Oct. 8, 1940. J. LAWSON ET AL 2,217,225

FEEDING MEANS FOR KNITTING MACHINES

Filed May 12, 1936 7 Sheets-Sheet 1

FIG. 2.

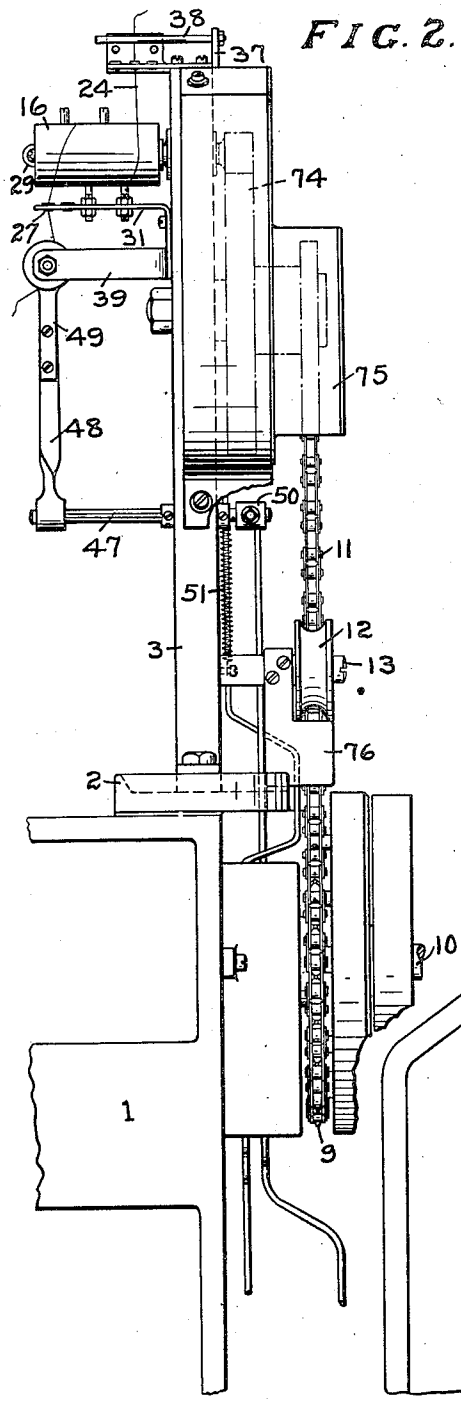
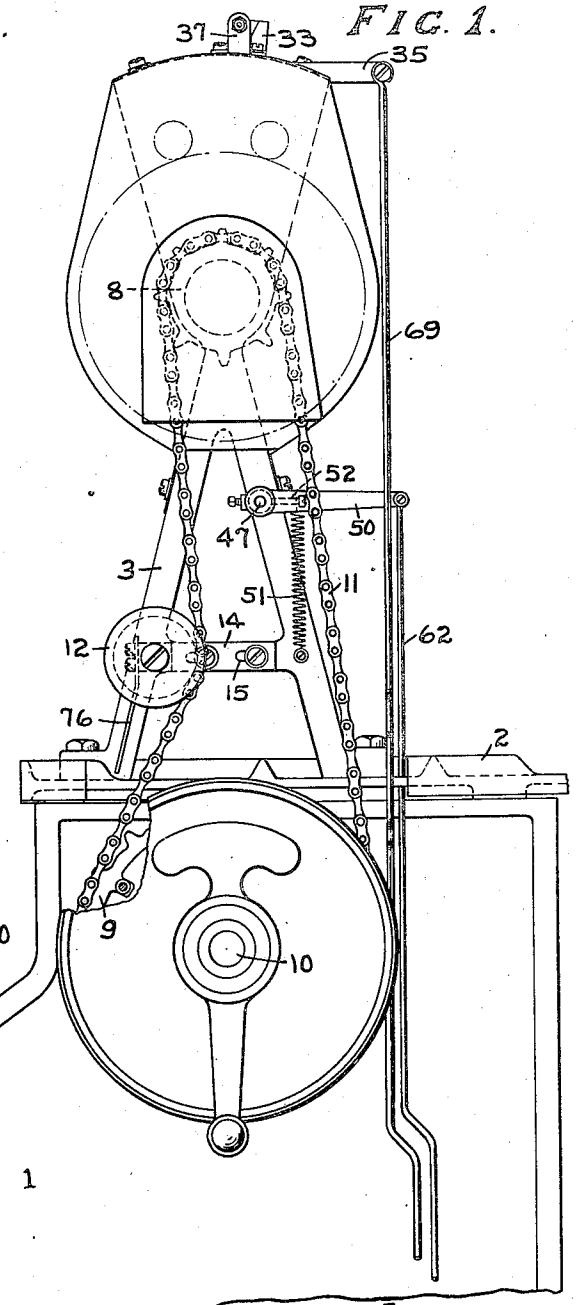


FIG. 1.



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Filed May 12, 1936 7 Sheets-Sheet 2

FIG. 3.

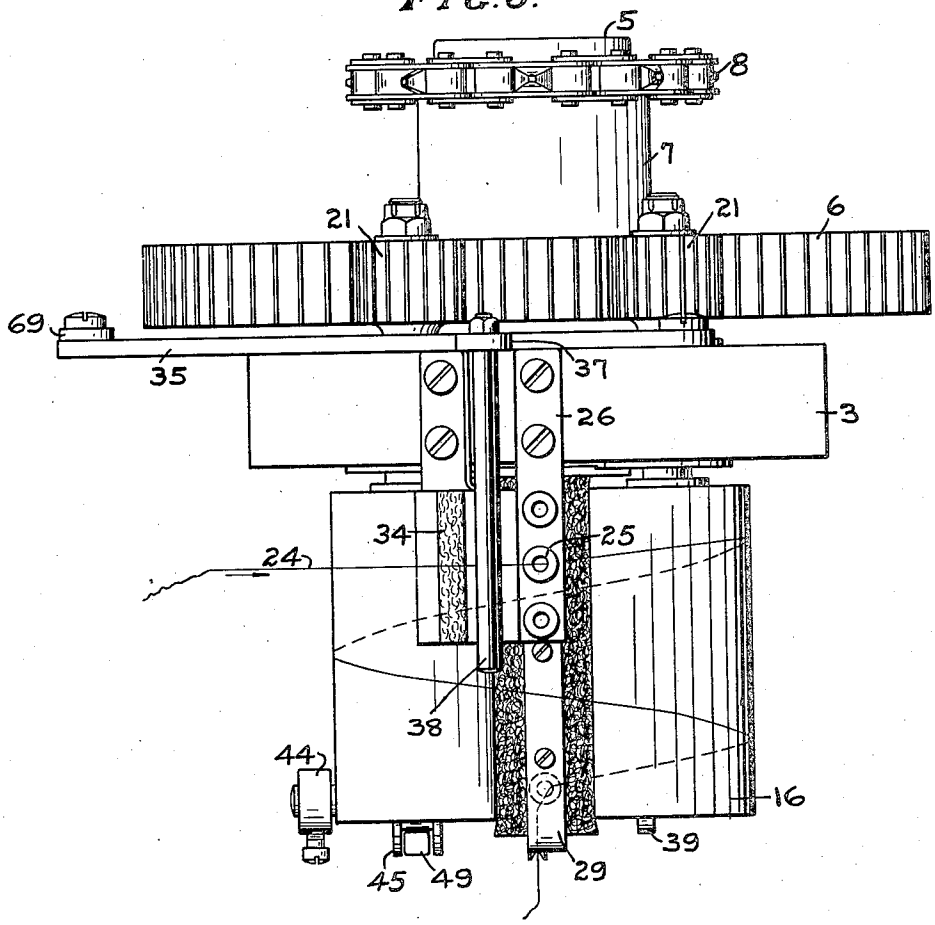


FIG. 16.

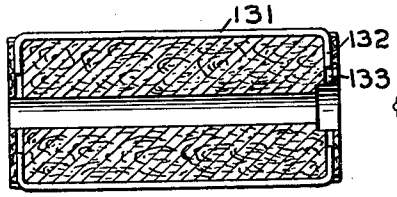


FIG. 18.

