May 22, 1928. 1,670,389

A. D. STEWART ET AL

SPLICING ATTACHMENT FOR KNITTING MACHINES

Filed Dec. 15, 1922 3 Sheets-Sheet 1

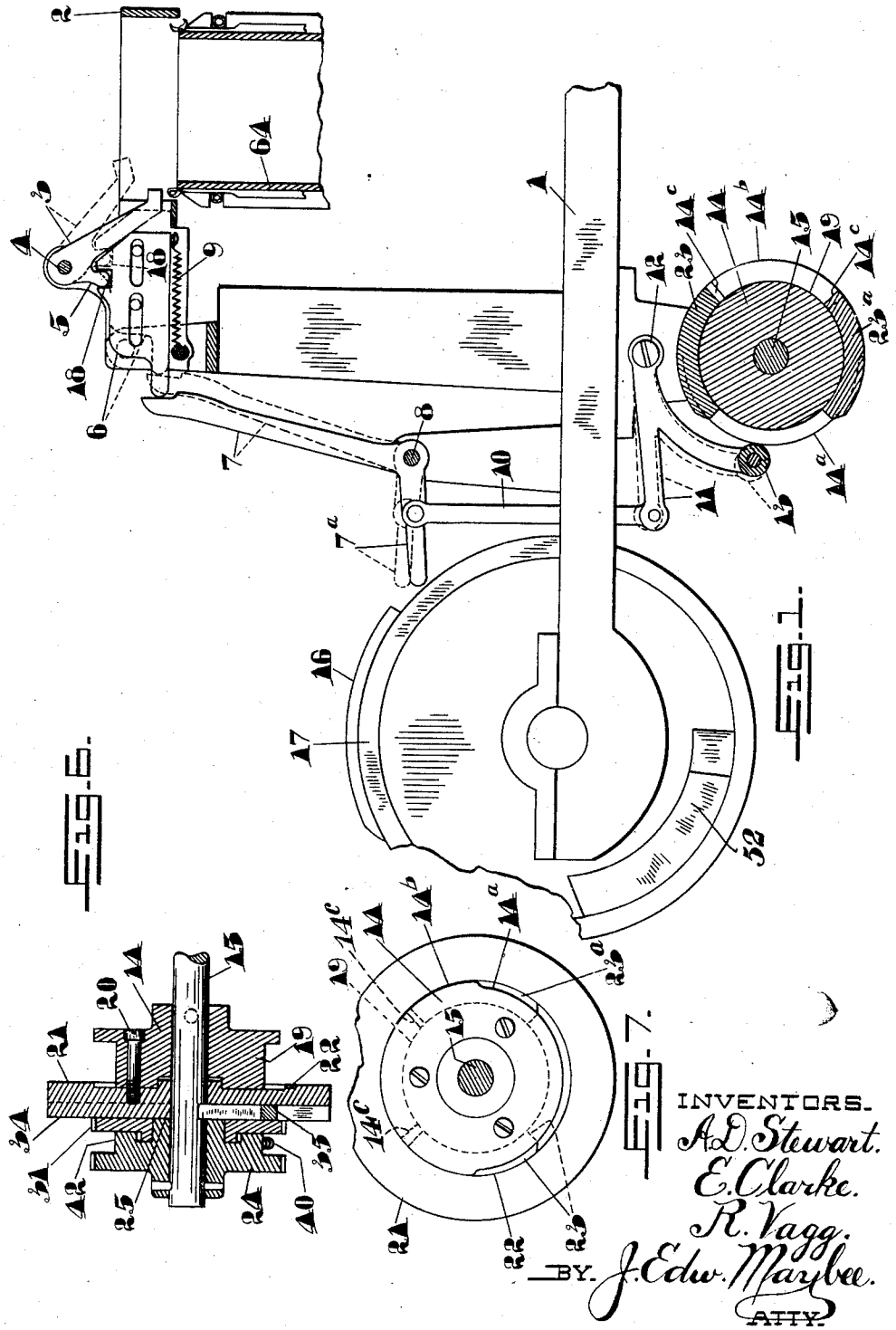


Fig. 1.

Fig. 6.

Fig. 7.

