May 15, 1945. I. H. C. GREEN 2,376,050

MACHINE FOR KNITTING

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FIG. 1.

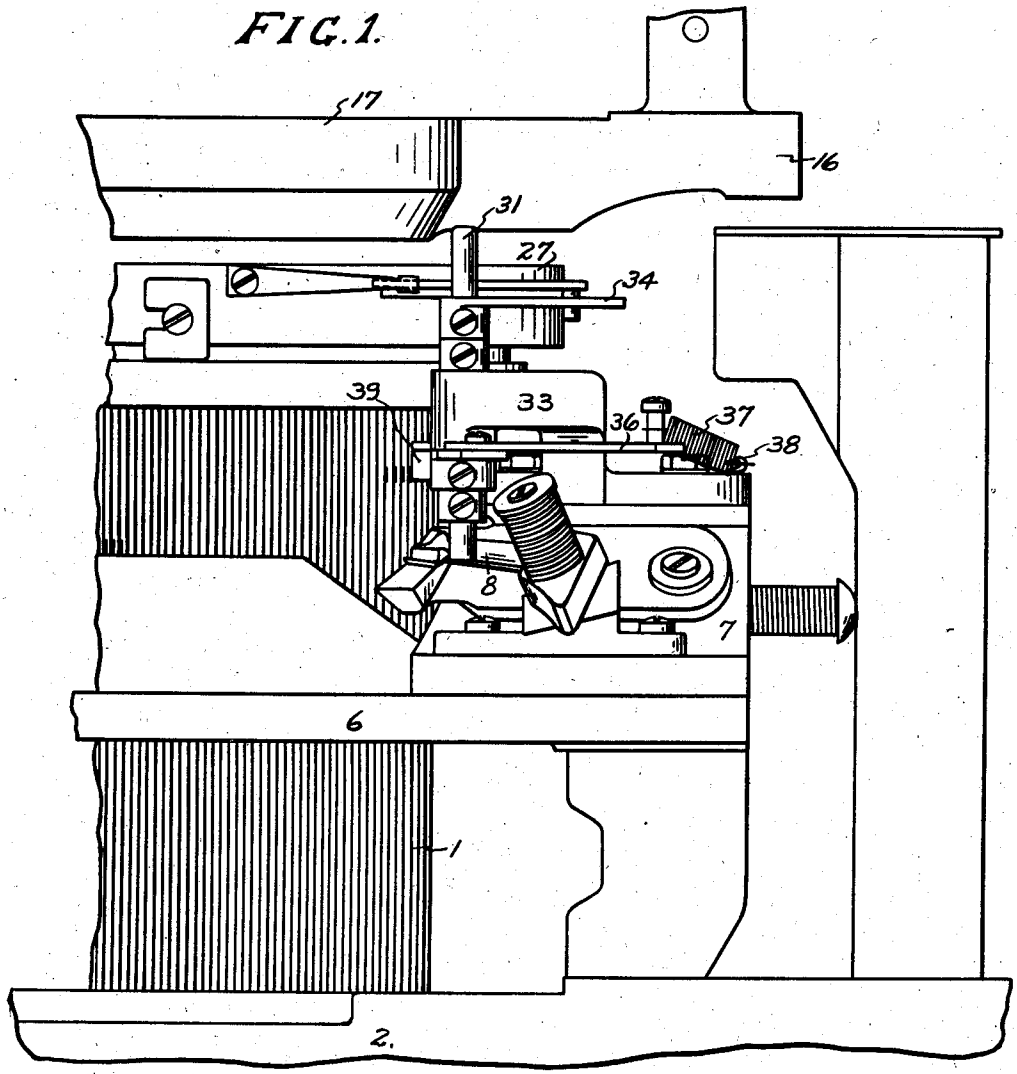
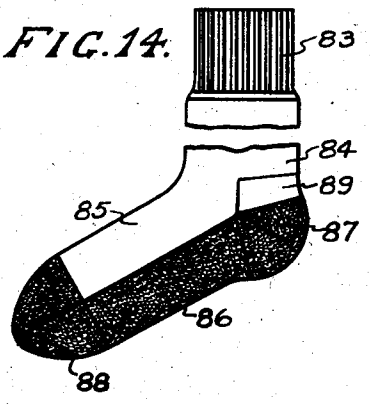


FIG. 14.



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FIG. 2.

