

F. WILCOMB.

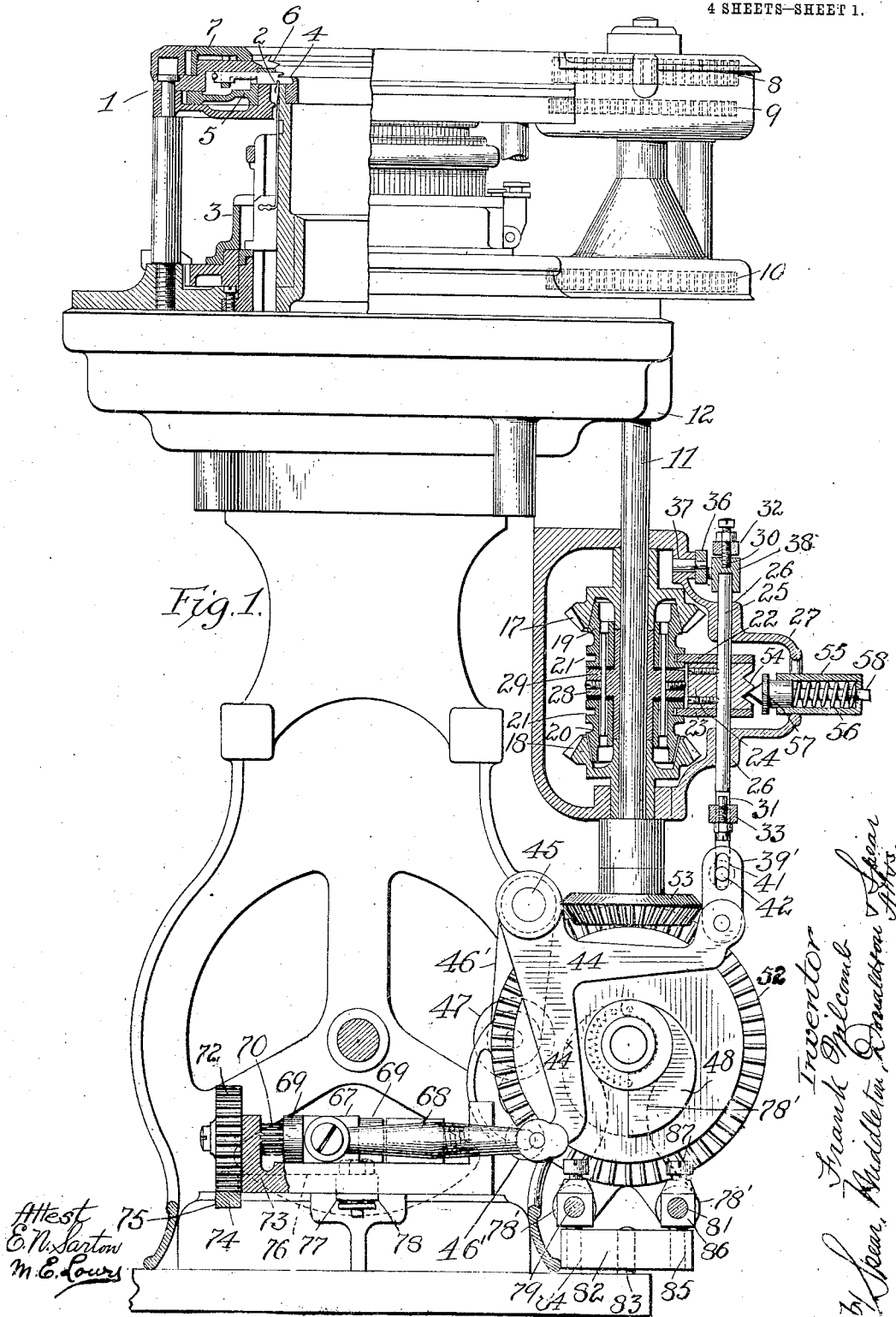
CIRCULAR KNITTING MACHINE FOR MAKING HOSIERY AND THE LIKE.

APPLICATION FILED DEC. 13, 1906. RENEWED JUNE 11, 1912.

1,049,020.

Patented Dec. 31, 1912.