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Filed Dec. 15, 1922 3 Sheets-Sheet 2

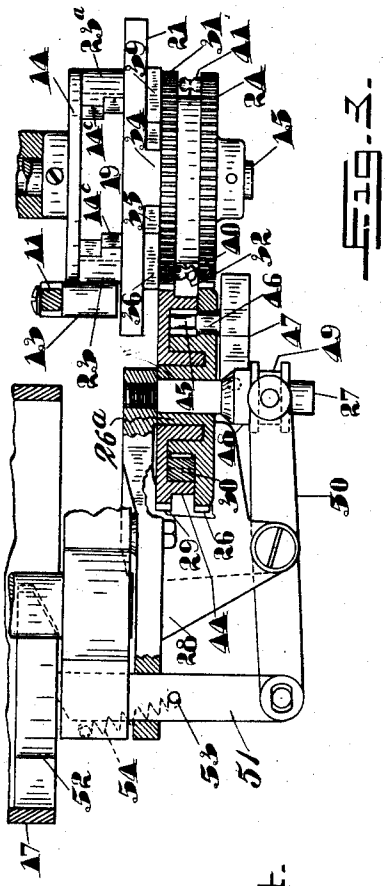


Fig. 3.

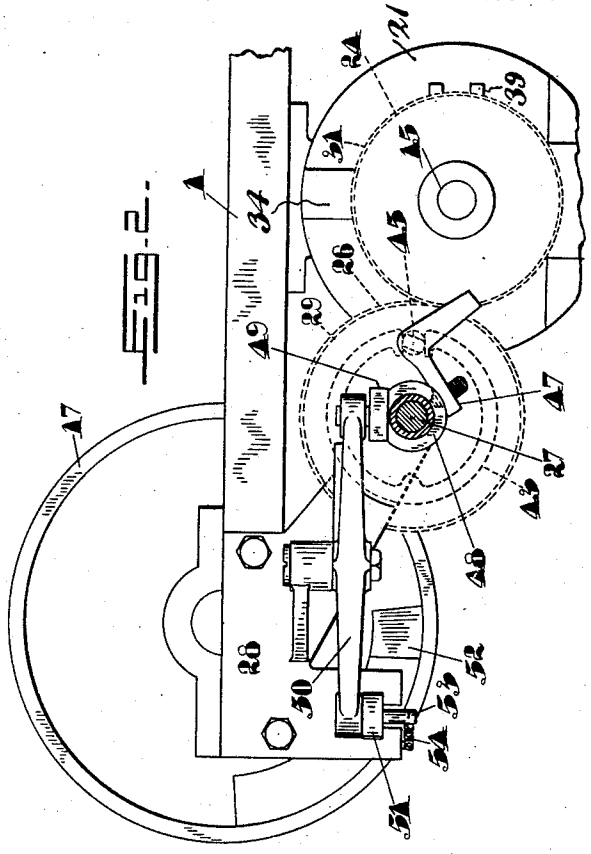


Fig. 2.

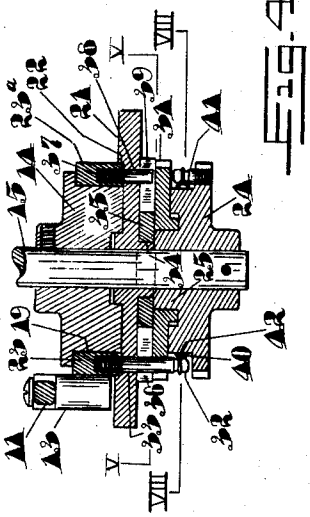


Fig. 4.

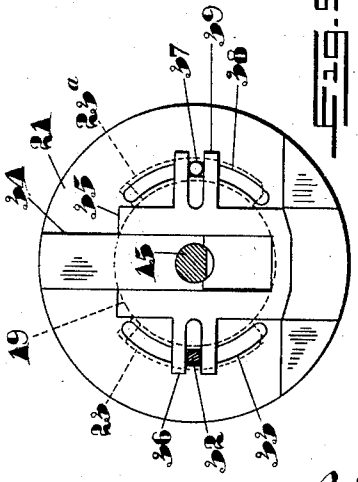


Fig. 5.