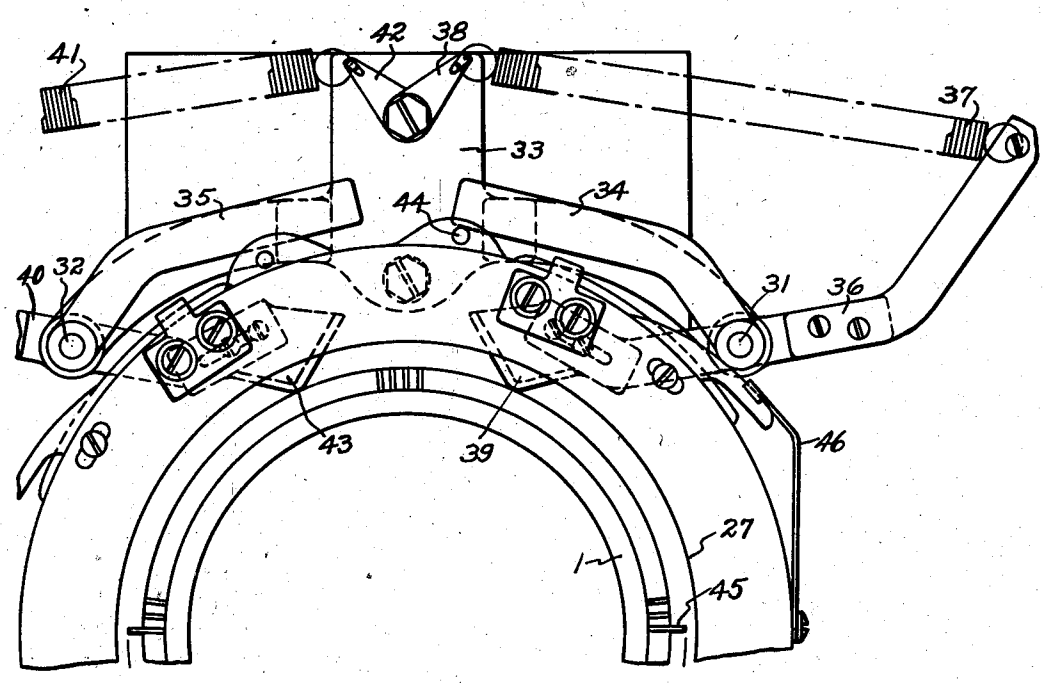
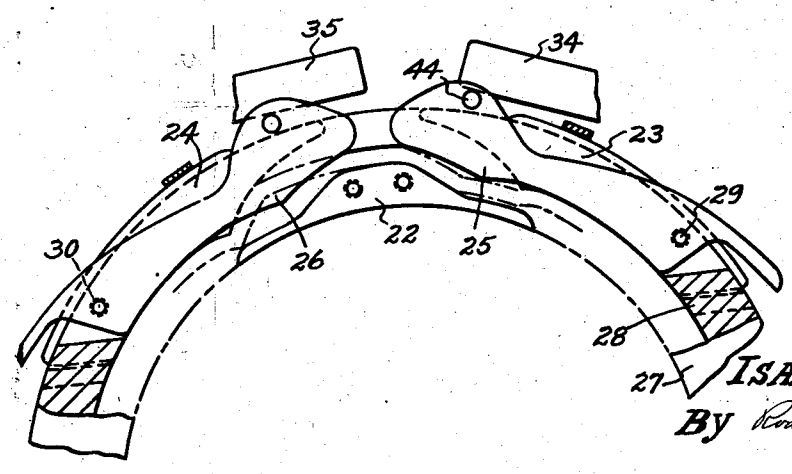


FIG. 3.



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MACHINE FOR KNITTING

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FIG. 4.

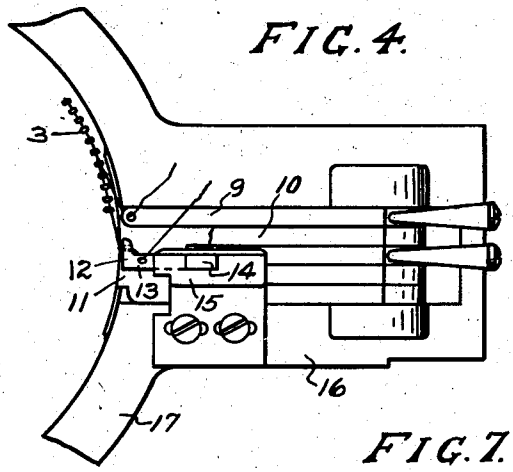


FIG. 4a.

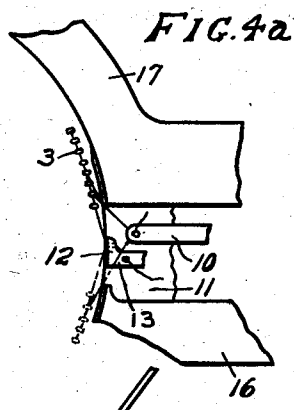


FIG. 7.