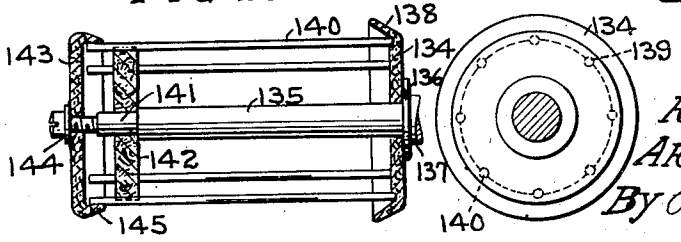


FIG. 17.

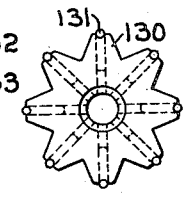


FIG. 19.

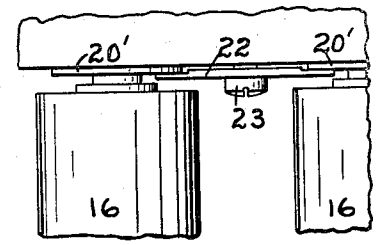


FIG. 4.

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FEEDING MEANS FOR KNITTING MACHINES

Filed May 12, 1936 7 Sheets-Sheet 3

FIG. 7.

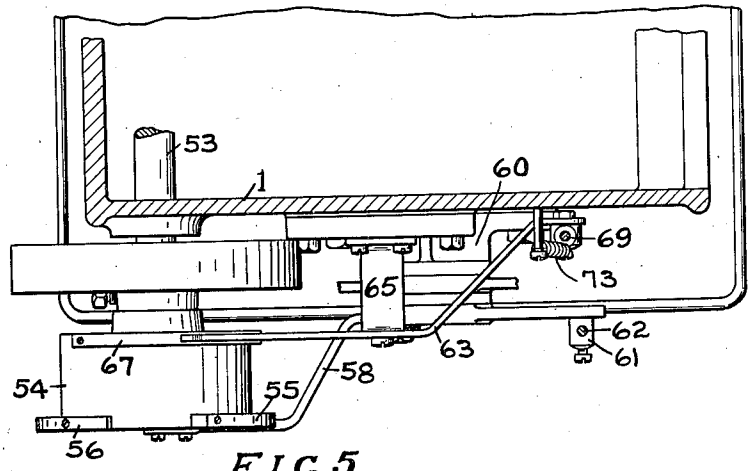


FIG. 6.

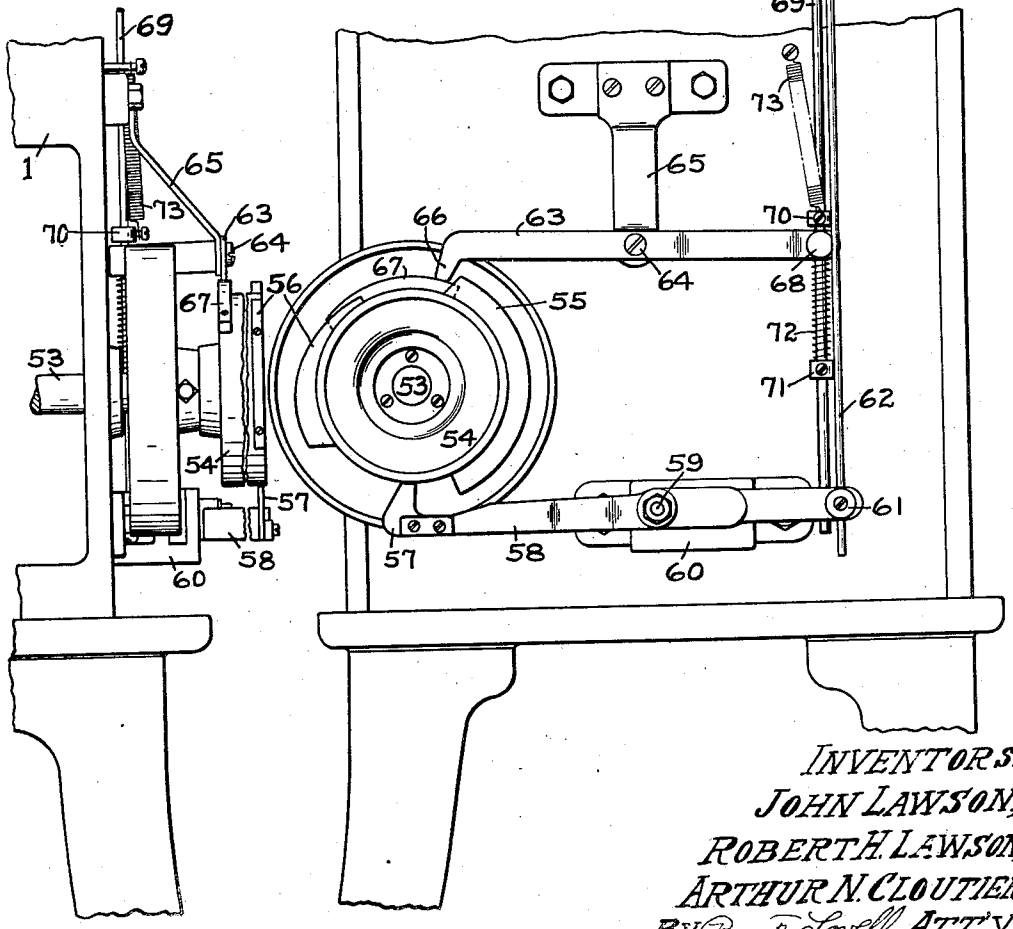


FIG 5.

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FEEDING MEANS FOR KNITTING MACHINES

Filed May 12, 1936 7 Sheets-Sheet 4

FIG. 9.

