearwardly, as is clearly shown in Figure 2, and slidably penetrate the upper portion of the control finger 165 heretofore described.

It is thus seen that upon the cam 171 (Figure 13) engaging the lower end of the control finger 165, it will be moved in a counter-clockwise direction thus moving the upper portion thereof outwardly to not only move the first and second needle lowering cams 43 and 44 outwardly to inoperative position but to also cause the bell crank 157 to move in a clockwise direction in Figure 2 thus permitting the sinker cam 155 (Figure 5) to move upwardly to inoperative position.

The switch cam 51 and the widening pick 45 are shown in Figure 23 in the position they occupy during rotary knitting. However, during reciprocatory knitting, that is, during the knitting of the heel and toe pockets of a stocking, the switch cam 51 is moved downwardly and outwardly toward the needle cylinder 15 and the widening pick 45 is also moved downwardly to a neutral position, as shown by dotted lines in Figure 23, for the usual narrowing operation which takes place in the knitting of the heel and toe pockets. The structure of the switch cam 51 and the widening pick 45 is conventional, the operation thereof merely being controlled in proper sequence to the operation of the various other knitting cams shown in Figure 23 for producing the stocking shown in Figures 25 to 28, inclusive. This switch cam 51 may be identical to the switch cam 15 shown in the Page Patent No. 1,697,081 of January 1, 1929.

Now, referring to Figure 5, it will be observed that the switch cam 51 has a stem portion 176 integral therewith which is oscillatably mounted in a bracket 177 suitably secured, as by a screw 180, to the bed plate 13. This bracket 177 has a spirally extending slot 181 therein in which a pin 182 extending from the stem 176 of the switch cam 51 is adapted to have sliding movement. The outer end of the stem 176 has a cam member 183 fixed thereon which extends outwardly and the lower surface of which is adapted to be engaged by the upper end of a vertically disposed thrust rod 185 (Figure 1).

This thrust rod 185 also has an arm 186 fixed on the upper end thereof which extends to the left in Figure 1 and is adapted to engage the upper surface of a pin 186*a* associated with the widening pick 45 for operating upon the same in substantially the manner shown in said Patent No. 1,152,850 as is well known to those familiar with the art. Thus, the widening pick 45 is held in the lowered or dotted line position shown in Figure 23 by the arm 186 (Figure 1) during narrowing of the heel and toe and the stem 176 of the switch cam 51 has conventional spring means, not shown, associated therewith which tends to urge the cam member 183 downwardly at its outer end to engage the upper end of the thrust rod 185 substantially as shown in Figure 1. The thrust rod 185 normally assumes a lowered position by its own weight.

Now, by referring to Figure 21, it will be observed that the lower end of the thrust rod 185 is pivotally connected, as at 187, to the outer end of a control finger 190 which is oscillatably mounted intermediate its ends on a suitable horizontally disposed shaft 191 extending from the standard 11 of the frame 10 which, as shown in

Figure 21, is disposed forwardly of the main pattern drum 86.

The arrangement of the means for controlling movement of the switch cam 51 and the widening pick 45 in Figure 23 is conventional with the exception of the arrangement of the cams shown in Figure 21. It will be observed that the main pattern drum 86 has a pair of circularly spaced stepped cams or cam members 194 and 196 which are spaced apart from each other to form notches 197 and 198 therebetween and the reading end of the control finger 190 is positioned in these notches 197 and 198 during narrowing in the knitting of the heel and the toe respectively.

Most of the parts heretofore described are the usual parts of a circular knitting machine and it is with these parts that the present invention is adapted to be associated.

Loop head

The loop head is best shown in Figure 7 and comprises a loop jack cylinder designated broadly at 205. The loop jack cylinder 205 is of substantially tubular construction and has a longitudinally extending bore 206 therein which is partially restricted at the lower end thereof as at 207. The lower restricted end 207 of the loop jack cylinder 205 is slidably penetrated by the lower end of a loop jack cylinder shaft 210 which extends upwardly and has a collar 211 fixedly mounted intermediate the ends thereof as by a set screw 212.

The outside diameter of the collar 211 is such that it slidably engages the inner walls of the loop jack cylinder 205 and this is engaged by a set screw 214 for securing the loop jack cylinder 205 to the collar 211. The loop jack cylinder 205 has an enlarged lower portion 215 provided with an annular flange 216 at the lowermost end thereof (Figures 7 and 9). This enlarged portion 215 as well as the flange portion 216 are provided with coinciding vertically extending circularly spaced grooves 217 which are disposed above and, in this instance, are spaced radially of every sixth needle in the needle cylinder 15, this being most clearly shown in Figure 24. This indicates that there are one hundred eight needles 22 in the needle circle and eighteen loop fingers associated with the loop jack cylinder. It is to be understood however that the number of needles and the relative number of loop fingers may be varied according to the size of the stocking being knitted and also according to any variations in patterning which may be desired.

For example, the loop fingers, to be presently described, may be of smaller size relative to the needle cylinder than that shown in Figures 7 and 24 and may be spaced closer together to thus provide a greater number of elongated or enlarged loops on the inner face of the fabric being knitted in a given number of wales than would obviously be the case in using the number of needles and loop fingers shown in the drawings.

A loop jack broadly designated at 220 is mounted for vertical sliding movement in each of the grooves 217 in the enlarged portion 215 and the flange 216 of the loop jack cylinder 205. One of the loop jacks 220 is most clearly shown in Figure 10, all of the loop jacks 220 being identical. The loop jack has an enlarged portion or butt 221 at the upper end thereof and an outwardly projecting portion 222 intermediate the ends thereof, this outwardly projecting portion 222 is slotted, as at 223.

A reduced upper end portion 224 of a loop finger broadly designated at 225 is mounted for sliding pivotal movement in the slot 223 and on a pin 226 carried by the outwardly extending portion 222 of the loop jack 220. There is one of these loop fingers 225 depending from each of the loop jacks 220. The loop finger has an enlarged upper portion 227 integral therewith to the outer end of which a tension spring 230 is suitably connected, this tension 230 extending upwardly and being suitably connected to the outer end of the projection 222.

It will be observed in Figure 7 that the outer end of the enlarged portion 227 of the loop finger 225 extends substantially beyond the outer end of the projection 222 on the corresponding loop jack 220 and, therefore, the tension spring 230 normally urges the corresponding loop finger 225 outwardly at its lower end. The flange 216 serves to maintain alinement of the loop fingers 225 with the slots 217 in the enlarged portion 215 of the loop jack cylinder 205 when they swing outwardly as shown in the right-hand portion of Figure 7. The loop finger has a stem portion 231 integral with the enlarged portion 227, the lower end of which is provided with an inwardly facing hook portion 232. The tension spring 230 has been omitted from the loop jack and loop finger 220 and 225, respectively, in Figure 10 for purposes of clarity and the function of the loop jacks 220 and their corresponding loop fingers 225 will be later described.

The loop jack cylinder 205 has intermediate and upper reduced portions 233 and 234 and the shoulder thus formed at the juncture of the portions 233 and 234 supports the lower inner edge of a sleeve or collar 235 which is fixedly mounted on the reduced upper portion 234. The purpose of this collar 235 will also be later described.

Now, the vertically disposed loop jack cylinder shaft 210 extends upwardly and, as is clearly shown in Figures 1, 2 and 7, is rotatably mounted in a sleeve portion 236 of a bearing block 237 which extends outwardly or forwardly in Figure 2 and is suitably secured, as by screws 240, to the upper end of a substantially inverted U-shaped bracket 241. It will be observed in Figures 1 and 5 that the legs of the inverted U-shaped bracket 241 straddle the various knitting mechanisms disposed at the front of the machine and are suitably secured, as by screws 242, to the upper surface of the bed plate 13.

As heretofore stated, the loop jack cylinder 205 must rotate at the same speed as the needle cylinder 15 and there are various means which may be provided for imparting rotation thereto such as the usual means associated with the wrap head of a knitting machine or with the dial mechanism of a knitting machine such as is shown in United States Patent No. 1,641,101. The particular driving means for the loop jack cylinder shown in the present drawings is substantially the same as that shown in said Patent No. 1,641,101.

It will be observed in Figures 1 and 2 that the upper portion of the loop jack cylinder shaft 210 has a beveled gear 243 fixed thereon, the lower edge of the hub of which slidably and rotatably engages the upper surface of the sleeve portion 236 of the bearing block 237 to thus support the loop jack cylinder shaft 210 and its associated loop jack cylinder 205 and the other parts carried thereby. This beveled gear 243 meshes with a beveled gear 244 fixed on a horizontally disposed shaft 245 on the other end of

which a similar beveled gear 246 is fixedly mounted.

