Jan. 4, 1966 R. H. LAWSON ETAL 3,226,955

METHOD AND APPARATUS FOR FEEDING YARN TO A KNITTING MACHINE

Filed April 25, 1963 5 Sheets-Sheet 1

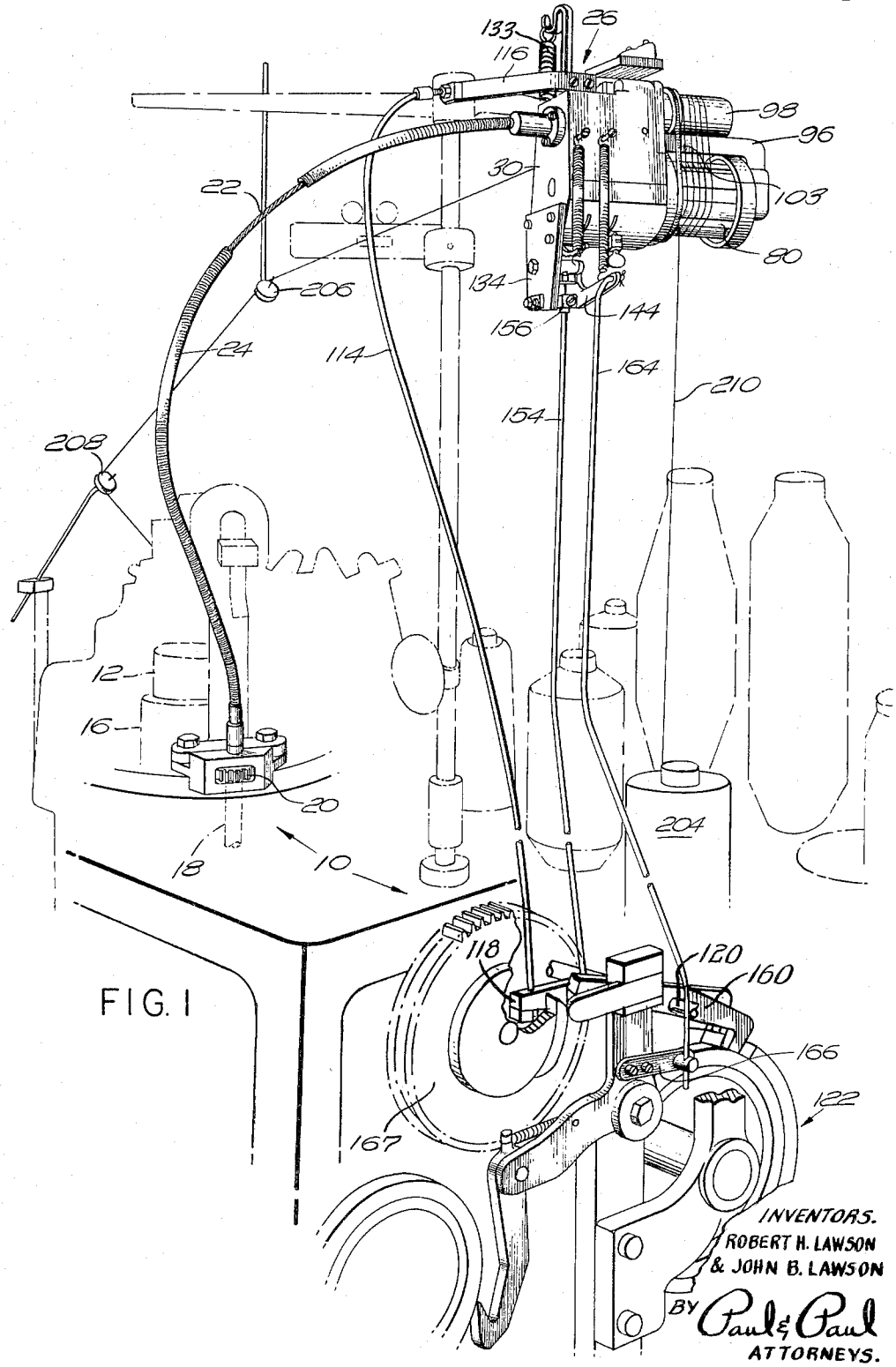


FIG. 1

INVENTORS.
ROBERT H. LAWSON
& JOHN B. LAWSON
BY Paul & Paul
ATTORNEYS.