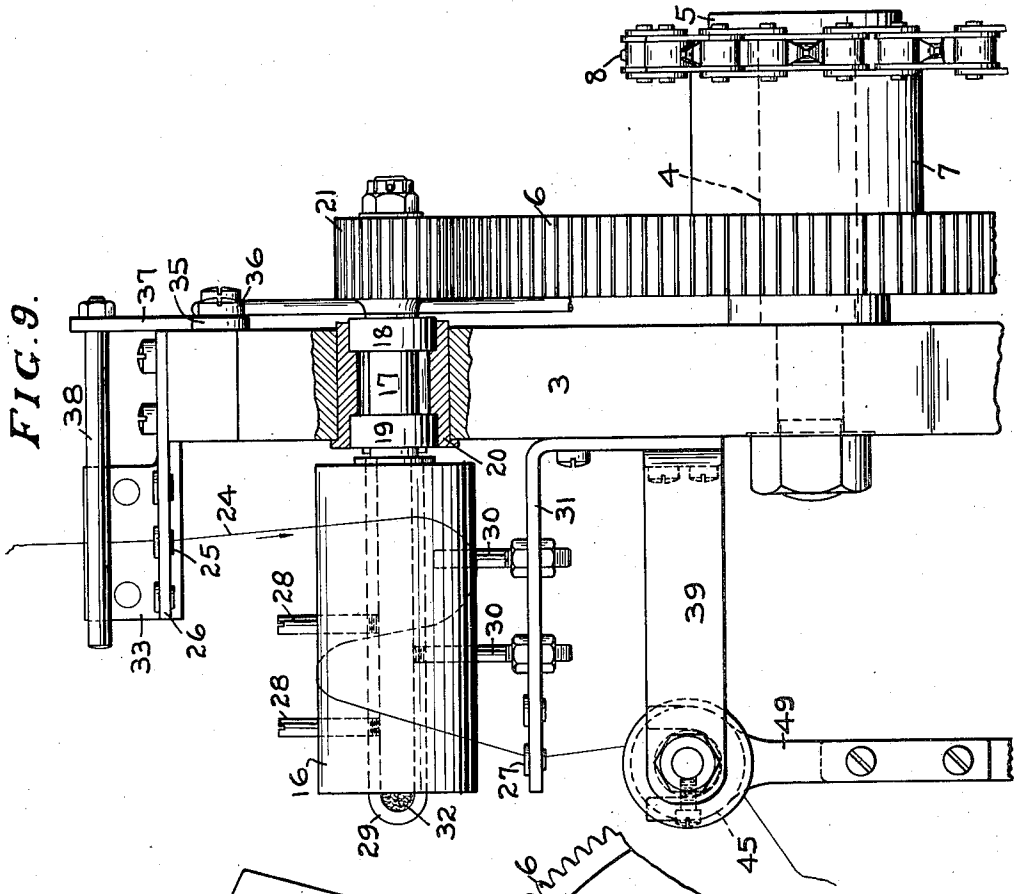
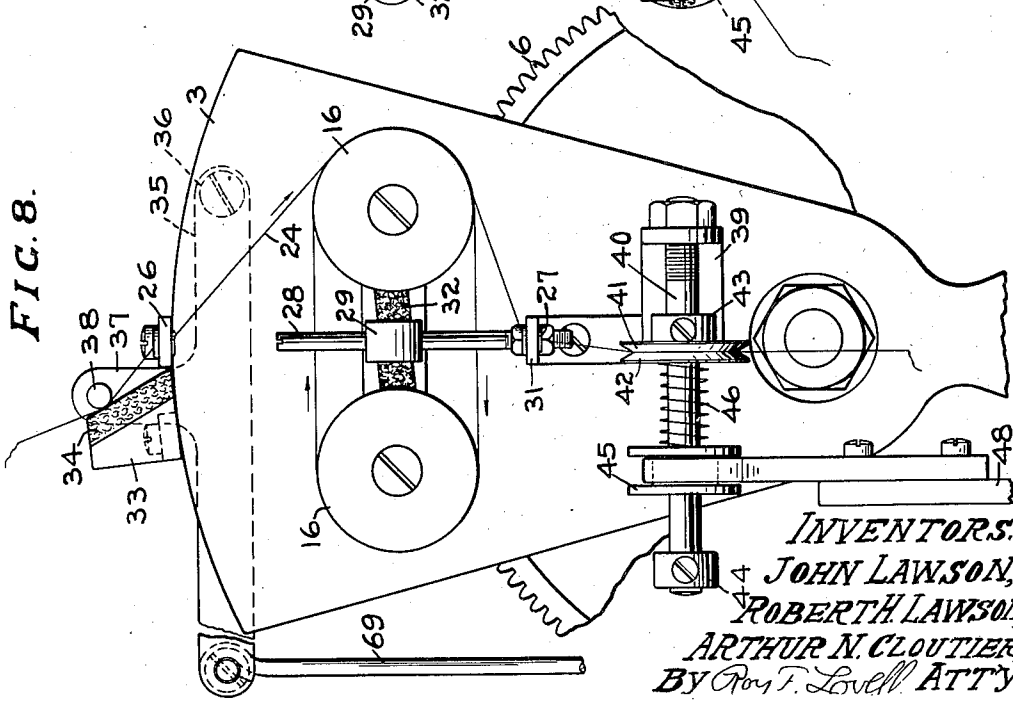


FIG. 8.



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FEEDING MEANS FOR KNITTING MACHINES

Filed May 12, 1936 7 Sheets-Sheet 5

FIG. 11.

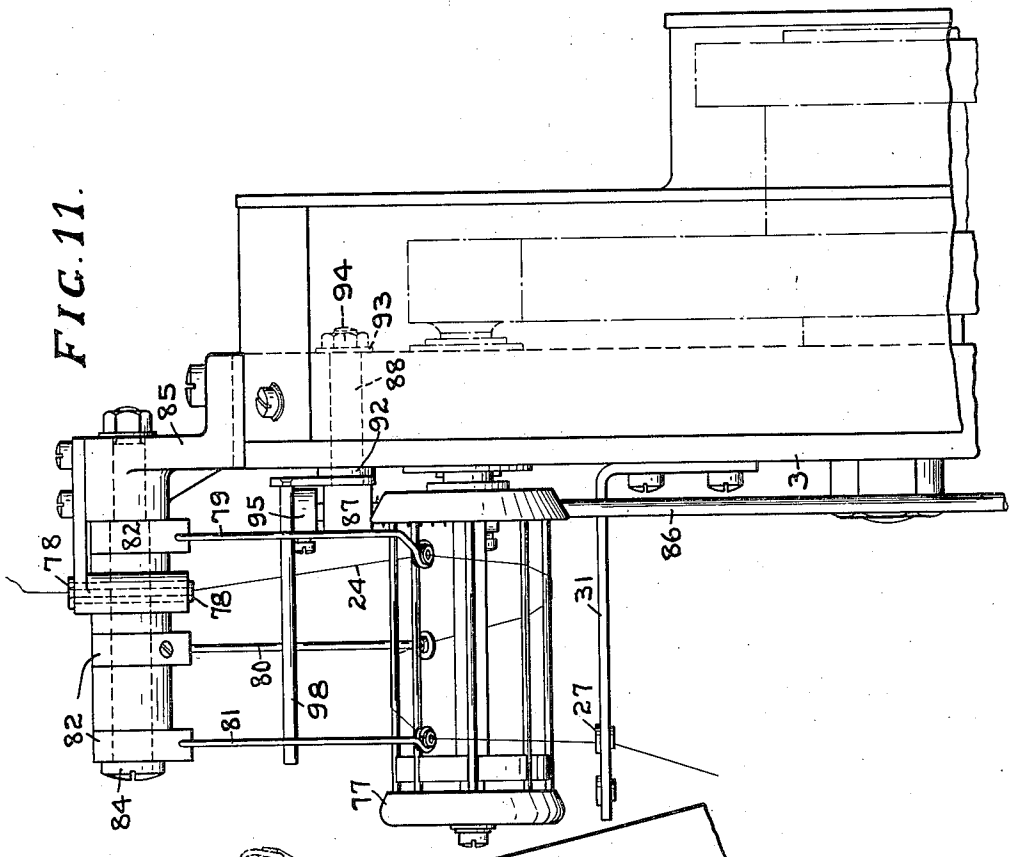
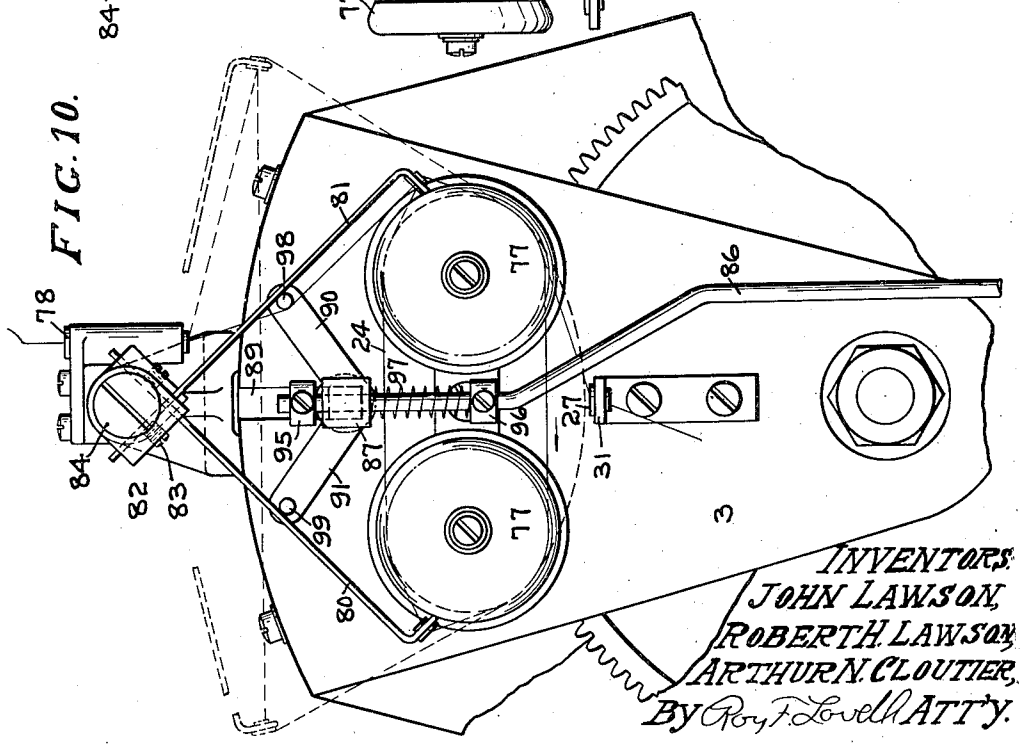


FIG. 10.



