May 20, 1947. H. E. CRAWFORD ET AL 2,420,771

KNITTING MACHINE AND METHOD

Filed Nov. 30, 1945 6 Sheets-Sheet 1

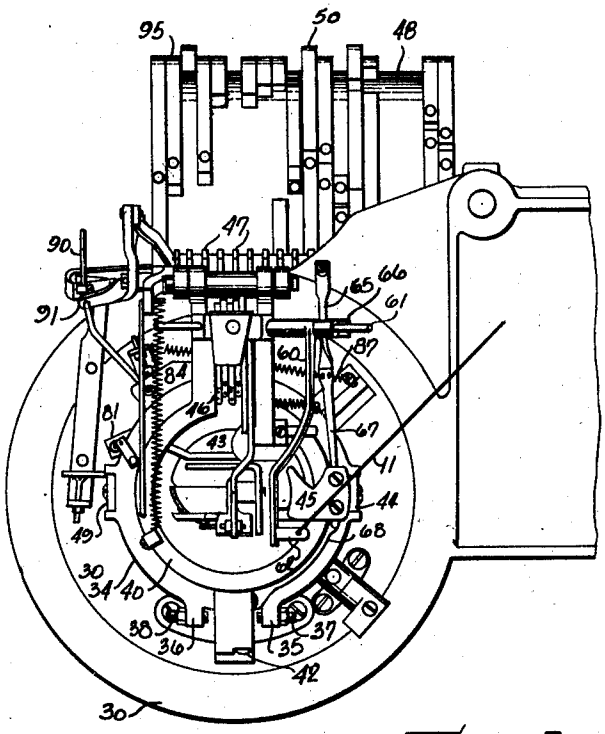


Fig-1

HERMAN E. CRAWFORD & CECIL CRAWFORD,

Inventors.

By Paul Eaton

Attorney

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KNITTING MACHINE AND METHOD

Filed Nov. 30, 1945 6 Sheets-Sheet 2

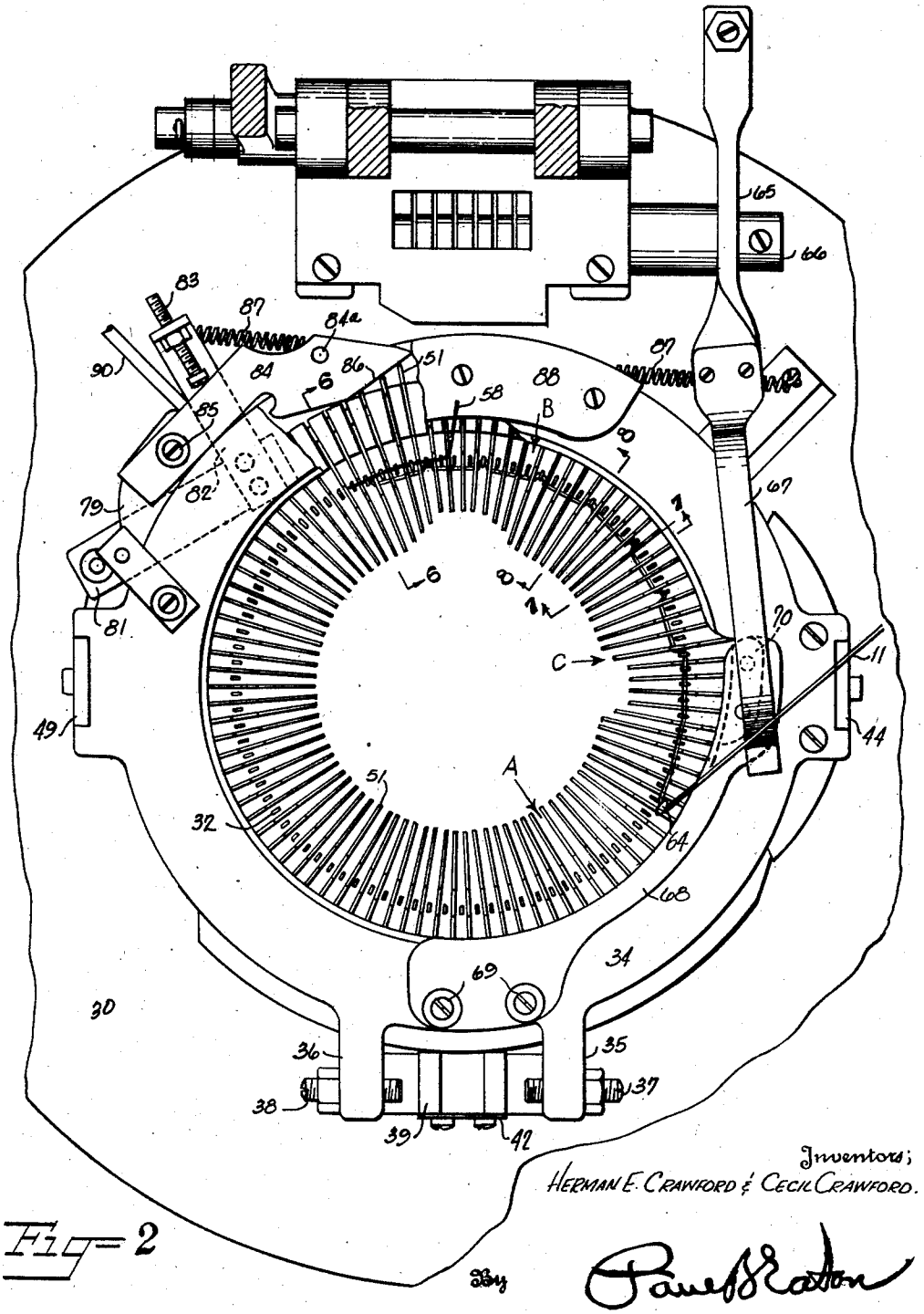


Fig-2

Inventors;
HERMAN E. CRAWFORD & CECIL CRAWFORD.