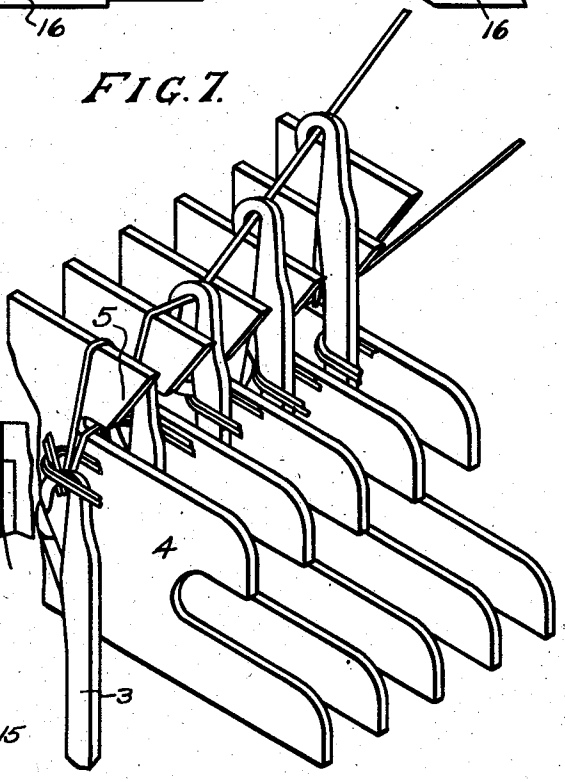


FIG. 5.

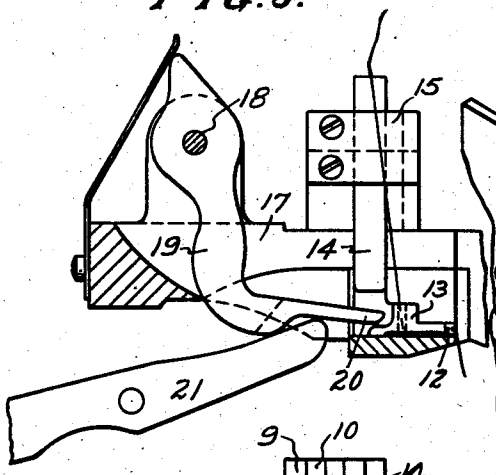
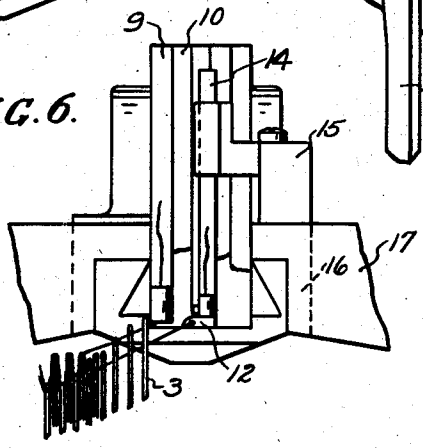


FIG. 6.



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MACHINE FOR KNITTING

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FIG. 8.

