Sept. 3, 1929. J. JONES ET AL 1,726,568

KNITTING MACHINE

Filed July 22. 1927 3 Sheets-Sheet 1

FIG. 1.

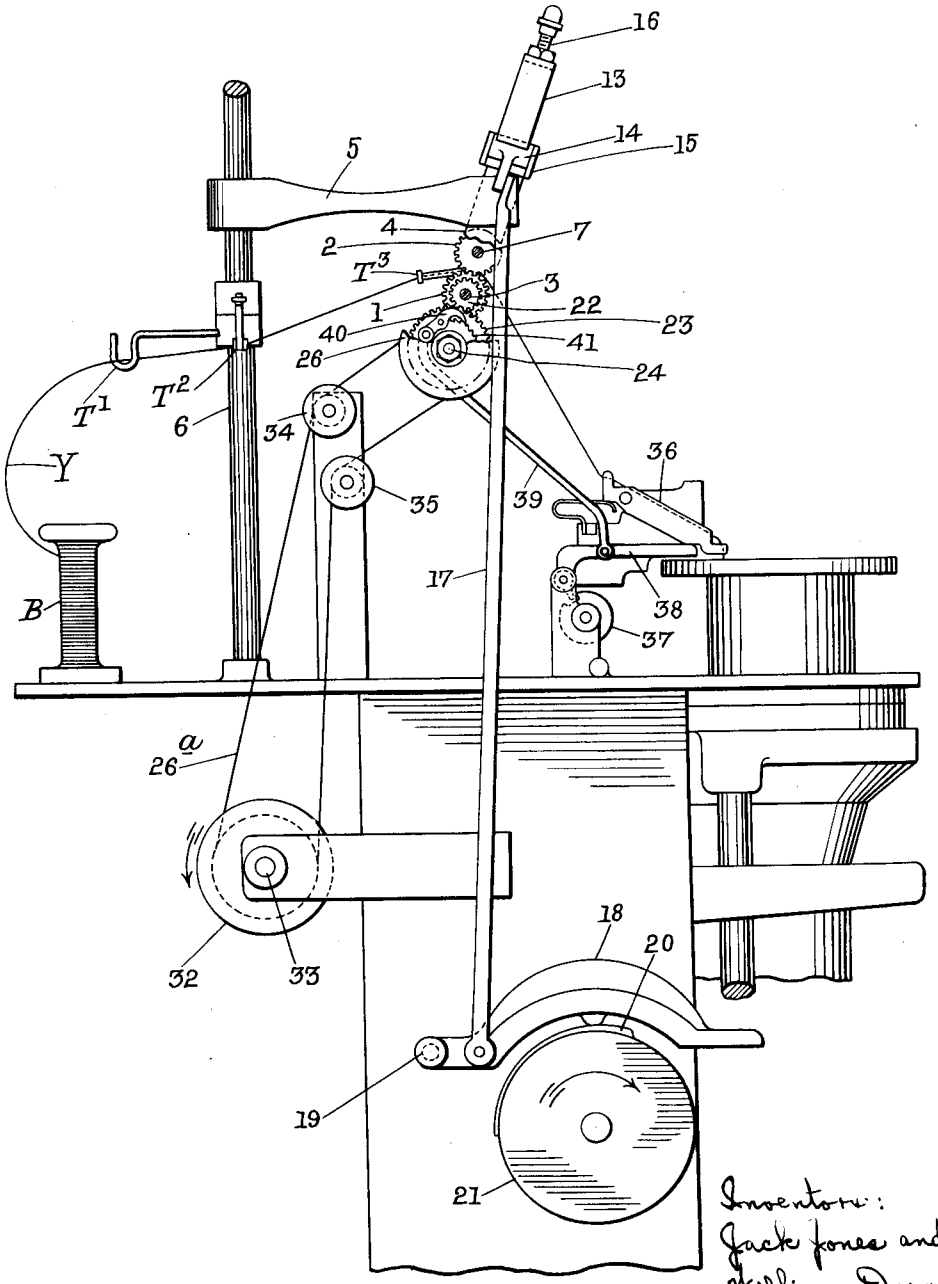

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FIG. 2.