The horizontally disposed shaft 245 is mounted for rotation in spaced upstanding portions 250 integral with the bearing blocks 237 (Figure 1). These upstanding portions 250 also support a suitable cast cover or shield 251 which surmounts the beveled gears 243, 244, 246 and the shaft 245 as well as a beveled gear 252. The beveled gear 252 meshes with the beveled gear 246 and is fixedly mounted on the upper end of a vertically disposed shaft 253. This shaft 253 is supported by the hub of the bevel gear 252 engaging a laterally projecting portion 254 integral with the bearing block 237 and in which the shaft 253 is rotatably mounted. The shaft 253 is also rotatably mounted in a bearing stand 256 which extends downwardly and is suitably secured, as by screws 257 (Figure 5), to the upper surface of the bed plate 13.

Referring to Figure 1, it will be observed that the shaft 253 slidably or loosely penetrates the bed plate 13 and has a beveled gear 260 fixed on the lower end thereof which engages the beveled gear 20 heretofore described, this beveled gear 20 being constantly driven with the beveled gear 16 which, in turn, transmits rotation to the needle cylinder 15. It is thus seen that the needle cylinder 15 and the loop jack cylinder 205 rotate in unison.

Referring to Figures 7 and 23, it will be observed that the enlarged lower portion 215 of the loop jack cylinder 205 is surrounded by an annular cam plate 261 which is mounted for vertical sliding movement on the enlarged lower portion 215 of the loop jack cylinder 205. This loop cam ring 261 has a lower surface 262 and is provided with an upwardly stepped lower surface 263 and also has a substantially inverted V-shaped notch 264 therein. It might be stated that the surfaces 263 and 264 of the cam ring 261 are exaggerated in Figure 23 so as to provide a true conception of the relative positions of the loop jacks 220 and the loop fingers 225 relative to the needles 22 in the needle cylinder 15, it being evident that the surfaces 263 and 264 would not embrace as great a length of the cam ring 261 as shown in Figure 23 since this cam ring 261 is of substantially less diameter than the mean vertical plane of the needle cams shown therebelow. This is also true of the constrictor or binder ring to be later described.

It will be observed in Figure 7 that the upper butt 221 on each of the loop jacks 220 has the lower end of a tension spring 265 connected thereto which extends upwardly and is connected to the upper edge of the reduced portion 234 of the loop jack cylinder 205. These tension springs normally urge the butts or outwardly extending portions 222 of the loop jacks 220 against the lower surfaces 262, 263 and 264 of the cam ring 261.

During ordinary circular knitting, it is necessary that the loop fingers 225 be elevated to inoperative position, that is, to a position to where they will not interfere with normal operation of the needles and the various other cooperating knitting instrumentalities. Therefore, the cam ring 261 is clampingly encircled by a substantially annular portion 267 of a loop jack actuating arm 270 (Figures 1 and 7) which extends outwardly and is suitably secured, as by screws 271, to a vertically movable bracket 272. The vertical movable bracket 272 is mounted for vertical sliding movement on a medial portion of the vertically disposed shaft 253 heretofore described. The lower edge of the bracket is normally supported on a collar or spacer 273 resting upon the upper end of the vertically disposed bearing stand 256. This collar 273 is of a predetermined height so the lower surfaces of the loop jack cam ring 261 may be properly positioned relative to the loop jack cylinder 205 as shown in Figure 7. While the loop jack cam ring 261 is held downwardly in this position by a collar 274 fixedly mounted on the upper end of a vertically disposed connecting rod 275, this collar engages a projection 276 on the vertically movable bracket 272. This projection 276 is slidably penetrated by the connecting rod 275.

Referring to Figure 3, it will be observed that the lower end of the connecting rod 275 is pivotally connected, as at 280, to the front end of a lever arm 281 which is oscillatably mounted intermediate its ends, as at 283, on a bearing block 284. The bearing block 284 is suitably secured as by screws 285 to the upper surface of the bed plate 13.

The outer or rear end of the lever arm 281 is bent laterally in a step-by-step manner, as shown in Figure 5, and the rear end thereof rests upon the upper surface of an angle clip 286 which is suitably secured to the upper portion of a thrust rod 287 by any suitable means such as screws or rivets 288.

The thrust rod 287 extends downwardly in Figures 3 and 4 and slidably penetrates an auxiliary thrust rod guide bracket 291 which is suitably secured, as by screws 292, to the vertical surface of the bed plate 13. This thrust rod 287 is also mounted for vertical sliding movement in the thrust rod guide plate 84 heretofore described and the lower end thereof is normally urged against the periphery of the main pattern drum 86, by the springs 265 (Figure 7) as shown in Figure 19, during ordinary rotary and reciprocatory knitting.

However, the thrust rod 287 is adapted to be engaged by a cam member 293 suitably secured to the periphery of the main pattern drum 86 and, in so doing, the thrust rod 287 is moved upwardly from the position shown in Figure 19 to the position shown in Figure 3 to thus move the vertically movable bracket 272 and the corresponding cam ring 261 downwardly to operative position.

Now, the cam ring 261 is normally urged upwardly by the springs 265 connected to the upper ends of the loop jacks 220 as the cam 293 in Figure 19 moves out of engagement with the lower end of the thrust rod 287. The butts or projections 222 then engage the lower surfaces of the cam ring 261 causing the same to move upwardly, in the manner heretofore described, until the jacks 220 engage the collar 235.

It will be noted in Figure 7 that the annular portion 267 of the cam ring actuating arm 270 is bifurcated at one end thereof and this bifurcated portion is penetrated by a suitable screw 267a for clamping the annular portion 267 around the cam ring 261.

In order to control the radial position of the hooked lower ends 232 of the loop fingers 225 relative to the needles 22, a constrictor ring, broadly designated at 295, which is encircled by the latch ring is provided. This ring 295 comprises a substantially vertically disposed tubular portion 296 having a horizontally extending substantially annular flange portion 297 integral therewith and disposed at the lower edge thereof. It will be ob-

served in Figure 7 that this constrictor ring 295 is spaced substantially from the latch ring 66 so as to provide a space therebetween through which the latches and hooks of the needles 22 may pass with rotary movement of the needle cylinder 15. The lower edge of the constrictor ring 295 is spaced substantially from the latch ring 66 so as to provide a space therebetween through which the latches and hooks of the needles 22 may pass with rotary movement of the needle cylinder 15. The lower edge of the constrictor ring 295 is disposed substantially in the same horizontal plane as the lower edge of the latch ring 66 and the upper edge of the tubular portion 296 is shown as being disposed at a slightly higher elevation than the upper surface of the latch ring 66.

The inner surface of the tubular portion 296 of the constrictor ring 295 is slidably engaged by the stem portions 231 of the loop fingers 225 during rotation of the loop jack cylinder 205 to thus normally hold these fingers 225 in the vertical position in which those fingers 225 disposed in the left-hand portion of Figure 7 are shown, the stems 231 of the loop fingers 225 being urged against the inner surface of the tubular portion 296 by the corresponding tension springs 230. Referring to Figure 8, it will be observed that the vertically disposed tubular portion 296 of the constrictor ring 295 is cut away to provide an opening 298 which extends through an arc of approximately 90 degrees and the bottom of which is partially closed by the flange portions 297. However, the flange portion 297 is also cut away to provide an opening 300 therein which is off-set relative to the opening 298 in the tubular portion 296. In order to provide communication between the opening 298 and the opening 300 in the respective tubular portion 296 and the flange portion 297, the lower edge of the portion 296 is cut at an angle, as at 301, as is most clearly shown in Figures 7 and 23.

An angularly disposed yarn guiding bar or stem 302 is disposed above the opening 300 in the flange 297 of the constrictor ring 295 and extends downwardly at an angle in a circular direction from the juncture of the openings 298 and 300 and in substantially parallel relation to the angular surface 301 of the tubular portion 296 of the constrictor ring 295 to thus assist in guiding the loop yarn, to be later described, from the opening 298 downwardly through the opening 300 substantially as shown in Figure 23. The stem 302 is suitably secured to the flange 297.

The constrictor ring is supported in proper spaced relation to the inner wall of the latch ring 66 by means of a pair of angle clips 303 and 304, the vertical legs of which are secured, as by welding, to the outer surface of the tubular portion 296 of the constrictor ring 295, at points spaced substantially opposite each other, and the horizontal legs of which extend outwardly radially of the constrictor ring 295 and are suitably secured as by respective screws 305 and 306, to the upper surface of the latch ring 66 (Figures 5 and 6).