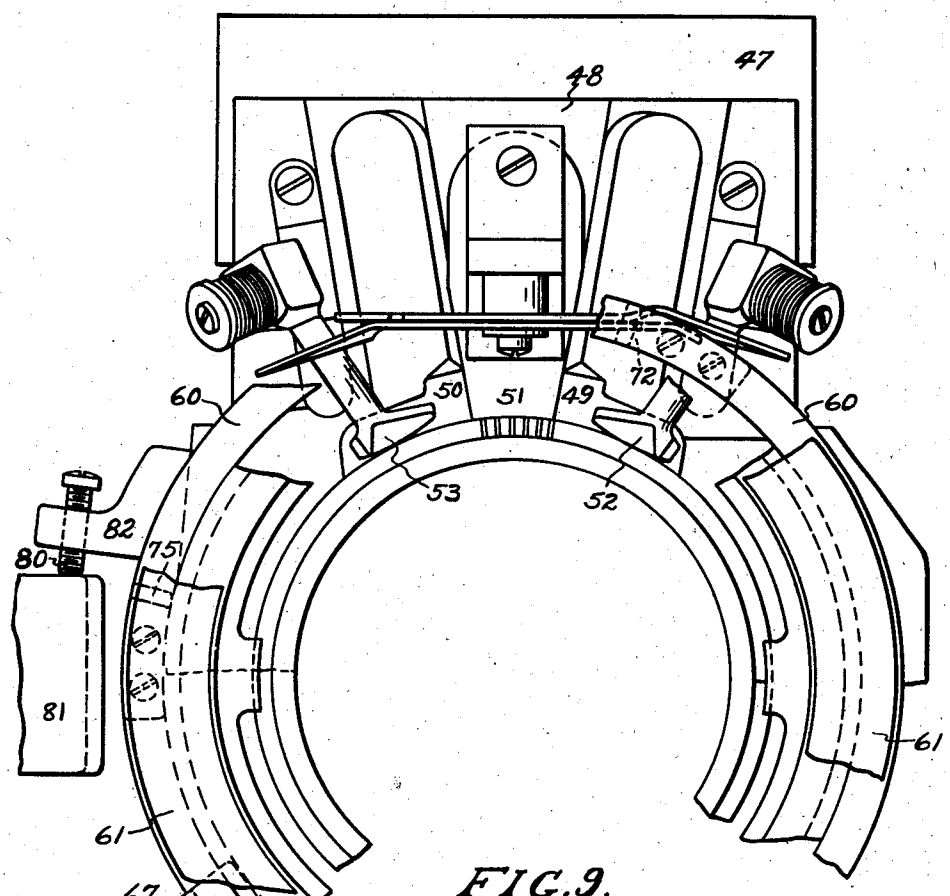
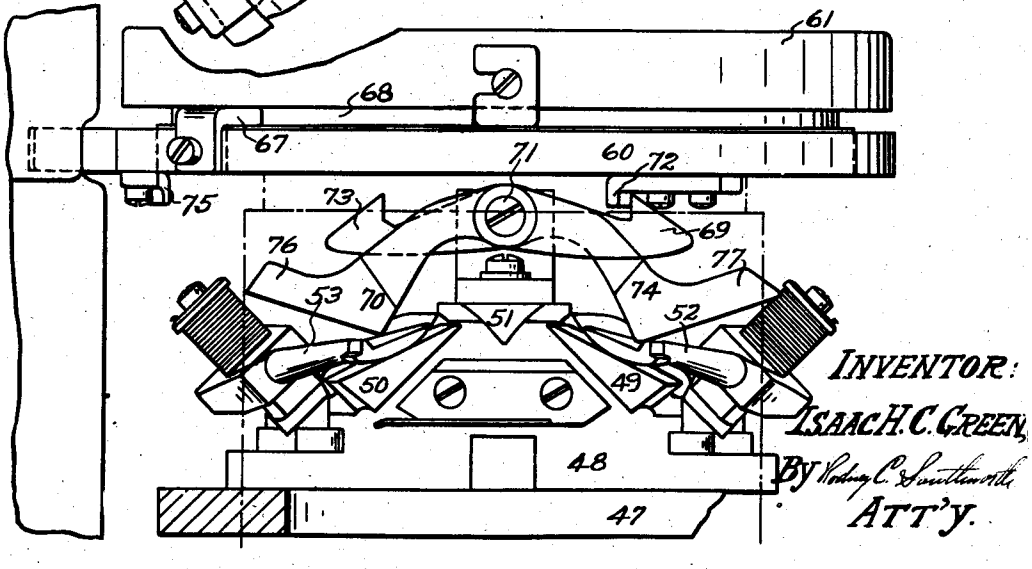


FIG. 9.



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FIG. 10.

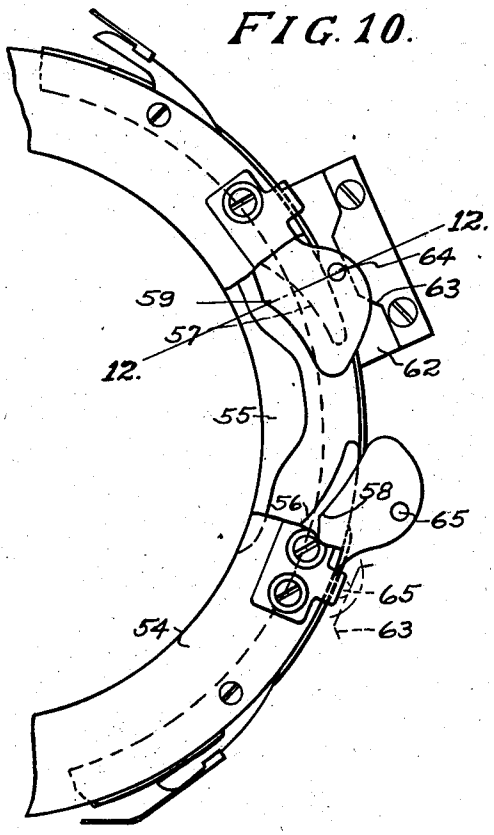


FIG. 12.

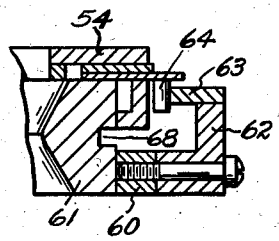


FIG. 13.

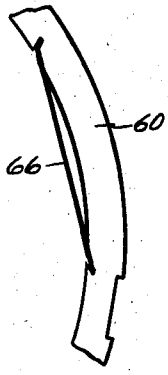
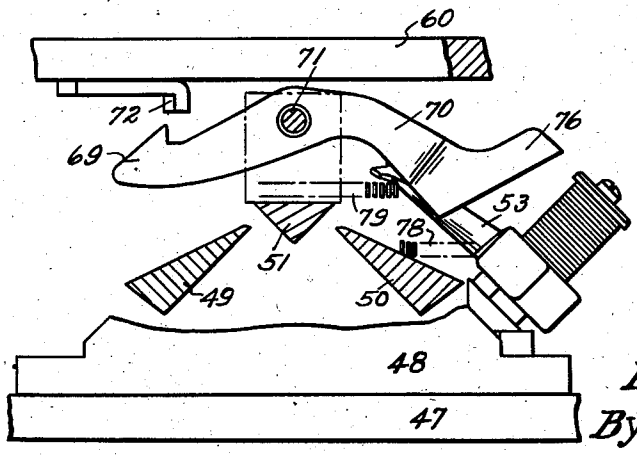


FIG. 11.