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FEEDING MEANS FOR KNITTING MACHINES

Filed May 12, 1936 7 Sheets-Sheet 6

FIG. 13.

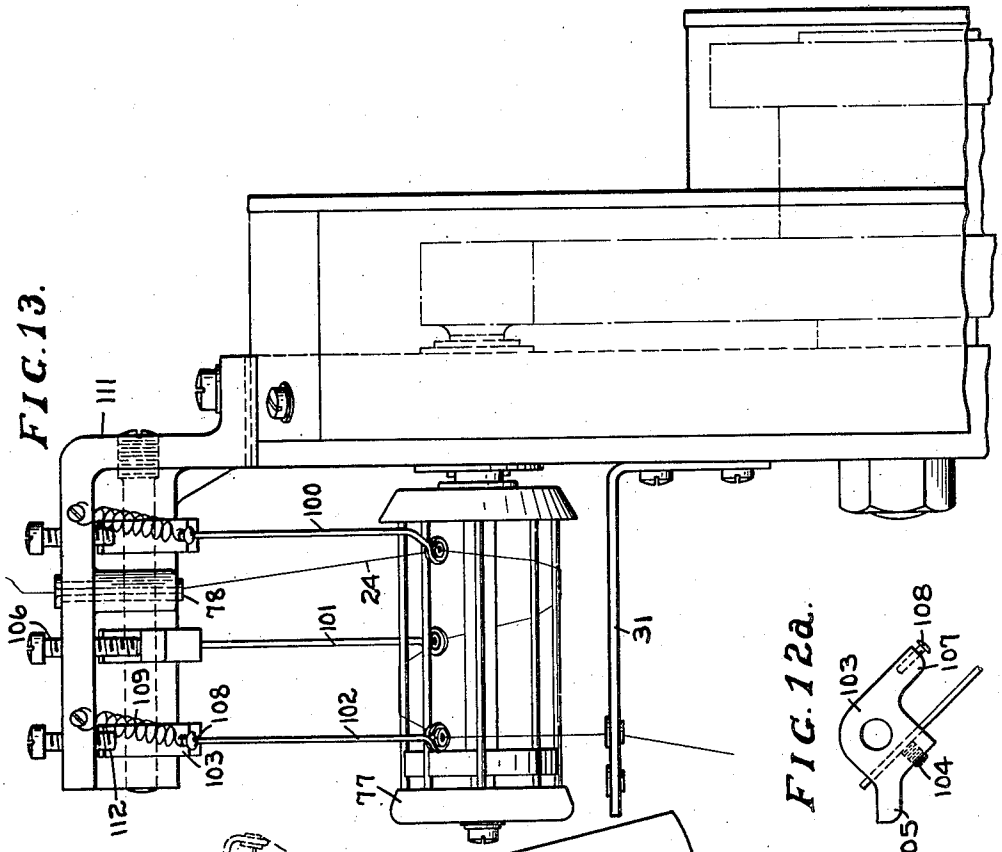
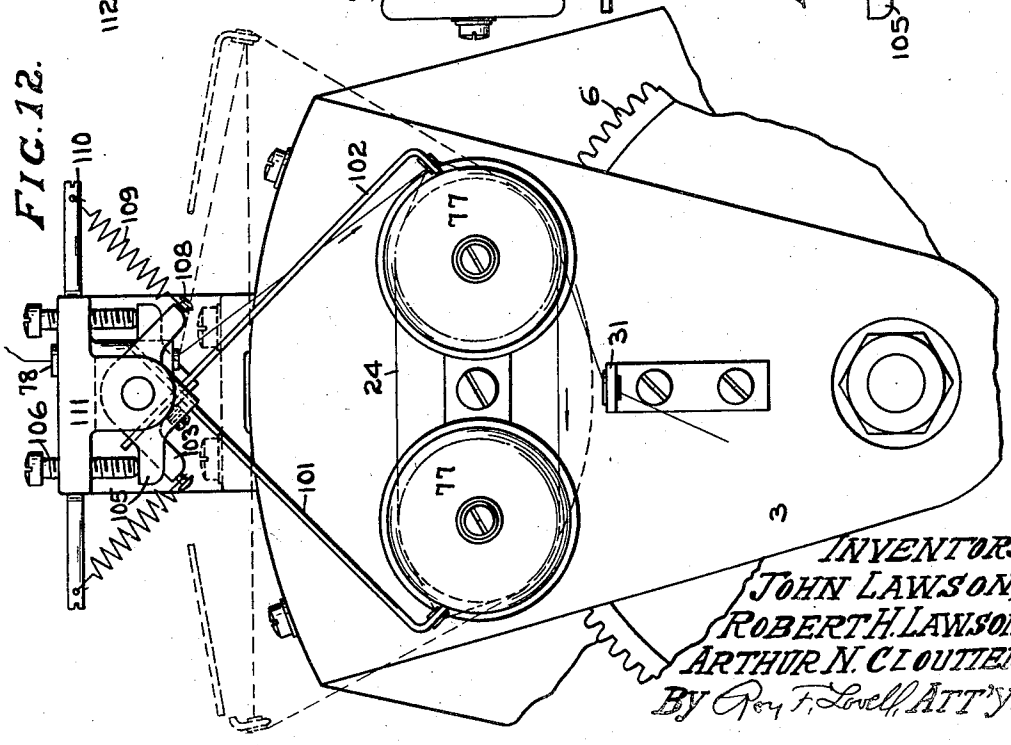


FIG. 12a.

FIG. 12.



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FEEDING MEANS FOR KNITTING MACHINES

Filed May 12, 1936 7 Sheets-Sheet 7

FIG. 15.