Now, as the needles pass above second jack raising cam 57 as shown in Figure 23, during the knitting of the shaggy portion of a stocking, it is necessary that the lower hooked ends of the loop fingers 225 move outwardly substantially in the manner in which the right-hand loop finger 225 is shown in Figure 7. Therefore, by referring to Figures 5 and 6, it will be observed that the legs of a substantially U-shaped loop finger cam member or plate 307 rest upon the upper edge of the substantially tubular portion 296 of the constrictor ring 295 and this cam plate 307 bridges the opening 298 in the tubular portion 296. The loop finger cam plate 307 has a projection 307a thereon which is suitably secured, as by screws 310, to the upper surface of a substantially L-shaped cam support plate 311 (Figures 5, 6 and 7) which is disposed between the lower surface of the bracket 147 heretofore described and the upper surface of the latch ring 66 and is thus secured to the latch ring 66 by the bolts 150 heretofore described.

During ordinary reciprocatory and rotary knitting, such as in the elastic top, leg, heel, foot and toe portions of a stocking other than the portions of the stockings which have the enlarged loops therein, it is necessary that the lower ends of the loop fingers 225 be held inwardly of the inner surface of the latch ring 66 throughout each revolution thereof so as to not interfere with normal operation of the latch needles. Therefore, by referring to Figure 6, it will be observed that there is provided a loop finger deflecting or knock-off plate 312 which is disposed above the substantially U-shaped loop finger cam 307. This loop finger deflecting plate 312 is provided with a concave inner surface 313 which is adapted to be engaged by the medial portions of the stems 231 of the loop jack cylinder 205 during ordinary knitting operations and during which the deflecting plate 312 is in an operative position as shown in Figure 6. This will deflect the lower ends of the loop fingers 225 inwardly to thus prevent them from being moved outwardly to follow the inner surface of the loop finger cam 307, which they would do by the virtue of the tension springs 230, as shown in Figure 5, in the event of the loop finger deflecting plate being moved to inoperative position as shown in Figure 5. This loop finger deflecting plate 312 is pivotally mounted, as at 314 on the angle clip 304. The deflecting plate 312 has an extension arm 315 integral therewith which extends rearwardly and outwardly therefrom and is normally urged, as by a tension spring 316, against the upper end of the vertical leg of a bell crank 317 at its rear end (Figures 4, 5 and 6). The tension spring 316 is suitably connected at one end thereof intermediate the ends of the extension 315, its other end being suitably connected, as at 320, to the upper end of the rear post 76.

It will be observed in Figure 4 that the vertical leg of the bell crank 317 is substantially longer than the horizontal leg thereof and this bell crank 317 is oscillatably mounted, as at 321, on an angle clip 322 suitably secured, as by screws 323 (Figures 5 and 6), to the upper surface of the frame 10 adjacent the bed plate 13. The free end of the horizontal leg of the bell crank 317 has the upper end of a thrust rod 324 pivotally connected thereto as at 325 (Figure 4). The thrust rod 324 extends downwardly in Figures 4 and 20 and is adapted to successively engage the periphery of the main pattern drum 36 or a cam member 326 suitably secured to the periphery of the main pattern drum 36. It will be observed in Figures 4 and 20 that the lower portion of the thrust rod 324 is mounted for vertical sliding movement in the thrust rod guide plate 84 heretofore described. When the cam 326 in Figure 20 is in engagement with the lower end of the thrust rod 324 as shown, this causes the bell crank 317 in Figure 4 to move in a counter-clockwise direction to assume the position shown in Figure 6 with the

result that the deflecting plate 312 will be moved in a clockwise direction about its pivot point 314 from the position shown in Figure 5 to the position shown in Figure 6.

It might be stated that this plate 312 moves out of operative position immediately following the lowering of the loop fingers 225 so they may be accurately controlled for taking the loop yarn in their hooks. Also, this plate 312 moves into operative position immediately before the loop jack cylinder is elevated to inoperative position so as to move the loop fingers free of the knitted fabric as the loop yarn finger 61 moves to inoperative position.

Feed control for loop yarn

Referring to Figure 1, it will be observed that there is provided a cone 330 which is suitably supported on the creel stand 92 and which has a package of yarn 331 thereon from which a loop yarn L extends. It is preferred that this loop yarn be of a softer texture than that of the body yarn, such as a yarn having angora rabbit hair fibers therein. However, it is to be understood that any desired type of yarn may be employed for forming the elongated loops on the inner face of the stocking as shown in Figure 29. This loop yarn L extends upwardly and passes through a suitable yarn guide 332 depending from the bar 96 and then the yarn L extends downwardly and through a suitable spring pressed disk type of yarn tension device 333. It will be noted that the loop yarn L is introduced to the needles in exactly the same manner in which the elastic yarn R is introduced to the needles.

After the yarn L has passed through the tension device 333 it then extends downwardly at an angle and passes through a horizontally bent portion 334 of the loop yarn feed finger 61. The loop yarn feed finger 61 is suitably secured to a lever arm 335 which extends rearwardly, as shown in Figures 3 and 5, and is pivotally mounted on the shaft 64 extending from the rearwardly extending portion 65 of the latch ring 66, this shaft 64, as shown in Figure 5, being an extension of that portion of the shaft 64 shown in Figure 15 on which the body yarn feed finger 62 is pivotally mounted.

The lever arm 335 of the loop yarn feed finger 61 has a bunter 336 suitably secured to an intermediate portion thereof which is shown in the form of an adjustment screw in Figure 3 and the lower end of which is adapted to be engaged by the upper end of a thrust rod 337. This thrust rod 337 extends rearwardly and then downwardly through the thrust rod guide members 291 and 84, successively (Figures 4, 5 and 18), and the lower end thereof is adapted to, at times, engage the periphery of the main pattern drum 86 and to, at other times, engage a cam member 340 suitably secured to the periphery of the main pattern drum 86. Although the cam member 340 is shown in engagement with the lower end of the thrust rod 337 in Figure 18, the loop yarn feed finger 61 is shown in an operative position in Figure 3 and will occupy this position when the cam 340 has moved out of engagement with the lower end of the thrust rod 337 in Figure 18.

Clamp and cutter mechanisms

The loop yarn L and the body yarn Y, may be clamped and cut in any desired manner, the main difference between the showing of the clamping and cutting means for these yarns in the present drawings and the usual clamping and cutting means being that the usual clamp and cutter plate has been omitted from above the center of the needle cylinder and the clamp and cutter mechanisms are, instead, mounted on the flange 297 of the constrictor ring 295 as shown in Figure 22.

As the body yarn feed finger 62 and the loop yarn feed finger 61 are elevated to inoperative position, the yarn is pulled by the needles around the upper surface of the flange portion 297 of the constrictor ring 295 in a counterclockwise direction in Figure 5 and is successively directed to a clamping mechanism indicated broadly at 341 and then to a cutting mechanism indicated broadly at 342 in Figure 5. Now, by referring to Figure 22 it will be observed that the clamping mechanism 341 comprises a block 343 which is suitably secured, as by screws 344, to the outer wall of the tubular portion 296 of the constrictor ring 295, these screws 344 also serving to hold a plate 345 against the outer surface of the block 343. This plate 345 confines a vertically movable bar 346 being mounted for vertical sliding movement in the block 343.

The bar 346 has a presser foot 347 suitably secured to the lower end thereof which is turned upwardly at the leading edge thereof as shown in Figure 5 so that the yarn may pass beneath the leading edge thereof to thus be clamped therebetween the lower surface of the presser foot 347 and the upper surface of the horizontal flange 297 of the constrictor ring 295. This presser foot 347 is urged downwardly by a suitable tension spring 350 which is connected at its upper end to an outwardly projecting spring anchor portion 351 integral with the upper end of the vertically disposed bar 346, the lower end of the tension spring 350 being suitably connected to the plate 345, as by a pin 352.

In order to insure that the yarn may be properly directed to the clamping device 341 and also to the cutting device 342, there is provided a pair of vertically disposed guide pins 353 and 354 which are fixed at their lower ends, as by a pressed fit, in the horizontal flange 297 of the constrictor ring 295. It will be observed in Figure 5 that the pin 353 slidably penetrates the presser foot 347. The pin 354 serves to direct the yarn which extends from the hooks of the needles to the corresponding yarn feed fingers, between the operating end of a stationary lower blade 355 and a movable upper blade 356 of the cutting mechanism 342. This lower blade 355 is an integral part of a vertically disposed plate 357 which is suitably secured, as by screws 360 (Figure 22), to a block 361. The screws 360 slidably penetrate this block 361 and are threadably embedded in the tubular portion 296 of the constrictor ring 295.