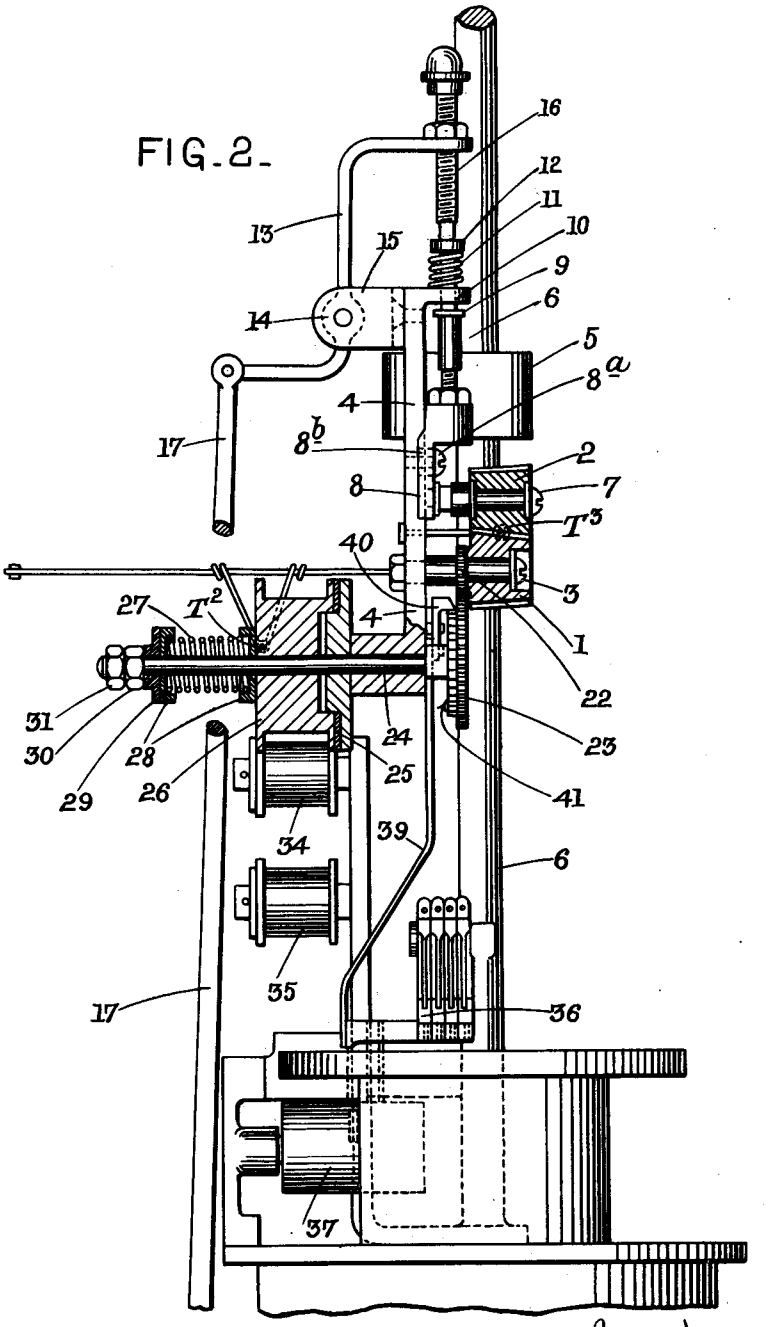

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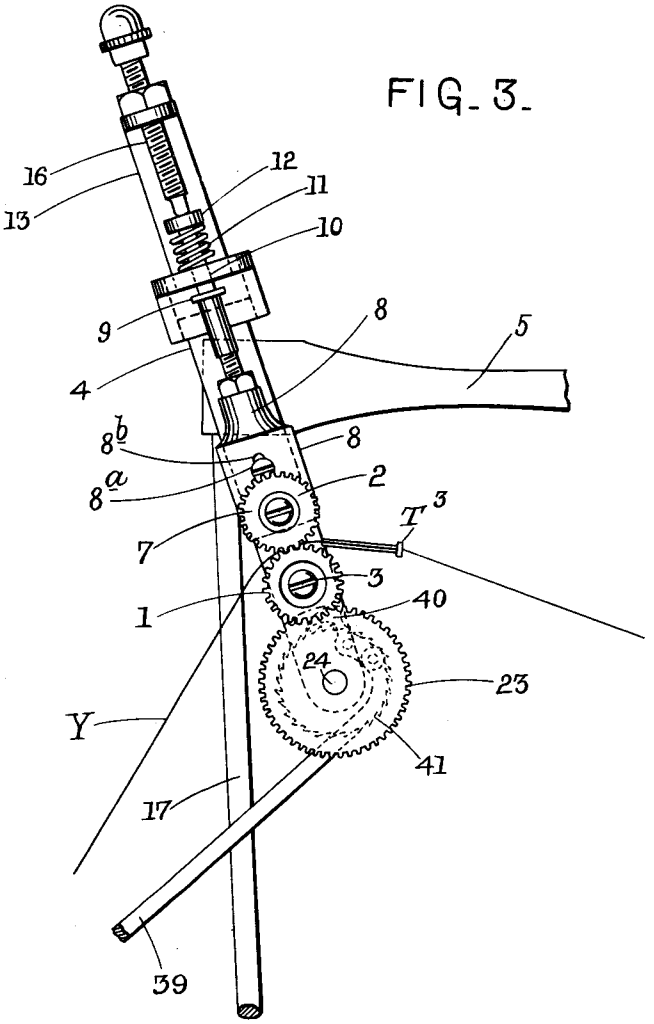
FIG. 3.