4 SHEETS—SHEET 1.



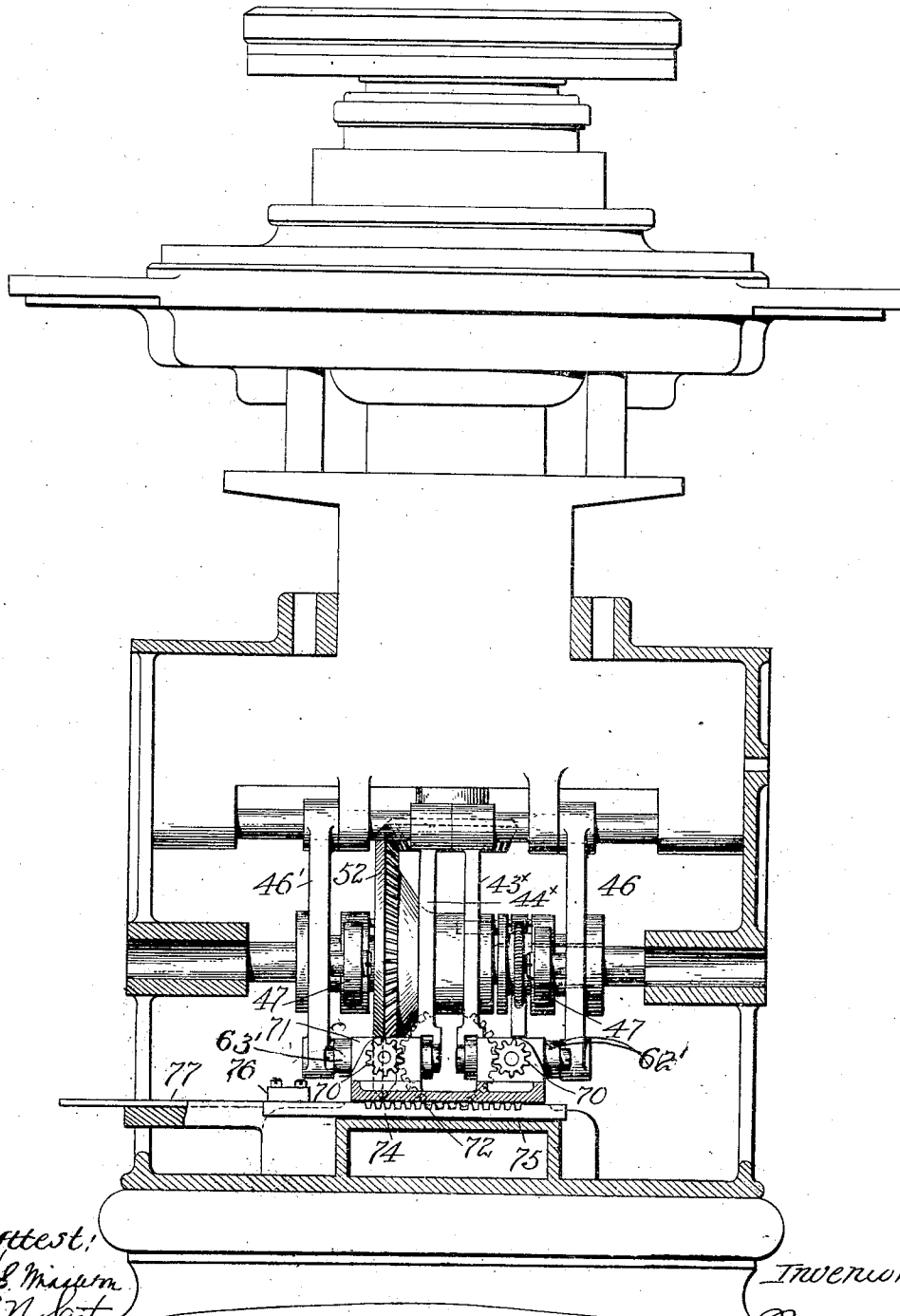
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4 SHEETS—SHEET 2.

Fig. 2.