Jan. 4, 1966 R. H. LAWSON ETAL 3,226,955

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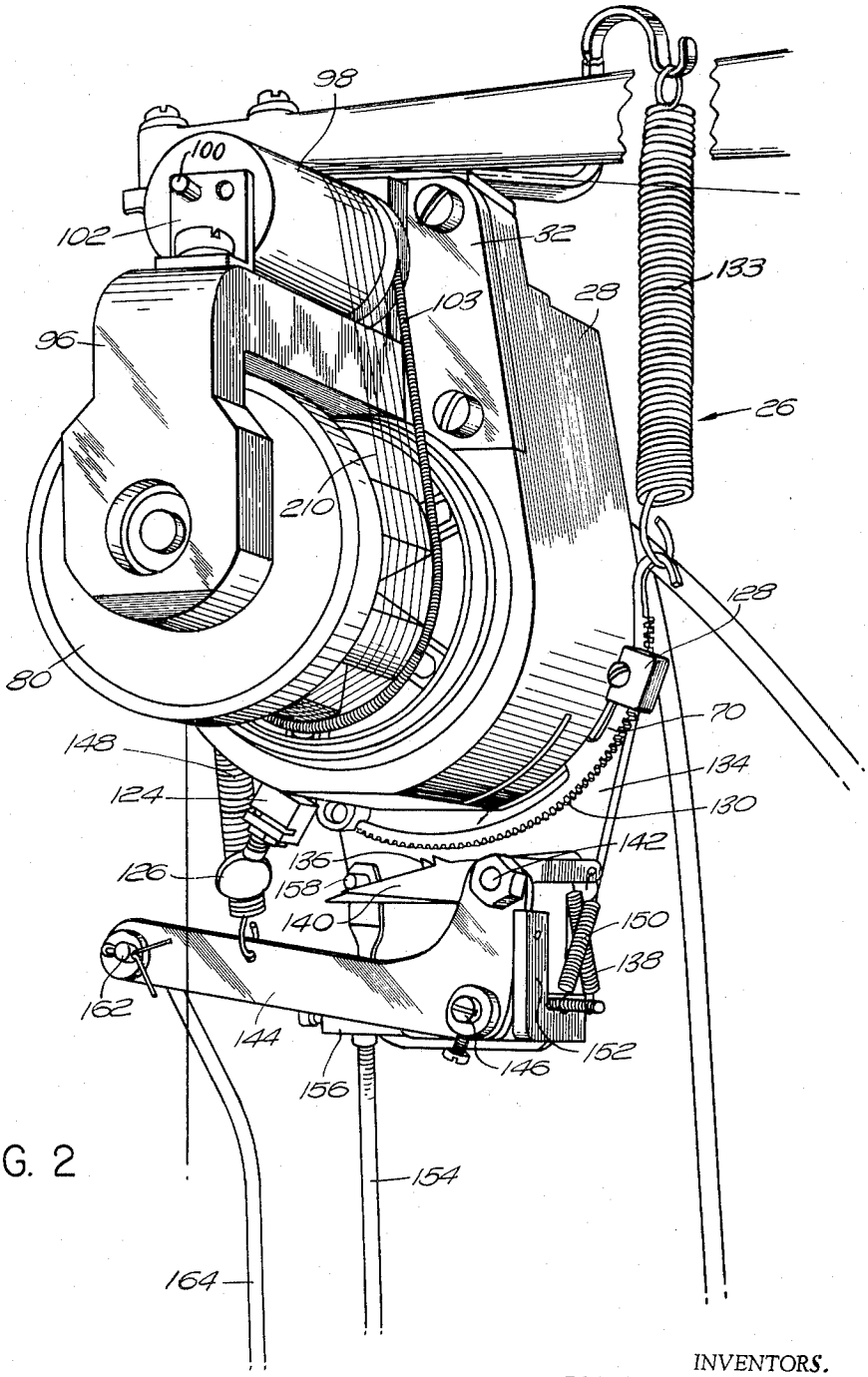


FIG. 2

INVENTORS.
ROBERT H. LAWSON &
BY JOHN B. LAWSON
Paul & Paul
ATTORNEYS.

Jan. 4, 1966 R. H. LAWSON ETAL 3,226,955

METHOD AND APPARATUS FOR FEEDING YARN TO A KNITTING MACHINE

Filed April 25, 1963 5 Sheets-Sheet 3

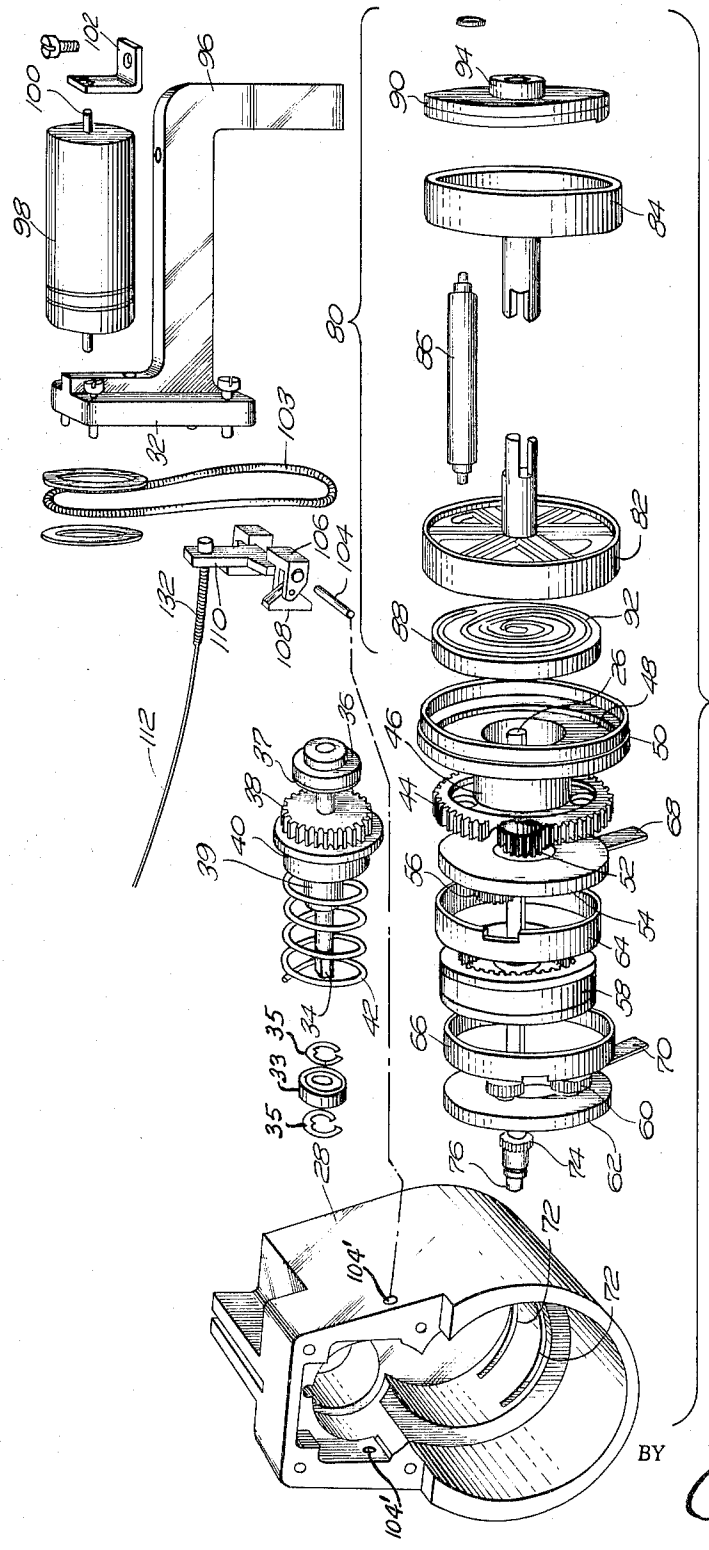


FIG. 3

INVENTORS.
ROBERT H. LAWSON &
JOHN B. LAWSON

BY Paul & Paul
ATTORNEYS.