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Patented Sept. 3, 1929. 1,726,568

UNITED STATES PATENT OFFICE.

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KNITTING MACHINE.

Application filed July 22, 1927, Serial No. 207,769, and in Great Britain May 27, 1927.

This invention relates to circular knitting machines for knitting hosiery or other fashioned articles and more particularly to improved means for feeding the yarn to the needles of such machines.

In many circular knitting machines it is customary to feed the yarn positively to the needles, that is to say in such a way that the drawing off of the yarn from the bobbin or other package is not dependent upon the drag of the machine, but is effected positively by an intermediate device such as a pair of intermeshing gear wheels, the object being to obtain a steady feed of yarn irrespective of the tightness of the winding of the bobbins or other packages, without which stripes tend to appear round the fabric due to the differing tension of the yarn and without which moreover the length of the article being knitted will vary according to the tightness of the winding of the bobbin or other package. In such positive feeds the rate of the yarn has hitherto been controlled either automatically by the yarn itself, or else it is fixed, such as by means of a hand-screw, and remains constant throughout the knitting of the fabric or article.

The object of the present invention is the provision of means for feeding the yarn positively to the needles of a circular knitting machine provided with "fashioning" mechanism always at the rate required during the "fashioning" of the fabric or article being knitted. By "fashioning" is meant in the present specification the gradual or progressive alteration (reduction or increase) of the size of the knitted loops, for instance in the case of stockings the gradual or progressive reduction of the size of the knitted loops for the required portion, say from the middle of the panel or calf section to the ankle.

The invention comprises a positive yarn feed device, the rate of delivery of which is automatically controlled by a cam rotated in phase with the cam which is known in the art as the "quality" cam, that is, the cam which controls the height of the cylinder relatively to the height of the needles and hence controls the length of the loop or stitch. The "quality" cam is hereinafter referred to as the "stitch length regulating means." Preferably the cam for controlling the rate of yarn delivery of the positive feed device is mounted on or fitted to the shaft of the stitch length regulating means.

Conveniently the positive feed device may consist of or comprise a pair of intermeshing gear wheels which feed the yarn between them by their rotation, and the invention will hereinafter be described with reference to this particular form of feed device, but it will be understood that the principle of the invention may be readily adapted to other forms of positive feed device and that such other equivalent devices in conjunction with means for controlling the rate of delivery by means of a cam rotated in phase with the stitch length regulating means are included within the invention.

When employing a pair of intermeshing gear wheels as the feed device, the control of the rate of delivery may be obtained by having the axis of one of the gear wheels (for instance the driver wheel) fixed, while the axial position or distance of the other gear wheel (for instance the follower wheel) relatively to the former is automatically adjusted by means of a rod or other mechanism operated by a cam rotated in phase with the stitch length regulating means. In this way the degree of intermeshing of the gear wheels and thereby the rate of delivery of the yarn is controlled.

The gear wheels may be of any desired shape, such for instance as cylindrical or conical etc.

Conveniently the driver wheel, (preferably the gear wheel with the fixed axis) may be driven by means of a gear mechanism connected to a pulley driven by a belt from another pulley on the back shaft of the machine.

Further, when, as is usually the case in knitting hosiery, a number of yarn feeds are employed, one or more of these feeds may be fitted or provided with yarn feed control mechanism of the present invention, and in this case a suitable clutch device may be inserted between the positive yarn feed device of the given yarn feed and its driving pulley

or other driving device, so that when the particular feed is thrown out of action, the positive yarn feed device may be stopped by a suitable stop motion and the pulley and belt or other driving mechanism of the given positive yarn feed device allowed to run freely.