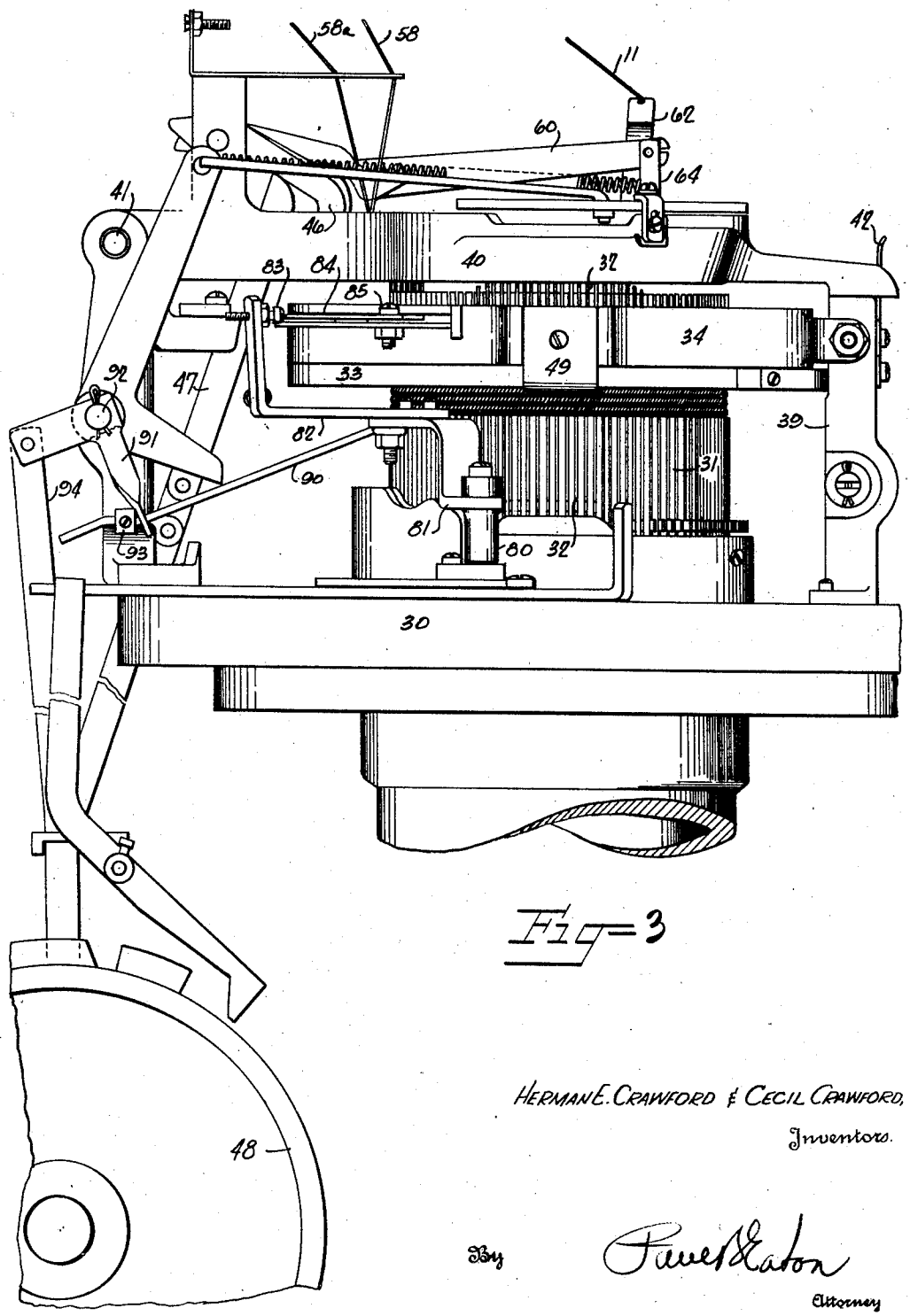
By Paul & Paton

Attorney

May 20, 1947. H. E. CRAWFORD ET AL 2,420,771

KNITTING MACHINE AND METHOD

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Fig—3

HERMAN E. CRAWFORD & CECIL CRAWFORD,
Inventors.