Jan. 4, 1966 R. H. LAWSON ETAL 3,226,955

METHOD AND APPARATUS FOR FEEDING YARN TO A KNITTING MACHINE

Filed April 25, 1963 5 Sheets-Sheet 4

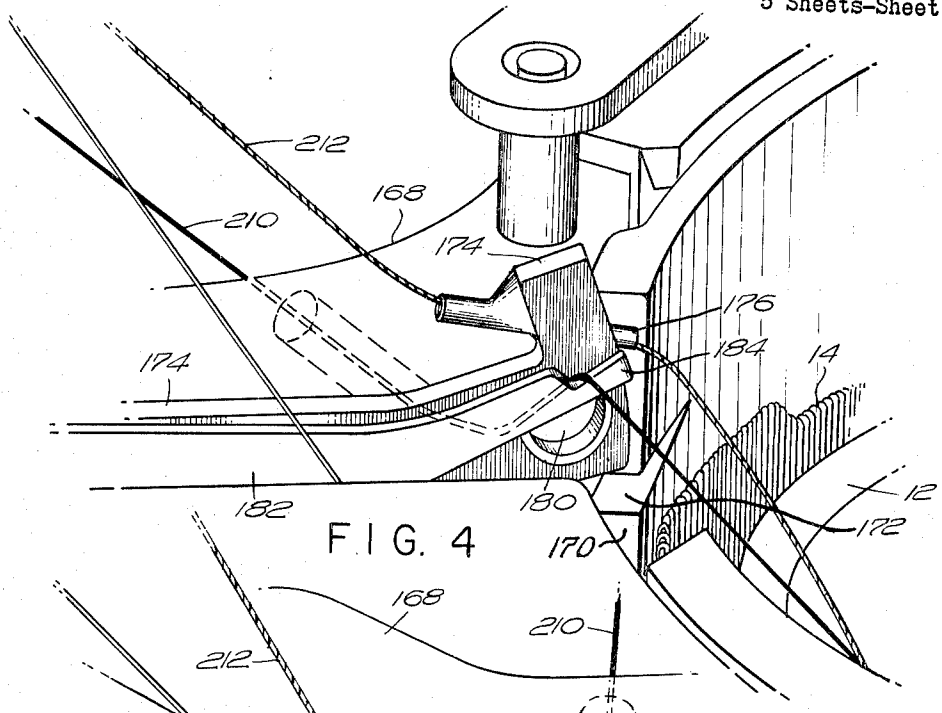


FIG. 4

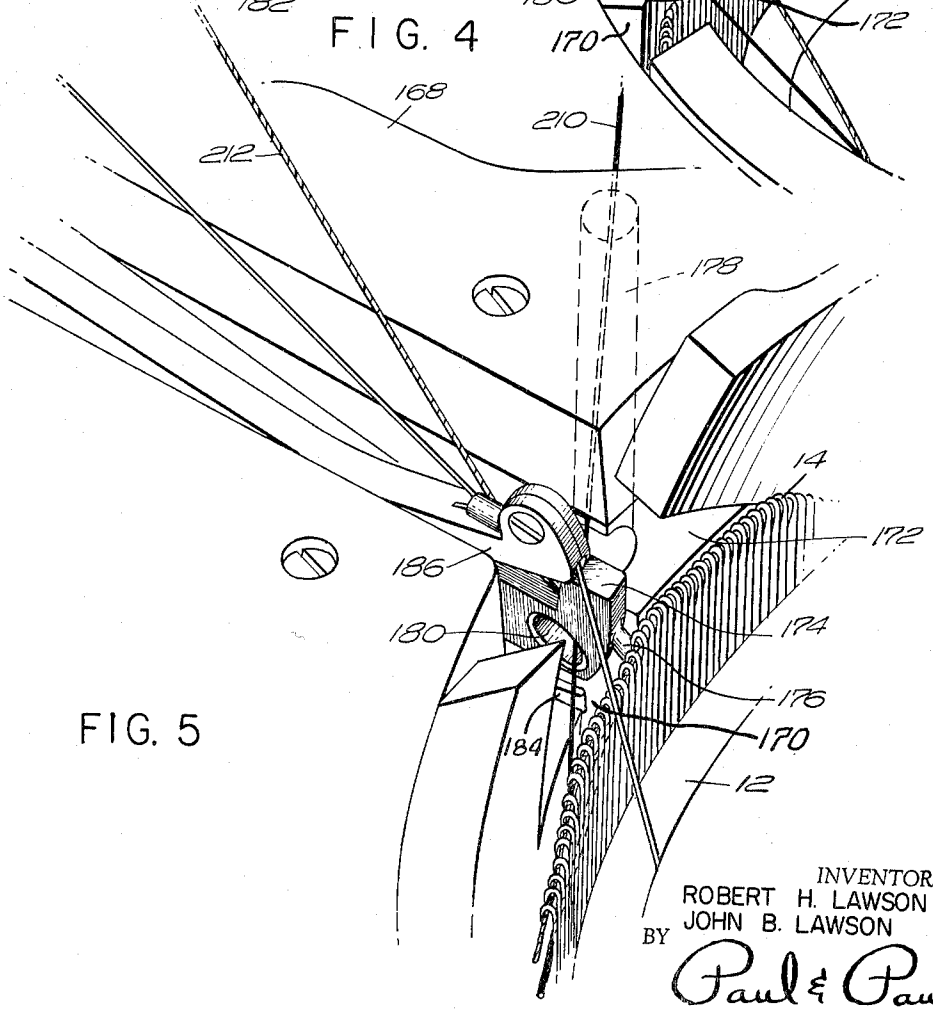


FIG. 5

INVENTORS.
ROBERT H. LAWSON &
JOHN B. LAWSON
BY Paul & Paul
ATTORNEYS.

