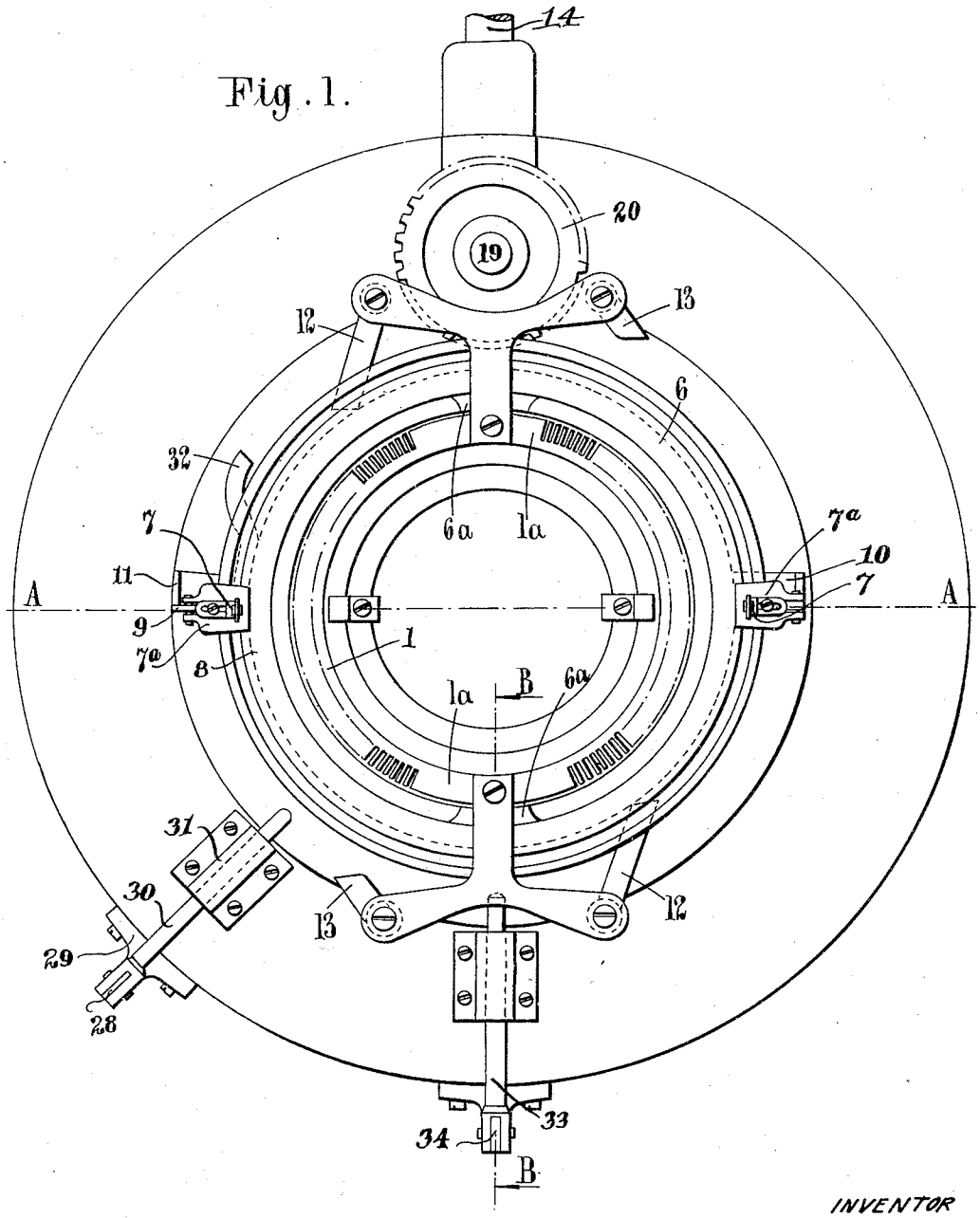
Nov. 6, 1928. 1,690,729

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CIRCULAR KNITTING MACHINE AND THE PRODUCTION OF FABRICS THEREON

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Fig. 1.



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Fig. 2.