The movable blade 356 is oscillatably mounted intermediate its ends on a cap screw 362 which is threadably embedded in the plate 357. The head of the screw 362 is spaced from the blade 356 and the stem of the screw is surrounded by a suitable compression spring 363 (Figure 5) so as to resiliently hold the blade 356 against the blade 355.

The blade 356 is normally in an open position relative to the stationary blade 355 and is moved operatively by a connecting rod 364 which is pivotally connected to the tail end of the blade 356 and extends upwardly therefrom as shown in Figures 1, 2 and 22, only the upper portion of the connecting rod 364 being visible in Figures 1 and 2. The upper end of the connecting rod 364 is pivotally connected, as at 365, to the front end

of an irregularly shaped lever arm 366 which extends rearwardly and then downwardly and again rearwardly and is oscillatably mounted on the end of the shaft 64 remote from the end on which the yarn feed finger arm 335 is mounted. The lever arm 366 then extends rearwardly and has a substantially U-shaped portion 367 integral therewith to which the upper end of a thrust rod 370 (Figures 1, 2 and 5) is pivotally connected as at 371.

It will be observed, in Figures 2 and 11, that the thrust rod 370 then extends downwardly and is provided with a longitudinally extending slot 374 which is slidably penetrated by a reduced outer end portion 85a integral with the shaft 85 heretofore described. In Figure 11 it will be observed that this reduced portion 85a has a collar 375 fixed thereon, as by a set screw 376 to which the lower end of a tension spring 377 is connected. This tension spring 377 extends upwardly and is suitably connected to a medial portion of the vertically disposed thrust rod 370. Thus, the tension spring 377 normally urges the lower end of the thrust rod 370 against the upper surface of the main pattern drum 86. This thrust rod is also adapted to be successively engaged by a pair of circularly spaced cam members 380 and 381 suitably secured to the periphery of the main pattern drum 86 (Figure 11).

It is thus seen that upon either one of the cam members 380 or 381 in Figure 11 engaging the lower end of the thrust rod 370, the thrust rod 370 will cause the lever arm 366 to move in a clockwise direction in Figure 2, thus moving the front end thereof downwardly and to move the movable blade 356, in Figure 22, to an opened position so the yarn may be introduced thereto in the manner heretofore described. Each of the cam members 380 and 381 is of sufficient length to provide ample time for the yarn to be introduced to the cutter mechanism 342 after which the corresponding cam 380 or 381 moves out of engagement with the lower end of the thrust rod 370 and the tension spring 377 will urge the same downwardly to cause the movable blade 356 in Figure 22 to move in a counterclockwise direction to thus sever the yarn.

Stocking structure

Referring to Figures 25 to 30, inclusive, there is shown a typical stocking or anklet which may be knitted on the present machine and it is to be understood that the present improvements in a knitting machine are not limited to producing a stocking of the type shown in Figures 25 to 30, this showing being made by way of illustration only.

Referring to Figure 25, the stocking comprises a ring top or selvage 400, a cuff portion 401, an elastic or ribbed ankle or leg portion 402, a heel pocket 403, a foot portion 404 and a toe pocket 405. The ring top 400 in Figure 25, the ankle 402 and the foot 404 may be knitted in the usual manner of rotary knitting and the heel and toe pockets 403 and 405 are, of course, knitted in the usual manner of reciprocatory knitting.

If so desired, the ankle portion 402 may also be knitted in the usual manner of rotary knitting. However, in the present instance, the ankle portion 402 is knitted in the same manner in which the usual elastic top of a stocking is knitted and, in order to produce a ribbed effect in the ankle of the stocking, I have incorporated the features of my attachment described in said Patent No. 2,420,771 as heretofore described. After the stocking, as shown in Figure 25, is removed from the machine it is looped in the usual manner along the line 407 at the juncture of the foot 404 and the toe pocket 405. When the stocking is being worn or on display, it is to be understood that the cuff portion 401 may be turned down over the ankle portion 402 as shown in Figures 26, 27 and 28 if so desired.

The structure of the cuff portion 401 of the stocking is peculiar to the present invention since it is produced on a machine embodying the features of the present invention and the inner face of the fabric has a plurality of walewise extending closely spaced rows of enlarged loops 410 thereon as is most clearly shown in Figures 27, 29 and 30. It will be observed that each of the loops 410 embraces a plurality of wales and the length of the yarn in each loop is substantially greater than the distance between the wales in which opposed ends of each loop are interknitted with the body fabric. In this instance, the loops are shown as embracing three wales and being interknitted in the wales at each side of the said three wales.

In Figure 29, I have shown a few wales and courses representing a portion of the fabric from which the cuff portion 401 of the stocking shown in Figures 25, 26, 27 and 28 is formed. For purposes of description, the wales are indicated by the reference numerals W1 to W13 and the courses shown are indicated at C1 to C6. All of the courses may be identical as shown in Figure 29 and it will be observed that the loop yarn is knitted simultaneously with the body yarn in the wale W2 and is then floated past the three wales W3, W4 and W5 inside of the fabric and is then knitted simultaneously with the body yarn in the wale W6. Now, although the loop yarn is floated past the wales W3, W4 and W5, there is a considerable slack in this portion of the yarn extending past the last-named wales thus resulting in the actual length of this portion of the yarn being substantially greater than the distance from the wales W2 to W6 and with the result that a fuzzy effect is produced in the top of the stocking as is clearly shown in Figures 26 and 27.

The loop yarn is then floated across the wale W7 and knitted into the wale W8 simultaneously with the body yarn. The structure as described in the wales W2 to W8 is then repeated around the stocking. The reason that the loop yarn is knitted with the body yarn in the spaced wales W6 and W8 and is floated across the wales W7 is merely to provide a space between the loops 410 which extend across the wales W3 to W5 and W9 to W11 in Figure 29. In this instance, the portion of the loop yarn which is floated across the wale W7 is held taut. However, it is to be understood that smaller loops may be formed if so desired by merely extending the loops across alternate wales and by providing a substantially greater length to the loops extending across alternate wales than the distance between alternate wales which would produce a slightly different ornamental effect from that shown in Figures 26 to 28. The formation of these loops 410 is shown schematically in Figure 30.

If so desired, the loop yarn may be knitted simultaneously with the body yarn in only a single wale between each of the loops 410, there being many other designs which may be produced to embody the loops 410 on a machine including the features of the present invention.

It will be observed in Figure 25 that the cuff portion 401 of the stocking is of substantially greater diameter than the ankle portion 402 of the stocking. This effect is produced by pro-

viding an elastic yarn in the ankle portion 402 of the stocking to not only produce a softer texture to the knitted fabric in the cuff portion of the stocking but to also permit the cuff portion of the stocking to be easily turned down over the angle portion 402 of the stocking in the manner shown in Figures 26 to 28, inclusive. It will be noted that the elastic yarn is laid into the loops formed of both the loop yarn and the body yarn in a portion 401*a* of the stocking to produce a tapered appearance to this portion 401*a*. It is preferred that an additional body yarn be knitted with the first body yarn in the portions 401*a* and 402 of the stocking shown in Figure 25. However, additional yarn feed fingers would then be required as well as cams on the main pattern drum 86 for operating the same.

Method of operation

As heretofore stated, the base fabric of the stocking is knitted in substantially the usual manner of rotary and reciprocatory knitting and the various knitting instrumentalities which are operated in knitting the base fabric of the stocking may vary as to structure and means of operation substantially from that shown in the present drawings. However, these knitting instrumentalities and their manner of operation are shown and described so as to illustrate that the enlarged loops 410 in the cuff portion 401 of the stocking shown in Figures 25 to 30 may be produced on many different types of circular knitting machines, it merely being required that various cams on the main pattern drum 86 be properly designed to produce the desired pattern and that the various parts of the machine which are usually positioned adjacent the upper end of the needle cylinder are mounted on the constrictor ring 265 since this constrictor ring is necessary to the proper function of the loop fingers 225.

In operation, the main pattern drum 86 rotates in a clockwise direction, in Figure 15, thus moving the cam 87 out of engagement with the lower end of the thrust rod 81 and permitting the body yarn feed finger 62 to move into the operative position shown in Figure 15. The body yarn Y at this time extends from the eye of the main body yarn feed finger 62 to the clamping mechanism 341 and is thus introduced to the hooks of the needles 22 as rotation is imparted to the needle cylinder 15 in a counter-clockwise direction in Figures 5 and 6 or from right to left in Figure 23. Rotation in unison with the needle cylinder 15 is also imparted to the loop cylinder 205 in the manner heretofore described.