Attest:
 E. N. Sinton

Inventor

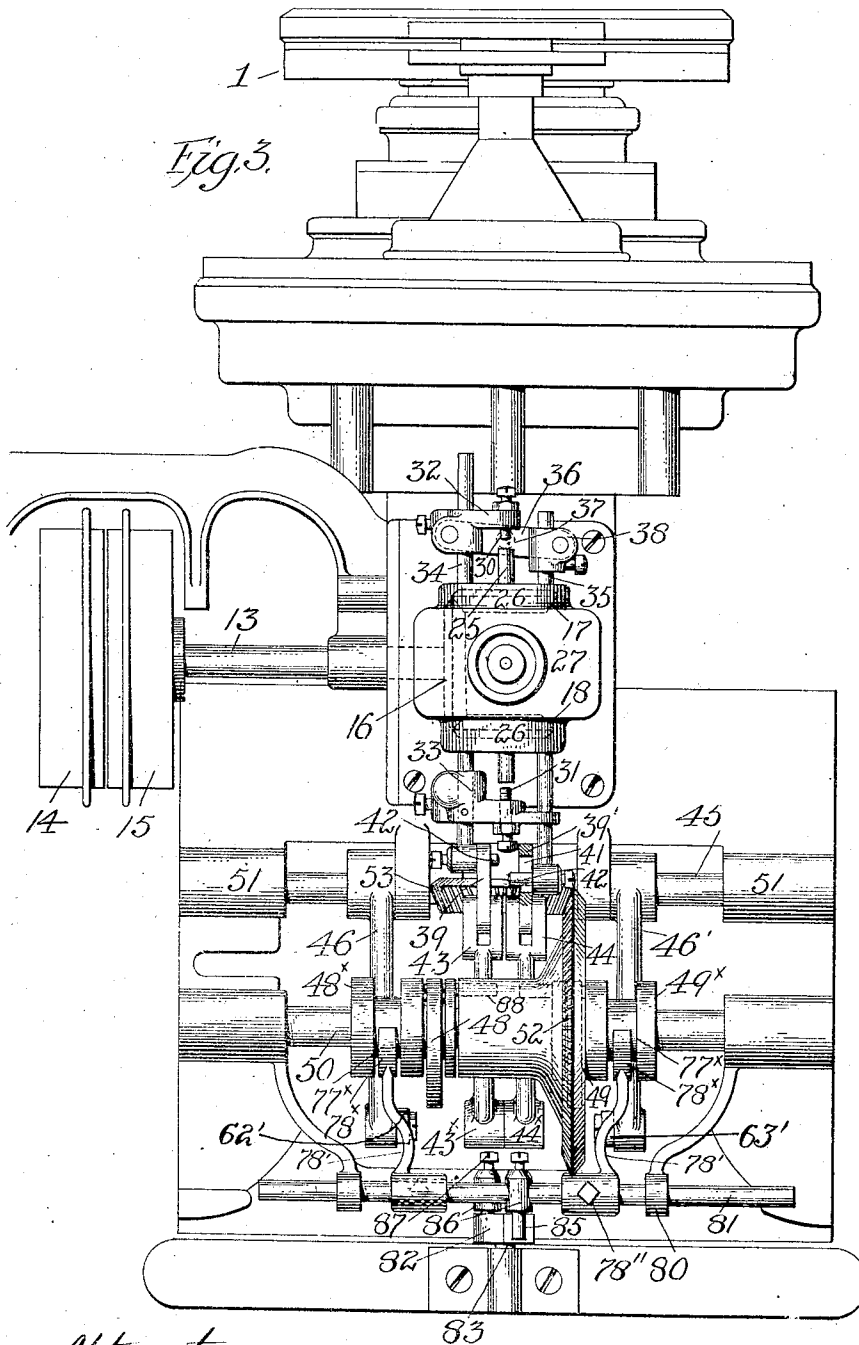
Frank Wilcomb
 by Spear, Middleton, Donaldson & Spear. Attys.