By Paul Eaton
Attorney

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KNITTING MACHINE AND METHOD

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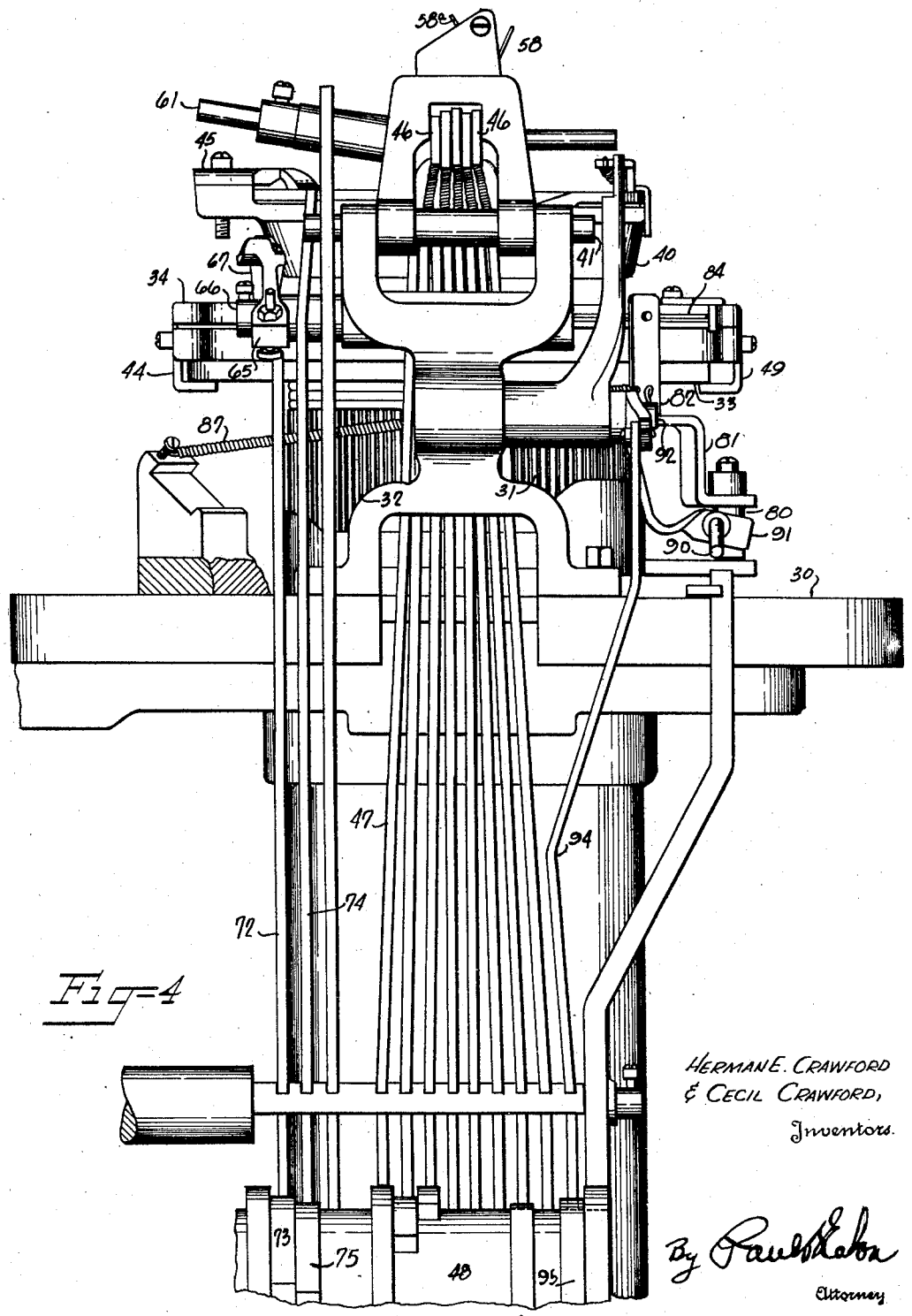


Fig-4

HERMAN E. CRAWFORD & CECIL CRAWFORD, Inventors.

By Rawls & Lake Attorneys

May 20, 1947. H. E. CRAWFORD ET AL 2,420,771

KNITTING MACHINE AND METHOD

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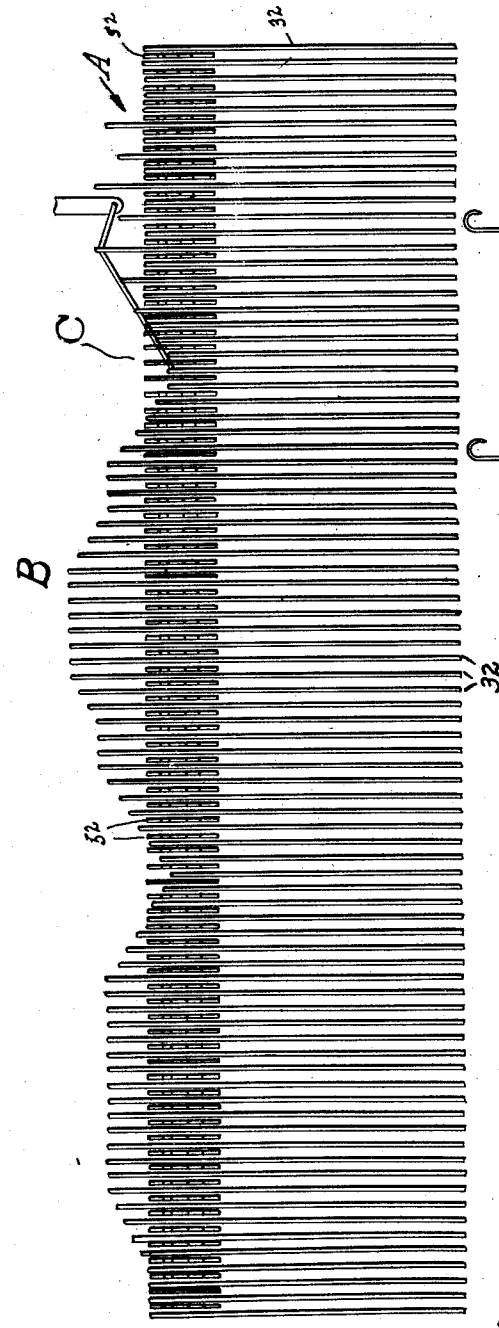