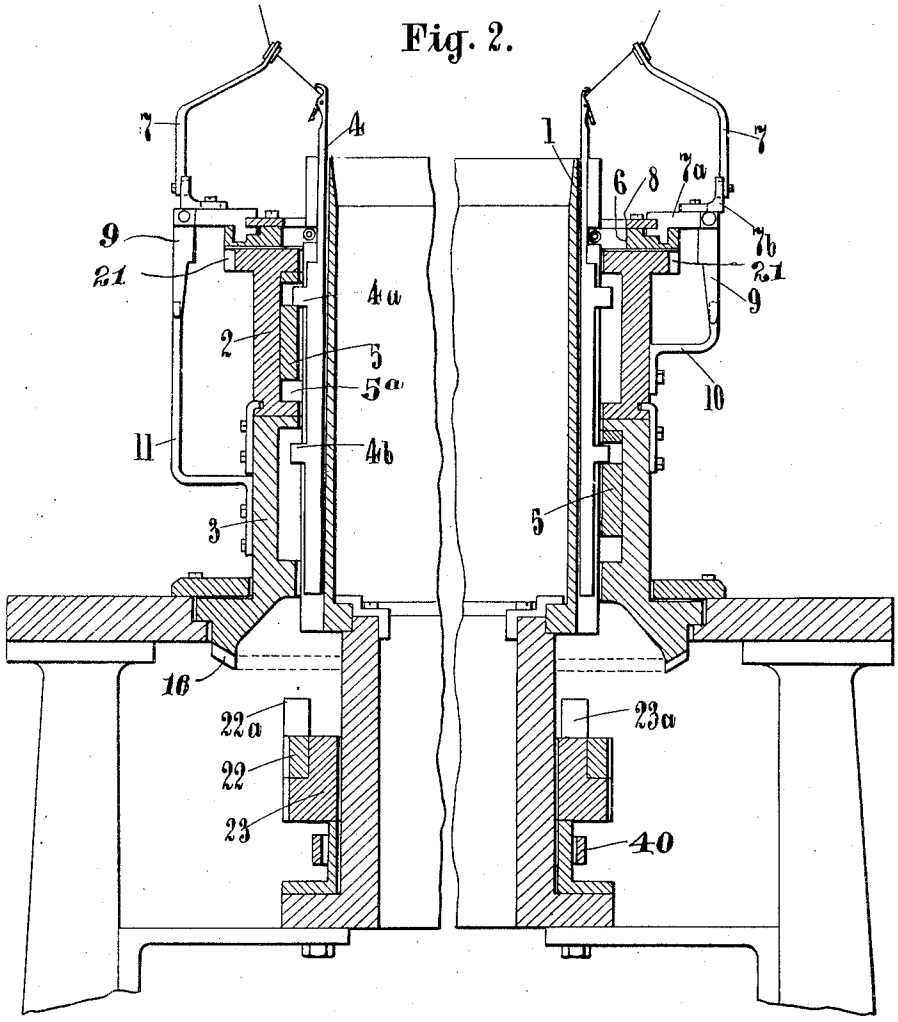
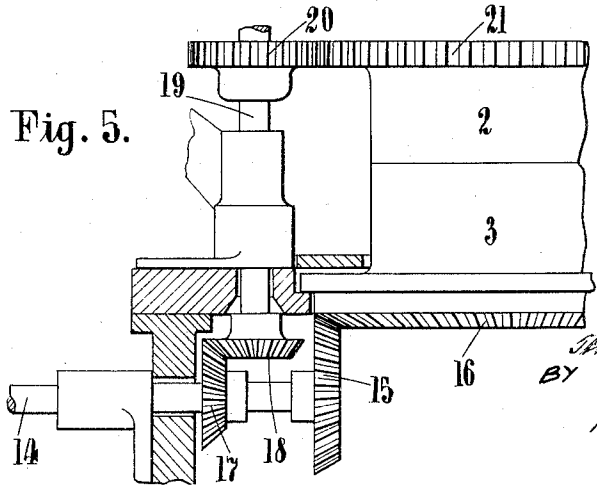


Fig. 5.



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Fig. 3.