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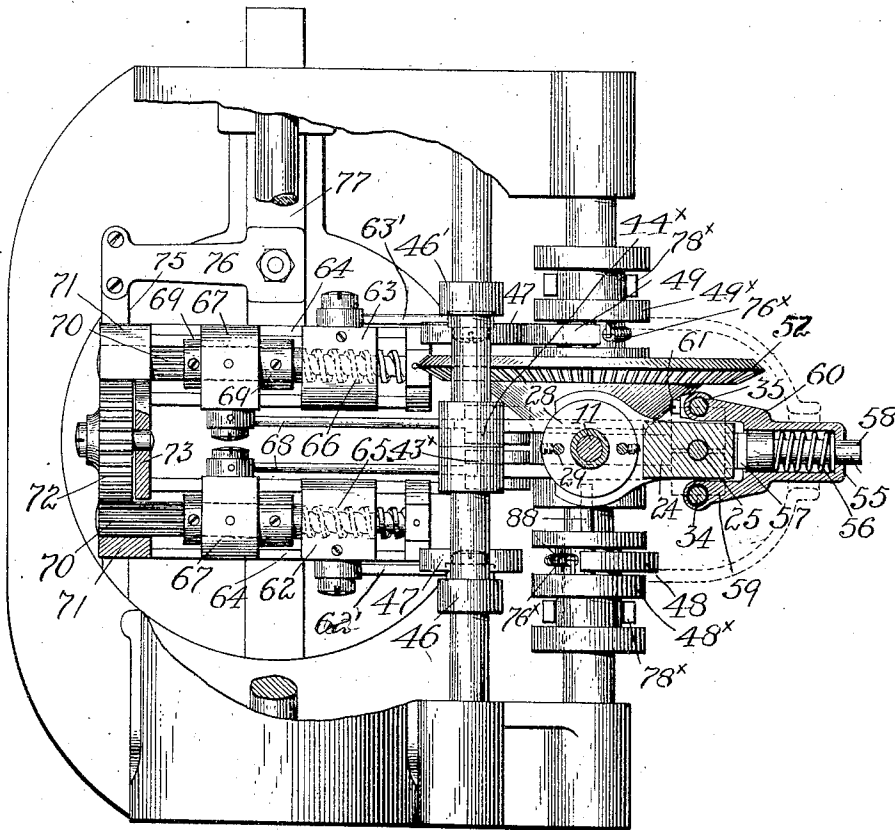
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4 SHEETS-SHEET 4.

Fig. 4.



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UNITED STATES PATENT OFFICE.

FRANK WILCOMB, OF NORRISTOWN, PENNSYLVANIA, ASSIGNOR TO WILCOMB MACHINE COMPANY, OF NORRISTOWN, PENNSYLVANIA, A CORPORATION.

CIRCULAR-KNITTING MACHINE FOR MAKING HOSIERY AND THE LIKE.

1,049,020.

Specification of Letters Patent.

Patented Dec. 31, 1912.

Application filed December 13, 1906, Serial No. 347,616. Renewed June 11, 1912. Serial No. 703,099.

To all whom it may concern:

Be it known that I, FRANK WILCOMB, citizen of the United States, residing at Norristown, Pennsylvania, have invented certain new and useful Improvements in Circular-Knitting Machines for Making Hosiery and the Like, of which the following is a specification.

My invention relates to circular knitting machines known as hosiery machines, in which a reciprocating movement of the needle cams is necessary when the heel and toe portions of the stocking are being formed.

One of the objects of my invention is to provide means for giving the moving parts a reciprocating motion with a uniform velocity of the cams in respect to the needles.

Heretofore machines of this character having a reciprocating motion have employed crank movements, but these are objectionable because they necessarily impart a more rapid movement during the middle of the stroke than at the ends of the stroke.

By my invention the velocity of the cams over the needles is uniform at all parts of the stroke.

Another object of my invention is to provide means whereby the length of the reciprocating stroke is automatically shortened step by step during the narrowing operation of the heel and toe, and whereby said stroke is automatically lengthened step by step during the widening operation in the knitting of said parts. One advantage of lengthening and shortening the stroke is to materially reduce the time necessary to knit the heel and toe, and a further reduction of time results from the fact that the knitting cam is traveling over the needles with a uniform velocity whether on the widest part or narrowest part of the heel and toe.

Other objects of my invention will appear hereinafter.

The invention consists in the features, combination and arrangement of parts hereinafter described and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical sectional view from front to rear of the machine, parts being shown in elevation for convenience of illustration. Fig. 2 is a front view of the machine with parts in section. Fig. 3 is a rear view, and

Fig. 4 is a plan view of the operating mechanism below the knitting head, parts being shown in section and parts being broken away.

In these drawings 1 indicates the knitting head which comprises the needles 2; the movable cam ring 3 therefor; the web holders 4 with their cam carrying ring 5 and the sinkers 6 with their cam carrying ring 7.