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SPLICING ATTACHMENT FOR KNITTING MACHINES

Filed Dec. 15, 1922 3 Sheets-Sheet 3

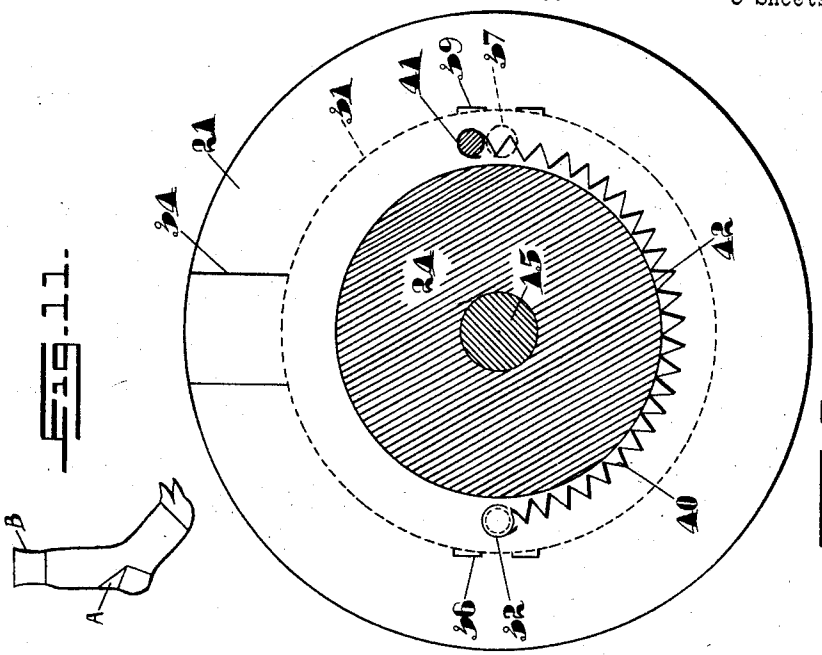


Fig. 11.

Fig. 8.

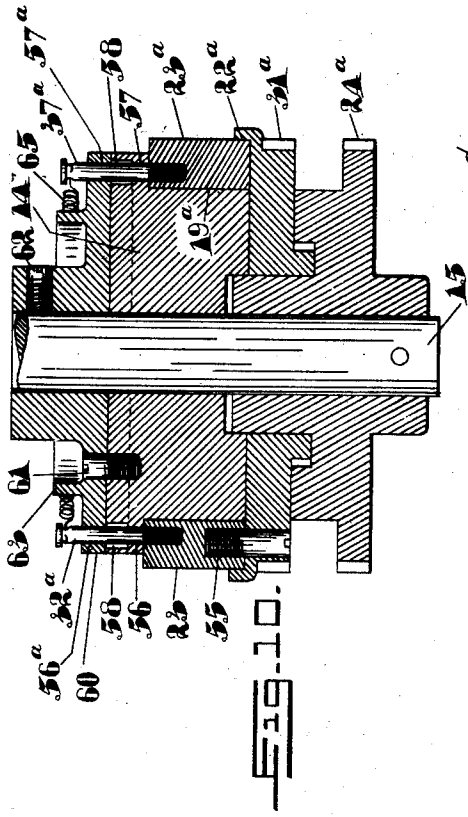


Fig. 10.

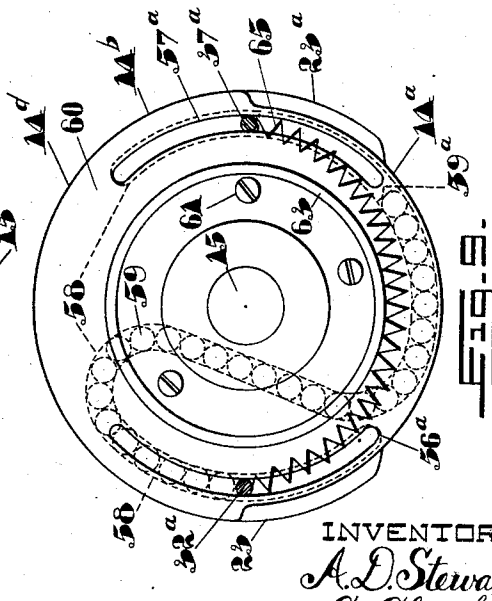


Fig. 9.

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Patented May 22, 1928. 1,670,389

UNITED STATES PATENT OFFICE.

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SPLICING ATTACHMENT FOR KNITTING MACHINES.

Application filed December 15, 1922, Serial No. 607,263, and in Canada June 22, 1922.

This invention relates to knitting machines and more particularly to the rotary type of knitting machines and our object is to devise means for automatically forming a reinforcing splice of any desired shape on the work while it is being knitted and particularly for forming a splice which commences at zero and gradually increases to a width equal to half the circumference of the work, or vice versa.