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Patented May 15, 1945 2,376,050

UNITED STATES PATENT OFFICE

2,376,050

MACHINE FOR KNITTING

Isaac H. C. Green, Pawtucket, R. I., assignor to Hemphill Company, Central Falls, R. I., a corporation of Massachusetts

Application April 7, 1943, Serial No. 482,143

5 Claims. (Cl. 66—93)

This application concerns a knitting machine of the circular, independent needle type adapted to knit hosiery and in which at certain parts of a knitted stocking pile or terry loops are formed. Such hosiery is the subject matter of Davis Patent #2,144,563 and is very popular for athletic wear, military uses and other purposes. There is no particular difficulty in incorporating the pile or terry loops during circular work, but in reciprocatory knitting as in forming heels and toes, considerable difficulty is experienced. At that time it is necessary to narrow and widen and that causes the pile yarn to be missed by many of the sinkers so that it does not appear in the finished fabric in each course, or in all of the desired stitches in a course.

Here mechanism is disclosed which is adapted to control the feeding of the pile yarn in such relationship to the so-called body yarn and simultaneously to regulate the rection of sinkers as to separate the two yarns a maximum amount or extent and project nibs of sinkers between the yarns at such time and in such manner that there shall be a pile loop at each stitch intended.

In the following description taken in reference to the accompanying figures of drawings; two forms of mechanism are described by means of which the general purposes of the invention are to be carried into effect.

In the figures of drawings:

Fig. 1 is an elevation of a part of a circular type hosiery machine to which the invention has been applied.

Fig. 2 is a plan of part of a cylinder, sinker cam cap and certain controlling devices applied thereto.

Fig. 3 is a detail view of sinker cams, the cap having been cut away to show these cams more clearly.

Fig. 4 is a detail view of feeding levers and of yarns as they are fed to passing needles.

Fig. 4a is a view similar to Fig. 4, but showing feeding during a different phase of the production of a stocking.

Fig. 5 is a section showing the feeding means for the pile yarn.

Fig. 6 is a third view of the mechanism shown in Figs. 4 and 5, but as seen from the inside of the needle circle.

Fig. 7 is an isometric view showing a few needles and sinkers and the yarns being drawn by them.

Fig. 8 is a plan view showing a modified form of the invention, certain parts being cut away, and illustrating narrowing picks and other elements controlled by those picks.

Fig. 9 is a view of the mechanism shown in Fig. 8, but as it would be seen if viewed from the inside of the needle cylinder.

Fig. 10 is a detail view of sinker cams and special control for those cams as it is applied by the mechanism of this modified form of the invention.

Fig. 11 is a sectional view showing needle cams, one pick and means controlled by that pick for regulating the action of the sinker cams.

Fig. 12 is a section taken at the line 12—12, Fig. 10.

Fig. 13 is a detail of a friction ring employed in this modification.

Fig. 14 is a conventional illustration of a stocking knitted by mechanism described in this case, said stocking being viewed inside out.

Now referring to the Figs. 1–7, a needle cylinder 1 of usual type is rotatable in a frame which has a circular base 2 and that cylinder carries the usual latch needles 3, Fig. 7, each of these needles having the usual butt. Instep needles have long butts while sole needles have short butts. A plurality of sinkers 4, one for each needle, have special nibs 5 which are adapted to project between the two feeding yarns. Each of these sinkers has a butt (not shown) and is controlled by action of certain cams on those butts. There are a plurality of cams which are adapted to engage needle butts and control them, those cams including the usual stitch cams, center cam and raise cams all of which are supported by a cam plate 6 and the stitch cams of which are operated in conjunction with a cam block 7. There are also the usual narrowing picks 8 for the purpose of raising one needle at a time during each stroke of heel and toe knitting.

Yarns are fed by a series of yarn levers or fingers shown more clearly in Figs. 4, 5 and 6. The lever 9 feeds a yarn is the pile yarn employed during knitting the high splice and the double sole. That finger is controlled to move to and from feeding position once each course. Lever 10 feeds a similar pile yarn during formation of the heel and toe. Of course, there is the usual mechanism employed on this type of machine to raise and lower these yarn levers so as to introduce or withdraw a yarn at desired times. There are other levers for feeding other yarns during knitting different parts of the stocking. Those are not important here and will not be described.