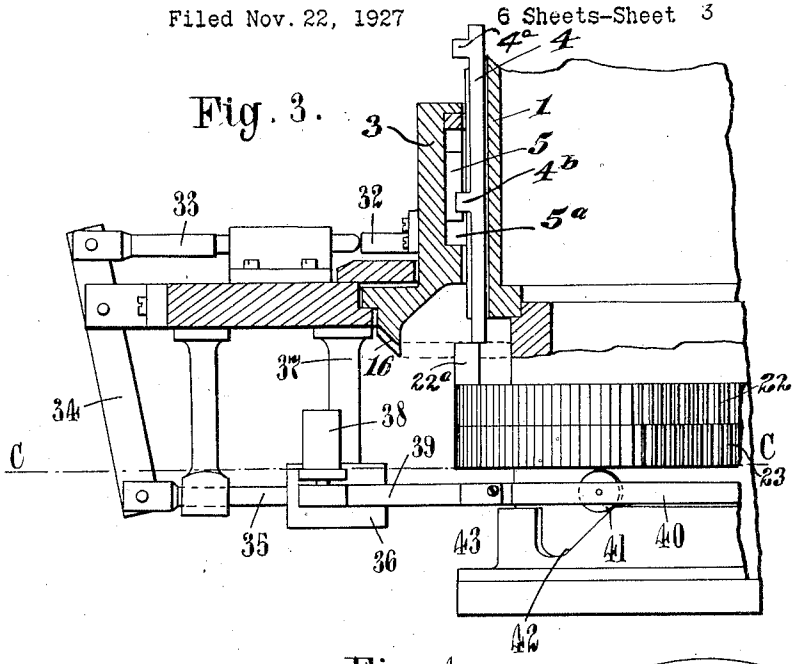
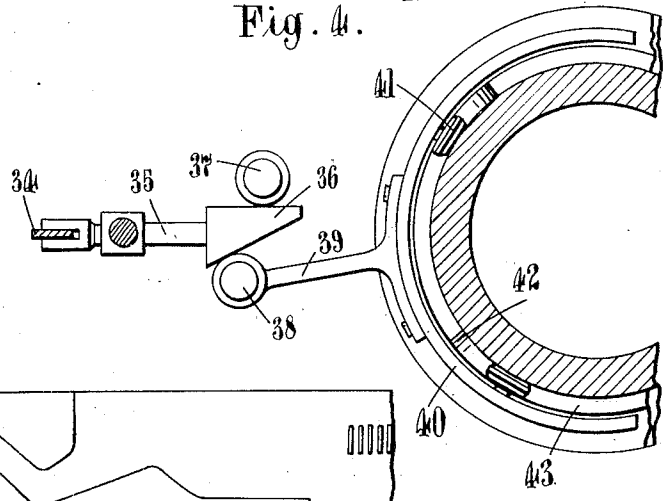


Fig. 4.



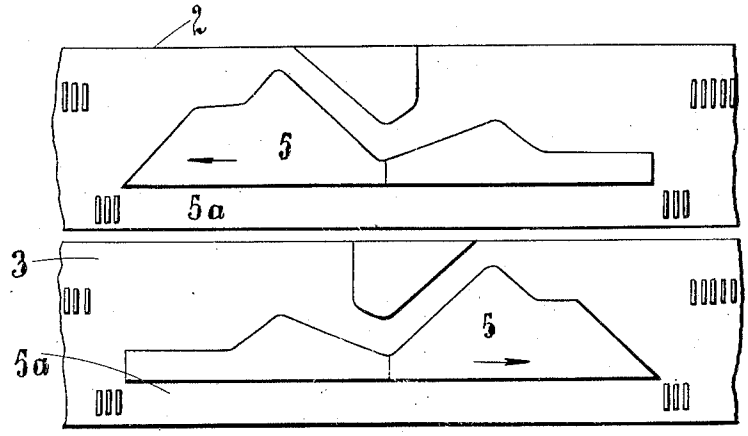


Fig. 6.

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Fig. 7.