Since the selvage 400 does not have the elongated loops 410 knitted thereinto, the loop fingers 225 are caused to remain in an elevated or inoperative position because the lower end of the thrust rod 287 in Figure 19 being in engagement with the periphery of the main pattern drum 86.

The loop finger deflector plate 312 is also caused to remain in the operative position shown in Figure 6 during the knitting of the ring top or selvage 400 by means of the cam 325 (Figure 20) being in engagement with the lower end of the thrust rod 324. This causes the lower ends of the loop fingers 225 to move in a substantially circular path and prevents them from moving outwardly as shown in Figures 5 and 24. It might be stated that the substantially tubular portion 296 of the constrictor ring 295 is of such length that when the loop fingers 225 are in a raised position, their lower ends will still be confined in the constrictor ring 295 and will move in sliding engagement with the inner surface of the tubular portion 296 thereof.

Before knitting the first or selvage course in the ring top 400 of the stocking shown in Figure 25, the rubber or elastic yarn R is introduced to the needles as the cam member 138 in Figure 12 moves out of engagement with the reading end of the control finger 135 to thus lower the elastic yarn feed finger 63 to operative position. Also, at this time, the first and second needle lowering cams 43 and 44 are moved into operative position and the sinker cam 155 is permitted to move into operative position because of the cam 171*a* in Figure 13 moving out of engagement with the lower end of the control finger 165.

Also, as the elastic yarn feed finger 63 moves into operative position, the cam member 152 (Figure 16) engages the lower end of the thrust rod 151 to open the conventional clamping means of the clamp and cutter mechanism 141 heretofore described to thus release the elastic yarn R so that it may be directed to the needles. The function of the various connections intervening between the main pattern drum 86 and the respective elastic clamping and cutting mechanism 141, the elastic yarn feed finger 63, the first and second needle lower cams 43 and 44 and the sinker cam 155 will be more clearly described later in the specification when the manner of operation of the various elements is given with respect to the knitting of the ankle portion 402 of the stocking shown in Figure 25.

After a few courses, say four courses, have been knitted to form the ring top or selvage 400 of the stocking shown in Figure 25, the elastic yarn feed fingers 63 again moves to inoperative position because of the cam 137 (Figure 12) moving into engagement with the control finger 135 and the needle lowering cams 43 and 44 along with the sinker cam 155 are also provided to move to inoperative position because the cam 171*a* moving into engagement with the lower end of the control finger 165 in Figure 13. Also, the cam 152 (Figure 16) then moves out of engagement with the lower end of the thrust rod 151 to operate the conventional elastic yarn cutting and clamping mechanism 141 for cutting and clamping the elastic yarn as the elastic yarn feed finger 63 is moved to inoperative position.

As the elastic yarn feed finger 63 is moved to inoperative position, the loop yarn L is then introduced to the needles because of the cam 340 (Figure 18) on the main pattern drum 86 moving out of engagement with the lower end of the thrust rod 337 to thus permit the loop yarn feed finger 61 to move downwardly to operative position between the inner surface of the latch ring and the hooks of the needles. At this point, the loop yarn L extends from the eye of the loop yarn feed finger 61 to the clamping mechanism 341 (Figures 5 and 6) and is picked up by certain of the needles as will be presently described.

At substantially the same time that the loop yarn feed finger 61 is moved into operative position, the loop jacks 220 and their corresponding loop fingers 225 are permitted to move downwardly to operative position because of cam 293 in Figure 19 engaging the lower end of the thrust rod 287 which, in turn, causes the cam ring 261 to move downwardly to occupy substantially the position shown in Figure 7.

The loop finger deflecting plate 312 is also moved from the position shown in Figure 6 outwardly to the inoperative position shown in Fig-

ure 5 so that with continued rotation of the needle cylinder 15 and the loop jack cylinder 205, the loop fingers 225 will successively be moved outwardly at their lower ends in engagement with the inner surface of the loop finger cam plate 397 as shown in Figures 5, 7 and 24. It has already been stated how the hook portions 232 on the lower ends of the loop fingers 225 are moved outwardly because of the corresponding tension springs 230 (Figure 37).

Now, the upper ends of the needles 22 in Figure 23 follow the same path during all rotary knitting from right to left in Figure 23 regardless of whether or not the loop yarn L is being directed thereto by the loop yarn feed finger 61. As heretofore stated, certain spaced needle jacks 30 are provided with long butts while the jacks therebetween are provided with short butts 32 and, in this instance, the needle jacks are divided into successive groups of three jacks each corresponding with six needles wherein the leading two jacks 30 are provided with long butts 31 and the third needle jack 30 is provided with the short butt 32 and there is one of these jacks 30 provided under every other needle as is clearly shown in Figure 23.

Thus, the needles 22 are divided into successive groups of six needles each wherein the first and third needle of each group will be elevated to take the loop yarn and there will thus be three needles between the third needle of one group and the first needle of the next adjacent group which will not take the loop yarn L. There is, of course, a lowered needle (the second needle) in between the first and third needle in each group which does not take the loop yarn L.

Therefore, as the needles 22 and the needle jacks 30 move from right to left in Figure 23, every first and third needle is caused to be elevated to a relatively high position as the corresponding needles move past the loop yarn feed finger 61 to thus cause them to take the yarn from the loop yarn feed finger 61. The fifth needle between the third needle of one group and the first needle of the next adjacent group are caused to move upwardly to an intermediate position while the needles therebetween are caused to assume a relatively low position.

A few of the needles that are caused to assume the relatively high, intermediate and low positions are indicated at 22*a*, 22*b* and 22*c*, respectively, in Figure 23. The needles 22*a* are caused to assume a relatively high position because of the jacks 30 having the long butts 31 thereon being disposed therebelow and riding up the cam 57 to the uppermost point thereof and, although these particular long butt jacks move downwardly immediately thereafter as they move from right to left in Figure 23, the corresponding needles will remain in relatively high position until they engage the top center cam 40. The needles 22*b*, which are raised to the intermediate position, are caused to do so because of the short butt jacks riding up the cam 57 and then riding along the notch 57*a* thus preventing the particular corresponding needles from being raised high enough to take the yarn from the loop yarn feed finger 61. These needles 22*b* are provided with the jacks 30 therebeneath merely for the purpose of taking the elastic yarn in a manner to be later described, and are not instrumental in taking the loop yarn L.

The needles 22*c* do not have a needle jack 30 therebeneath and, therefore, they will ride upon the upper surface of the needle cams 53 and the

projection 52*a* on the needle cam 52 to thus be elevated to the desired position for taking the yarn from the main yarn feed finger 62 only as they pass successively over and beneath the stitch cams 42 and 41.

Now, by referring to Figures 5 and 23 it will be observed that the substantially U-shaped cam 397 will permit the hooked lower ends 232 (Figure 7) on the loop fingers 225 to move outwardly beyond the hooks of the needles and between the needles 22*a* which are raised to the relatively high position shortly after the yarn has been directed to these particular needles from the yarn feed finger 61 but before these needles reach the stitch cams. These loop fingers 225 are again moved inwardly before reaching the stitch cams and the inwardly facing hooks 232 on the lower ends thereof will then ensnare the loop yarn and direct the same inwardly. This causes a substantially greater length of yarn L to be pulled through the eye of the loop yarn feed finger 61 than would normally be the case if the loop fingers 225 were not provided.

These loop fingers then retain the yarn thereon as the needles pass through the stitch cams and also as these needles, in addition to the needles therebetween, take the yarn from the body yarn feed finger 62. Thus, stitches are formed simultaneously from both the body yarn and the loop yarn Y and L, respectively, on the spaced needles 22*a* as the needles pass through the stitch cams to form stitches substantially as shown in the wales W2, W6, W8 and W12 in Figure 29.

The loop fingers 225 then cause elongated loops 410 to be formed with opposed ends of these loops being knitted simultaneously with the loops being formed on every first and third needle 22*a* in each group. The length of these loops, that is, the amount that the loops 410 project from the inner face of the base fabric knitted from the body yarn is, of course, determined by the distance from the needle circle to the inner face of the substantially tubular portion 296 of the constrictor ring 295 because, as is clearly shown in Figure 5, these loop fingers, after having moved outwardly to traverse the inner edge of the substantially U-shaped loop finger cam 397 are again caused to move inwardly to traverse the inner face of the tubular portion 296 of the constrictor ring 295 during the formation of stitches by the needles 22*a*.