With regard to the cam controlling the rate of delivery of the feed device, this may be placed on the shaft stitch length regulating means or may be driven in phase with the stitch length regulating means by gear mechanism from the shaft of the stitch length regulating means or other suitable shaft of the machine, but preferably a cam surface for the purpose is formed or provided on the stitch length regulating means itself.

The accompanying drawings show by way of example one convenient form of yarn feed control mechanism constructed in accordance with the invention, it being understood that this is given only by way of illustration and can be varied widely without departing from the spirit of the invention.

Figure 1 is a side elevation of so much of the machine as is necessary to illustrate the invention, the driving pulley 26 and friction clutch 25 and the fixed bearing bracket 4 hereinafter referred to being partly broken away.

Figure 2 is a sectional front elevation (on a larger scale than Figure 1) of part of the mechanism shown in Figure 1 looking from the right of Figure 1, the clutch 25, driving pulley 26 and its spring tensioning device, and also the yarn feed gear wheels 1 and 2 being shown in section for clearness.

Figure 3 is a fragmentary side elevation of parts of the mechanism, looking from the right of Figure 2, i. e. on to the opposite side of the machine to that seen in Figure 1.

Referring to the drawings, the feed device comprises a pair of intermeshing conical gear wheels 1 and 2, placed with their apexes oppositely directed, the driver wheel 1 rotating about a shaft or stud 3 carried by a fixed bearing bracket 4, which in turn is carried by a projecting bracket 5 supported by a standard 6. The follower wheel 2 is mounted on a shaft or stud 7 fixed in a sliding member 8.

The sliding member 8, which is arranged to slide longitudinally on the bracket 4, is fixed to a rod 9 working in the bearing 10 in the bracket 4 and is supported by the upward pressure of a return spring 11 which is fitted between bearing bracket 4 and the abutment head 12 fixed to the end of the rod 9. The sliding member 8 is held to the bracket 4 by a screw 8^a passing through a slot 8^b in the member 8. The movement of the rod 9 (and thus of the sliding member 8) is governed by the bell crank lever 13 which is pivoted about a pin 14 supported by a lug 15 projecting from the bracket 4.

One end of the bell crank lever 13 is provided with a screw 16 the end of which bears against the abutment head 12 on the rod 9, the abutment head 12 being kept in contact with the end of the screw 16 by means of the return spring 11.

The other end of the bell crank lever 13 is pivoted to a connecting rod 17 connecting it with a cam lever 18 which is pivoted to the frame of the machine at 19 and bears upon a cam surface 20 constituting the cam for controlling the rate of delivery of the yarn feed gear wheels 1, 2 this cam being here shown as formed or provided on the rim of the "quality" cam wheel 21, the surface (not shown) of the actual stitch length regulating means being formed on the face of the cam wheel 21 in accordance with the usual practice.

The screw 16 working in the end of the bell crank lever 13 provides a means for initial adjustment of the slide 8.

Secured on the axle of the fixed-position gear wheel 1 is a toothed wheel 22 meshing with a toothed wheel 23 mounted on a spindle 24, which also carries a friction clutch 25 and a loose pulley 26 adapted to engage the friction clutch but to revolve freely when the rotation of the spindle 24 is arrested as will be hereinafter explained. For sake of clearness the clutch 25 and the pulley 26 are partly broken away in Figure 1 and are shown in section in Figure 2. The pulley 26 is held into engagement with the cutch 25 by means of a spring tensioning device (shown in section on Figure 2) mounted on the spindle 24 and consisting of a helical spring 27, seating rings 28, adjusting washer 29, adjusting nut 30 and lock nut 31. The pulley 26 is driven by a belt 26^a from a pulley 32 on the back shaft 33 of the machine, the belt passing over intermediate pulleys 34, 35.

The feed mechanism may be fitted with any suitable device for stopping the feed when the yarn being fed is no longer required and the feeder arm is thrown out of action. For instance a stop motion may be provided working in conjunction with the mechanism employed for throwing the feeder arm out of action. In the form illustrated, in which the feeder arm 36 is thrown into and out of action in the manner usually employed in hosiery machines i. e. by its own cam on the usual cam drum 37 through the medium of a pivoted lever 38, we have arranged a stop motion to be operated by the lever 38, this stop motion comprising a link 39 pivoted to the lever 38 and operating a pawl 40 into and out of engagement with the ratchet wheel 41 secured on the spindle 24. The pawl 40 is pivoted on the bearing bracket 4. Thus when the feeder arm 36 is thrown out of action by the cam mechanism raising the lever 38, the pawl 40 actuated by the link 39 engages with the ratchet wheel 41 and stops the rotation of the spindle 24 and thereby that of the feed gear

wheels 1 and 2, the pulley 26 then revolving freely.