We attain our object by means of the constructions hereinafter described and illustrated in the accompanying drawings in which

Fig. 1 is a side elevation, partly in section of part of a knitting machine showing the segments for varying the low portion of the splicing finger actuating cam;

Fig. 2 a side elevation of the gearing and clutch for actuating the segments;

Fig. 3 a plan view partly in section, of the same;

Fig. 4 a horizontal section of the cam and segment actuating means;

Fig. 5 a vertical section on the line V—V in Fig. 4;

Fig. 6 a longitudinal section of the parts shown in Fig. 4;

Fig. 7 a rear view of the cam and its disk;

Fig. 8 a vertical section on the line VIII—VIII in Fig. 4 on an enlarged scale;

Fig. 9 a rear elevation of the cam showing a modified form of means for actuating the segments in opposite directions to one another;

Fig. 10 a horizontal section of the same; and

Fig. 11 a side elevation of the finished hose.

In the drawings like numerals of reference, indicate corresponding parts in the different figures.

1 is part of a rotary knitting machine frame on which is suitably carried a latch ring 2 within which the needle cylinder 64 is rotated. In this type of knitting machine a plurality of controlled fingers are used for bringing the yarns from the bobbins to and from their feeding positions relative to the knitting needles and the finger 3 is used for feeding yarn to the desired needles for forming a reinforcing splice A (see Fig. 11), on the hose as it is being knitted.

This splice is commonly formed on the leg of the hose and adjacent the heel thereof, see Fig. 11, and heretofore it has been the practice to form the splice by automatically feeding yarn by means of the finger 3 to substantially one-half of the knitting needles on each revolution of the needle cylinder whereby the reinforcing splice is formed half way round the hose and is substantially rectangular in shape.

To overcome the difficulties of the latter method and to form a reinforcing splice of variable widths to produce any desired pattern on the hose while the latter is being knitted, we provide means adapted to actuate the splicing finger 3 to feed different lengths of yarn to the desired knitting needles on each revolution of the needle cylinder as hereinafter described.

The finger 3 is pivoted on a spindle 4 carried at the rear of the latch ring and is provided with a depending lug 5 adapted to be received between the shoulders 18 formed on the slide 6 which is slidably mounted at the rear of the latch ring 2. It is obvious that a movement of the slide in either direction will cause one of the shoulders to engage the lug and swing the finger 3 on its pivot. The free end of the finger is provided with a hole through which the yarn from a bobbin (not shown) passes and when this free end is brought to the position shown in full lines in Fig. 1 the yarn is fed to the knitting needle hooks as they are rotated past the finger. When the finger is swung up to the position shown in dotted lines, in Fig. 1, the yarn is lifted out of the path of the needle hooks. One arm of a bell crank lever 7 fulcrumed at 8 on the frame of the machine is adapted to engage one end of the slide 6 to actuate it to swing the finger 3 to its non-feeding position relative to the knitting needles and a spring 9 connected with the slide and a suitable stationary part tends to move the finger to its feeding position relative to the knitting needles. Intermediate the ends of the other arm 7^a of the bell crank 7 is pivotally connected one end of a link 10, the other end of which is pivotally connected with one arm of a bell crank 11 which is fulcrumed at 12 on the frame of the machine. The other arm of the bell crank 11 is curved downwardly and carries an anti-friction roller 13 adapted to engage the periphery of a cam 14 secured to a shaft 15 which is suitably journalled on the

frame of the machine. This shaft is one commonly employed and is driven by mechanism, not shown, in synchronism with the needle cylinder 2. The periphery of the cam 14 is formed with a low and a high portion 14^a and 14^b respectively on the cam surface. These portions are substantially equal in length. The low portion 14^a is adapted to permit the bell crank 11 to rock sufficiently to allow the spring 9 to actuate the slide 6 to rock the finger 3 to its feeding position relative to the knitting needles as hereinbefore described.

The splicing finger 3 is normally held in its nonfeeding position by means of a cam 16 secured to the periphery of the timing drum 17 which is journalled on the machine and rotated in any suitable manner. This drum cam is adapted to engage the free end of the arm 7^a to rock the bell crank 7 to actuate the slide 6 to hold the finger 3 in its inoperative position against the tension of the spring 9. It will readily be seen that when the arm 7^a is disengaged by the cam 16 that the roller 13 will engage the periphery of the cam 14 whereby the finger 3 will be actuated to and from its feeding position relative to the knitting needles on each revolution of the cam 14 and thus form a reinforcing splice extending half way round the hose and being substantially rectangular in shape as hereinbefore mentioned.