Jan. 4, 1966 R. H. LAWSON ETAL 3,226,955

METHOD AND APPARATUS FOR FEEDING YARN TO A KNITTING MACHINE

Filed April 25, 1963 5 Sheets-Sheet 5

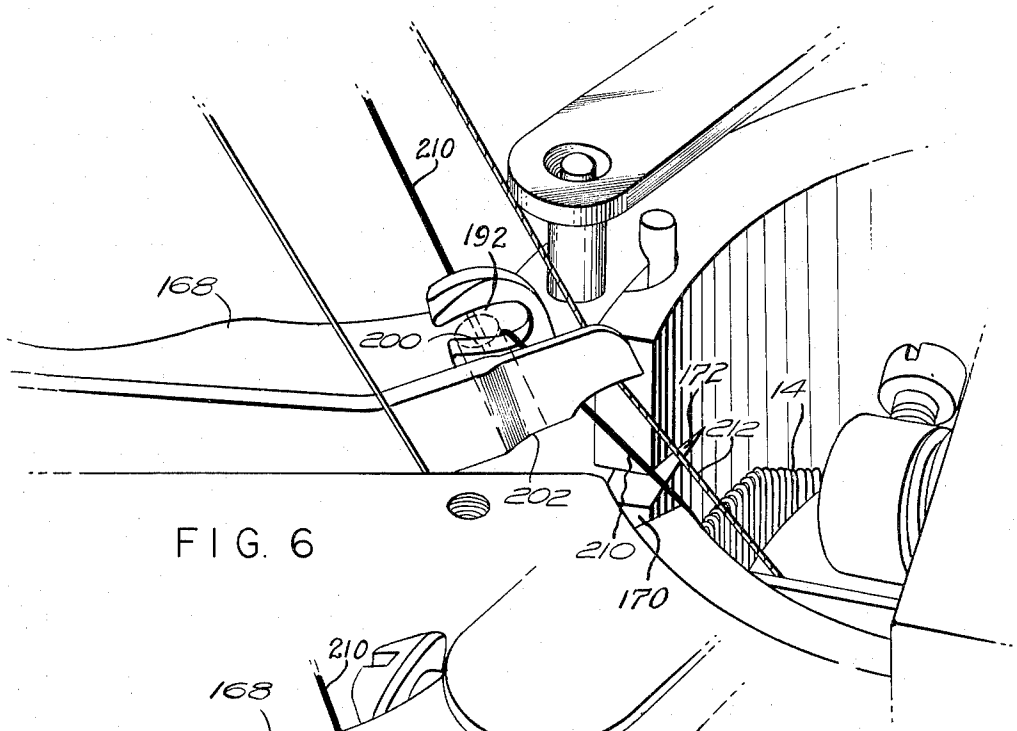


FIG. 6

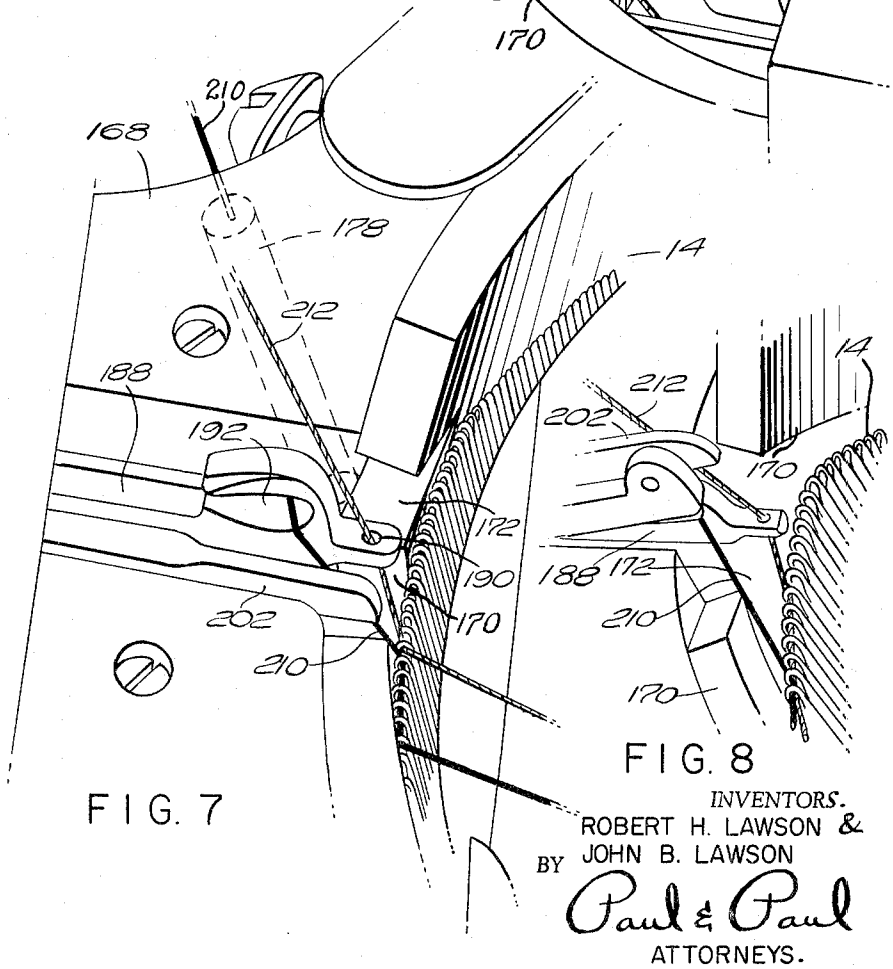


FIG. 7

FIG. 8

INVENTORS.
ROBERT H. LAWSON &
BY JOHN B. LAWSON
Paul & Paul
ATTORNEYS.

United States Patent Office 3,226,955
Patented Jan. 4, 1966

3,226,955

METHOD AND APPARATUS FOR FEEDING YARN TO A KNITTING MACHINE

Robert H. Lawson, Pawtucket, R.I., and John B. Lawson, Wilbraham, Mass., assignors to Lawson Engineering Co., Pawtucket, R.I., a corporation of Rhode Island

Filed Apr. 25, 1963, Ser. No. 275,619
18 Claims. (Cl. 66—125)

This invention relates generally to circular knitting machines and particularly to an improved method and means for feeding yarn to such machines.