The body yarn is to be fed at a point very close to the center of the mouthpiece 11 and is thread-

ed through the offset end 12 of a special, vertically movable, feeding finger 13. This finger 13 rests upon the mouthpiece when in lowered or active position and is guided during its vertical movements by the projecting part 14 and a guide 15. That guide 15 attaches to the side of projection 16 extending from the carrier ring 17.

Normally each of the levers 9, 10, etc., swings about pivot 18 in the usual way. However, the feeding finger 13 is raised by a specially shaped lever 19 pivoting at 18 and having a reduced end 20 which engages in a sort of slot adjacent the lower end of the finger itself. The lever 19 is in turn moved by a second controlling element 21 similar to that which affects levers 9, 10, etc.

The lever 10, the yarn fed by which is knitted as a pile yarn in the heel and toe, is shorter than the others and feeds the yarn much farther from the needle circle. In fact, the yarn fed by that finger is guided in the corner of the mouthpiece and switches from one side to the other according to the direction of reciprocatory strokes. The body yarn is fed very close to the circle of needles and it is for that reason that finger 13 moves vertically. The shape of the offset projection 12 is such that the heel and toe pile yarn can feed over the top of that projection without interference.

As shown in Figs. 2 and 3, sinkers are controlled by cams including center sinker cam 22, side sinker cams 23 and 24, and movable cams 25 and 26. These cams are mounted in a sinker cam cap 27 and the sinkers themselves are movable in a sinker head 28. Normally the cams 23 and 24 control in the casting off movement so that, when there is no pile yarn being knitted, the action of the machine is more or less normal. When pile yarn is to be knitted, sinkers are projected inwardly for an extent sufficient to move the nibs 5 beneath the topmost or pile yarn.

Cam 23 pivots at 29 while cam 24 pivots at 30 and unless pushed in by special mechanism later to be described, neither of these cams will have any effect. At either side of the cam block 7 there is a spindle 31 at the front and 32 at the back of the machine, these spindles being supported in an appropriate bracket 33, Fig. 1. Each of these spindles is free to rotate in its bearing in the bracket and at its upper end spindle 31 has fixed thereto an angularly bent arm 34 while spindle 32 has a similar arm 35. At the lower end of spindle 31 there is a second arm generally designated by numeral 36, that arm being permanently held to move with the spindle and also with the arm 34. A spring 37 connects at the outer end of arm 36 and also to a hook 38, Figs. 1 and 2. At the other end of the arm 36 there is adjustably attached a triangular shaped cam or follower 39.

At the opposite side of the machine there are similar parts including arm 40, spring 41, hook 42 and follower 43. Normally the spring 37 which has considerable tension moves arms 36 and 34 in such a manner that the lever 34 pushing on a pin 44 projecting from the movable cam 25, will hold that cam inwardly. At such times as the follower 39 rides upon needle butts 45, the arm 36, also arm 34, will be moved against the tension of spring 37 so that cam 25 will not be held in its innermost or active position. In fact, it will be moved out by the leaf spring 46.

At the rear of the machine the follower 43 will perform the same function and cam 26 will be controlled in the same manner. In counterclockwise rotation or strokes of knitting the cam 26 governs; in clockwise strokes cam 25 and its attendant mechanism controls.

The followers 39 and 43 are at such a level that they contact and ride upon needle butts in that group of needles raised to instep level. In other words, the followers ride upon the butts of the long butt group of needles and upon short butts of those needles picked up to that same level during knitting the heel or toe. The timing of the mechanism is such that just as follower 43, for example, falls from the last butt in the instep group, the cam 26 will move in and will push sinkers inwardly to project the nibs of those sinkers between the yarns. In actual practice that occurs so that in reciprocatory work, about the fourth sinker after the leading short butt needle will have its nib projected between the yarns. Then all following sinker nibs will have the pile yarn drawn over them as illustrated in Fig. 7. When the cam 26 is pushing sinkers inwardly, cam 25 may or may not be in its active position depending on whether the follower 39 is riding on any of the needle butts.

In circular work as during knitting the high-splice or double sole, cam 26 is maintained in position and, of course, there are no needle butts at a level to contact either of the followers 39 or 43. The yarn finger 9 feeding a pile yarn at that time is moved to and from feeding position once each course. That is done by mechanism well known to those skilled in the art. Cam 25 remains in position during this rotary work. It assists in holding the work down on the needles.

During knitting in the stocking leg or at any other part where there is no pile yarn being knitted, the yarns which are fed are never at a position to be drawn over sinker nibs. They will always be taken in the throats of sinkers and for this reason, cam 26 may be in position and sinkers move in at an early point in the cycle without interference. However, when a yarn change is made, the cam 26 must be withdrawn and the change made at a time when sinkers are not advanced so that the newly inserted yarn would follow over sinker nibs. In reverse strokes as in clockwise reciprocations in the heel or toe cam 25 as governed by follower 39 acts in the same way as the opposite set of parts functions when knitting in the other direction.