In the present machine I have shown the several cam carriers as being rotatably mounted and cooperating with a non-rotary cylinder and needles, but it will be understood that I do not limit myself in this respect as the invention may be applied to the type of machine in which the needle cylinder rotates and the cam rings are stationary.

In the present embodiment of my invention the cam rings are rotated by gears 8, 9 and 10 fixed on a vertical shaft 11, suitably journaled in the frame 12. This shaft is designed to have at times continuous rotary motion for operating knitting devices for continuous circular knitting in forming the leg and at times to be revolvably reciprocated when the knitting devices are to be operated in making the heel and toe portions. The main drive shaft of the machine is indicated at 13, being driven by the pulleys 14, 15. This drive shaft carries on its inner end a bevel gear 16 and cooperating with this gear to drive the vertical shaft are two clutch controlled gears 17 and 18, both meshing therewith, and one located at the upper and the other at the lower part of the said drive gear 16. The bevel gears 17 and 18 are loose on the vertical shaft 11 and are designed to be connected therewith for rotating it in either one direction or the other according to which is clutched thereto by the friction clutches 19 and 20. These clutches comprise conical members to engage conical interior surfaces on the bevel gears and each clutch is formed with a grooved portion 21 to receive one of the forks 22, 23 as the case may be, extending from a block 24, which is fixed to a reversing rod 25 adapted to slide vertically in bearings 26 on a box 27 suitably secured to the frame. These clutch members have a splined connection with the vertical shaft 11, consisting of a center block 28 fixed to the shaft and having pins or rods 29 fixed thereon and extending parallel with the shaft.

into openings in the clutches so that said clutches may have sliding movement along the shaft, but when either is in engagement with its gear the motion of said gear will be transmitted through the clutch and the splined connection described, to the vertical shaft.

The clutches are thrown in and out by the vertical movements of the block 24 attached to the reverser rod, the movement of said block being imparted through the forks 22, 23, directly to the clutch members.

The reverser rod is operated vertically by pins or studs 30, 31 carried respectively by arms 32, 33 which are fixed to a rod 34 adapted to reciprocate vertically in bearings in the said box 27. This rod is connected with a companion rod 35 arranged on the other side and parallel with the reverser rod and adapted also to reciprocate vertically through bearings in the said box. The connection between the two rods 34, 35 is made by a lever 36 pivoted centrally to the box or frame at 37 and having its ends pivotally connected to the said rods; at one end through the arm 32, and at its other end through the block 38 fixed to the rod 35. These rods are operated vertically through link connections 39, 39' which are slotted at 41 to receive pins 42 extending from the said rods. The slotted links are respectively connected with levers 43, 44 which are supported on a rod or shaft 45 suitably supported in the frame of the machine at 51. This shaft or rod also has loosely supported thereon levers 46, 46', connected respectively as will hereinafter be described with the levers 43, 44. The levers 46 and 46' are provided with rollers 47 adapted to be acted on by cams 48, 49 fixed on a cam shaft 50, having suitable bearings in the frame at 51. This shaft is driven through a bevel gear 52 fixed thereon and a bevel gear 53 fixed to the lower end of the vertical shaft 11. The cams 48, 49 are set reversely upon the shaft 50 so as to impart alternately movements to the levers 46, 46' and these levers, through connections to be hereinafter described, operate alternately the levers 43, 44, and by this means first one lever and then the other pulls downwardly the rod connected thereto so that a reciprocating motion is imparted to the rods 34, 35, and this through the studs or pins 30, 31 will impart a reciprocating vertical movement to the reverser rod 25 so as to shift the clutches 19, 20 into and out of connection with their respective clutch gears, and thus a rotary reciprocating movement will be imparted to the vertical shaft, and thus to the gearing 8, 9 and 10 will reciprocate the rotary parts of the knitting head to knit the heel or toe of the stocking. It will be observed that this rotary movement imparted from the vertical shaft 11 to the movable

parts of the knitting head through the gearing 8, 9 and 10 will be uniform in velocity at practically all parts of the stroke and thus the cams will be carried over or past the knitting devices, such for instance as the needles, web holders and sinkers with a uniform velocity instead of with a varying speed, as is the case where crank connections are employed.