Normally, inelastic yarn and covered elastic yarn pass through the guide eye of a conventional yarn finger or other non-revolvable yarn guide in an acceptable manner. The increased tension generated in the yarn when its direction is abruptly changed at such a guide eye does not impede the passage of the yarn through the guide eye, though it may affect the knitting somewhat. The increased tension will not cause appreciable elongation of inelastic yarn, but it will cause covered elastic yarn to elongate. Covered elastic yarn elongates in a reasonably uniform manner which is acceptable, though not ideal. On the other hand bare elastic yarn, and particularly bare spandex, sticks erratically to polished surfaces, and it is undesirable to feed it through yarn guides because this may result in irregular feeding.

In view of the difficulties normally experienced in feeding elastic yarn, whether covered or bare, to a circular knitting machine, it is generally recognized that it would be advantageous to guide said yarn from its source to the needles of the machine over a path having a minimum of turns and over which the yarn may pass with the utmost freedom, and that this concept would be particularly advantageous in connection with bare elastic yarns. However, embodiment of this concept in a circular knitting machine, irrespective of the type of yarn to be handled, has proved to be most difficult because of the complex nature of the machine. Accordingly, an important object of the invention is to provide a circular knitting machine with means for stretching bare elastic yarn and feeding it to the needles of the machine over a path having a minimum number of turns and along which the yarn may pass over freely revolvable guides with the utmost freedom.

Another object is to provide such a machine with means for placing an inelastic yarn in action and removing it from action simultaneously with a bare elastic yarn fed to the needles along such a path having a section which approaches the needles at a tangent to the needle circle and for laying the yarns on the needles in position for plating.

Another object is to provide such a machine with means for placing an inelastic yarn in action and removing it from action simultaneously with a bare elastic yarn, and positively feeding the bare elastic yarn along such a path approaching the needles at a tangent to the needle circle, whereby to lay one of the yarns on the needles below, and pressed harder against the needle shanks than, the other for plating on the outside of the fabric.

Another object is to provide such a machine with means for placing an inelastic yarn in action and removing it from action simultaneously with a bare elastic yarn, means continuously driven from the main drive of the machine and having a driving connection with the means for stretching and positively feeding the bare elastic yarn, and means for interrupting the driving connection simultaneously with removal of said yarns from action whereby to terminate the yarn feed during selected revolutions of the needle cylinder.

Another object is to provide such a machine wherein the means for stretching and positively feeding the bare elastic yarn operates periodically while the machine is

in operation to feed yarn to selected parts of the work (for example, a surgical stocking), and always in predetermined timed relation with stitch length varying movements of the needle cylinder relative to the surrounding needle control cams whereby to vary the length of yarn fed to the needles per revolution of the needle cylinder to accommodate the changes in stitch length necessary to effect fashioning.

Other objects of the invention will become apparent when the following specification is read with reference to the accompanying drawings, in which:

FIGURE 1 is a perspective view of a circular knitting machine constructed in accordance with the invention;

FIGURE 2 is a perspective view of the yarn stretching and feeding mechanism;

FIGURE 3 is an exploded perspective view of the yarn stretching and feeding mechanism;

FIGURE 4 is a perspective view at a yarn feed showing leg yarns raised out of action;

FIGURE 5 is similar to FIGURE 4, but shows the leg yarns lowered into action;

FIGURE 6 is a perspective view of a modified arrangement, showing the leg yarns raised and clear of the needles;

FIGURE 7 is similar to FIGURE 6, but shows the leg yarns about to be laid into the needles; and

FIGURE 8 is similar to FIGURE 7, but shows the leg yarns lowered and laid into the needles.

Referring particularly to FIGURE 1, the invention may be embodied, for example, in a two-feed Bentley model KL circular knitting machine, generally designated 10, which is conventionally provided with a cylinder 12, needles 14 (FIGS 4–8) and needle control cams, generally designated 16. Although not shown, the machine is also provided with needle control jacks, a dial, bits for forming inturned welts and means for vertically adjusting the needle cylinder whereby to automatically regulate the length of the stitches or knitted loops, which, in a Bentley model KL circular knitting machine is effected independently of the main pattern means, as fully disclosed in the patent to Scott, No. 1,569,632, January 12, 1926. For actuating the dial, the machine is fitted with an upright shaft 18 and suitable gears. The shaft 18 mounts a spur gear (not shown) which meshes with a spur gear 20 to which is connected one end of a flexible shaft 22 extending through a cable 24 to a yarn stretching and feeding mechanism, generally designed 26.

Referring particularly to FIGURES 1–3, the yarn stretching and feeding mechanism 26 comprises a housing 28 closed at one end 30 and having a cover plate 32 at the opposite end. Suitably journaled in the housing 28, as by a ball bearing 33 pressed into the housing, is a shaft 34 which is axially fixed by means of a pair of snap rings 35 fitted over the shaft and positioned respectively on opposite sides of the bearing 33. Affixed to the shaft 34 is a friction clutch member or drive collar 36 having a drive face 37 of suitable friction material. Fitted over the shaft 34 and freely revolvable and axially slidable thereon is a spur gear 38 to which is attached a collar 39 of reduced diameter. Fitted over the collar 39 is a ball bearing 40 and a compression spring 42, one end of which is seated against the ball bearing. Spring 42 urges bearing 40, collar 39 and gear 38 to the right (FIG. 3), and when gear 38 engages the drive face 37 of collar 36, the gear 38 and collar 39 rotate with the shaft 34 and collar 36.

The gear 38 meshes with a spur gear 44 integrally formed with a cylindrical neck 46 terminating in a radially extending flange 48 provided with a rim 50. On the opposite side of the gear 44 and axially spaced therefrom but affixed thereto is a sun spur gear 52.

Adjacent the gear 44 is a disc 54 on which is mounted

a set of planetary gears 56 which mesh with the sun gear 52. The planetary gears 56 extend axially into and mesh with an internal ring gear 58. Also extending axially into and meshing with the ring gear 58 is a set of planetary gears 60 carried by a disc 62. A pair of annuli 64 and 66 serve to space the discs 54 and 62 from the gear 58. Extending radially from the discs 54 and 62 respectively are a pair of levers 68 and 70 which extend freely through a pair of arcuate slots 72 formed in the bottom of the housing 28. The planetary gears 60 mesh with a sun gear 74 affixed to one end of a shaft 76, which shaft end is journaled in the end 30 of the housing 28, the opposite end of the shaft 76 being journaled in the distal end of a bracket arm 96. The shaft 76 extends freely through the disc 62, annulus 66, internal ring gear 58, annulus 64, disc 54, sun gear 52, gear 44, neck 46 and flange 48 to drive spaced discs 88 and 90 mounted on the opposite end thereof.