When it is desired to withdraw follower 43 and cam 26 from active position, mechanism not specifically illustrated is controlled by pattern means on the machine. This mechanism includes a bell crank lever engageable with the arm 40 and other linkage extending down to be controlled by suitably patterned cams.

During operation of the machine a stocking to be knitted may start with a transferred rib top or with any other type top or edge and the leg of the stocking will be knitted as above described or in any convenient manner. Preferably, at the high splice, the pile yarn fed by lever 9 will be thrown into action and sinkers will then be controlled so that all those sinkers at the sole feed of the stocking will be projected inwardly to have their nibs inserted beneath the pile yarn but above the body yarn. Throughout the high splice the pile yarn may be knitted as described, although it may not be inserted until the start of knitting in the heel.

At the start of the heel reciprocatory work commences and the entire long butt group of needles is first moved to instep level as is well known to those skilled in the art. At the start of the heel yarn lever 9 will moved out of action just after

the yarn lever 10 is lowered to feeding position. Follower 43 will ride on the long butts and as that follower drops from the last long butt, cam 26 will be projected inwardly moving all sinkers into the position shown in Figs. 3 and 7 as those sinkers pass the point of the cam. In actual practice the fourth sinker in that group over which the heel needles knit will be the first which may safely have its nib projected between the yarns. In opposite strokes the same applies since follower 39 allows cam 25 to control the sinkers similarly.

After the start of the heel picks 8 come into action and then at each stroke, one short butt needle will be moved up to the instep level. The follower 43 will then ride upon all the long butts and in addition, as many short butts as have been moved upwardly to the instep level. That means that progressively the number of short butt needles first becomes smaller and correspondingly, the first sinker to be moved in for each direction of knitting will be the fourth sinker following the first needle knitting in the short butt group. Of course, variations may make it desirable to project the third or fifth sinkers instead of the fourth, but that is a matter of individual construction and practice. After the narrowing has been completed widening starts, but the action continues as above described. At each stroke one short butt needle will be moved upwardly, but since the widening picks come into play, they move down two such needles so that the effective group increases by one needle at each stroke. Naturally, the instep group of needles decreases correspondingly. That means that followers 39 and 43 fall from the needle butts upon which they ride one needle earlier than for the previous course, and thus, as the widening progresses the first sinker nib to be projected inwardly will follow the number of needles as it did in the narrowing operation.

Now referring to Figs. 8–13, a modification will be described in which the controlling movement for graduating the sinkers is taken from the picks rather than the needle butts. In Figs. 8 and 9 a cam plate 47 has a cam block 48 on which are operatively positioned stitch cams 49 and 50 and a center guard cam 51. In this form of the invention feeding may be by means similar to that previously described and the needles and sinkers are of similar or identical construction. The narrowing picks 52 and 53 are of usual construction and it is by means of these picks that the graduating of sinkers is obtained. The outline of the cylinder is shown in dot and dash lines.

In Fig. 10 a sinker cam cap 54 has sinker cams which are the same as are similarly shown in Fig. 3. There is a center sinker cam 55, a front sinker cam 56 and corresponding rear sinker cam 57. There are also the movable cams 58 and 59 which correspond to cams 25 and 26.

For maintaining one or the other of these movable cams in a position to project sinkers inwardly so that their nibs are engaged between yarns, a ring 60 is carried by and is frictionally moved by the sinker head 61. This ring carries a cam holder 62 and a cam 63, the latter being adapted to engage either one of the pins 64 or 65 as the case may be, and thereby push the movable cam inwardly against the tension of one of the leaf springs. A stop limits outward movement of these cams.

The sinker head is permanently attached to the needle cylinder and oscillates to and fro during heel and toe knitting. Naturally the ring 60 which is frictioned to move with the head by means of the frictioning springs 66 would move to the same extent unless otherwise restricted. As shown in Fig. 9, a plurality of angular clips 67 engage within a groove 68 in the sinker head and prevent vertical movement of the ring.

There is a latch 69 at one end of a lever 70 pivoted at 71, and this latch and lever are normally pressed by means of a spring (not shown) so that the latch engages a detent 72. A second latch 73 is identical with the latch 69 only it is adapted to work in the reverse direction. The second latch is a part of a lever 74 also pivoted at 71 and correspondingly pressed by a spring to engage a second detent 75 when the ring 60 moves in a direction so that those two elements are engaged.

The arm 70 and the corresponding arm 74 have projections 76 and 77, respectively, which engage on the upper edge of the picks 53 and 52, respectively. Whenever a pick is raised as when it picks up a needle, it will swing its corresponding lever so that the latch 69 or 73, as the case may be, will be disengaged from the corresponding detent.