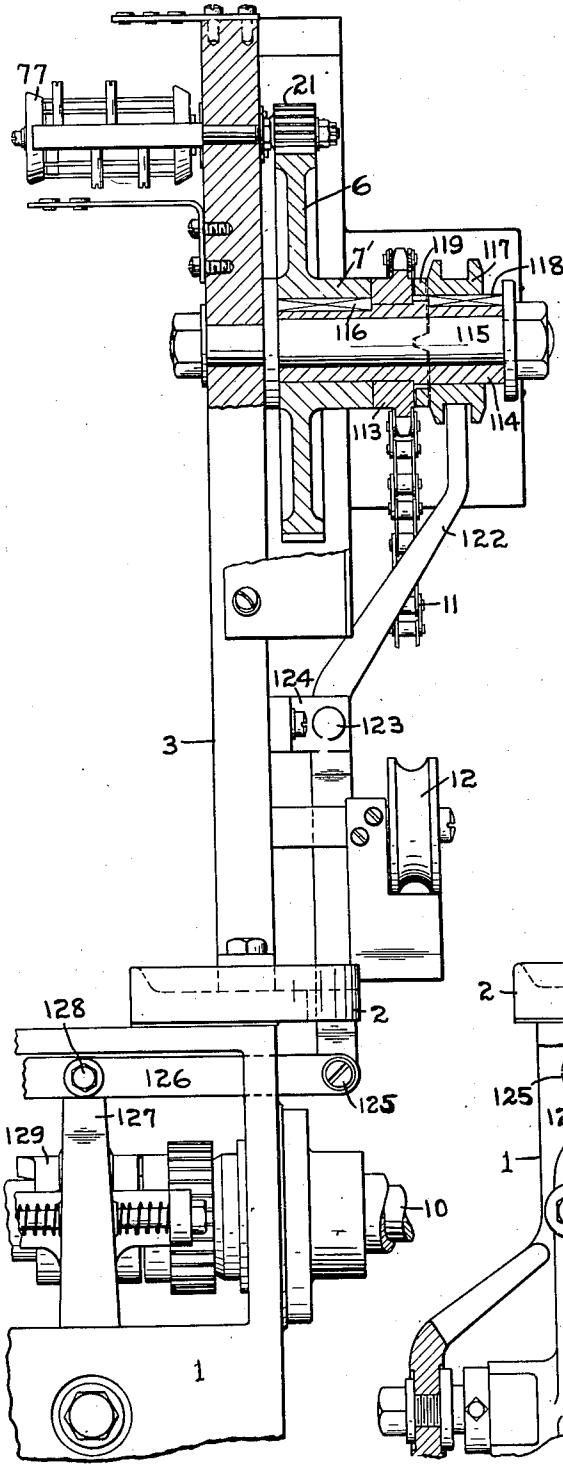
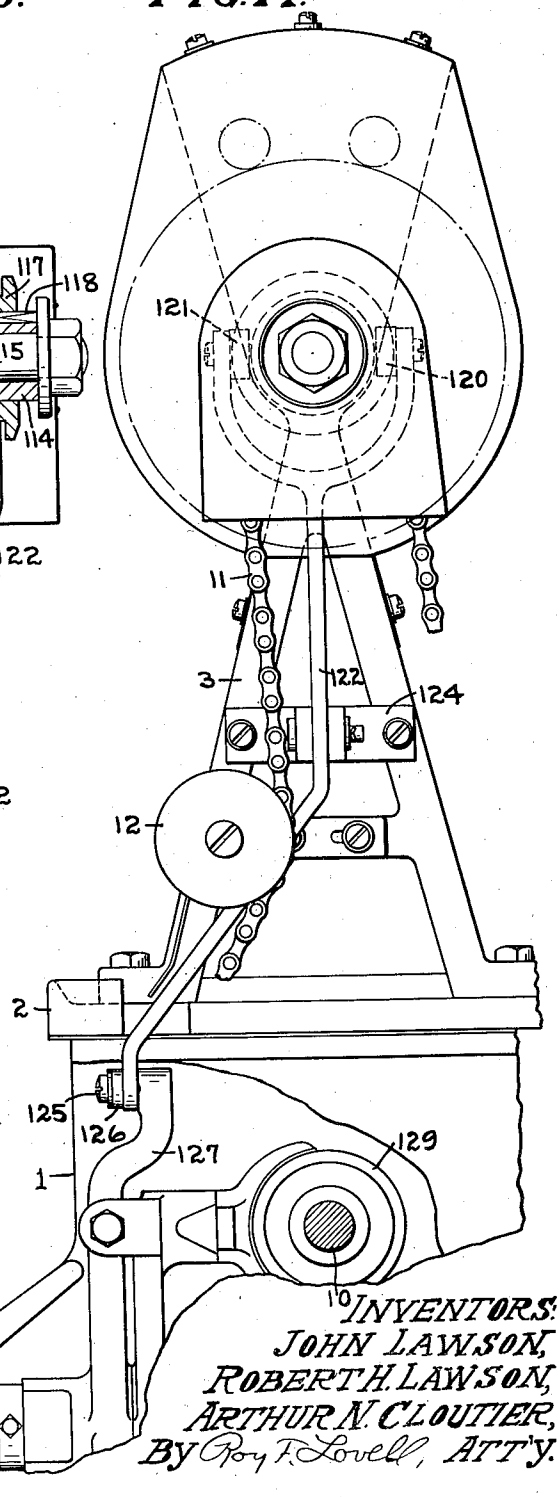


FIG. 14.



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Patented Oct. 8, 1940

2,217,225

UNITED STATES PATENT OFFICE

2,217,225

FEEDING MEANS FOR KNITTING MACHINES

John Lawson, Bristol, Robert H. Lawson, Pawtucket, and Arthur N. Cloutier, Lonsdale, R. I.; said Robert H. Lawson and said Cloutier assignors to Hemphill Company, Central Falls, R. I., a corporation of Massachusetts

Application May 12, 1936, Serial No. 79,278
In Canada May 21, 1935

10 Claims. (Cl. 66—132)

This case deals with mechanism for furnishing yarn to the needles of a knitting machine and especially for feeding rubber yarn such as Lastex in machines adapted for knitting hosiery. The case is a continuation as to all common subject matter of United States applications Serial Nos. 14,492 and 56,363 respectively.

In the figures of drawings:

Fig. 1 is an elevation illustrating the manner in which the furnishing means is attached to a hosiery machine and the connection for driving said furnishing means;

Fig. 2 is an elevational view showing the mechanism of Fig. 1 as seen from the front of the machine;

Fig. 3 is a plan view illustrating the feeding rolls and part of the supporting and driving means therefor;

Fig. 4 is a fragmentary view showing the manner in which the furnishing roller assemblies are secured to their supporting bracket;

Fig. 5 is an elevation of the lower portion of the machine shown in Fig. 1 wherein the cam control from the main cam shaft is illustrated in detail;

Fig. 6 is a corresponding view of what has been shown in Fig. 5 as seen from the front of the machine;

Fig. 7 is a plan of as much of the invention as was shown in Figs. 5 and 6;

Fig. 8 is an elevation showing in detail certain features of the feeding rollers, clamping means and the yarn tension which has been applied;

Fig. 9 is a detail view, partly in section, showing what has been illustrated in Fig. 8 as seen from the front of the machine;

Figs. 10 and 11 are detail views showing a modified form of the invention for rendering the feeding mechanism inactive during reciprocatory knitting or at other desired times;

Figs. 12 and 13 correspond to Figs. 10 and 11 but show another modification;

Fig. 12*a* is a detail of one of the elements for holding a yarn tensioning wire;

Figs. 14 and 15 illustrate another modified form of the device for rendering the feeding mechanism inactive during reciprocatory knitting;

Fig. 16 illustrates in detail one form of yarn feeding roller;

Fig. 17 is an end view of the roller shown in Fig. 16;

Fig. 18 is a sectional view showing another form of feeding roller; and

Fig. 19 is an end view of the rollers shown in Fig. 18.

The yarn furnishing device herein shown has been developed for the general purpose of feeding yarns of any nature to knitting machines of single or multi-feed types and it is the special purpose of this case to disclose specific forms of the invention for application to hosiery machines. In the knitting of stockings certain portions of the fabric are produced by a continuous rotary motion of the machine and other parts, for example, the heel and toe, are usually made by a reciprocatory movement of the cylinder and needles or the cams, as the case may be. It is desirable to rotate the yarn furnishing rollers or wheels continuously at a fixed rate of speed which speed must be at least as great as the maximum rate at which the yarn is to be advanced, and preferably at a speed considerably in excess of this minimum requirement. In practice the yarn is threaded through certain guides and wrapped or snubbed about one or more feeding rollers having comparatively smooth surfaces whereupon, by frictional engagement between said rollers and yarn, the yarn will be fed under a practically constant tension regardless of conditions under which the yarn is released from the cone or conditions of taking the yarn at the needles.

It is the tendency of these furnishing rollers to feed the yarn under an absolute minimum of tension, all as has been described in the United States applications 14,492 and 56,363 above mentioned, and any desired amount of drag may be imposed upon the yarn just prior to its being taken at the needles whereby an even tension may be assured at all times. For the knitting of rubber yarns either covered or uncovered, it has been found practically essential that these rubber yarns be drawn from the cone positively, and that they be delivered to the needles under a predetermined tension which does not vary upon a change in the rate at which said yarn is to be taken by the needles or wherein there is a tendency for the yarn to feed improperly due to unexpected influences. When knitting and floating alternately there will be a continuous change in the rate at which the rubber yarn will be drawn by the needles and it is a function of the yarn furnishing means herein disclosed to automatically compensate for this change in rate at which the yarn is demanded, and at the same time, to feed the yarn under the proper condition.

For certain purposes the rubber yarn may be fed to only a few courses in some portion of the stocking such as when forming a garter at the

top thereof, or may be fed continuously throughout the entire stocking with the exception of the heel and/or toe as when knitting a surgical stocking. In such practice it is essential that the feeding means be rendered inoperative or at least ineffective for feeding the yarn at all times except when it is to be incorporated in the stocking. In the production of surgical stockings, the foot and leg portions are usually knitted of rubber or at least with a plurality of yarns one of which is rubber, and the heel and toe, in case a toe is desirable, are knitted in a reciprocatory manner and of cotton or other similar materials. At this time it would be essential to discontinue the knitting and thus the feeding of the elastic yarn. This case sets forth several satisfactory means for accomplishing the latter purpose.