Discs 88 and 90, containing spiral grooves 92, are a part of spool assembly 80, which includes heads 82 and 84, respectively at opposite ends thereof, and a plurality of circumferentially spaced segments 86. The spool per se is fully described in applicant's copending application, Serial No. 405,023, filed October 15, 1964. The rim 50 of the flange 48 fits over the head 82 and is affixed thereto for driving the spool ends 82, 84 carrying the segments 86.

Accordingly, it will be evident that the heads or spool ends 82 and 84, which hold the segments 86 in a uniformly spaced arcuate relationship, are driven separately from the discs 88 and 90 containing the spiral grooves that control the radial position of the segments 86.

Sun gears 52 and 74 are of the same size. Planet gears 56 and 60 are also the same size. Since planet gears 56 and 60 mesh with ring gear 58, flange 48 and shaft 76 will turn at the same rate. This means that the spool ends 82 and 84 and the discs 88 and 90 containing spiral grooves 92 will turn at exactly the same speed, with the result that segments 86 will remain at any selected distance radially from the axis of the spool assembly 80. However, angular movement of either disc 54 or 62, through control levers 68, 70, will cause relative angular adjustment between spool ends 82 and 84 and discs 88 and 90 resulting in segments 86 moving radially outward or inward, to change the effective diameter thereof regardless of whether spool assembly 80 is revolving or not. Each lever 68, 70 controls movement of the segments through one-half of the full range of radial movement so that movement of the segments through the full range of radial movement may be effected by angularly moving both levers.

Above the bracket 96 is a Gaudet roll 98 carried by a shaft 100 disposed at a slight horizontal angle relative to the shaft 76 and having opposite end portions journaled respectively in the cover plate 32 and in a bracket 102 carried in turn by the bracket 96. A belt 103, preferably elastic, may operatively connect the spool 80 with the roll 98 so that the spool and roll will turn in unison at the same surface speed for a better grip on the yarn, and especially elastic yarn.

Received in openings 104' in opposed wall areas of the housing 28 is a pin 104 mounting for oscillation a pair of block mounts 106. Pivotally connected to each mount is a brake shoe or block 108, the pivots being located above a horizontal plane containing the axis of the pin 104. The block mounts 106 are affixed to an upright lever 110 to which is connected a wire 112 which extends through a cable 114 (FIG. 1), one end of which is attached to a bracket 116 carried by the housing 28. The lower end of the wire 112 is attached to a lever 118 pivoted on a shaft 120, the lever being controlled by drum mechanism generally indicated at 122, which in effect is an extension of the main control drum. Interposed between the lever 110 and the housing 28 is a compression spring 132 fitted over the wire 112. A downward pull by the lever 118 on the wire 112 tensions the wire 112 and causes

the lever 110 to pivot counterclockwise, as viewed in FIG. 3, against the influence of spring 132. Tensioning of wire 112 not only compresses spring 132 but also causes blocks 108 to swing downwardly in an arc and thereby move to the left to press against gear 38 moving it, against the influence of spirng 42, away from engagement with friction surface 37 on drive collar 36 and simultaneously moving the collar 39 into engagement with a friction surface (not shown) in housing 28, which results in positive braking of gear 38. Thus, if wire 112 is untensioned, spool 80 will revolve but tensioning of wire 112 will positively stop spool 80.

The end of the lever 68 which extends out of the housing terminates in a block 124 (FIG. 2) through which is threaded a screw 126 which engages the housing 28 and adjustably fixes the lever in position. The end of the lever 70 which extends out of the housing terminates in an arcuate rack 130 biased counterclockwise, as viewed in FIGURE 2, by a tension spring 133 anchored through the medium of a bracket to the housing 28. A plate 134 (FIG. 2) depending from the housing 28 pivotally mounts a pawl 136 biased clockwise, as viewed in FIGURE 2, by a tension spring 138. A pawl 140 is pivoted, as at 142, to one end of a bell crank 144, which in turn is pivoted to the plate 134, as at 146. The bell crank 144 is biased clockwise, as viewed in FIGURE 2, by a tension spring 148 anchored to the housing 28, and the pawl 140 is biased clockwise, as viewed in FIGURE 2, by a tension spring 150 anchored to the plate 134. The clockwise movement of the bell crank 144 is limited by a stop 152, which is part of plate 134.

Associated with the pawls 136 and 140 is a rod 154 extending downwardly through a guide 156 on plate 134. The upper end portion of the rod 154 is provided with a laterally extending pin 158 overlying adjacent extremities of the pawls 136 and 140. The lower end portion of the rod 154 is connected to a lever 160 pivoted on the shaft 120 and controlled by the mechanism 122.

Pivotally connected to the bell crank 144, as by a pin 162, is a rod 164, the lower end portion of which is connected to a lever 166 controlled by a cam located on bull gear 167 to operate crank 144 once every four revolutions of the cylinder 12.

Referring particularly to FIGURES 4 and 5, a bracket or extension 168 of the usual latch ring carries a throat plate 170. Disposed near the back 172 of the throat plate is a pivotally mounted specially formed yarn finger 174 which carries on the top thereof a yarn guide 176. The bracket 168 has formed therein a large channel or passageway 178 through which yarn may pass and the yarn finger 174 has formed therein a large opening 180 for yarn. Disposed adjacent the yarn finger 174 is a pivotally mounted specially formed finger 182 having at one end thereof a platform 184, as shown. A yarn finger is generally designated 186.

In the operation of the machine, elastic yarn 210 (FIG. 1) from a package 204 located directly below the mechanism 26 may be drawn off the end of the package and spiraled a suitable number of times around the spool 80 and roll 98, said spool 80 being geared to deliver yarn at a lower rate than that at which yarn is demanded by the machine so that the elastic yarn is passed in stretched condition over positionally fixed freely revolvable rolls or pulleys 206 and 208. From the roll 208 the yarn passes freely through opening 178 (FIG. 5) in the bracket 168, through the opening 180 and then freely through the throat plate 170, from one side thereof, to the needles, rubbing very lightly against the yarn fingers, bracket 168 and throat plate 170. The path of the yarn from the spool 80 to the needles 14 of the knitting machine may not be straight, but it is at least devoid of all sharp turns, except where it passes over a pulley. At no point does it change more than 10 degrees in direction without going around a pulley. Yarn approaching the needles through

the passage 178 and opening 180 does so along a line which is tangent to the needle circle.