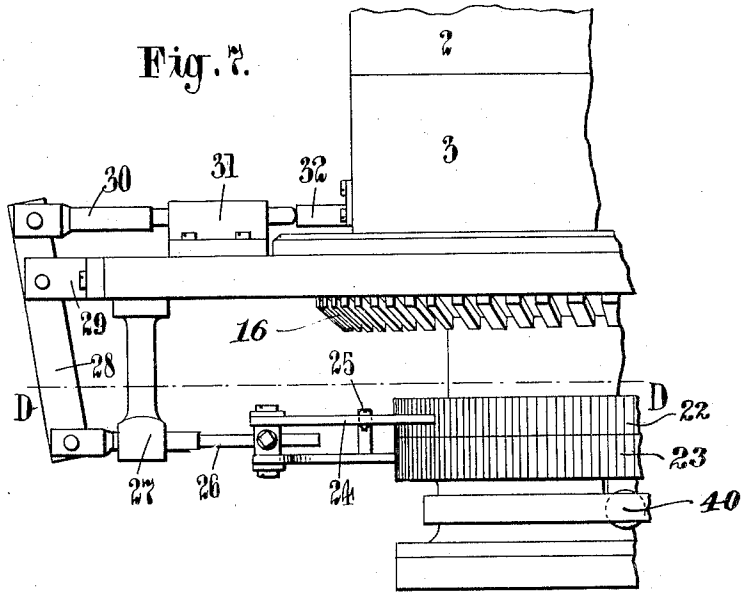
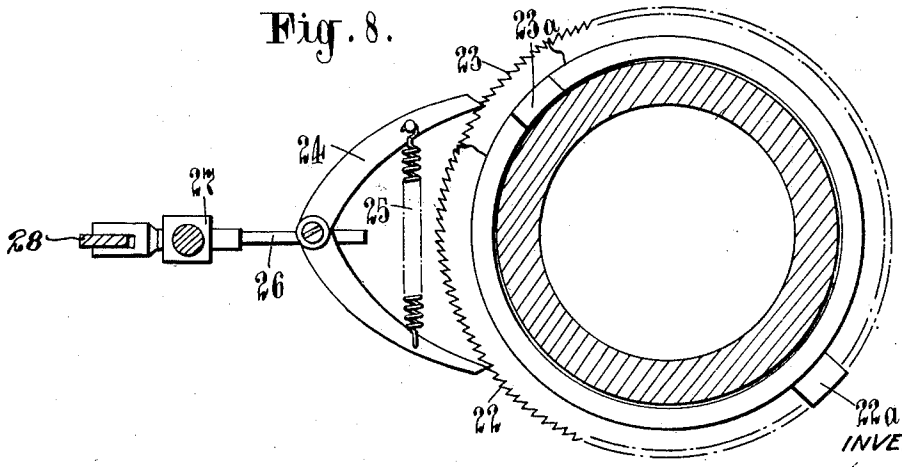


Fig. 8.



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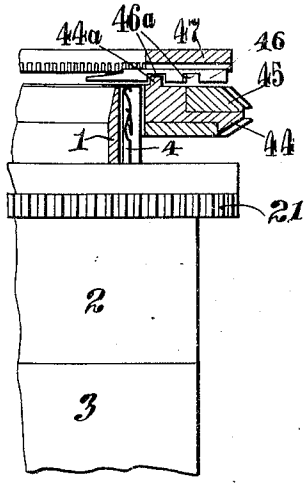


Fig. 10.

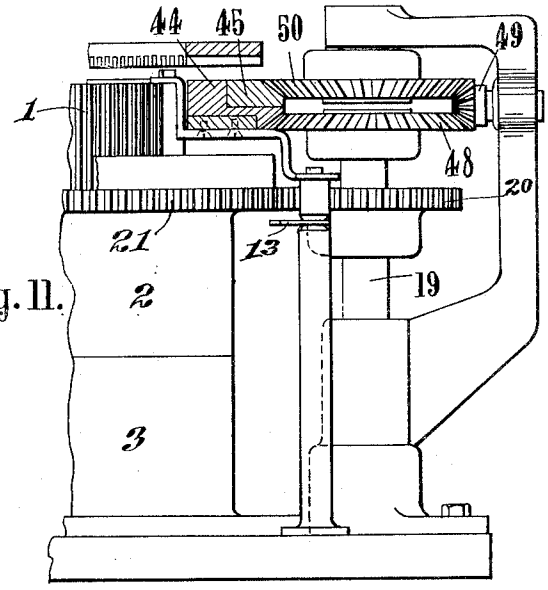
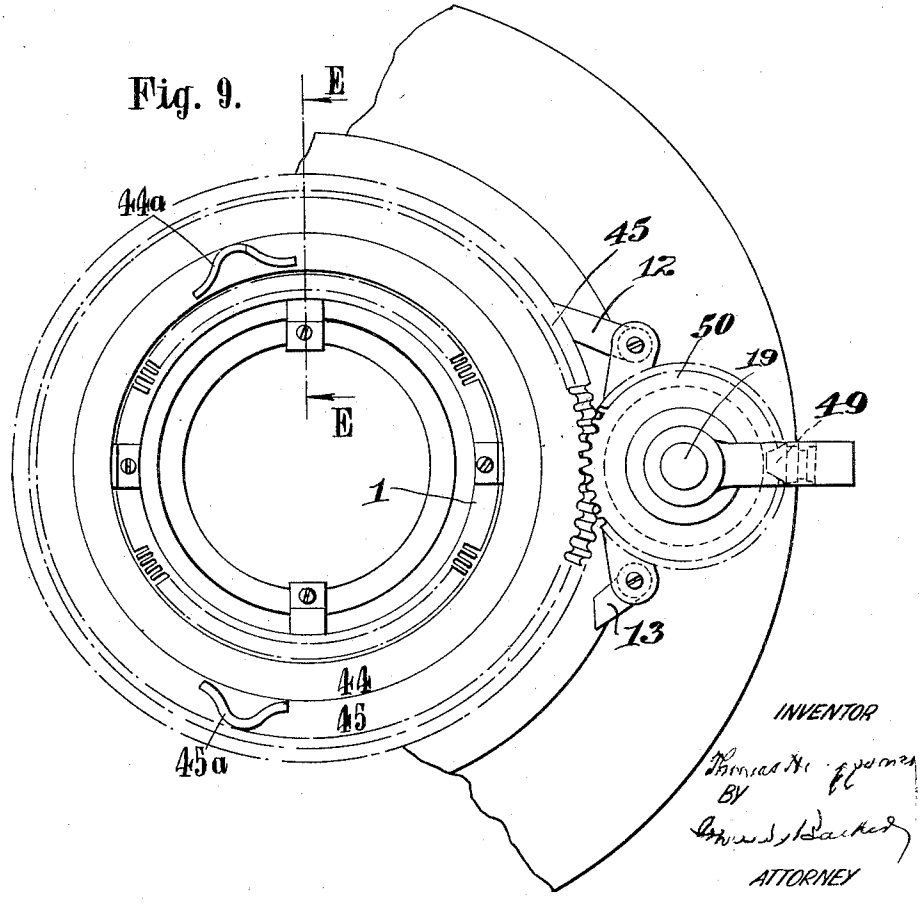