Fig-5

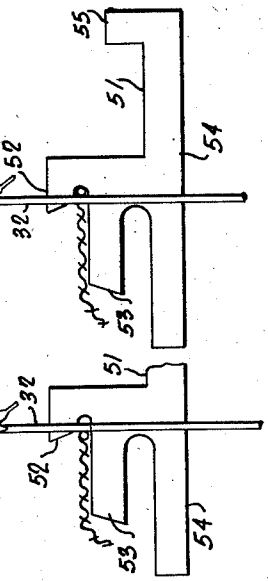


Fig-8

Fig-7

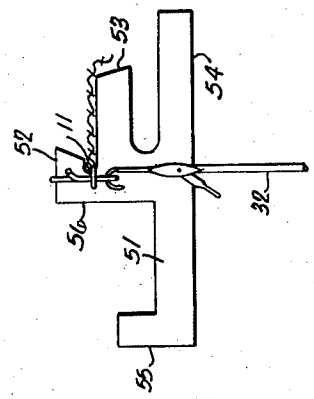


Fig-6

HERMAN E. CRAWFORD & CECIL CRAWFORD
Inventors.

By Paul Maton
Attorney

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KNITTING MACHINE AND METHOD

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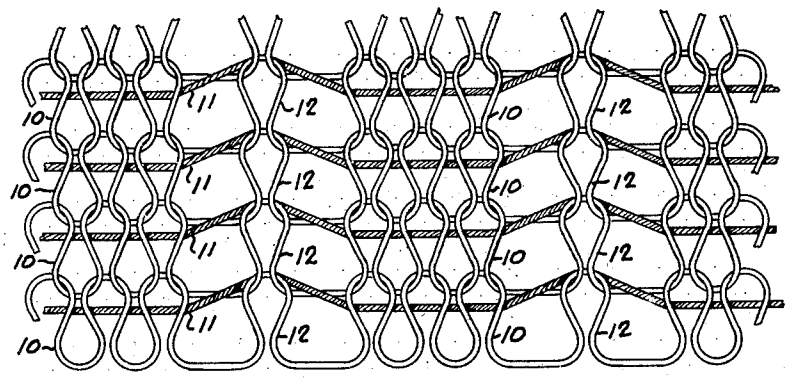


Fig-9

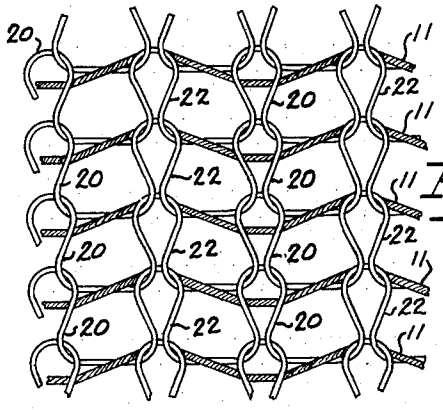


Fig-10

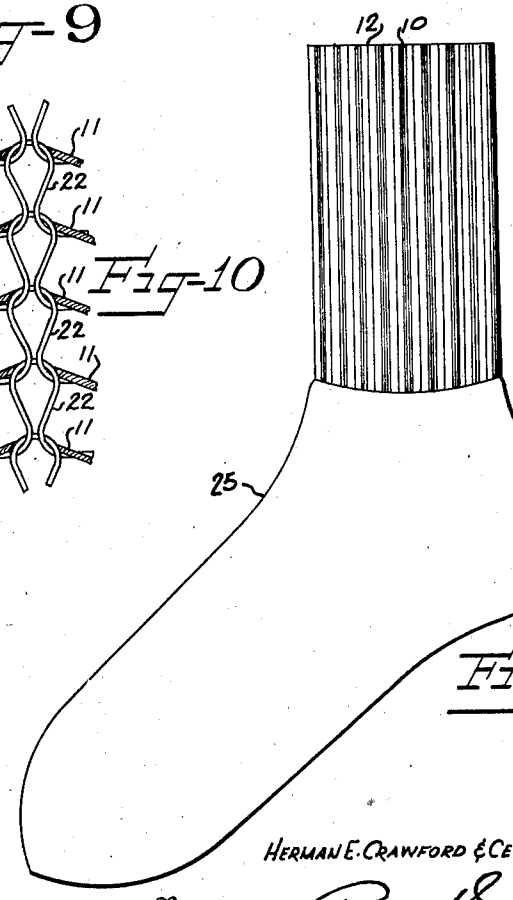


Fig-11

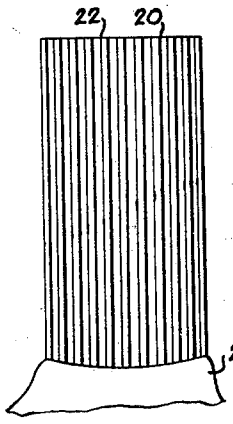


Fig-12

Inventors:

HERMAN E. CRAWFORD & CECIL CRAWFORD

By Paul & Eaton

Attorney

Patented May 20, 1947 2,420,771

UNITED STATES PATENT OFFICE

2,420,771

KNITTING MACHINE AND METHOD

Herman E. Crawford, Kernersville, and Cecil Crawford, Durham, N. C.

Application November 30, 1945, Serial No. 632,073

5 Claims. (Cl. 66—9)

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This invention relates to a method and apparatus for making an elastic stocking wherein the elastic strand is laid in in front of some of the needles and back of the other needles and the only body yarn which is fed to the needles is fed by the conventional feed fingers at the throat plate, and immediately past the throat plate and through the knitting wave, the sinkers are moved inwardly to cause the body yarn to be deposited on the top of the nibs of the sinkers so that during a knitting operation when the needles are lowered by the conventional knitting cams through the knitting wave, the entire body yarn loops will be formed on top of the nibs of the sinkers, thus forming very elongated loops and resulting in a very flexible fabric which can be stretched to a much greater extent than in the conventional fabric where the elastic yarn is laid in and conventional knitting takes place, or, where the sinkers are not fully advanced inwardly.

It is an object of this invention to provide in a circular knitting machine, means whereby the rubber yarn can be laid in in advance of the throat plate and so laid in that some of the needles will be raised higher than others so that the elastic strand will be laid in front of some of the needles and in back of the other needles. The sinkers at this point are moved outwardly and all the needles are lowered so the elastic yarn is caught in the hooks of the raised needles, and moved downwardly. Then the sinkers are moved inwardly to catch the elastic strand below the nibs of the sinkers while the needles are all raised upwardly to their highest point, thus, placing the elastic strand below the latches of those needles of which it is deposited in front of and in back of the other needles, and then a conventional body yarn or yarns is fed at the throat plate and a movable cam is moved inwardly while the elastic strand is being laid in to move the sinkers in advance of and through the knitting wave inwardly to the point where the body yarn will be laid on top of the nibs of the sinkers and thus will be knitted while deposited on top of the nibs of the sinkers thus forming very elongated loops and, since there are no other body yarns incorporated into the fabric and since the elastic strand is laid in with very little, if any, tension other than enough to keep it taut, the very elongated loops will enable the stocking to be stretched to a much greater extent than if the body yarn loops were of conventional structure by being formed on top of the second step of the sinkers as has heretofore been the custom. During the knitting of the first course in a stocking, the elastic strand is not laid in.

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It is another object of this invention to provide a stocking having at least the top portion provided with an elastic feature by the incorporation thereinto of an elastic strand by laying the strand in front of some of the needles and back of the other needles and not knitting the elastic strand at any point and then knitting the entire body yarn or yarns with very long loops by advancing the sinkers immediately after the throat plate has been passed and through the knitting wave so that the body yarn or yarns are laid on top of the sinkers and, thus, knitting of the fabric occurs on top of the sinkers whereas the tension of the rubber yarn is sufficient to hold the fabric down on the needles when the needles are moved upwardly through the loops thereon for the formation of another course during the knitting operation.

This invention also relates to an improved method and means of making seamless knit elastic hosiery. It is well known throughout the trade that all known methods such as laying-in elastic yarn and knitting-in elastic yarn does not produce a desirable fabric for elastic top stockings or stockings made with the elastic yarn incorporated throughout the stockings because the fabric, in which the elastic yarn is incorporated is knit with regular size loops or stitches or with tuck stitches; it is also known that the regular size stitches hold the elastic yarn in such a manner that the elastic yarn cannot slip between the stitches thus causing the elastic yarn to break when the fabric is stretched. It is also well known that when tuck stitches are made in order to loosen the fabric, the desired result is not obtained because the tucked stitches cause the fabric to be wide and bulky so that the elastic yarn cannot draw the fabric—to make the top or stocking or elastic portion as narrow as it should be to properly fit the ankle. Another purpose of this invention is an improved elastic fabric whereby the simulated ribs or protruding portions of the fabric are much more noticeable and this is a much desired effect.