In order to control and insure the proper engagement of the friction clutch cones with their respective gears I employ a spring detent 57 engaging the tooth 54 on the block 24 which carries the shifting forks. This detent is supported in a barrel or boss 55 which contains the spring 56 for forcing the detent against the tooth 54. The detent has a stem or tail portion 58 which is guided through the boss or barrel 55, and this barrel is carried by arms 59 and 60, the former of which engages loosely the shifting rod 34 and the latter of which is fixed by a screw or pin 61 to the shifting rod 35 so as to move up and down therewith. The action of this detent is to hold the clutch member in engagement with its clutch gear and to act as a pressure device for throwing the clutch forks in either one direction or the other when the said clutch forks have been moved to such an extent as to cause the point of the tooth 54 to ride over the point of the detent tooth, for instance, with the parts in position shown at Fig. 1 the detent is holding the upper clutch cone in engagement with the gear. Now if the reverser rod is moved downwardly the detent will simultaneously be moved upwardly and its point will get above the point of the tooth 54, and thus the pressure of the spring acting through the inclined surfaces of the teeth, now in contact, will throw the clutch fork so as to complete its movement downwardly and press the clutch cone 20 hard against the lower clutch gear. This detent therefore performs the function both of a detent for maintaining the clutch cones in a position to which they have been moved and also as a means for completing the action of said cones when started in either direction.

I will now describe the means whereby the rotary reciprocating stroke of the machine is varied to meet the conditions of narrowing or widening the heel or toe. For this purpose the levers 46, 46' together with their rollers are adjustable in position in relation to the cams 48, 49 so as to be acted upon to a greater or lesser degree by the said cams. For this purpose the levers are connected with adjustable blocks 62, 63, these blocks being adapted to reciprocate upon ways or tracks 64 fixed to the base of the machine. The blocks have screw threaded openings through which pass the screw shafts 65, 66. Plain extensions of these screw shafts also pass through blocks 67 and 130

on each side of these blocks collars 69 are fixed to the screw shafts so that as these shafts reciprocate longitudinally the blocks 67 will also reciprocate. These blocks slide on the said way or tracks 64 and are connected by links or pitmen 68 with the arms 48*, 44* of the levers 43, 44. The screw shafts at their forward ends are formed with gear teeth providing elongated gears 70. These gears are supported in bearings 71, and there is a gear wheel 72 journaled in the base frame or bracket 73 which gear meshes with the elongated gears. The gear 72 also meshes with a rack 74 sliding in a guide-way 75 of the base plate, and this rack bar is connected by an arm 76 with a slide-bar 77 movable in a guide-way 78, in said base plate or frame, said slide-bar extending to one side of the machine in convenient position to have power applied thereto for operating it automatically.

It will be seen from the above that the cams 48, 49 impart movement to the levers 46, 46', and through these levers and the links 62', 63', Figs. 2, 3 and 4, the blocks 62, 63 are reciprocated and these being connected by the screw shafts with the blocks 67, move the same forward and backward and thus through the links 68 impart movement to the shifting rods 34, 35 alternately through the levers 43, 44.

Now, by operating the slide 77 the rack 74 will, through the gear 72 and the elongated gears 70, turn the screw shafts so as to vary the relative positions of the blocks 63 and 67, and therefore of the levers 46 and 43 and 46' and 44, and therefore changes the timing of the operation of the clutch with respect to the motions of the cam shaft so as to give the desired length of stroke to the rotary parts of the knitting head. This adjustment takes place gradually in either direction so that the length of stroke is gradually lengthened or shortened in accordance with the direction in which the controlling slide 77 is moved. In other words, by operating the controlling slide the length of time which either clutch is maintained in operative or driving position is lengthened or shortened to thus vary the length of the knitting stroke.

It will be understood that the slide 77 may be operated manually by the attendant when the heel or toe is being formed. It will be also observed that this lengthening and shortening of the stroke does not interfere with the uniform velocity of the cams in their travel over the knitting devices.

The cams 48, 49 are pivotally supported in their carrier blocks 48* 49* and are held in operative position by springs 76*, this construction being necessary in order to allow each cam to yield on its idle stroke when it strikes the roller of the lever 46 or

46', as the case may be, which is not to be operated on this stroke.