Fig. 11.

Fig. 9.



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CIRCULAR KNITTING MACHINE AND THE PRODUCTION OF FABRICS THEREON

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Fig. 12

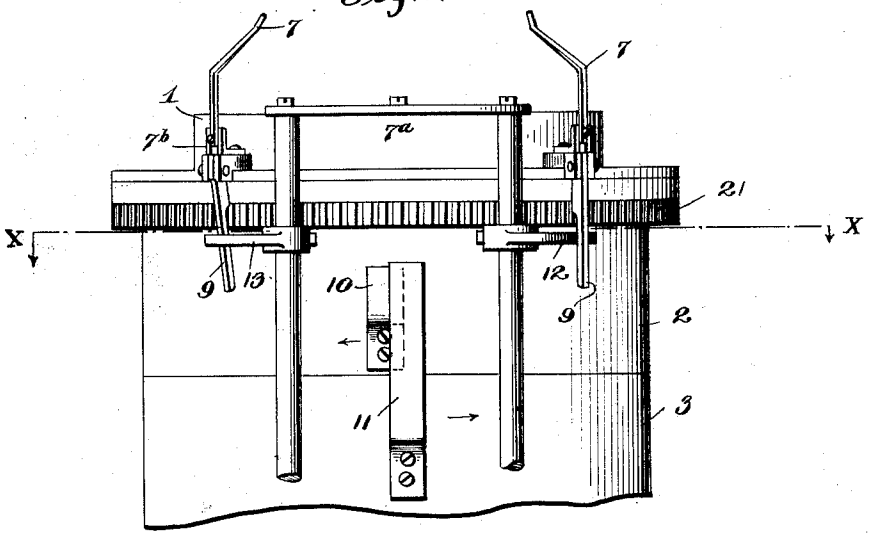
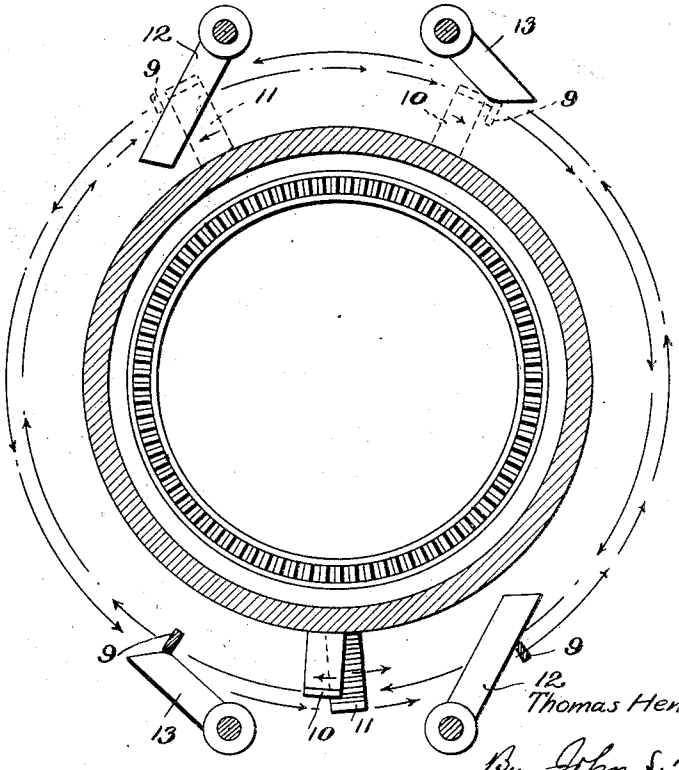