Referring to Figs. 1 through 9, a typical hosiery machine has been illustrated with the frame 1 and circular base 2. Other parts of the machine would include a needle cylinder of either the rotary or stationary type, the cams for operating thereon, sinkers and yarn guides for delivering yarn to the sinkers and needles to form a fabric. All of these elements are commonly employed and need no illustration or explanation in this case. A bracket or support 3 has been attached to the circular base and is provided at its upper end with a shouldered stud 4 having a flange 5 at its outer end to serve as a bearing for a gear 6 having a hub 7 upon the outer end of which a sprocket 8 is secured. This sprocket is permanently attached to hub 7 for driving the gear. Another sprocket 9 has been attached to be driven by the main shaft 10 and by means of a chain 11 the gear 6 is continuously rotated in timed relationship to the other driven elements of the knitting machine. A roller 12 has been mounted to revolve freely upon a bearing 13 attached to a small bracket 14 having slots 15 therein. This bracket 14 is attached to the main bracket 3 by means of bolts or screws passing through the slots 15 and thus the roller 12 may be adjusted laterally throughout a small extent for the purpose of tensioning chain 11 in the proper manner.

Two yarn furnishing wheels or rollers 16 have been permanently attached to spindles 17 each mounted to rotate within anti-friction bearings 18 and 19 which are in turn held within a bushing 20. A small pinion 21 has been fixed to the opposite end of each spindle 17 and serves to clamp bearings 18 and 19 onto the spindle as shown, see United States application Ser. No. 56,363. Each of these spindles, its bearings, roller, pinion and bushing, form an assembly which is quickly removed from or replaced in the bracket 3 by the removal or swinging to a vertical position of a retaining member 22, Fig. 4. This element 22 serves to retain two bushings 20 and their assemblies within the bracket. To remove one or both assemblies it is merely necessary to loosen screw 23 and swing element 22 out of engagement with the flanges 20' on the inner ends of each bushing. As gear 6 is rotated whenever the knitting machine is in operation the furnishing wheels or rollers 16 will also be continuously rotated as they are driven from gear 6 through the pinions 21. A yarn 24 is threaded through one of a series of yarn guides 25 in projecting bracket 26 attached to the upper end of the main support or bracket 3, then about one of the wheels 16 to the opposite wheel and then back to the first from which it is led down through another yarn guide 27 and to the usual feeding means adjacent the needles. A tension may be interposed between this latter guide 27 and the needles or it is quite possible to allow the yarn to feed directly from said wheels to the needles. In the latter case the yarn will be delivered under a comparative absence of any tension and may not be controlled quite as well as it would be if a slight amount of tension were applied. As will appear later, we have provided means for imposing tension upon the yarn at this position which tension is also capable of being varied to fashion the stocking or article produced, or for any other purposes for which a variation at which the yarn is delivered might be required.

The rollers 16 are preferably formed of some hard, wear-resisting fibrous material, but may be of metal or any desirable substance. To keep the yarn 24 from contacting itself as it passes about said rollers, a series of pins 28 are threaded within an extending element 29 and project upwardly of the rolls, while another series of pins 30 are secured within another angular bracket 31 below the rolls for keeping separate the stretches of yarns passing between said roll. One of the pins 30 is also threaded within element 29 for the purpose of steadying it and maintaining a greater rigidity of the parts. A felt 32 is retained by means of element 29 and this felt extends lengthwise of the rollers and between them to maintain their surfaces free from lint or dirt and also to wipe any oil from them. If there is any tendency of yarn 24 to cling to the rollers and to wrap about them, the felt will very effectively strip said yarn from the surface of the roll thus preventing any tangling of the yarn as it passes to and fro between the rollers.

Whenever the feeding of this yarn 24 is discontinued for any reason, we have provided means for automatically clamping the said yarn between the cone and the rollers or wheels so that it will not be accidentally drawn from the cone after a suitable amount of slack has been drawn to allow the smooth surfaced rolls 16 to revolve freely and without driving effect upon the yarn, feeding of which has been discontinued. A second projecting bracket 33 has been attached to the upper end of the support 3 and a pad 34 made of leather or other suitable material and attached to said bracket by means of rivets or any suitable connecting elements. A lever 35 has been pivoted at 36 and carries about its mid-portion a projection 37 to which an extending pin 38 has been attached. This pin 38 has been positioned opposite the leather pad 34 so that the yarn 24 may be guided downwardly between the two. Whenever lever 35 is in a raised position whereupon pin 38 is removed from said pad 34, no resistance will be offered to the yarn 24, but whenever lever 35 is drawn downwardly as it is when knitting of the yarn is to be discontinued, the pin 38 will clamp said yarn against the leather pad and offer considerable resistance to its being drawn by means of rollers 16. The timing of this clamping means is very accurately controlled from the main cam shaft and clamping would preferably occur a brief instant after yarn had ceased to be required at the needles so that enough slack would have been drawn by the rolls to allow them to rotate freely within the yarn which remains loosely wrapped about them while knitting thereof is discontinued.

As shown in Figs. 1, 2, 8 and 9, a bracket 39 has been attached to the support 3 and carries

a spindle 40 at its outer end upon which a pair of tension discs 41 and 42 are free to slide. One collar 43 is adjusted in such a position that the tension disc 41 will be maintained in vertical alignment with the guide 27. Another collar 44 is fixed to the outer end of spindle 40 and prevents other parts from passing beyond the end of that spindle. A collar 45 is slidably mounted on spindle 40 and when in the position shown in Fig. 8, will maintain the tension discs in contact by means of a spring 46. A shaft 47, Figs. 1 and 2, is rotatable in a bearing in support 3 and is held in axial position by means of collars on either side of the bearing. An arm 48 is fixed to the inner end of shaft 47 and carries a forked extension 49 which engages the grooved collar 45. This forked arm is used to relieve the tension on spring 46 when the feeding yarn is not to be taken by the needles, and also to vary the tension on the spring when it is desired to fashion by means of these instrumentalities.

A lever 50 is attached at the outer end of shaft 47 and is adjustable thereon by means of a set screw. A spring 51 is attached at one end to the bracket or support 3 and at the other end, to an extending screw 52 whereby the tension of the spring is exerted in such a manner that arm 48 will be moved toward the left, Fig. 8, to relieve compression on spring 46 unless other cam controlling means on the main cam shaft of the machine is functioning to tension this spring 46 and thus exert a restraining influence on the thread or yarn passing between the discs.

Referring to Figs. 5, 6 and 7 the main cam shaft 53 has a cam drum 54 fixed to the outer end thereof which cam drum carries cams in two different planes. Cams 55 and 56 at the outer end of said drum function upon the toe 57 of a lever 58 pivoted at 59 upon an element 60 securely bolted to frame 1. This lever 58 has a pivotal connection 61 at its opposite end to which the vertical rod 62 is adjustably connected. Rod 62 attaches at its other end to lever 50 and whenever the toe or follower 57 is engaged by either of cams 55 or 56, this lever 58, rod 62, levers 50 and 48 will be moved to compress spring 46 thereby pressing the discs together so that the yarn 24 will be drawn by the needles with a certain predetermined amount of resistance being offered thereto between the feeding rollers and the needles. The particular cam set-up which we have shown on cam drum 54 is adapted for making a so-called surgical stocking, but it would be within the skill of the knitting mechanic to replace these cams by others which would control the tensioning and clamping means for knitting any type of stocking. The surgical stocking herein contemplated is to have a foot and leg portion knitted of elastic yarn but the heel is to be knitted from the ordinary textile materials. A cam 55 is of a height and length sufficient to properly tension the elastic yarn throughout the foot, while cam 56 will control the tension on the elastic yarn throughout the ankle and calf portions of the leg. It will be noticed that cam 56 gradually falls off in height so that as the stocking is being knitted from toe to top, greater tension will be imposed upon said elastic yarn throughout the ankle thereby fashioning the same.