Since the loop fingers 225 have to move inwardly of the constrictor ring 295, it will best be observed in Figure 23 that the loop yarn passes inwardly above the portion of the flange 297 of the constrictor ring which defines the lower wall of the opening 298. It will be observed in Figure 7 that these fingers 225 move inwardly and downwardly at their lower ends, due to the arcuate path that they follow since they are pivoted at their upper ends, this occurring at substantially the time that the fingers approach the left-hand wall of the opening 298 in Figure 23 and thus causing the loops extending therefrom to the needles 22*a* to move downwardly through the opening 300, the finger 302 also assisting in directing the loop yarn downwardly at this point (Figure 8).

Thus, as these needles 22*a* move past the body yarn feed finger 62, the loop yarn is disposed below the path of travel of any other body yarn feed fingers which may be employed, such as in knitting the body fabric from two or more yarns in the ankle portion 402. On the other hand, the lower edge of the constrictor ring 295 is disposed

at such an elevation that the hooks in the lower ends of the loop fingers 225 will be disposed at an elevation slightly below the lower edge of this constrictor ring 295 but not sufficiently low enough to cause the loop yarns to be moved below the latches of the needles.

Thus, as the needles 22a pass through the stitch cams, both the loop yarn and the body yarn are disposed between the hooks and latches of the needles as these needles cooperate with the sinkers 25 in drawing stitches in the usual manner. It will be noted that the needles are arranged in groups of six needles each wherein the terminal needle of each group is disposed at a high elevation and there is one other high needle disposed between the terminal needles of adjacent groups, this high needle having one needle disposed between the same and the terminal needle of an adjacent group and which does not take the loop yarn and also having three needles disposed at the other side thereof and between the same and the other terminal needles defining said group, these three needles also failing to take the loop yarn. This particular arrangement of needles is particularly for producing the fabric structure shown in Figure 29 wherein three loops are formed of the body yarn between each pair of loops which are knitted simultaneously of both the body yarn and the loop yarn, such as in the wales W3, W4 and W5 in Figure 29. This also provides the means for knitting from both yarns simultaneously in two alternate wales while knitting of only the body yarn in the wale therebetween, such as in the wales W6, W7 and W8 in Figure 29.

Although, the loop yarn is shown as being floated across the wale W7 in Figure 29 and being knitted simultaneously in the wale at opposed sides of the wale W7, it is to be understood that certain cams, not shown, may be included in the series of needle cams shown in Figure 23 to thus cause the needle knitting in wale W7 to also knit both yarns simultaneously so that all three wales W6, W7 and W8 have both of the yarns knitted thereinto simultaneously. It is preferable that the loop yarns be plated on the outside of the body yarns in the wales in which they are knitted simultaneously with the body yarns so as to provide a relatively unobstructed background for the enlarged loops 410 and in the wales between adjacent rows of loops as shown in Figure 29. It is to be understood however that the loop yarns may be plated on the inside of the fabric or on the same side in which the portions of loop yarns from which the loops are formed are floated on the inside of the fabric. It is evident that the loop fingers 225 are withdrawn from previously formed loops as they are effective in forming loops in a subsequent course.

In order to cause the elongated loops to project upwardly at the top of the stocking at the juncture of the cuff portion 401 with the ankle portion 402, such as in the area indicated at 401a in Figure 25 when the cuff is turned down as shown in Figures 26 to 28, inclusive, and following the knitting of the desired number of courses in the cuff portion 401, the elastic yarn R is introduced to the needles simultaneously with the cam 155 (Figure 5) being moved into operative position so as to not only lay in the elastic yarn R in the courses disposed in the area 401a but to also produce a ribbed effect in this portion which will extend into the ankle portion 402. The loop yarn is not knitted into the ankle portion 402 but is knitted into the portion 401a shown in Figure 25 and, as is clearly stated in said Patent No. 2,420,771, the length of the stitches formed in the ankle portion 402 and the portion 401a disposed thereabove may also be substantially greater than the normal length of the stitches, such as the stitches formed in the foot 404 and the heel and toe pockets 403 and 405, respectively.

The elastic yarn R is introduced to the needles by the movement of the elastic yarn feed finger 63 and the first and second needle lowering cams 43 and 44 (Figure 23) simultaneously moving into operative position and in which instance the elastic yarn R extends from the elastic yarn clamping and cutting mechanism 141 (Figure 6) to the eye of the elastic yarn feed finger 63.

As the elastic yarn feed finger 63 is moved downwardly to operative position, the leading end of the cam 153 (Figure 16) engages and elevates the thrust rod 151 thus releasing the elastic yarn from the corresponding conventional clamping and cutting mechanism 141.

As heretofore stated, these cams 43 and 44 and the elastic yarn feed finger are moved into operative position at this point because of the cam 171a (Figure 13) on the main pattern drum 36 moving out of engagement with the lower end of the control finger 165 and thus permitting the control finger 165 to move forwardly at its upper end in Figure 2 or in a clockwise direction. This releases the cams 43 and 44 which are conventionally spring biased to move inwardly to operative position and also permits the cam 155 in Figure 5 to move upwardly or towards the observer as the spring 156 thereon is released by the horizontal leg of the bell crank 157 in Figure 2, being moved downwardly, the function of this cam 155 is clearly shown in said Patent No. 2,420,771.

Since a needle jack 30 is disposed beneath alternate needles 22 as shown in Figure 23, after the needle butts have passed through the stitch cams, the butts of all the needles will engage the first needle lowering cam as they move from right to left in Figure 23 so that alternate needles will be properly engaged by the upper ends of the corresponding needle jacks 30 as their butts move along the lower surface of the cam 52. The short and long butts 31 and 32 of all of the needle jacks 30 will then engage and ride up the cam 53 thus elevating alternate needles to where they will take the yarn from the elastic yarn feed finger 63 after which these alternate needles will again be lowered to the level of the needles therebetween by the second needle lowering cam 44.

This will cause the elastic yarn to be tucked into alternate stitches subsequently formed on these needles in the usual manner. After knitting a predetermined number of courses, say, seven courses, the corresponding cams on the pattern drum are effective to cause the loop yarn feed finger 61 to be elevated to inoperative position and to also cause the loop finger deflecting plate to again be moved into operative position as shown in Figure 6. The loop jack cam 261 will also be elevated at this time by means of the corresponding cam 293 (Figure 19) moving out of engagement with the lower end of the thrust rod 267, the tension in the tension spring 265 then causing the loop jacks 220 and their corresponding loop fingers 225 to move upwardly and to therefore cause the loop jack cam 261 to also move upwardly.

It will be observed, in Figure 23, that the various needles and needle jack cams coincide with the loop finger cam plate 307 and the surface 264 in the loop jack cam 261 so the needles are

disposed at a lower elevation than the lower ends of the loop fingers 225 as they are moved outwardly beyond the outer surfaces of the needles therebeneath and then, as the needles are elevated to take the yarn from the loop yarn feed finger 61, the cam surface 264 on the loop jack cam 261 causes the loop jacks 220 and their corresponding loop fingers 225 to move downwardly as they are swung inwardly by the loop finger cam plate 307 so that the lower ends of the loop fingers pass between the spaced needles which have taken the loop yarn from the loop yarn feed finger 61.

As the loop yarn feed finger is moved upwardly to inoperative position, the terminal needles which have taken the loop yarn will cause the loop yarn to extend from the loop yarn feed finger 61 half way around the outer surface of the tubular portion 296 of the constrictor ring 295 and to thus direct this loop yarn to the clamping mechanism 341 to be clamped thereby and to further cause the loop yarn to be directed to the cutting mechanism 342 (Figures 5 and 6).

The cam 380 (Figure 11) then moves into engagement with the lower end of the thrust rod 376 causing the same to move upwardly and to thereby cause the lever 366 (Figure 2) to move in a clockwise direction and to cause the connecting rod 364 (Figures 2 and 22) to move downwardly to permit the loop yarn to be directed between the free ends of the blades 355 and 356 of the cutting mechanism 342. The cam 380 (Figure 11) then moves out of engagement with the lower end of the thrust rod 376 permitting it to move downwardly and to thus cause the movable cutter blade 355 in Figure 22 to move in a counterclockwise direction to thus sever the loop yarn.

The elastic yarn R continues to be fed to the needles in the manner heretofore described until the ankle portion 402 (Figure 25) of the stocking has been completed, at which time the cam 171 (Figure 13) moves into engagement with the lower end of the control finger 165 to move the first and second needle lowering cams 43 and 44 radially of the needle cylinder to inoperative position and to also move the cam 155 to inoperative position.

The cam 138 (Figure 12) also moves into engagement with the control finger 135 to thus move the elastic yarn feed finger 63 to inoperative position.

As the elastic yarn feed finger 63 is moved to inoperative position in the manner heretofore described, the conventional elastic yarn clamping and cutting mechanism 141 is operated because of the cam 153 (Figure 16) moving out of engagement with the lower end of the thrust rod 151.