Referring to Fig. 7 it is evident that if the low portion 14^a of the cam 14 is normally decreased to zero and then gradually increased in length on each revolution of the cam 14, and the cam 16 permits the roller 13 to engage the cam 14, the splicing finger will be held in its feeding position, relative to the knitting needles, a slightly longer period on each revolution of the cam 14 thus gradually feeding yarn to more needles on each revolution of the needle cylinder to form a splice which slightly increases in width in every transverse row of stitches. It is also evident that if the low portion 14^a is normally lengthened to its limit and then gradually decreased in length on each revolution of the cam, the finger 3 will gradually feed less needles on each revolution and thus form a splice slightly decreasing in width in every transverse row of stitches. It is also obvious from the above that any desired shape of reinforcing splice or any desired figure could be produced on a hose, while it is being knitted, by first gradually increasing the length of the low portion 14^a and then gradually decreasing the length of it or vice versa.

To automatically form an inverted V or triangular shaped reinforcing splice on a hose while the latter is being knitted, we provide the following means. As hose are generally knitted by starting at the top B, see Fig. 11, it will be necessary to start the triangular splice at the apex and gradually increase its width on each row of transverse stitches until the base of the splice extends substantially half way round the hose. The cam 14 is provided with a hub 19 to which is secured, by means of the cap screws 20, a disk 21 having a recess formed therein adjacent the hub to provide a circular shoulder 22 concentric with the hub. A pair of arcuate segments 23 and 23^a revolvably mounted on the hub 19 are held thereon by engagement with the shoulder 22. The peripheries of the segments are flush with the high portion 14^b of the cam 14 and the circumference of each segment is substantially one-quarter the circumference of the cam so that when the segments are moved on the hub 19, relative to the cam, in opposite directions to one another, the length of the low portion 14^a of the cam will be varied. With this arrangement it is evident that the length of the low portion 14^a may be varied from zero to substantially half the circumference of the cam and thus hold the finger 3 in its feeding position relative to the knitting needles for variable periods. Preferably the forward ends of the segments are tapered off to permit the roller 13 to easily ride over them and the rear ends of the segments are formed with extensions 14^c adapted to lie side by side when the rear ends are brought together. The purpose of these extensions is to overlap the rear ends of the segments and the adjacent ends of the high portion 14^b, when the forward ends of the segments are brought together whereby the roller 13 is engaged, to prevent the roller dropping into engagement with the low portion of the cam, at the rear ends of the segments.

The segments are turned on the hub 19 relative to the cam 14 as follows. A pinion 24 secured to the shaft 15 provided with a hub 25 meshes with a gear 26 journalled on a stud 27 which is carried by a bracket 28 secured to the frame of the machine. The gear 26 is provided with a hub 26^a on which is journalled the hub of a gear 29 which is rotated by the gear 26 by means of a friction clutch 30 as hereinafter described. A pinion 31 meshing with the gear 29 is journalled on the hub 25 of the pinion 24. A laterally extending pin 32 secured to the segment 23 passes through an arcuate slot 33 formed in the disk 21 and is secured in any suitable manner to the pinion 31 to form a driving connection for the segment.

Assuming the hose to be started at the top B, it will be necessary to start the splice at the apex as hereinbefore mentioned which will necessitate the segments being normally positioned on the cam 14 to decrease the length of the low portion 14^a to zero. The length of the low portion will have to be

gradually increased, which is accomplished by so arranging the gear ratio of the train of gears 24, 26, 29 and 31 that the speed of the gear 31 will be slightly slower than that of the shaft 15 to which the cam 14 is secured. The gears thus produce a differential action so that a certain number of revolutions of the shaft 15 is required to cause the segment 23 to revolve on the hub 19, through an arc of 90°, relative to the cam 14 and thus lengthen its part of the low portion 14^a to its limit. From the above it follows that the needle cylinder will have to make a certain number of revolutions before the segment is revolved through its 90° arc relative to the cam and the number of revolutions of the needle cylinder will agree with the number of revolutions of the cam and the number of rows of transverse stitches that are formed in the splice A.

The other segment 23^a is actuated to turn on the hub 19 relative to the cam 14 and in the opposite direction to the segment 23 in the following manner. On the disk 21 is formed a guide 34 on which is slidably mounted a slide 35 having a pair of laterally extending jaws 36. These jaws are adapted to embrace the pin 32 so that a movement of the pin 32 in either direction will cause the slide 35 to be moved on its guide. To the segments 23^a is secured a laterally extending pin 37 which passes through an arcuate slot 38 formed on the disk 21 and between a pair of jaws 39 formed on the slide 35. These jaws are formed on the side of the slide opposite to the jaws 36. With this arrangement it is evident that a rotary movement of the pin 32 and its segment 23 in either direction will cause the slide 35 to be moved in a corresponding direction and thus actuate the pin 37 to revolve the segment 23^a in the opposite direction to the segment 23 whereby the forward ends of the segments are actuated towards one another to decrease the length of the low portion 14^a of the cam 14 or are moved away from one another to increase the length of the low portion. A tension spring 40 having one end connected with the pin 32 and the other end connected with a pin 41 secured to the pinion 24 tends to move the pin 32 and thus the segments 23 and 23^a to decrease the length of the low portion 14^a. The pinion 24 is provided with a laterally extending flange 42 adapted to form a guide for the spring 40, see Fig. 8.