Fig. 13



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UNITED STATES PATENT OFFICE.

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CIRCULAR-KNITTING MACHINE AND THE PRODUCTION OF FABRICS THEREON.

Application filed November 22, 1927, Serial No. 234,961, and in Great Britain October 8, 1926.

This invention relates to improvements in circular knitting machines and the production of fabrics thereon and has for its principal object the provision of new or improved means for producing flat or non-circular fabrics on such machines, a specific object of the invention residing in the provision of means for producing such fabrics in a more expeditious manner than has hitherto been possible.

In accordance with customary practice flat or non-circular fabrics are produced on circular knitting machines by imparting reciprocatory motion to the needle cylinder or cam box in such a manner that only a fraction of the total number of needles take thread. It will be appreciated that in knitting by reciprocation the production is comparatively slow and a further object of the invention consists in providing means for overcoming this existing disadvantage.

With the above and other objects in view the principal feature of this invention consists in the provision of means for producing flat fabrics with selvedge edges on circular knitting machines by imparting continuous rotary motion to the needle-operating means.

By the expression "fabrics with selvedge edges" is to be understood fabrics with finished edges, such fabrics being distinguished from fabrics joined by loose thread loops at the front or rear.

A further feature of the invention consists in producing flat fabrics on a circular knitting machine without reciprocation of the needle cylinder or cam box in such a manner that the knitting operation is continuous; that is to say there is no appreciable time interval between the completion of one course and the commencement of the next succeeding course.

Another feature of the invention resides in producing flat fabrics on circular knitting machines without reciprocation of the cam box or needle cylinder and in which the direction of knitting is opposite in successive courses.

Still another feature of the invention consists in producing flat fabrics on circular knitting machines without reciprocation of the cam box or needle cylinder by the employment of two cam boxes rotating in opposite directions and yet another feature resides in utilizing needles each having butts engaging the cams of each of the said cam boxes.

Further features of the invention will be appreciated from a consideration of the following description of a convenient embodiment of the present invention.

For the purpose of more fully describing the nature of this invention, reference will now be made to the accompanying drawings, wherein:—

Figure 1 is a plan view of a circular knitting machine in accordance with this invention, the sinkers and operative means therefor having been removed.

Figure 2 is a sectional elevation on line A—A of Figure 1.

Figure 3 is a vertical section through part of the machine on line B—B of Figure 1.

Figure 4 is a sectional plan on line C—C of Figure 3.

Figure 5 is a part sectional elevation illustrating the drive for the cam boxes.

Figure 6 is a diagrammatic view illustrating the needle cams.

Figure 7 is an elevational view showing part of the mechanism employed for increasing the width of the fabric being produced.

Figure 8 is a sectional plan on line D—D of Figure 7.

Figure 9 is a plan view showing the sinker cams.

Figure 10 is a detail sectional view showing the method of mounting and operating the sinkers, the section being taken at the position E—E of Figure 9.

Figure 11 shows in part sectional elevation suitable means for driving the sinker cams.

Fig. 12 is an elevation of the upper portion of the knitting cylinder and the boxes that carry the knitting cams, showing the switching mechanism for the thread guides, many other parts of the machine being omitted.

Fig. 13 is a horizontal section on the line x—x of Fig. 12.

In one method of carrying out the invention same will be described as applied to a circular knitting machine employing latch needles fitted within a stationary needle cylinder 1. Two revolving cam boxes or races 2, 3 are provided disposed one over the other around the cylinder 1 and adapted to be driven round said cylinder in opposite directions at equal speeds.