The ring heel indicated at 402a in Figure 25 is then knitted in a conventional manner wherein the needles traverse the same path from right to left in Figure 23 that they traversed in knitting the cuff portion of the stocking but the loop yarn feed finger 61 and the elastic yarn feed finger 63 will then be disposed in a raised or inoperative position and only the body yarn Y will be directed to all of the needles from the body yarn feed finger 62.

It will be observed in Figure 21 that the cam 194 will then move out of engagement with the control finger 191 thus permitting the switch cam 51 to move into operative position to elevate all of the long butt needles which is substantially half of the needles, and to move the widening pick 45 downwardly to the dotted line position in Figure 23. The narrowing and widening then takes place successively in the well known manner of reciprocatory knitting and the step on cam 196 engages the control finger 190 in Figure 21 to release the widening pick 45. The cam 196 then causes the cam 51 to move upwardly to lower the rest of the needles for knitting the foot 404. The foot portion 404 is then knitted in the same manner in which the ring heel 402a was knitted after which the cam 196 moves out of engagement with the lower end of the control finger 190 in Figure 21 to again permit the narrowing and widening operations to take place in the forming of the toe pocket 405 and during which the step on cam 194 engages the control finger 190 to widen the toe pocket and to subsequently provide for the forming of the usual loopers rounds.

It is evident that during the knitting of the heel and toe pockets 403 and 405, the gap closer is moved into operative position by means of the cams 140a and 140 (Figure 14) successively engaging the lower end of the thrust rod 126 and the tension arm 104 (Figure 2) is permitted to operate because of the cam 120 (Figure 17) moving out of engagement with the lower end of the thrust rod 114 and the cam 121 subsequently moving into engagement therewith and then out of engagement therewith for the knitting of the heel and toe pockets respectively. Thus, the tension arm 104 is permitted to oscillate on its axis 106 as the tension in the body yarn Y varies during reciprocatory movement of the needle cylinder and the gap closer functions in the usual manner to hold the body yarn feed finger 62 in an operative position adjacent the throat plate, as shown in Figure 15.

Following the knitting of the usual loopers rounds, the lower end of the thrust rod 81, in Figure 15, is engaged by the cam 87 on the main pattern drum 86 to thus move the body yarn feed finger 62 upwardly to inoperative position and to move the body yarn Y clear of the needles to complete the knitting of the stocking. As the cam 87 moves into engagement with the lower end of the thrust rod 81 to move the finger 62 to inoperative position, the cam 381 (Figure 11) moves into engagement with the end of the thrust rod 376 to open the cutter blades 355 and 356 relative to each other in Figure 22 and to thereby receive the body yarn as it is directed thereto from beneath the presser foot 347 of the clamping mechanism 341 (Figure 22). The cam 331 (Figure 11) then moves out of engagement with the lower end of the thrust rod 376 to thus cause the movable cutter blade 356 to move downwardly to sever the body yarn, after which the cam 87, in Figure 15, moves out of engagement with the lower end of the thrust rod 81 to again start the knitting of another stocking in the manner heretofore described to thus complete the cycle of the knitting of a stocking of the type shown in Figures 25 to 30, inclusive.

It is thus seen that I have provided improvements in a knitting machine for knitting tubular fabrics wherein the inner surface of any part of the tubular knit fabric, such as the leg portion of a stocking is provided with walewise extending rows of elongated weftwise extending loops and wherein the loops may be interknitted in alternate or spaced wales and the portions of the loop yarn extending between the points at which they are interknitted with the body yarns may be of substantially greater length than the distance between the points at which they are knitted to thus produce a fabric having a very soft fuzzy texture on the inside thereof which not only

serves as a means of warmth to the wearer of the article but also provides an ornamental effect in the instance of the enlarged looped formations being provided in the cuff portion of a stocking such as that shown in Figures 25 to 28, inclusive.

In the drawings and specification there has been set forth a preferred form 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 defined in the claims.

I claim:

1. In a circular independent needle knitting machine having a rotary circular series of needles therein and also having a set of stitch cams through which the needles pass in forming stitches and also having means for directing a body yarn to all of the needles to form a base fabric therefrom as the needles pass through the stitch cams; the combination of a loop head having a plurality of circularly spaced loop fingers thereon, means for imparting rotation to said loop fingers in unison with the needles disposed adjacent the loop fingers, means for directing an auxiliary yarn to certain spaced needles at a point in advance of the stitch cams, means for independently moving each of the loop fingers radially from a point at one side of the circular series of needles and across the path of the needles and at a point between said spaced needles and in advance of the stitch cams, the loop fingers being positioned at such a level as to engage the loop yarn as they move across the path of the circular series of needles and between adjacent spaced needles, and means for holding said loop fingers in a predetermined position relative to the needles after the loop fingers have moved across the path of travel of the needles whereby a substantially greater amount of the auxiliary yarn will be directed to said spaced needles than is normally required to thereby result in elongated loops subsequently being formed as the spaced needles pass through the stitch cams to form stitches therewith simultaneously from both the body yarn and the auxiliary yarn and wherein said elongated loops will be interknitted with the stitches formed of the body yarn.

2. In a circular independent needle knitting machine having a rotary needle cylinder provided with a circular series of needles and also having at least one set of stitch cams through which the needles pass in forming stitches and also having means for directing a body yarn to all of the needles to form a base fabric therefrom as the needles pass through the stitch cams; the combination of a loop head having a plurality of circularly spaced loop fingers thereon, means for imparting rotation to said loop fingers in unison with the needles disposed adjacent the loop fingers, means for directing an auxiliary yarn to certain spaced needles at a point in advance of the stitch cams, means for independently moving each of the loop fingers radially from a point at one side of the circular series of needles and across the path of the needles and at a point between said spaced needles and in advance of the stitch cams, the loop fingers being positioned at such a level as to engage the loop yarn as they move across the path of the circular series of needles and between adjacent spaced needles, means for holding said loop fingers in a predetermined position relative to the needles after the loop fingers have moved across the path of travel of the needles whereby a substantially greater amount of the auxiliary yarn will be directed to said spaced needles than is normally required to thereby result in elongated loops subsequently being formed as the spaced needles pass through the stitch cams to form stitches therewith simultaneously from both the body yarn and the auxiliary yarn and wherein said elongated loops will be interknitted with the stitches formed of the body yarn, and means for introducing an elastic yarn to the needles in certain courses in which the auxiliary and body yarns are knitted simultaneously.

3. In a circular independent needle knitting machine having a rotary circular series of needles therein and also having at least one set of stitch cams through which the needles pass in forming stitches and also having means for directing a body yarn to all of the needles to form a base fabric therefrom as the needles pass through the stitch cams; the combination of a loop head disposed above and in axial alinement with the circular series of needles and having a plurality of circularly spaced loop fingers thereon, means for imparting rotation to the loop head and its loop fingers in unison with the circular series of needles, means for varying the position of the loop fingers in a vertical plane relative to the needles so as to cause the loop fingers to, at times, be disposed above the hooks of the needles, pattern controlled means for lowering the loop fingers to operative position relative to the hooks of the needles, pattern controlled means for, at times, causing said loop fingers to remain inoperative while in a lowered position, and, at other times, to cause the loop fingers to independently and sucessively move radially outwardly and inwardly in advance of the needles passing through the stitch cams, and cam means controlling the elevation of the loop fingers as they move outwardly and inwardly to cause the same to pass in back of the needles and then between certain spaced needles and then inwardly to form elongated loops as the spaced needles subsequently pass through the stitch cams and whereby a tubular knitted article may be formed in which certain courses may be knitted to form a base fabric having inwardly facing loops thereon.

4. An improvement in a circular independent needle knitting machine having a rotary needle cylinder provided with a plurality of vertically movable latch needles and said machine also having at least one set of stitch cams through which the needles pass in forming stitches and also having means for directing a body yarn to the needles to form a base fabric therefrom as the needles pass through said stitch cams, said improvement comprising a loop head disposed above the needle cylinder and including a loop jack cylinder provided with a plurality of circularly spaced vertically extending grooves therein, means for rotating the loop jack cylinder in unison with the needle cylinder, a loop jack mounted for vertical movement in each of said grooves in the loop jack cylinder and each of the loop jacks having an outwardly extending projection thereon, spring means normally urging said loop jacks upwardly relative to the needle cylinder, a loop finger pivotally connected to the projection on each of the loop jacks, spring means normally urging said loop fingers outwardly, cam means encircling the loop jack cylinder and engaging the upper surfaces of the projections on said loop jacks to cause the corresponding loop fingers to move in an irregular path upwardly and downwardly with rotation of the loop jack cylinder, pattern controlled means for varying

the vertical position of the loop jack cam, means to permit the loop jacks and their corresponding loop fingers to move upwardly to inoperative position at predetermined periods according to a desired pattern, pattern controlled means for varying the position of the loop fingers radially of the needle cylinder to cause the loop fingers to independently move outwardly over the upper ends of the needles and then inwardly and downwardly between certain spaced needles, and means for introducing an auxiliary yarn to the needles in advance of the inward and downward movement of the loop fingers between said spaced needles to thus form elongated loops of the auxiliary yarn wherein each elongated loop is interknitted with the body yarn as the corresponding needles subsequently pass through the stitch cams.