It will be noted that the two pairs of differential gears 24 and 26, 29 and 31 hereinbefore described are always in mesh and as the pinion 24 is secured to the shaft 15 it follows that the gear 26 which meshes therewith is being constantly driven. To drive the other pair of gears the friction clutch 30 is provided which clutch may be of any well known type having an expanding member 43 carried by the gear 26 and adapted to engage the inner periphery of a laterally directed flange 44 formed on the gear 29. The expanding member is actuated to frictionally engage the flange 44 by means of a cam 45 formed on the inner end of a stem 46 which is journalled in the web of the gear 26 and thus rotated therewith. The stem 46 is secured to or formed on a rock arm 47 which is adapted to be engaged by the conical end of a sleeve 48 slidably and rotatably mounted on the stud 27. On the outer end of this sleeve is formed a groove the sides of which are adapted to engage a shoe 49 pivotally carried at one end of a lever 50 which is fulcrumed intermediate its ends on the bracket 28. The other end of this lever is connected by means of a pin and slot connection with one end of a member 51 slidably mounted in part of the bracket 28 and having its other end tapered off for engagement with a cam 52 secured to the timing drum 17.

From the above description it is evident that when the cam 52 engages the sliding member 51 that the lever 50 will be swung on its fulcrum to force the conical end of the sleeve 48 into engagement with the rock arm 47 which will turn the cam 45 on its axis to expand the member 43 to frictionally engage the flange 44 and thus drive the gear 29. A tension spring 54 having one end connected with a suitable stationary part and the other end connected with a pin 53 secured to the sliding member 51 tends to normally hold the latter in position to be engaged with the cam and also tends to hold the sleeve 48 out of engagement with the rock arm 47. Preferably the pin 53 extends upwardly through the sliding member 51 to engage the bracket 28 and thus limit the movement of the member 51 inwardly.

In Figs. 9 and 10 we show a modified arrangement for actuating the segment 23^a as follows. The pinions 24^a and 31^a are substituted for the pinions 24 and 31 respectively and the cam 14^d and hub 19^a are substituted for the cam 14 and hub 19 respectively. The pinion 31^a is recessed to form a circular shoulder 22^a, adjacent the hub 19^a formed on the cam 14^d, to engage the segments 23 and 23^a and hold them on the hub. The segment 23 is connected by means of a pin 55 with the pinion 31^a and is provided with a pin 32^a and the segment 23^a is provided with a pin 37^a. These pins 32^a and 37^a extend laterally from the segments and pass through arcurate slots 56 and 57 formed in the cam 14^d and in the inner face of the cam is formed a groove 58 having its opposite ends concentric with the adjacent arcuate slots 56 and 57. This groove extends from the upper end of one arcuate slot to the lower end of the other slot so that

by inserting a flexible member 59 in the groove the pin 37^a will be moved in the opposite direction to the pin 32^a when the latter is actuated by the pinion 31^a. Preferably the flexible member 59 is formed by inserting a plurality of steel balls in the groove and the groove adjacent the slot 57 extends beyond the ends thereof and in a concentric arc to permit an arcuate key 59^a to engage the pin 37^a. The cam 14^d is rotated and the balls 59 and key 59^a are retained in the groove 58 by means of a flanged hub 60. This hub is connected by means of grub screws 61 and 62 with the cam 14^d and the shaft 15 respectively and is provided with the arcuate slots 56^a and 57^a adapted to permit the pins 32^a and 37^a to pass through the hub.

It is evident that with the above arrangement the pinion 31^a will gradually turn the segment 23 on the rotating hub 19^a relative to the cam 14^d when the clutch is in and thus gradually increase the length of the low portion 14^a on each revolution of the cam. It is also obvious that the pin 32^a will engage the balls 59 which engage the key 59^a in the groove 58 to actuate the pin 37^a in a direction opposite to the direction of the pin 32^a so that the segment 23^a will be turned on the hub 19^a in the opposite direction to the segment 23. To tend to move the segments to decrease the length of the low portion 14^a we provide the tension spring 65 having its ends connected with the pins 32^a and 37^a. On the flanged hub 60 is formed a laterally directed circular rib 63 on the periphery of which the spring 65 is guided.