The needles 4 are provided with two butts 4^a, 4^b, each butt being adapted to coact with one of the two cam races, and as the cams rotate, the needles are caused to rise and fall in succession first by the one cam and then by the other, the opposite rotation of the cams

causing the successive motions to progress first in one direction and then in the other.

A cam 5 such as is used in each box is shown in Figure 6, it being understood that the cam of one box is oppositely disposed to that of the other.

As the cams 5 appertaining to the boxes 2, 3 pass each other twice in each revolution, and in order to avoid these passing points, the two diametrically opposed parts of the cylinder 1 at said passing points are void of needles and may be plain as at 1^a; needles being fitted in either or both sides of the cylinder dependent upon whether one or two pieces of fabric is or are required to be produced.

For the purpose of feeding yarn to the needles a guide bar or rail 6 is suitably fixed above the upper cam box 2 concentric with the needle cylinder, and the yarn guide or guides 7 is or are adapted to move freely along said bar. The fixing of the bar 6 may be effected by bracket portions 6^a Fig. 1 to the cylinder 1 at the plain parts 1^a.

The yarn guide may comprise a base portion 7^a slidable in a groove in the bar 6 and held therein by fixing ring 8, an angle piece 7^b secured by screw and slot connection to the base piece 7^a so as to be adjusted in a radial direction, and the guide proper 7 adjustably secured in a vertical direction by screw and slot connection to an upstanding part of said angle piece 7^b Figs. 1 and 2. To the underside of the adjustable angle piece 7^b of the guide 7 is pivoted a depending finger 9, preferably tapered, said finger being capable of a certain degree of radial movement against spring or frictional resistance which serves to retain the finger in any position to which it is moved.

On the upper cam box 2 is an outwardly projecting arm 10 which may be of angle shape, a corresponding but longer arm 11 being provided on the lower box 3. The operation (see particularly Figs. 12 and 13) is such that the arm 10 on the upper box 2 engages the depending finger 9 and propels the guide 7 round the cylinder until same has passed all of the needles at the one side of the machine, after which a fixed deflector 12 (Figure 1) coacts with said finger 9 to deflect same outwards from the path of arm 10 and withhold the guide 7 from further movement in that direction. Immediately afterwards the second arm 11 carried by the lower and oppositely rotating box 3 (which arm 11 projects out a little further than arm 10) coacts with the deflected depending finger 9 and propels same round in an opposite direction so as to traverse the guide back past all the needles until a second deflector 13 is reached which functions to press the pivoted finger inwards to its original position. This cycle of operation is repeated, the guide being propelled to and fro, and during each travel of said guide across the needles, yarn is fed and a row or course of stitches produced.

In this way fabric is produced without reciprocation of the cam box or any other part of the machine excepting the relatively light and easily moved yarn guide or guides.

In the drawings two yarn guides with the necessary deflectors are shown, and with such arrangement two pieces of fabric can be simultaneously knitted.

The opposite rotation of the two cam boxes 2, 3 at equal speeds is effected from a single drive shaft 14 (Figure 5). The lower box 3 may be driven through intermeshing gears 15, 16 directly from shaft 14, and the upper box through intermeshing bevels 17, 18 on the driveshaft 14 and an intermediary shaft 19 respectively, and a further gear 20 on the last-named shaft meshing with the gear 21 on the cam box 2.

In order to enable the width of the fabric (or each piece of fabric) produced to be varied, means are provided for bringing needles at each side of the group from an idle position in a secondary race (indicated at 5^a and Figure 6) wherein same are not operated upon by the cams 5, into a knitting position wherein said cams 5 engage the butts 4^a, 4^b.

In one method of accomplishing this two rings 22, 23 (hereinafter called lifting rings) encircle a cylindrical portion of the machine below the needle cylinder, one of the rings conveniently being of angle section to form a bearing for the other ring Figs. 2, 3, 7 and 8. These rings carry upstanding bits or lugs 22^a, 23^a which are positioned immediately beneath the lower ends of the stems of those needles which are in the idle position, i. e. with their butts in the secondary cam races 5^a.

In one arrangement the bits 22^a, 23^a are of a size sufficient to engage with one needle only, said bits being spaced apart so as to be located beneath the idle needle next adjacent to the operative group or row at each side or end thereof, and when it is desired to widen the knitted fabric, the rings with bits are lifted so as to raise to the operative position a needle on each side of the group (or each group) at predetermined intervals, say for example at each revolution of the machine, the raising being effected while the knitting cams 5 are passing each other in a plain portion 1^a of the cylinder.