It will be understood that the machine is adapted to perform continuous circular knitting in making the leg or foot of the stocking and to be changed in its action from this continuous knitting to the rotary reciprocating action when forming the heel and toe. When performing continuous circular knitting it will be understood that the shifting mechanism for the clutches is not in action and that the movement from the drive shaft 18 is imparted to the bevel gear 16 and one of the clutch gears continuously to the vertical shaft 11. At this time the cams 48, 49 are shifted on their shaft 50 so as to be out of line with the rollers on the levers 46, 46', this position being represented in Fig. 3. For this purpose the blocks or collars 48* 49* carrying the cams are adapted to slide on the said shaft and are therefore provided each with an annular groove 77* adapted to receive the fork 78*. Each of these forks extends down and is divided into two arms 78' at its lower end Fig. 1, and through these ends the rods 79, 81 extend, being slidably mounted in bearings 80 on the frame. One of the forks is secured to one of these rods and the other fork is secured to the other rod, the fastening means may consist of the set screw 78''. The rods are connected so as to move in opposite directions by a lever 82, pivoted on the frame at 83 and having its forked ends engaging pins 84, 85 extending down from bosses or collars 86 fixed to the said rods by the set screws 87. By moving the shift rods by hand the operator may shift the cams longitudinally of their shaft 50 either into or out of line with the rollers on the levers 46, 46' and in this way the mechanism for imparting the rotary reciprocating motion to the knitting machine may be thrown into or out of operation at will. The blocks or collars carrying the cams have a splined connection with the shaft consisting in the present instance of a pin 88 on each collar extending into openings in the hub of the bevel gear 52.

In Figs. 2 and 3 the cams are adjusted to a position out of line with the rollers 47 whereas in Fig. 4 they are adjusted into line with said rollers to operate the same and the mechanism connected therewith.

From the above it will be seen that I provide positively operating connections between the driving mechanism and the parts to be driven and positively operated and connected mechanism for varying the action of the driving connections so that the timing of the parts of the knitting machine will not be interfered with.

It will also be understood that the devices for lengthening and shortening the stroke of the rotary movable parts of the knitting

head can be used with any of the well known constructions for making the needles operative and inoperative to increase or decrease the length of the needle row, or the "picking" of the needles to make them operative or inoperative may be done if desired by hand.

It will be understood that where, in the appended claims, I refer to a "rotary knitting member" I mean the cam rings in the form of machine used herein to illustrate my invention, or other rotary parts which perform or aid in performing the knitting, such as the needle cylinder in the other type of rotary machine.

I claim:—

1. In combination in a circular knitting machine, a rotary knitting member, driving means including operating means for imparting a rotary reciprocatory movement to the said member uniform as to velocity and means for varying the length of stroke.
2. In a circular knitting machine, a rotary knitting member, driving means therefor for giving said rotary knitting member a rotary reciprocating movement, and means cooperating with said driving mechanism for varying the length of the reciprocatory strokes of said member, substantially as described.
3. In combination, in a circular knitting machine, a rotary knitting member, reversing drive mechanism therefor including clutch means, and the shifting and yielding detent for holding the clutch in the position to which it is shifted, said detent shifting in a direction opposite to that of the clutch, substantially as described.
4. In combination, in a circular knitting machine, a rotary knitting member, reversing drive mechanism therefor including clutch means, and the detent for holding the clutch in the position to which it is shifted, said detent also acting to impel the clutch in the direction in which it is started, and means for positively operating the said detent in a direction opposite to the movement of the clutch, substantially as described.
5. In combination, in a circular knitting machine, a rotary knitting member, reversing driving means therefor, including clutch members, a toothed block for shifting the clutch, means for shifting said block, and a spring detent engaging the toothed block, said detent having shifting movement in a direction the reverse of that of the toothed block, substantially as described.
6. In combination, in a circular knitting machine, a rotary knitting member, reversing means therefor comprising a clutch, and means operating the clutch comprising the shifting rod 26, the shifting rods 34, 35, having means for operating the rod 26, the pivoted lever connecting said rods 34, 35, and the means for operating said rods alternately in opposite directions, substantially as described.
7. In combination, in a circular knitting machine, a rotary knitting member, reversing driving means therefor including clutch members, a toothed block for shifting the clutch, a rod for shifting said block and a spring detent engaging the toothed block, said detent having shifting movement in a direction the reverse of that of the toothed block, rods 34, 35, for operating the rod of the shifting block, said rods 34, 35 being connected to move in opposite directions, substantially as described.
8. In combination in a circular knitting machine, a rotary knitting member, a driving mechanism therefor, comprising the reversing clutch and shaft to which rotary reciprocatory movement is imparted by said clutch, and means for reversing the clutch driven from the reciprocatory shaft, said means including a shaft geared to the reciprocatory shaft and connections therefrom to the clutch, and a power transmitting member joined to said connections for varying their operation and the period of operation of the clutch, substantially as described.
9. In combination, in a circular knitting machine, a rotary knitting member, a shaft with connections thereto for driving the same, shifting clutch means for imparting reciprocatory rotation to said shaft, a shaft, cams thereon, connections operated by said cams for shifting the clutch means and driving connections from the reciprocatory shaft to the cam shaft for driving the same, and a power transmitting member for altering the relation of the said connections to the cam for varying the lengths of stroke, substantially as described.
10. In combination, in a circular knitting machine, a rotary knitting member, drive mechanism including an automatically operating reversing member whereby a rotary reciprocation is imparted to the knitting member, reversing means including cams, a connection leading from each cam to the reversing member, and means by which said cams are rendered operative and inoperative each in relation to its own connections, substantially as described.
11. In combination, in a knitting machine, a rotary knitting member, driving means for said knitting member including reversing devices to give a reciprocatory movement and adjustable means for producing different length of the periods between the reversing actions to vary the lengths of the strokes, substantially as described.
12. In combination, in a knitting machine, a rotary knitting member, driving means including the clutches with means for throwing them into action alternately to produce reciprocatory motion and adjustable