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 top plan view of a knitting machine equipped for the knitting of the stocking to be hereinafter described;

Figure 2 is a top plan view of the knitting machine with the latch ring broken away and re-

moved and part of the sinker ring broken away and showing a knitting machine equipped to manufacture the stocking to be hereinafter described;

Figure 3 is a side elevation of the upper portion of the knitting machine looking from the left hand side of Figure 1;

Figure 4 is a back view of the knitting machine looking from the top side of Figure 1;

Figure 5 is an exploded view of the needles and sinkers looking from along the line 5—5 in Figure 2;

Figure 6 is a sectional view taken along the line 6—6 in Figure 2 and omitting the cylinder and other details of the machine;

Figure 7 is a view taken along the line 7—7 in Figure 2 and omitting certain details of the machine;

Figure 8 is a sectional view taken along the line 8—8 in Figure 2 and omitting the needle cylinder and other parts of the machine and showing the positions of the needles and sinkers in the elastic yarn;

Figure 9 is a view of one type of fabric which can be made on this machine;

Figure 10 is a view of another type of fabric made on this machine;

Figure 11 is an elevation of a stocking made in accordance with the showings in Figure 9;

Figure 12 is an elevation of the top portion of a stocking made from the fabric as shown in Figure 10.

Referring more specifically to the drawings, the numeral 30 indicates the main circular bed plate of the knitting machine in which a cylinder 31 is rotatably mounted having conventional needles 32 mounted in vertical grooves therein for reciprocation by conventional means. The cylinder also has on its upper end a sinker receiving portion 33 on which a sinker guide ring 34 is mounted for movement relative to the portion 33, said motion being limited by arms 35 and 36 in which adjusting screws 37 and 38 are mounted and a vertical post 39 extends upwardly from circular plate 30 which limits the back-and-forth oscillatory movement of the sinker guide ring 34. This sinker guide ring 34 is held loosely in position by means of a pair of brackets 44 and 49 secured on the sinker guide ring 34 and having a portion projecting below the portion 33.

The knitting machine also has a latch ring 40 pivoted as at 41 and latched in closed position by means of a spring member 42. The knitting machine also has a plate 43 on which conventional cutting and clamping mechanisms are mounted, this plate 43 being supported by an arm 45 in a conventional manner.

The knitting machine also has a plurality of conventional body yarn feed fingers 46 and a plurality of push rods 47 for manipulating the same, said push rods being driven by a conventional main pattern drum 48 having a plurality of cams 50 thereon. The machine is also equipped with a plurality of sinkers 51 mounted in radially disposed slots in the upper end of the cylinder 31. These sinkers have nibs 52 and an intermediate portion 53, and the bottom portion 54, and an uprising portion 55, and an intermediate vertical face 56.

The yarn feed fingers 46 are adapted to feed one or more body yarns 58 to the needles at the throat plate. The machine is also equipped with a conventional elastic yarn feed comprising an arm 60 pivotally secured on a pin 61 and having

an outwardly extending portion 62 on its free end through which elastic yarn 11 passes. This arm 60 has a downwardly extending feed finger 64 through which strand 11 passes.

The machine is also equipped with means for withdrawing or moving radially outward the sinkers at a point immediately after the elastic strand is fed thereto so that when the raised needles are lowered the elastic strand is engaged by the hooks of the needles and moved downwardly below the nibs of the sinkers so that when the sinkers are advanced inwardly, the elastic strand will be held below nibs of the sinkers. This comprises a lever 65 pivoted as at 66 and having a leaf spring 67 secured thereto, the free end of the leaf spring being adapted to press onto a leaf spring 68 secured as at 69 to the sinker guide ring and having on its lower portion a cam 70 which is adapted to be moved downwardly between the vertical portions 55 and 56 of the sinkers to move them outwardly to the position shown in Figure 2. This lever 65 is manipulated by means of a push rod 72 controlled by a cam 73 on the main pattern drum 48.

The yarn feed lever 60 is controlled by a push rod 74 which is controlled by a cam 75 on the main pattern drum.

Pivotally mounted on a post 80 is an arm 81 having secured thereto an arm 82 which arm has an adjusting screw 83 in its upper end adapted to contact a cam 84 pivoted as at 85 on a special sinker cam 79. This cam 84 has a sloping surface 86 which is adapted to engage the sinkers 51 during rotation of the cylinder to advance the sinkers immediately after they have passed the throat plate to cause all body yarns to be laid on top of the nibs of the sinkers. This pivoted cam 84 is normally urged by a tension spring 87 to move in a clockwise direction in Figure 2 where it is not held out of operative position by the main pattern drum.

The swinging member 81 has pivotally secured thereto a rod or link 90 which slidably passes through the lower end of an L-shaped lever 91 pivoted as at 92. The rod or link 90 has an adjusting collar 93 thereon for adjusting the distance which swinging of lever 91 will withdraw the face 86 from contact with the sinkers. The L-shaped or bell crank lever 91 has pivotally secured to its other end a push rod 94 which normally rests on the main pattern drum 48 and is elevated by a cam 95 when an elastic strand is not being knitted into the fabric.

In Figure 2 the sinker guide ring is shown in medial position but it is understood that during the laying in of the elastic strand it will be rotated slightly further in a clockwise manner to cause adjusting screw 37 to rest against post 39.

The cam member 84 has an uprising pin 84a which rests against the outer edge of an adjustable plate 88 on sinker guide ring 34 when allowed to move inwardly under tension of spring 87.