The shaft 18 (FIG. 1) actuates the spur gear 20 which turns the flexible shift 22 and thus the shaft 34 and collar 36. When knitting a stocking, for example, a surgical stocking, the lever 118 is in lowered position to tension wire 112 during the knitting of all parts of the stocking except for the leg and foot. During the leg and foot, lever 118 is in raised position, releasing the wire 112 so as to permit blocks 108 to release gear 38, permitting gear 38, under the influence of spring 42, to engage the friction surface 37 of collar 36, thus turning spool 80.

It is thus seen that the spool 80 may be started and stopped at will by tensioning or releasing wire 112. Thus at the start of the leg or foot lever 118 will ride off a cam on drum 122 permitting lever 118 to rotate clockwise as seen in FIGURE 1, releasing wire 112 and starting the rotation of spool 80. Of course, at the start of the heel or ring toe, lever 118 will ride onto a cam to stop the rotation of spool 80 and prevent creepage of the yarn.

When fashioning is to be effected, in the normal well known manner by relative axial movement between the cylinder and stitch cam or cams, the end of the lever 160 connected to the rod 154 is raised by the drum 122, thus raising rod 154 and pin 158. Pawl 136 rises under the influence of spring 138 and engages rack 130. Simultaneously pawl 140 rises under the influence of spring 150 and engages rack 130. Lever 166 moves rod 164 up and down, rocking the bell crank 144 once every four revolutions of the cylinder 12. Thus pawl 140 advances rack 130 in step by step movements against the influence of spring 133 until block 128 strikes pawl 136. Each successive position of the rack 130 is held by the pawl 136 while the pawl 140 is being retracted in preparation for its next rack advancing movement. When the block 128 strikes the pawl 136, the latter is secured against rack holding engagement with the teeth of the rack. Thus the rack 130 will oscillate back and forth through the distance of one tooth until both pawls 136 and 140 are drawn away from the rack by the lowering of rod 154.

As indicated hereinbefore, the rack 130 is formed integral with the lever 70 extending from the disc 62. As the rack 130 is advanced, the angular relation of the disc 62 to the disc 54 changes. Thus the angular relation between shaft 76 and discs 88 and 90 connected to it on the one hand and the heads 82 and 84 on the other hand, about the axis of the shaft 76, is varied, in consequence of which the effective diameter of the spool and the amount of yarn metered out to the needles is varied.

The mechanism 26 may be operated to feed yarn 210 periodically, and, in addition, as when fashioning, the diameter of the spool may be selectively changed in coordination with vertical movements of the needle cylinder while the machine is in operation, all as predetermined by arrangement of drum 122. It should be noted that spiraling the yarn about the spool 80 provides a way of averaging sudden pulls as the yarn feeds from the package, thus resulting in more uniformly tensioned yarn, i.e., changes in yarn tension are gradual when compared with changes in yarn tension that occur when the yarn is metered through nip rolls. In addition, the yarn is not damaged, as it often is when metered through nip rolls.

By mounting spool 80 directly over the package 204, the elastic yarn is stretched only the amount necessary to remove it from the package as it is wound about spool 80 and roll 98. The yarn will then be stretched by the difference in amount of yarn fed in comparision with the amount of thread demanded by the knitting needles. An inelastic yarn 212 (FIGS. 4, 5) extends from a source thereof through guide 176 atop the finger 174 to the needles. The inelastic yarn 212 and the elastic yarn 210 are both fed to the needles with the bare elastic yarn 210 lower on and pressed harder against the needle shank then the inelastic yarn 212 so that the bare elastic yarn is positioned to plate to the outside of the fabric. During rotary knitting, when the finger 174 swings upwardly, the movement is sufficient to take the yarns out of action, and when it swings downwardly, the movement is sufficient to place both yarns in action. But during reciprocatory knitting of the heel and toe, when the finger 174 swings upwardly, the bare elastic yarn 210 is not raised by the finger 174 sufficiently to clear all of the needles. Accordingly, the finger 182 swings upwardly and engages the yarn 210, elevating it sufficiently to clear the needles.

Referring particularly to the modification shown in FIGS. 6, 7 and 8, at the back 172 of the throat plate is a pivotally mounted specially formed yarn finger generally designated 188. This yarn finger is provided with a guide eye 190 in the end thereof and with a guide 192 on the top thereof. Disposed alongside the yarn finger 188 is a pivotally mounted yarn finger 202.

Referring particularly to FIGURES 6, 7 and 8, the bare elastic yarn 210 issuing from the channel 178 passes freely over the guide 192 to the needles. The inelastic yarn 212 passes through guide eye 190 to the needles and is placed lower on and tighter against the shanks of the needles than the bare elastic yarn 210 so that it is positioned to plate to the outside of the fabric. During rotary knitting, when the finger 188 swings upwardly the movement is sufficient to take both yarns out of action, and when the finger 188 swings downwardly, the movement is sufficient to place both yarns in action. To make certain that the bare elastic yarn 210 is laid into the needles, the finger 202 swings down and engages the yarn 210, lowering it sufficiently for the purpose intended. Finger 202 then rises immediately.

It will be understood that while normally either a finger 182 or a finger 202 is used, a machine may be fitted with both fingers to assure more positive entering of the elastic yarn and to assure the elastic yarn being lifted to a sufficiently high level for clearing the needles.

It will also be understood that a mechanism 26 is capable of handling either inelastic or elastic yarns, with the rate of rotation depending upon the type of yarn handled. It should also be understood that while it is particularly advantageous to use the mechanism 26 when handling elastic yarns which are bare, it is also advantageous to use the mechanism 26 when handling elastic yarns which are covered. Obviously, the number of yarns that may be simultaneously handled by the mechanism 26 for feeding a multi-feed machine depends upon the length of the segments 86 and the angle at which the roll 98 is set relative to the spool 80, which angle determines the spacing between spirals of the yarn.