When, for example the device illustrated in the drawings is applied to a circular knitting machine making women's hose, a number of bobbins will be employed supplying the yarns for the different feeders, for welt, leg or panel, heel, foot and toe, (four feeder arms serving for these respectively as usual are indicated in Figure 2) and the positive yarn feed controlling device may be applied to the leg or panel yarn feed mechanism to vary the rate at which the leg or panel yarn is fed to the needles (it being of course understood that similar controlling mechanism may be applied also to any or all of the other yarn feed mechanisms).

Thus when knitting a stocking beginning at the top with a slack stitch for the knee, the cam 20 acting through the pivoted cam lever 18, connecting rod 17, bell crank lever 13, screw 16, rod 9 and slide 8 first moves the follower gear wheel 2 fully into mesh with the driver gear wheel 1 and the yarn is fed at the maximum rate. As the stocking progresses and the stitches are made correspondingly tighter towards the ankle, the cam 20 allows cam lever 18 to fall progressively, thus allowing the return spring 11 to raise the slide 8 and move the gear wheels apart to feed the smaller quantity of yarn required. The range over which the rate of delivery of the yarn is to be varied, may be adjusted by means of the adjustment screw 16. In the drawings the leg or panel yarn marked Y is shown passing from the bobbin B over the thread guide T′, through thread guide eyes T^2, T^3, between the feed gear wheels 1 and 2 and thence to the feeder arm 36.

It is to be understood that we do not limit ourselves to the particular means above described for controlling the rate of feed of the pair of intermeshing gear wheels, as any other means controlled by a cam rotated in phase with the stitch length regulating means may be employed. For instance the axes of both the intermeshing gear wheels may be moved towards and away from each other under the control of a cam rotated in phase with the stitch length regulating means. Or for instance the intermeshing gear wheels may be rotated about fixed axes and be driven by a variable speed friction drive controlled by a cam rotated in phase with the stitch length regulating means.

As explained above, the invention is not limited to the use of the intermeshing gear wheel type of positive feed, as any known equivalent devices may be employed, provided that the rate of feed thereof is controlled by a cam rotated in phase with the stitch length regulating means of the circular knitting machine. For instance we may employ a pair of driven presser rollers with the yarn passing and being gripped between them, driven by a variable speed friction drive controlled by a cam rotated in phase with the stitch length regulating means.

What we claim and desire to secure by Letters Patent is:—

1. A circular knitting machine comprising in combination a positive yarn feed device, cam means for controlling the rate of delivery of said device, stitch length regulating means, said cam means being rotated in phase with the stitch length regulating means.

2. A circular knitting machine comprising in combination a positive yarn feed device, a stitch length regulating cam, and means for controlling the rate of delivery of said feed device, said means comprising a cam rotated in phase with the stitch length regulating cam.

3. A circular knitting machine comprising in combination a positive yarn feed device, a stitch length regulating cam, a shaft carrying said cam, and means for controlling the rate of delivery of said feed device, said means comprising a cam on the shaft of the stitch length regulating cam.

4. A circular knitting machine comprising in combination a positive yarn feed device, a stitch length regulating cam, means for controlling the rate of delivery of said feed device, said means comprising a cam surface provided on the stitch length regulating cam.

5. A circular knitting machine comprising in combination a pair of intermeshing gear wheels which positively feed yarn between them by their rotation, stitch length regulating means, cam means for controlling the feed of the gear wheels, said cam means being rotated in phase with the stitch length regulating means.

6. A circular knitting machine comprising in combination a gear wheel, a fixed axis for the gear wheel, a second gear wheel intermeshing with the first gear wheel to form a positive yarn feed device, an adjustable axis for the second gear wheel, stitch length regulating means, and cam means for controlling the position of the adjustable axis with respect to the fixed axis, said cam means being rotated in phase with the stitch length regulating means.