A second lever 63 is pivoted at 64 to a depending bracket 65. This lever has its cam engaging end 66 in contact with a cam 67 on cam drum 54 during the knitting of the heel of a stocking. If the stocking were to have a toe it would be necessary to provide another cam to function during the knitting of that toe. At its outer end, lever 63 carries a connection 68 through a hole in which rod 69 is free to slide. This rod 69 has one collar 70 adjustably fixed above the connection 68 and another collar 71 below the element and maintaining a spring 72 under compression between itself and element 68. Another spring 73 is fixed to the frame of the machine at one end and at its other end to the collar 70. By means of spring 73 the rod 69 which attaches at its upper end to lever 35 will always maintain that lever in uppermost position so that the pin 38 will not clamp yarn 24 against the leather pad 34. However, since spring 72 has greater strength than spring 73, the lever 63 will pull rod 69 downwardly whenever it rides up on cam 67. Spring 72 provides a certain amount of resilience so that pin 38 is not pressed against the pad 34 with too great force, and it is not necessary to adjust these parts to as close limits since the movement of lever 63 always moves pin 38 into contact with pad 34 and then compresses spring 72 as the element 68 slides upon rod 69.

In actual practice the stocking is knitted from toe to top but since the toe is not actually formed on such a stocking, knitting commences in a circular manner in the foot which is to be knitted of elastic yarn. During this part of the operation the elastic yarn will be fed by means of the furnishing device, the clamp will be open and a maximum amount of tension imparted to the elastic yarn by means of discs 41 and 42. If necessary or desirable, an inturned or outturned welt portion may be formed at the beginning of the foot portion so that it will not be necessary to resort to other means for preventing the ravelling of the end of the foot. When the heel is reached the knitting of the elastic yarn is to be discontinued and ordinary textile yarn or yarns fed to the reciprocating segment of needles as this heel is produced by narrowing and widening in the usual manner. At this time clamping members 34 and 38 will engage the elastic yarn at the proper time and also discs 41 and 42 will be entirely ineffective for tensioning the yarn. After the heel is completed knitting will continue on through to the top of the leg portion, and by means of cam 56, that leg portion will be fashioned or shaped as desired. If greater tension is placed upon the elastic yarn it will be extenuated as it is knitted and the fabric formed therefrom will be of tighter and smaller stitches after the tension has been relaxed thereon. The reverse applies as the tension on said yarn is relieved as it will be at the lower end of cam 56.

For the protection of the machine operator and to prevent oil or grease from being thrown onto the knitting fabric or about the room, casings 74 and 75 are placed over the gears and the sprocket and chain respectively. Another small guard 76 is attached below tension disc 12 and in front of the chain running under that disc. It is obvious that these casings may be extended to enclose the entire driving mechanism.

Referring to Figs. 10 and 11, we have shown a modified form of the invention whereby the yarn wrapped about the feeding or furnishing wheels is to be loosened up so that it will not be effectively fed at times when it is not to be taken by the needles. In these figures a modified form of feeding wheel or roller has been generally illustrated at 77, but is rotatable upon the same

spindles and in the same manner as the wheels 16. A yarn is to be threaded through a guide 78 and around one wheel, over to the other wheel and back to the first from whence it is threaded through guide 27 to the needles. A tension device may or may not be used, and this tension means may take the form of that illustrated in Figs. 8 and 9 or may be of any other standard type. A series of yarn guiding and controlling wires 79, 80 and 81 are each attached at their upper ends to blocks 82 by means of set screws 83. These blocks 82 are freely rotatable on a projecting bearing 84 which is in turn fixed in an angular bracket 85 secured to the upper end of support 3. These wires 78–81 each have a porcelain eye in the outer end through which the yarn is threaded as illustrated in Fig. 11, and these wires are allowed to move downwardly towards the surfaces of the yarn furnishing wheels when those wheels are to actively feed that yarn. A rod 86 is to be controlled from cam means, not shown, but which may be of a design necessary and may be attached to drum 54 on the main cam shaft. This rod 86 is guided at its upper end and is slidable within a head 87 of a squared bolt 88 projecting through the support 3 which has been slotted at 89 to provide a working fit for the squared portion 88. A V-shaped member having arms 90 and 91 has a square hole therein so that it will fit over bolt 88. A washer 92 maintains the elements 90 and 91 properly spaced from support 3 and another washer 93 and nut 94 maintains these elements in slot 89 but provide for their sliding vertically therein. In the position shown in Figs. 10 and 11, element 88 is lying in the bottom of the slot 89. A collar 95 is adjustably attached to the upper end of rod 86 and another collar 96 has been fixed below the squared portion 87 and maintains a spring 97 under slight compression between the head 87 and collar 96. Each arm 90 and 91 of the V-shaped member carries an outwardly projecting pin 98 and 99, pin 98 bearing under wires 79 and 81 while pin 99 supports wire 80.

In the position shown the adjustment of parts is such that pins 98 and 99 will hold the wires 79–81 in a position so that they will just clear the rotating wheels 77; in this position the yarn will be fed by the wheels in the normal way. Whenever it is desired to stop feeding the yarn, suitable cams will function upon rod 86, either directly or indirectly, and spring 97 will be compressed. When the spring has been thus charged it will slowly move the wires 79–81 outwardly to the dotted line position shown in Fig. 10 whereupon the yarn will be drawn outwardly to give the wheels a certain amount of slack and also to remove the yarn from the periphery of the wheels throughout practically the entire extent which it was wrapped about them. In this position there will be very little tendency for the rotating wheels to feed the yarns.

Referring to Figs. 12, 12a and 13, we have shown a modification of the invention shown in Figs. 10 and 11 which is entirely automatic in its operation. In this construction wires 100, 101 and 102 are adjustably secured in blocks 103 by means of set screw 104. This block 103 and the manner in which the wire is fixed therein is shown in detail in Fig. 12a. The yarn is threaded through the wires and about feeding rollers generally designated at 77 in the same manner as had been indicated in Figs. 10 and 11. Each of the blocks 103 has a projection 105 which acts as a stop for terminating the movement of the end of a wire down toward the surface of a feeding wheel. This stop 105 strikes against an adjustable stop screw 106 and by means of this screw, the extent of movement of the outer end of a wire toward the wheel 77 may be adjusted. The opposite side of each block 103 has a projection 107 within which a pin 108 is driven, and to this pin 108 we have attached a spring 109 which is also fixed at its other end to a projecting element 110 threaded within the bracket 111. Another adjustable stop screw 112 is used opposite the screw 106 for each block and has for its purpose limiting the movement of each wire upwardly as shown in the dotted line position whenever extension 107 strikes against one of the screws 112. The tension in each spring 109 has been carefully regulated so that when yarn is drawn by the needles the wires 100—102 will be pulled downwardly before any yarn is drawn from the supply, whereupon the said yarn will be effectively snubbed about wheels 77 and will be fed by them. When drawn down to this position the wires will be held in the full line position of Fig. 12 until such time as it is desired to discontinue feeding said yarn by the wheels. The tension in springs 109 will take advantage of the slack which instantaneously occurs on either side of the wheels so that the yarn will be quickly drawn away from the feeding wheels to the dotted line position whereupon there will be very little tendency for it to be advanced. Either of the modifications of the invention shown in Fig. 10–13 may be used with or without a tensioning means between the feeding wheels and the needles.

Referring to Figs. 14 and 15, we have shown a modified form of the invention wherein the rotation of the feeding means is discontinued during reciprocatory knitting or at such times as it is not desired to feed the yarn by means of said feeding rollers. The chain drive for rotating gear 6 is practically the same as that employed with the device as previously described. Chain 11 drives a sprocket 113 which is freely rotatable upon a bushing 114 which is in turn free to rotate on stud 115 secured at the support 3. The gear 6 has a hub 7' which is fixed by means of a key 116 to the bushing 114. At the outer end of said bushing a collar 117 is prevented from rotating relatively to the bushing by means of another key 118 but is free to slide axially along the key and bushing. This collar has a series of projecting teeth 119 herein shown as four in number, which engage corresponding indentations in the adjacent hub of sprocket 113. When in engaging relationship with the sprocket, rotation of the sprocket will be conveyed by means of collar 117, key 118, bushing 114, key 116 and gear 6 through pinion 21 to the feeding wheels generally indicated at 77. When the collar or clutch 117 is moved to outer position whereupon there is no driving connection between it and the sprocket, the sprocket will merely be rotated idly upon bushing 114 and the feeding wheels will not be rotated for purposes of feeding.