Assuming the hose has been knitted from the top B to where the splice A is formed the mode of operation is as follows. The timing drum 17 is rotated to disengage the cam 16 from the arm 7^a of the bell crank 7 and the roller 13 engages the cam surface of the cam 14. The segments 23 and 23^a are normally held by means of the spring 40 to decrease the length of the low portion 14^a of the cam 14 to zero so that the roller 13 will engage the segments and the high portion 14^b of the cam to hold the splicing finger 3 in its inoperative position relative to the knitting needles until the segments are moved to increase the length of the low portion 14^a. As the timing drum 17 is rotated the cam 52 engages the sliding member 51 which rocks the lever 50 to throw the friction clutch 30 in to operation for forming a driving connection between the gears 26 and 29. The gear 29 then rotates the pinion 31 which turns the segments 23 and 23^a as hereinbefore described, relative to the cam 14 to gradually increase the length of the low portion 14^a on each revolution of the cam until the length of the low portion is increased to its limit. When this point is reached the cam 52 has been rotated until its rear end disengages the sliding member 51 which permits the spring 54 to throw the friction clutch out of operation and permits the spring 40 to rotate the pinion 31 relative to the pinion 24 and thus return the segments to their normal position.

What we claim is:—

1. A knitting machine provided with a rotatable needle cylinder; a rotating cam having high and low portions formed on its cam surface; a yarn feeding finger adapted to be actuated by the cam to and from its feeding position relative to the knitting needles to feed splicing yarn to the needles, in combination with means mounted on the cam adapted to vary the length of the low portion; means including differential gearing operable by the rotation of the cam for actuating the cam varying means; a friction clutch for throwing the differential gearing into and out of operation; and actuating means for automatically operating the friction clutch from the knitting machine.

2. A knitting machine provided with a rotatable needle cylinder; a rotatable timing drum; a rotating cam having high and low portions formed on its cam surface; and a yarn feeding finger adapted to be actuated by the cam to and from its feeding position relative to the knitting needles to feed splicing yarn to the needles, in combination with means mounted on the cam adapted to vary the length of the low portion; means including differential gearing for actuating the cam varying means by the rotation of the cam; a cam secured to the drum; a friction clutch for throwing the differential gearing into and out of operation; and means for operating the friction clutch operable by the drum cam.

3. A knitting machine constructed as set forth in claim 2 in which the friction clutch operating means includes a sliding member adapted to be engaged by the drum cam; and a lever fulcrumed intermediate its ends and being pivotally connected with the sliding member.

4. A knitting machine provided with a rotatable needle cylinder; a rotary shaft; a cam secured to the shaft and having high and low portions formed on its cam surface; a yarn feeding finger adapted to be actuated by the cam to and from its feeding position relative to the knitting needles to feed splicing yarn to the needles, in combination with a pair of arcuate segments revolvably mounted on the cam and adapted to be moved relative thereto and in opposite directions to one another to vary the length of the low portion; resilient means tending to move the segments to decrease the length of the low portion; differential gearing including a gear connected with the shaft and a gear

adapted to be driven by the first gear and connected with one of the segments to actuate the latter in one direction; and means for actuating the other segment in a direction opposite to the first mentioned segment and operable by the first mentioned segment.

5. A knitting machine constructed as set forth in claim 4 in which means are provided whereby the differential gearing may be thrown into and out of operation.

6. A knitting machine provided with a rotatable needle cylinder; a rotary shaft; a cam secured to the shaft and having high and low portions formed on its cam surface; a yarn feeding finger adapted to be actuated by the cam to and from its feeding position relative to the knitting needles to feed splicing yarn to the needles, in combination with a pair of arcuate segments revolvably mounted on the cam and adapted to vary the length of the low portion; resilient means tending to move the segments to decrease the length of the low portion; means for actuating one of the segments to gradually increase the length of the low portion; a stud secured to the machine; a pinion connected with the shaft; a gear journalled on the stud and meshing with the pinion; a second gear journalled on the stud; a friction clutch adapted to form a driving connection between the two gears; actuating means adapted to automatically operate the clutch; a second pinion journalled on the shaft and meshing with the second gear and connected with one of the segments to acuate the latter relative to the cam in one direction; and means for actuating the other segment in a direction opposite to the first mentioned segment and operable by the first mentioned segment.