With the parts in the position shown in Figure 2, or with the sinker guide ring 34 slightly moved further in a clockwise direction, one or more strands of body yarn 58 and 58a are fed to the needles at the throat plate by means of one or more of the feed fingers 46. During the knitting of the first course, the body yarns are caught in the throat of the sinkers and the elastic yarn is fed to the needles. The cam on the main pattern drum 48 will be engaging the lower end of the push rod 94 and therefore the cam 84 will be

moved away from the sinkers. This will cause the first course of the body yarns and the elastic strand to be caught in the throat of the sinkers. After the first course is completed, the push rod 94 will fall off the cam 95. This will allow the cam 84 to move in a clockwise direction in Figure 2 to the position shown in Figure 2 under tension of spring 87 and will engage the sinkers 51 as they pass cam surface 86 and move them inwardly so that the body yarn or yarns fed to the needles as they pass the throat plate will be deposited on top of the nibs 52 of the sinkers while the needles are lowered by the conventional knitting cam through the knitting wave. As the first course is started, the yarn feed finger 60 is lowered to feed the elastic strand 11 to the outside of the needles between points A and C in Figures 2 and 5 to cause the elastic strand to be incorporated in the fabric. At point C in Figures 2 and 5 the sinkers will all be moved inwardly to place the elastic strand in the throats of the sinkers, and after passing point C, the needles will rise until they reach point B which will cause the elastic strand to be disposed behind all needles which do not have the elastic strand in their hooks. Immediately before the needles reach the point C in Figures 2 and 5, the cam 70 being lowered will withdraw the sinkers 51 at that point and thus allow the hooks of the needles being lowered to pull the elastic strand 11 downwardly so that when the sinkers are advanced immediately thereafter, the elastic strand will be caught below the nibs 52 of the sinkers, at which point it will remain.

In Figure 9, there is shown a fabric in which three needles are lowered and the fourth needle in a series is raised, thus, causing the elastic strand to be deposited on the outside of the raised needles and to pass onto the inside of the lowered needles when they are subsequently raised. This will cause the elastic strand to be disposed below the latches of the needles as they approach the knitting wave, so that when the knitting operation takes place, the strand which is behind three needles will remain behind the three needles and will be floated on the inside of the fabric; whereas, the elastic strand which is deposited in front of the fourth needle will be below the latches and will not be knitted but will be bound by the junction of the loops formed by these needles.

In Figure 10 is shown a fabric which is made by having every other needle lowered and the remaining needles raised so that the elastic strand 11 will be deposited in front of the lowered needles and in rear of the raised needles when the needles all raise subsequently to the depositing of the elastic strand.

Referring to Figure 9, the reference character 10 indicates the loops formed from body yarn, and the reference character 11 indicates the elastic yarn which is laid back of the loops 10 on the inside of the fabric; whereas, the loops 12 of body yarn are made on the needles which have the elastic strand 11 deposited in front of the needles. The elastic strand 11 where it passes back of the three wales is not bound by the loop structure of the wales but is floated loosely; whereas, when the elastic strand passing over the loop of the preceding course of loops 10 and is pinched or frictionally held by the loop at the junction point of the loop 12 in the preceding courses. This allows the legs of the loops 12 to be somewhat more elongated than the legs of the loops 10 because the loops 12 rob lengths of yarn from the loops 10 and, thus, produces the effect as shown

in Figure 9 when the fabric is extended. When the fabric is removed from the knitting machine, the tension of the elastic strands 11 pulls the wales together to produce a mock ribbed effect as shown in Figure 11.

In the fabric shown in Figure 10, where the elastic strand is laid in front of every other needle and behind the other needles, the same thing occurs in that the body yarn loops 20 have the elastic strand 11 laid therebehind, while the loops 22 on the other needles, having the elastic strand 11 laid in front of the same produces the same pinching action, and thus, the legs of the loops 22 are somewhat more elongated or rob the lengths of yarn from the legs of loop 20 and thus when the fabric is removed from the machine, the mock ribbed effect as shown in Figure 12 is produced.

The stocking shown in Figure 11 is designated by reference character 25; whereas, the stocking shown in Figure 12 is designated by the reference character 26.

In Figure 6, the body yarn is shown as being formed into loops while resting on top of the nibs 52 of the sinkers, thus producing very elongated loops. In this position, the elastic strand 11 can be disposed as shown on top of the fabric if it was to occur behind the needles; or, if it was laid in front of the needles, it would be on the lower side of the fabric being knitted.

In Figure 7, the position of the elastic strand is shown as being on the back of the needles where it is floated on the inside of the fabric; whereas, in Figure 8, the elastic strand is shown below the latch of the needle and being disposed on the outside of the needle so that it will pass upwardly over the hook of the needle during a knitting operation.

Although we have shown and described only two types of fabric, namely, where the elastic strand is laid behind three of the needles and in front of the fourth in recurring sequence and, also, where it is laid in front of one needle and behind the next adjacent needle throughout the diameter of the needle circle, it is evident that any combination can be used, as it could be laid in front of two needles and behind two needles throughout the courses, or, it could be laid in front of one needle and behind two needles, or, in front of two needles and behind one needle, and so on.