5. An improvement in a circular independent needle knitting machine having a rotary needle cylinder provided with a plurality of vertically movable latch needles and said machine also having at least one set of stitch cams through which the needles pass in forming stitches and also having means for directing the body yarn to the needles to form a base fabric therefrom as the needles pass through said stitch cams, said improvement comprising a loop head disposed above the needle cylinder and including a loop jack cylinder provided with a plurality of circularly spaced vertically extending grooves therein, means for rotating the loop jack cylinder in unison with the needle cylinder, a loop jack mounted for vertical movement in each of said grooves in the loop jack cylinder and each of the loop jacks having an outwardly extending projection thereon, spring means normally urging said loop jacks upwardly relative to the needle cylinder, a loop finger pivotally connected to the projection on each of the loop jacks, spring means normally urging said loop fingers outwardly, cam means encircling the loop jack cylinder and engaging the upper surfaces of the projections on said loop jacks to cause the corresponding loop fingers to move in an irregular path upwardly and downwardly with rotation of the loop jack cylinder, pattern controlled means for varying the vertical position of the loop jack cam means to permit the loop jacks and their corresponding loop fingers to move upwardly to inoperative position at predetermined periods according to a desired pattern, pattern controlled means for varying the position of the loop fingers radially of the needle cylinder to cause the loop fingers to independently move outwardly over the upper ends of the needles and then inwardly and downwardly between certain spaced needles, means for introducing an auxiliary yarn to the needles in advance of the inward and downward movement of the loop fingers between said spaced needles to thus form elongated loops of the auxiliary yarn wherein each elongated loop is interknitted with the body yarn as the corresponding needles subsequently pass through the stitch cams, and pattern controlled means for introducing an elastic yarn to the needles after they have passed through said stitch cams and in the same courses in which the loops are formed of the auxiliary yarn.

6. In a circular independent needle knitting machine having a needle cylinder provided with a series of vertically movable needles therein and also having at least one set of stitch cams through which the needles pass in forming stitches and also having means for directing a body yarn to all of the needles to form a base fabric therefrom as the needles pass through said stitch cams, an auxiliary yarn feed station disposed in advance of the stitch cams, means for elevating certain spaced needles to cause said spaced needles to take the auxiliary yarn from the auxiliary yarn feed station, a plurality of circularly spaced loop fingers disposed above the needle cylinder, means for causing each of the loop fingers to successively move outwardly above said spaced needles at a point immediately following that at which the auxiliary yarn is directed to said spaced needles, cam means operable to cause each of said loop fingers to subsequently move downwardly and then inwardly between said elevated spaced needles to ensnare the auxiliary yarn and to subsequently cause a greater amount of yarn to be drawn through the auxiliary yarn feed station than is normally required to extend between adjacent spaced needles whereby, upon the spaced needles subsequently passing through said stitch cams, elongated loops are formed from the auxiliary yarn and wherein the loops are interknitted with the body yarn as they pass through the stitch cams, said loop fingers retaining the loop yarn thereon until they are subsequently moved outwardly in a repetition of the above cycle to release the yarn therefrom.

7. In a circular independent needle knitting machine having a needle cylinder provided with a series of vertically movable needles therein and also having at least one set of stitch cams through which the needles pass in forming stitches and also having means for directing a body yarn to all of the needles to form a base fabric therefrom as the needles pass through said stitch cams, an auxiliary yarn feed station disposed in advance of the stitch cams, means for elevating certain spaced needles to cause said spaced needles to take the auxiliary yarn from the auxiliary yarn feed station, a plurality of circularly spaced loop fingers disposed above the needle cylinder, means for causing each of the loop fingers to successively move outwardly above said spaced needles at a point immediately following that at which the auxiliary yarn is directed to said spaced needles, cam means operable to cause each of said loop fingers to subsequently move downwardly and then inwardly between said elevated spaced needles to ensnare the auxiliary yarn and to subsequently cause a greater amount of yarn to be drawn through the auxiliary yarn feed station than is normally required to extend between adjacent spaced needles whereby, upon the spaced needles subsequently passing through said stitch cams, elongated loops are formed from the auxiliary yarn and wherein the loops are interknitted with the body yarn as they pass through the stitch cams, said loop fingers retaining the loop yarn thereon until they are subsequently moved outwardly in a repetition of the above cycle to release the yarn therefrom and pattern controlled means for introducing an elastic yarn to the needles after they have passed through said stitch cams and in the same courses in which the loops are formed of the auxiliary yarn.

8. In a circular independent needle knitting machine having a rotary circular series of needles therein and also having at least one set of stitch cams through which the needles pass in forming stitches and also having means for directing a body yarn to all of the needles to form a base fabric therefrom as the needles pass through the stitch cams; the combination of a

loop head disposed above and in axial alinement with the circular series of needles and having a plurality of circularly spaced loop fingers thereon, means for imparting rotating to the loop head and its loop fingers in unison with the circular series of needles, means for varying the position of the loop fingers in a vertical plane relative to the needles so as to cause the loop fingers to, at times, be disposed above the hooks of the needles, pattern controlled means for lowering the loop fingers to operative position relative to the hooks of the needles, pattern controlled means for, at times, causing said loop fingers to remain inoperative while in a lowered position and, at other times, to cause the loop fingers to independently and successively move radially outwardly and inwardly in advance of the needles passing through the stitch cams, cam means controlling the elevation of the loop fingers as they move outwardly and inwardly to cause the same to pass in back of the needles and then between certain spaced needles and then inwardly to form elongated loops as the spaced needles subsequently pass through the stitch cams whereby a tubular knitted article may be formed in which certain courses may be knitted of the base fabric only and other courses may be knitted to form a base fabric having inwardly facing loops thereon, said pattern controlled means for causing said loop fingers to remain inoperative while in a lowered position comprising a constricting ring partially surrounding the lower portions of the loop fingers and causing them to remain in a position spaced inwardly of the circular series of needles throughout their arc of movement other than that through which they pass as they move outwardly and then inwardly to draw the auxiliary yarn inwardly between adjacent spaced needles, and pattern controlled means for constricting the path through which the loop fingers pass throughout their entire circle of movement to prevent the loop fingers from moving outwardly and inwardly to take the yarn from between adjacent spaced needles according to a desired pattern.

9. An improvement in a circular independent needle knitting machine having a rotary needle cylinder provided with a plurality of vertically movable latch needles and said machine also having at least one set of stitch cams through which the needles pass in forming stitches and also having means for directing a body yarn to the needles to form a base fabric therefrom as the needles pass through said stitch cams, said improvement comprising a loop head disposed above the needle cylinder and including a loop jack cylinder provided with a plurality of circularly spaced vertically extending grooves therein, means for rotating the loop jack cylinder in unison with the needle cylinder, a loop jack mounted for vertical movement in each of said grooves in the loop jack cylinder and each of the loop jacks having an outwardly extending projection thereon, spring means normally urging said loop jacks upwardly relative to the needle cylinder, a loop finger pivotally connected to the projection on each of the loop jacks, spring means normally urging said loop fingers outwardly, cam means encircling the loop jack cylinder and engaging the upper surfaces of the projections on said loop jacks to cause the corresponding loop fingers to move in an irregular path upwardly and downwardly with rotation of the loop jack cylinder, pattern controlled means for varying the vertical position of the loop jack cam means to permit the loop jacks and their corresponding loop fingers to move upwardly to inoperative position at predetermined periods according to a desired patterns, pattern controlled means for varying the position of the loop fingers radially of the needle cylinder to cause the loop fingers to independently move outwardly over the upper ends of the needles and then inwardly and downwardly between certain spaced needles and above the needles, between said spaced needles and means for introducing an auxiliary yarn to the needles in advance of the inward and downward movement of the loop fingers between said spaced needles to thus form elongated loops of the auxiliary yarn wherein each elongated loop is interknitted with the body yarn as the corresponding needles subsequently pass through the stitch cams.

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