It should be noted that the spool 80 is positively geared to the machine 10 so that there can be no slippage in the drive. In addition, the diameter of the spool 80 is changed through a gear train, in consequence of which the yarn feed rate will be the same every time the yarn stretching and feeding mechanism 26 is set for the same diameter. Furthermore, any number of such mechanisms may be set to give the same diameter and consequently the same yarn feed rate.

It should be noted that when elastic yarn is removed from the needles, the spool continues to rotate for a time sufficient to relieve tension on the elastic yarn between clamp and cutter.

It will be understood, of course, that the present invention, as described and shown, is susceptible to various changes and modifications which may be made without any departure from the general principles or real spirit of the invention. Accordingly, it is intended to claim the present invention broadly, as well as specifically, as indicated in the appended claims.

What is claimed is:

1. In a circular knitting machine, the combination comprising a needle cylinder, a complement of needles operatively mounted in said cylinder, a throat plate means

outside said throat plate provided with a yarn guide opening disposed so that yarn passing through said opening approaches said needles at the knitting point along a line substantially tangent to the needle circle.

2. In a circular knitting machine, the combination comprising a needle cylinder, a complement of needles operatively mounted in said cylinder, and means outside the needle circle provided with a yarn guide opening disposed so that yarn passing through said opening approaches said needles along a line substantially tangent to the needle circle.

3. In a circular knitting machine, the combination comprising a needle cylinder, a complement of needles operatively mounted in said cylinder, a first finger for guiding a first yarn to said needles, means outside the needle circle provided with an opening for guiding a second yarn moving substantially freely past said first finger and approaching said needles along a substantially straight line tangent to the needle circle, said first finger being operable independently of said second finger for raising both of said yarns thereby to remove the same from said needles, a second finger adjacent, and operable independently of, said first finger for raising said second yarn and maintaining it in a still higher position throughout a selected portion of the knitting cycle.

4. The combination according to claim 3 wherein the knitting machine is provided with a throat plate, and the substantially straight line tangent to, and along which the second yarn approaches, the needle circle, extends through the back of said plate to the needles.

5. The combination according to claim 3 wherein the first yarn guide finger is provided with an opening for the second yarn, and the means for guiding the second yarn directs the same substantially freely through said opening.

6. The combination according to claim 3 wherein the second yarn is elastic, and means is provided for feeding said second yarn to the needles in a stretched condition, whereby said second yarn is pressed against the shanks of the needles tighter than, and positioned below, the first yarn for plating on the outside of the fabric.

7. In a circular knitting machine, the combination comprising a needle cylinder, a complement of needles operatively mounted in said cylinder, a first finger for guiding a first yarn to said needles, means outside the needle circle provided with an opening for guiding a second yarn moving substantially freely past said first finger and approaching said needles along a substantially straight line tangent to the needle circle, said first finger being operable independently of said second finger for raising both of said yarns thereby to remove the same from said needles, a second finger adjacent, and operable independently of, said first finger for lowering said second yarn and holding it in lowered position for a period of time sufficient for laying it into the needles.

8. The combination according to claim 7 wherein the knitting machine is provided with a throat plate, and the substantially straight line tangent to, and along which the second yarn approaches, the needle circle, extends through the back of said plate to the needles.

9. The combination according to claim 7 wherein the first yarn guide finger is provided with an opening for the second yarn, and the means for guiding the second yarn directs the same substantially freely through said opening.

10. The combination according to claim 7 wherein the second yarn is elastic and means is provided for feeding said second yarn to the needles in a stretched condition, whereby said second yarn is pressed against the shanks of the needles more lightly than, and positioned above, the first yarn so that the first yarn plates on the outside of the fabric.

11. In a circular knitting machine, the combination comprising a needle cylinder, a complement of needles operatively mounted in said cylinder, means outside the needle circle provided with a yarn guide opening disposed so that yarn passing through said opening approaches said needles along a line substantially tangent to the needle circle, and feed means operable for positively feeding elastic yarn through opening at a predetermined lower rate than that at which said yarn is incorporated into the fabric whereby to stretch the length of yarn extending from the feed means to said needles.

12. The combination according to claim 11 wherein the means for feeding the elastic yarn is active during selected portions of the knitting cycle, and the quantities of stretched elastic yarn fed to the needles during successive revolutions of the needle cylinder are predetermined.

13. The combination according to claim 11 wherein means is provided for guiding an inelastic yarn to the needles, and the stretched elastic yarn is pressed against the shanks of the needles tighter than, and positioned below, the inelastic yarn for plating on the outside of the fabric.

14. The combination according to claim 11 wherein means is provided for guiding an inelastic yarn to the needles, and the stretched elastic yarn is pressed against the shanks of the needles more lightly than, and positioned above, the inelastic yarn so that the inelastic yarn plates on the outside of the fabric.

15. In combination with a knitting machine having stitch control cams and a needle cylinder shiftable relative to each other axially of the needle cylinder for varying the stitch length thereby to effectively fashion the work, a yarn feeder for positively delivering yarn to the needles of the machine including a spool with parts angularly movable relative to each other, and a plurality of elements radially shiftable in response to said movement for varying the effective diameter of said spool and thereby the rate of yarn feed, and spool control means operable in predetermined timed relation to said axial shifting movement of the needle cylinder relative to the stitch control cams for varying the angular relation between said parts thereby to vary the effective diameter of said spool and thereby the rate of yarn delivery as required to effectively fashion the work.

16. The combination according to claim 15 wherein the spool control means is operable, while the machine is in operation, for varying the effective diameter of said spool and thereby the quantity of stretched yarn fed to the needles per revolution of the needle cylinder.

17. The combination according to claim 15 wherein the needle cylinder and the spool are operatively connected to a common drive, and a clutch responsive to the main controls of the machine is operable for interrupting the driving connection to said spool.

18. The combination according to claim 17 wherein means is provided for positively terminating rotation of the spool when the driving connection thereto is interrupted.

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ROBERT R. MACKEY, *Acting Primary Examiner.*

RUSSELL C. MADER, *Examiner.*