7. A circular knitting machine comprising in combination a pair of gear wheels intermeshing to form a positive yarn feed device, a fixed axis for one gear wheel, an adjustable axis for the other gear wheel, stitch length regulating means, cam means for controlling the position of the adjustable axis with respect to the adjustable axis, said cam means being rotated in phase with the stitch length regulating means, and means for providing a preliminary adjustment of the intermeshing gear wheels.

8. A circular knitting machine comprising in combination a positive yarn feed device, a feeder arm adapted to be moved into and

out of operative position, a stop motion for the feed device, means for automatically operating the stop motion by the movement of the feeder arm, stitch length regulating means, and cam means for controlling the rate of delivery of the feed device, said cam means being rotated in phase with the stitch length regulating means.

9. A circular knitting machine comprising in combination a positive yarn feed device, a clutch for driving said device, a feeder arm adapted to be moved into and out of operative position, a stop motion for the feed device, means for automatically operating the stop motion by the movement of the feeder arm, stitch length regulating means, and cam means for controlling the rate of delivery of the feed device, said cam means being rotated in phase with the stitch length regulating means.

10. A circular knitting machine comprising in combination a pair of intermeshing gear wheels which positively feed the yarn between them by their rotation, means for driving one of said gear wheels, a feeder arm adapted to be moved into and out of operative position, a stop motion for the feed device, means for automatically operating the stop motion by the movement of the feeder arm, stitch length regulating means, and cam means for controlling the rate of feed of the gear wheels, said cam means being rotated in phase with the stitch length regulating means.

11. A circular knitting machine comprising in combination a pair of gear wheels intermeshing to form a positive yarn feed device, a fixed axis for one gear wheel, an adjustable axis for the other gear wheel, means for driving one of the gear wheels, a feeder arm adapted to be moved into and out of operative position, a stop motion for the gear wheel driving means, means for automatically operating the stop motion by the movement of the feeder arm, stitch length regulating means, and cam means for controlling the position of the adjustable axis with respect to the fixed axis, said cam means rotating in phase with the stitch length regulating means.

12. A circular knitting machine comprising in combination a pair of gear wheels intermeshing to form a positive yarn feed device, a fixed axis for one gear wheel, an adjustable axis for the other gear wheel, a clutch for driving one of the gear wheels, a feeder arm adapted to be moved into and out of operative position, a stop motion for preventing rotation of the gear wheels, means for automatically operating the stop motion by the movement of the feeder arm, stitch length regulating means and cam means for controlling the position of the adjustable axis with respect to the fixed axis, said cam means rotating in phase with the stitch length regulating means.

13. A circular knitting machine comprising in combination a pair of gear wheels intermeshing to form a positive yarn feed device, a fixed axis for one gear wheel, an adjustable axis for the other gear wheel, means for providing a preliminary adjustment of the intermeshing gear wheels, a clutch for driving one of said gear wheels, a feeder arm adapted to be moved into and out of operative position, a stop motion for preventing rotation of the gear wheels, means for automatically operating the stop motion by the movement of the feeder arm, stitch length regulating means, and cam means for controlling the position of the adjustable axis with respect to the fixed axis, said cam means being rotated in phase with the stitch length regulating means.

14. A circular knitting machine comprising in combination a pair of gear wheels intermeshing to form a positive yarn feed device, a fixed axis for one gear wheel, an adjustable axis for the other gear wheel, means for providing a preliminary adjustment of the intermeshing gear wheels, a clutch for driving one of said gear wheels, a feeder arm adapted to be moved into and out of operative position, a stop motion for preventing rotation of the gear wheels, means for automatically operating the stop motion by the movement of the feeder arm, a stitch length regulating cam, a shaft carrying said cam, and means for controlling the position of the adjustable axis of one gear wheel with respect to the fixed axis of the other gear wheel, said means comprising a cam on the shaft of the stitch length regulating cam.

15. A circular knitting machine comprising in combination a pair of gear wheels intermeshing to form a positive yarn feed device, a fixed axis for one gear wheel, an adjustable axis for the other gear wheel, means for providing a preliminary adjustment of the intermeshing gear wheels, a clutch for driving one of said gear wheels, a feeder arm adapted to be moved into and out of operative position, a stop motion for automatically operating the stop motion by the movement of the feeder arm, a stitch length regulating cam, and means for controlling the position of the adjustable axis of one gear wheel with respect to the fixed axis of the other gear wheel, said means comprising a cam surface provided on the stitch regulating cam.

In testimony whereof we have hereunto subscribed our names.

JACK JONES.
WILLIAM DERWIN.