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

We claim:

1. An apparatus for knitting a stocking comprising a circular knitting machine having a throat plate provided with feed fingers and having sinkers and having a plurality of needles and means for raising and lowering the needles, means for introducing an elastic strand to the needles in advance of the throat plate, means for feeding body yarns to the needles at the throat plate. means disposed between the point of feeding of the elastic strand and the throat plate for moving the sinkers radially outwardly to allow the elastic strand to pass below the nibs of the sinkers, means for advancing the sinkers to hold the elastic strand below the nibs of the sinkers, means for raising the needles upwardly while the sinkers are advanced as the needles approach

the throat plate, means for moving the sinkers outwardly after the needles have been raised to take the body yarn at the throat plate, means for advancing the sinkers inwardly immediately after they pass the throat plate so that all body yarns fed to the needles will be disposed on top of the nibs of the sinkers while the needles are lowered in a knitting operation to thus produce elongated loops.

2. An apparatus for knitting an elastic top stocking which comprises a circular knitting machine having a cylinder provided with a plurality of vertically movable needles, and having a sinker ring and a sinker guide ring and having a throat plate provided with a plurality of yarn feed fingers for feeding body yarn to the needles and provided with a plurality of radially movable sinkers disposed between the needles, means for feeding an elastic strand to the needles at a point in advance of the throat plate, means for raising some of the needles prior to the point where the elastic strand is laid adjacent the outside of the needles to cause the hooks of the raised needles to take the elastic strand, means for moving the sinkers radially outward at a point between the throat plate and the point of feeding of the elastic strand to allow the elastic strand to be moved downwardly below the nibs of the sinkers when the raised needles are lowered, means for moving the sinkers inwardly to hold the elastic strand below the nibs of the sinkers while all of the needles are raised upwardly as they approach the throat plate, means for moving the sinkers outwardly after the needles have been raised to take the body yarn at the throat plate, means adjacent the throat plate and beyond the point of the feed fingers for advancing the sinkers inwardly so that the nibs of the sinkers appear between the needles whereby all the body yarns fed by the yarn feed fingers at the throat plate will be deposited on top of the nibs of the sinkers and remain in this position while the needles are lowered in the knitting wave to produce very elongated loops with the elastic strand laid in front of some of the loops and back of the other loops and said elastic strand being confined below the nibs of the sinkers during the loop formation.

3. That method of knitting an elastic topped stocking which comprises feeding an elastic strand to the needles of an independent needle circular knitting machine and raising some of the needles to cause the elastic strand to be engaged by the hooks of the raised needles, then moving the sinkers outwardly immediately after and beyond the point where the elastic strand is fed to the raised needles, then lowering the raised needles to lower the elastic strand, then moving the sinkers inwardly to confine the elastic strand below the nibs of the sinkers, then raising all of the needles disposed between the advanced sinkers to place the elastic strand on the back of the needles whose hooks do not engage the elastic strand, then moving the sinkers outwardly, then feeding all body yarns to the needles at the throat plate and advancing the sinkers inwardly between the needles immediately after the throat plate is passed and while the elastic strand is still below the nibs of the sinkers to cause the nibs of the sinkers to pass between the needles before they are lowered in the knitting wave to cause the body yarns to be disposed on top of the nibs of the sinkers during the knitting wave so that newly formed loops will be knitted while on the nibs of the sinkers, thus producing elongated loops.

4. That method of knitting a circular knit stocking on a circular knitting machine which comprises raising some of the needles, then feeding an elastic strand to the raised needles, then withdrawing the sinkers, then lowering the raised needles, then advancing the sinkers to place the elastic strand below the nibs thereof, then raising the needles to cause the elastic strand to be disposed on the inside of the needles whose hooks do not engage the elastic strand, then retracting the sinkers of the machine outwardly, then feeding all body yarns to the needles at the throat plate, then advancing the sinkers inwardly immediately past the throat plate and through the knitting wave so that the body yarns will be deposited on top of the nibs of the sinkers where the needles will knit the new course during the knitting wave while the elastic strand is held below the nibs of the sinkers, thus forming elongated loops on the nibs of the sinkers in the knitting wave and providing a stocking having an elastic strand laid in throughout the courses in front of some needles and behind others of the needles.

5. That method of knitting a stocking on a circular independent needle knitting machine which comprises raising some of the needles and leaving intervening needles lowered, feeding an elastic strand to the raised needles to cause the same to be engaged by the hooks of the raised needles, then moving the sinkers in advance of the raised needles outwardly, then lowering the raised needles, then moving the outwardly moved sinkers inwardly to place the elastic strand below the nibs of the inwardly moved sinkers, then raising all of the needles disposed between the inwardly advanced sinkers to cause the elastic strand to be deposited on the backs of the needles whose hooks do not engage the elastic strand while confining the elastic strand below the nibs of all of the sinkers, then moving the sinkers ouwtardly while feeding body yarns at the point where the sinkers are moved outwardly, then advancing the sinkers inwardly as they pass through the knitting wave, whereby all body yarn loops are formed on the nibs of the sinkers while the elastic strand is confined below the nibs of the sinkers to cause the needles to shed the body yarn loops.

HERMAN E. CRAWFORD.
CECIL CRAWFORD.

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