The collar 117 has a groove cut therein within which engage elements 120 and 121 fixed in the forked end of lever 122. This lever is pivoted at 123 to a bracket 124 and extends downwardly and outwardly at its lower end to be pivotally connected at 125 to a link 126. This link 126 is connected to lever 127 at 128 and whenever lever 127, which controls the clutch 129 for shifting the machine from rotary to reciprocatory motion and vice versa is moved, the collar 117 will also be engaged or disengaged from the sprocket. In

this manner the yarn furnishing means will be rotated throughout rotary movement of the machine, but will be maintained in an idle state whenever the machine is functioning in a reciprocatory manner. The controlling of collar 117 might be obtained from any suitable source on the machine such as from any of the cams, in which case the feeding wheels might be rotated or stopped at any desired times. For the production of surgical stockings wherein rubber is to be fed throughout all of the rotary knitting and not fed when reciprocating, the control herein shown will function in proper timed relationship. In the event that it is desired to stop the rotation of the feeding wheels at a precise instant a brake might be applied to the gear 6 or the wheels themselves to prevent any over-running.

In the first part of the case the feeding wheels 16 have been shown with plain, smooth cylindrical surfaces. In Figs. 16 and 17, we have shown a modification wherein the cylindrical wheels have been grooved to provide flutes 130, and hardened steel wires 131 have been inserted in the outer surfaces of these flutes. The wires 131 have angular projections 132 which are driven into drilled holes 133 in the ends of the rollers. It is the purpose of these hardened wires to present a wear resistant surface to the action of feeding yarn which tends to cut grooves in the surfaces of plain rollers such as 16 or the fluted rollers such as shown in Figs. 16 and 17 if they do not have these hardened elements. The wires 131 may be replaced with a small expenditure of time and at low cost. These wires may be formed of any wear resistant metals or alloys and may be chromium plated or given any other treatment to increase their resistance to the cutting action of the thread.

In Figs. 18 and 19 we have illustrated another form of feeding roller which works in much the same manner as that illustrated in Figs. 16 and 17, but is lighter and allows replacement of the wires more readily. A disc 134 is mounted on spindle 135 and bears against a washer 136 which is in turn held against a shoulder 137. This disc has an inwardly directed flange 138 and equally spaced holes 139 for the reception of the inner ends of wires 140. On a reduced end 141 of shaft or spindle 135 we have placed a disc 142 provided with spaced grooves in the periphery thereof which maintain the wires 140 in proper position. A third disc 143 completes the assembly and is held in position by means of a screw 144 threaded into the end of spindle 135. This disc 143 has a flange 145 which is clamped over the outer ends of wires 140 and maintains them in position. When the screw 144 is tightened the entire assembly becomes a unit for all practical purposes. The inner surface of flange 145 is slightly conical for purposes of more effectively clamping the wires in place.

The invention has been described in more or less specific terms, but these are not to be taken in a limiting sense and the invention is to be restricted only as defined in the appended claims.

We claim:

1. In a knitting machine the combination of knitting instrumentalities for knitting fabric, a supply of knitting yarn and a series of cams for actuating said instrumentalities, said cams and instrumentalities being rotatable relative to each other at times and at other times, reciprocated relatively to one another, positively driven yarn furnishing means interposed between said supply of knitting yarn and instrumentalities, said furnishing means being driven at a uniform rate throughout both rotary and reciprocatory knitting and means for clamping said yarn between the source of yarn supply and the furnishing means whereby said means will be ineffective to advance yarn to the instrumentalities.

2. A knitting machine having in combination knitting instrumentalities for forming fabric and cams for actuating said instrumentalities, said cams being rotated relatively to the instrumentalities at times and reciprocated relatively thereto at other times, yarn furnishing means positively driven and interposed between a supply of knitting yarn and instrumentalities, said furnishing means comprising at least one driven roller about which said yarn is snubbed or wrapped, said roller being rotated at a speed at least as great as the greatest speed at which it is desired to advance the yarn, clamping means interposed between said roller and the supply of yarn and means functioning in timed relationship with the other elements of said knitting machine for actuating said clamping means whenever it is desired to discontinue feeding of the yarn.

3. In a knitting machine the combination of knitting instrumentalities for knitting fabric and cams for actuating said instrumentalities, said instrumentalities being rotated relatively to said cams at times and reciprocated relatively thereto at other times, positively driven yarn furnishing means about which a yarn is wrapped to be fed to the knitting instrumentalities, yarn clamping means interposed between a supply of yarn and the furnishing means and yarn tension means interposed between said furnishing means and the knitting instrumentalities.

4. In a knitting machine the combination of knitting instrumentalities for knitting fabric and cams for actuating said instrumentalities, the instrumentalities being rotated relatively to said cams at times and reciprocated relatively thereto at other times, positively driven yarn furnishing wheels about which a yarn is wrapped to be fed to the knitting instrumentalities, yarn clamping means interposed between a supply of yarn and the furnishing means and the knitting instrumentalities, yarn tension means interposed between said furnishing means and the knitting instrumentalities, said clamping means being positively controlled in timed relation to the other elements of the knitting machine and said tension means being released while said clamping means is in engagement with said yarn.

5. In a knitting machine provided for knitting fabric by means of continuous rotation at certain times and by reciprocation of knitting instrumentalities at other times, the combination of positively and continuously rotating yarn furnishing means about which a knitting yarn is to be wrapped for feeding the same to the knitting instrumentalities, yarn clamping means in engagement with said yarn before it passes about said furnishing means and yarn tensioning means engaging said yarn between the furnishing means and knitting instrumentalities, pattern controlled means for actuating said clamping means to clamp the yarn during reciprocatory knitting and other means co-acting therewith for releasing said tensioning means while said clamping means is in engagement with said yarn.

6. In a knitting machine the combination of knitting instrumentalities for knitting fabric, said instrumentalities being rotatable at times and reciprocated to and fro at other times, yarn

furnishing means interposed between a supply of knitting yarn and said instrumentalities comprising a pair of positively rotated yarn furnishing wheels, said wheels being rotated at a speed in excess of that required for feeding the yarn at the greatest rate demanded and other means for guiding said yarn to one of the wheels, from that wheel to the next and back to the first from whence said yarn will be guided to the knitting instrumentalities, yarn clamping means interposed between said supply and furnishing means, said clamping device comprising a fixed element on the pathway of said yarn, a movable element opposite said fixed element and in position for pressing said yarn against the fixed element, means for moving said movable element against said fixed element in timed relationship to the movement of other parts of the machine.

7. In a knitting machine the combination of knitting instrumentalities for forming fabric, said instrumentalities being continuously rotated at times and reciprocated at other times, yarn furnishing means interposed between a supply of knitting yarn and said instrumentalities, said furnishing means including a support, a pair of rotatable yarn furnishing wheels about which said yarn is to be snubbed, said wheels rotating in pairs within the support and positive drive means connected to driven elements of said knitting machine and wheels for rotating them continuously, yarn clamping means interposed between said supply and furnishing means, said clamping means being actuated to clamp the yarn at predetermined intervals, a yarn tension device interposed between said furnishing means and the instrumentalities for tensioning the feeding yarn, this tensioning means being controllable as to the amount of drag which it imposes upon the feeding yarn and means for controlling this tension means to vary its effect on the yarn at certain predetermined times.

8. In a knitting machine of the type described, a yarn furnishing device including at least one yarn engaging roller, said roller comprising a central spindle, a pair of discs spaced on said spindle, a plurality of hardened, wear-resistant wires clamped between said discs for engagement with yarn to be advanced, and means for holding said wires in such a position that, as the roller unit is rotated, said wires generate a cylinder about said spindle.

9. In a knitting machine of the type described, a yarn furnishing device including at least one yarn engaging roller, said roller comprising a central spindle, a disc on said spindle having a plurality of indentations arranged therein equally distant from the central spindle, a disc having grooves in its outer surface aligning with said indentations, another disc at the opposite end of the spindle from said first mentioned disc having an inwardly directed flange thereon and a plurality of hardened, wear-resistant elements held in place within said indentations, grooves and flange.

10. A yarn furnishing device for knitting machines including a pair of positively rotated, smooth surfaced feeding wheels about which the feeding yarn is to be wrapped for feeding to the knitting instrumentalities of a knitting machine, a series of yarn guiding elements for leading the yarn to the wheels and away from the same, and a strip of absorbent material arranged longitudinally of the wheels and between them to wipe foreign matter from the surfaces thereof.

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