Referring to Fig. 11, the pick 53 has been swung so that its butt engaging end has lifted a needle from a lower pathway 78 to a higher pathway 79. It has also been engaged with the extension 76, swung the lever about pivot 71 so that the latch 69 has disengaged its detent 72.

In operation, this modified form of the invention operates in the same general manner as that first described. On counter-clockwise strokes of knitting the front pick 52 will be raised by the leading short butt needle and the latch 73 disengaged with detent 75, releasing the frictioned ring 60 so that it can move with the cylinder and sinker head to the position shown in Fig. 10. In that position the cam 63 will push the movable sinker cam 59 inwardly and the sinkers will then have their nibs 5 projected inwardly to have the pile yarn thrown over them. As in the first instance, about the fourth sinker following the leading short butt needle will be projected inwardly after which all following sinkers will have pile yarn measured over their nibs. The ring 60 is stopped in proper position by contact of an adjustable stop screw 80 engaging with post 81. The stop screw 80 is threaded into a lug 82 attached to the ring. At a properly spaced distance from the lug 82 a second lug with a similar stop screw is attached to function in the opposite direction. The cap 54 swings to and fro as is the usual practice, but its movement is not nearly so great as the movement of the ring 60. Hereafter when substantially the fourth sinker from the first or leading needle to take the yarns is mentioned, it is to be understood that the actual sinker may vary one or two either way but the first that can safely be projected so its nib will enter between the yarns is meant.

In clockwise strokes the leading short butt needle will be lifted by pick 53 unlatching the detent 72 and thereby allowing the ring to move to its opposite position as intended in dot and dash lines, Fig. 10. In that position the nibs of sinkers will be projected between the yarns as previously described relatively to counterclockwise knitting.

In Fig. 14 there is illustrated a stocking having a top 83, leg 84 and a foot including the instep 85, sole 86, heel 87, toe 88 and a highsplice 89. In this particular stocking the heel, sole and toe

have pile loops projecting to the inside of the fabric. The highsplice 89 might similarly be formed with pile loops at that area if so desired.

The invention has been described by illustrating and specifically describing two embodiments of the same, but it is to be understood that variations may be resorted to so long as control taken from either the needle butts, the picks or similar convenient elements is so employed as to move the sinker cams into a position to project the first sinker nib between the yarns. The particular first nib may vary, but will be the one which may safely project between the yarns and yet be as close as possible to the leading short butt needle knitting in the heel or toe. Since, in the first form of the invention described, control is taken from a varying number of needle butts in accordance with narrowing and widening; the projection of the leading sinkers will always bear the same relationship to the first needle knitting in that particular stroke. Likewise, in the second embodiment, the picks are actuated by the leading needle of a varying group of needles and the same relationship will still apply.

The invention is not to be limited other than by the scope of the appended claims.

I claim:

1. A circular, independent needle knitting machine having needles and sinkers to be rotated at times, and at other times, reciprocated, means for feeding yarns including a mouthpiece, a yarn feeding lever to feed a body yarn from a position centrally of said mouthpiece, a second lever adjacent one side of the mouthpiece for feeding a pile yarn during rotary work and a third lever for feeding a pile yarn during reciprocatory knitting, said last mentioned lever feeding its yarn so that it will swing during reciprocatory work to be fed first through one corner of the mouthpiece and then through the other, the construction of said body yarn feeding lever and the third lever being such that the pile yarn can cross over and feed above the body yarn feeding lever without interference.

2. Sinker controlling means for circular, independent needle knitting machines including in combination sinker cams movable to and from a position in which said cams will project sinkers inwardly and means for controlling the timed interval at which and during which said sinker cams shall be thus moved inwardly, said means being operable by narrowing picks.

3. In a circular, independent needle, knitting machine having needles, sinkers and narrowing picks, the combination of means to feed at least two yarns to said needles and sinkers so that one of said yarns will feed as a body yarn and another as a pile yarn in both rotary and reciprocatory work, means controlled by the narrowing picks for projecting sinkers inwardly so that their nibs will engage above the body yarn but below the pile yarn.

4. In a circular, independent needle, knitting machine having needles, sinkers and narrowing picks, the combination of means to feed at least two yarns to said needles and sinkers in such a manner that one of said yarns will feed as a body yarn and another as a pile yarn in both rotary and reciprocatory work, means for projecting sinkers inwardly so that their nibs will engage above the body yarn but below the pile yarn and means for controlling said projecting means which consists of a narrowing pick and needle functioning cooperatively so that the first sinker to be projected will be a predetermined sinker following the leading needle which takes the yarns.

5. In a circular, independent needle, knitting machine, sinker cam operating means which includes means rotatable with the cylinder in either direction and operatively associated with said sinker cams, means for arresting said rotation in one direction, locking means for preventing said rotation in the opposite direction and means operated by a narrowing pick for releasing said rotatable means from said locking means.

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