ble means for producing different lengths of period between the clutch actions to vary the lengths of the strokes, substantially as described.

5 13. In combination in a knitting machine, a rotary knitting member, driving means including reversing devices to give a reciprocatory motion to said member, cams for operating said reversing devices and
10 connections between said cams and the reversing devices, said connections being adjustable toward and from the cams to vary the action thereon and thus change the lengths of the reciprocating strokes of the
15 knitting member, substantially as described.

14. In combination, in a knitting machine, a rotary knitting member, driving means including reversing devices to give a reciprocatory motion to said member
20 cams for operating said reversing devices and connections between said cams and the reversing devices, said connections being adjustable toward and from the cams to vary the action thereon and thus change the lengths
25 of the reciprocating strokes of the knitting member, said adjustable connections including the screw shafts and the means for operating them, substantially as described.

15. In a circular knitting machine, the combination of a rotary knitting member, driving means therefor with a reversing device for imparting reciprocatory motion to the knitting member, and means for varying the action of the reversing device and
30 thereby the length of stroke of the knitting member consisting of the reciprocatory screw shafts, means for turning them and connections adjusted thereby for operating the reversing device, substantially as described.
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16. In combination, in a circular knitting machine, a rotary knitting member, driving means including a reversing device to produce reciprocatory motion of said knit-

ting member, and means for operating the reversing device including connections between the same and the reversing device including screw shafts, and means for turning them to vary the action of the cams on said connections, substantially as described. 50

17. In combination, in a circular knitting machine, a rotary knitting member, driving means therefor including a reversing device, operating cams for said device, and connections between said cams and said device including the levers, the longitudinally movable screw shafts, the threaded blocks thereon, the links connecting the blocks and levers, the blocks movable longitudinally with the shafts and the links and levers between the same and the reversing mechanism with means for turning the screw shafts to adjust the connections, substantially as described. 55

18. In combination, in a circular knitting machine, a rotary knitting member, driving means therefor including a reversing device and cams reversely set, with connections for operating the reversing device, said cams being yieldingly mounted, substantially as described. 60

19. In combination in a circular knitting machine, a rotary knitting member, driving means including an automatically operating reverser for reversing the direction of stroke of said rotary knitting member, a power transmitting member, and timing means operated thereby for varying the periods between the operations of the reverser to thereby vary the lengths of stroke of the knitting member, substantially as described. 75

In testimony whereof, I affix my signature in presence of two witnesses.

FRANK WILCOMB.

Witnesses:

LEILA JENKINS,
KATHERINE H. FOX.