7. A knitting machine provided with a rotatable needle cylinder; a rotary shaft; a cam secured to the shaft and having high and low portions on its cam surface; a yarn feeding finger adapted to be actuated by the cam to and from its feeding position relative to the knitting needles to feed splicing yarn to the needles in combination with a pair of arcuate segments revolvably mounted on the cam and adapted to vary the length of the low portion; resilient means tending to move the segments to decrease the length of the low portion; means for actuating one of the segments to gradually increase the length of the low portion; a stud secured to the machine; a pinion connected with the shaft; a gear journalled on the stud and meshing with the pinion; a second gear journalled on the stud; a friction clutch including an expanding member carried on the first gear and adapted to frictionally engage the second gear; a cam journalled in the first gear for actuating the expanding member and provided with a rock arm; means for rocking the rock arm to form a driving connection between the gears; a second pinion journalled on the shaft and meshing with the second gear and connected with one of the segments to actuate the latter relative to the cam in one direction; and means for actuating the other segment in a direction opposite to the first mentioned segment and operable by the first mentioned segment.

8. A knitting machine provided with a rotatable needle cylinder; a rotary shaft; a cam secured to the shaft and having high and low portions formed on its cam surface; a yarn feeding finger adapted to be actuated by the cam to and from its feeding position relative to the knitting needles to feed splicing yarn to the needles; a rotating timing cam carried on the machine, in combination with a pair of arcuate segments revolvably mounted on the first mentioned cam and adapted to vary the length of the low portion; resilient means tending to move the segments to decrease the length of the low portion; means for actuating one of the segments to gradually increase the length of the low portion; a bracket secured to the machine; a stud secured in the bracket; a pinion connected with the shaft; a gear journalled on the stud and meshing with the pinion; a second gear journalled on the stud; a friction clutch including an expanding member carried on the first gear and adapted to frictionally engage the second gear; a cam journalled in the first gear for actuating the expanding member and provided with a rock arm a sleeve axially movable on the stud and provided with a conical end adapted to engage the rock arm; a sliding member mounted on the bracket adapted to be engaged by the timing cam; a lever fulcrumed intermediate its ends on the bracket and connected at one end with the sliding member, the other end of the lever being suitably connected with the sleeve whereby a movement of the sliding member in one direction will cause the expanding member to frictionally engage the second mentioned gear; resilient means tending to hold the sleeve out of engagement with the rock arm; a second pinion journalled on the shaft and meshing with the second gear and connected with one of the segments to actuate the latter relative to the cam in one direction; and means for actuating the other segment in a direction opposite the first mentioned segment and operable by the first mentioned segment.

9. A knitting machine provided with a rotatable needle cylinder; a rotary shaft; a cam secured to the shaft and having high and low portions formed on its cam surface; a yarn feeding finger adapted to be actuated by the cam to and from its feeding position relative to the knitting needles to feed splicing yarn to the needles, in combination with a pair of arcuate segments revolvably

mounted on the cam and adapted to vary the length of the low portion; resilient means tending to move the segments to decrease the length of the low portion; means for actuating one of the segments to gradually increase the length of the low portion; a stud secured to the machine; a pinion connected with the shaft; a gear journalled on the stud and meshing with the pinion; a second gear journalled on the stud; a friction clutch adapted to form a driving connection between the two gears; actuating means adapted to automatically operate the clutch; a second pinion journalled on the shaft and meshing with the second gear; a pin secured in one of the segments and extending laterally through the last mentioned pinion to form a driving connection between the pinion and the segment; a disk secured to the cam and having a pair of diametrically opposite arcuate slots formed therein through one of which the said pin passes; a slide suitably guided on the disk and provided with two pairs of diametrically opposite jaws, one pair being adapted to embrace the said pin; a pin secured to the other segment and extending laterally through the second arcuate slot and being embraced by the second pair of jaws whereby a movement of the first pin in one direction will cause a movement of the other pin the opposite direction.

10. A knitting machine constructed as set forth in claim 9 in which the resilient means is a tension spring connected at one end with the first mentioned pin and at the other end with the first mentioned pinion to tend to move the segments to decrease the low portion.

11. A knitting machine constructed as set forth in claim 9 in which the finger actuating cam is provided with a hub on which the segments are mounted and the disk is provided with a recess to form a circular shoulder concentric with the hub and adapted to engage the segments.

Signed at Hamilton, Canada, this 12th day of December, 1922.

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