It will of course be understood that to produce a gradual widening of the fabric, the upstanding bits 22^a, 23^a must be gradually moved farther apart, and to do this an intermittent rotation of the lifting rings in opposite directions is effected, such rotation taking place immediately prior to the lifting motion of the rings to raise the needles.

To rotate the rings 22, 23 a double pivoted

clawker 24 may be provided (Figs. 7 and 8) the two arms of which are held by a spring 25 in engagement with circumferential ratchet teeth on the two rings, one clawker arm on each ring. The two arms of the double clawker are secured at their pivot to a radially extending rod 26 slidable within a fixed bracket 27, said rod being pivoted at its outer end to the lower end of a lever 28 fulcrumed between its ends to a fixed frame portion 29 and pivoted at its upper end to the outer end of a second radially extending pin 30 which is slidable within a fixed bearing 31.

The inner end of the sliding pin 30 is shaped as a curved or bevelled nose and normally pressed towards the machine cylinder by a suitable spring, and at each revolution of the lower cam box 3, a projection or cam piece 32 Figs. 1, 3 and 7 thereon coacts with said nose so as to press the pin 30 outwards and through the lever 28 and sliding rod 26 press apart the arms of clawker 24, thus rotating the lifting rings to the extent of a needle in opposite directions.

Immediately after operating the clawker 24 to rotate the lifting rings, the cam projection 32 coacts with and radially displaces another sliding pin 33 Figs. 1, 3 and 4 pivoted to the upper end of a second fulcrumed lever 34, the lower end of said lever being pivotally connected to the outer end of a further slidably mounted radially extending rod 35 carrying at its inner part a bevelled nose portion 36 which acts between a fixed vertical post or roller 37 and a second roller 38. The last-named roller 38 is carried by a radially projecting arm 39 secured to a rotatably mounted ring 40 which ring carries on inwardly projecting pins a plurality of suitably spaced rollers 41 (preferably four) which are normally accommodated within angle shaped recesses 42 in a relatively stationary ring or member 43.

The outward movement of pin 33 by the cam projection 32 effects an inward movement of rod 35 and bevelled nose 36, the latter partially rotating the ring 40 with rollers 41 which rollers ride upwardly out of the angle recesses 42 and in so doing lift the two lifting rings 22, 23 which rest upon said rollers. In this way the bits 22^a, 23^a lift the selected needles immediately after the lifting rings have been rotated to the required degree.

If desired, the ring and bit lifting means may be bluffed, i. e. rendered inoperative, for a predetermined number of courses, and the bits 22^a, 23^a made of sufficient size to raise a plurality of needles simultaneously at each side of the group or row, thus enabling a uniform or varied degree of widening to be produced at regular or variable intervals.

Means are also advantageously provided for throwing out of operation both the lifting and racking motion of the lifting rings so as to produce fabric of uniform width, and for bringing said motion into operation at the exact required times, such means comprising if desired, one or more travelling chains with projecting bits.

Above the needle cylinder and concentric therewith are suitably mounted two sinker cam rings 44, 45 Figs. 9, 10 and 11 adapted to be rotated in opposite directions at equal speeds, each ring having an upstanding cam piece 44^a, 45^a. The sinkers 46, which are adapted to slide radially in tricks in a fixed ring 47, have two recesses 46^a, and as the rings 44, 45 rotate, the cam pieces 44^a, 45^a coact alternately with said recesses to withdraw the sinkers and return same to the normal position. The cam pieces 44^a, 45^a are timed to withdraw the sinkers at the times the knitting cams 5 are operating upon the needles, and the passing of the two sinker cam pieces occurs at the plain portions 1^a of the needle cylinder.

The drive of the sinker rings may be effected indirectly from the main drive shaft 14 by extending upwardly the vertical shaft 19 and fixing thereon a bevel wheel 48 which meshes with a bevel gear at the circumference of the one sinker cam ring 44, an opposite rotation being transmitted to the second ring 45 by way of small idle bevel 49 and a separately mounted bevel 50 meshing with a bevel gear around said second cam ring. The one sinker cam ring 44 may be recessed to receive the second ring 45 and bring the upper faces thereof in one plane.

The invention is intended to apply to machines producing either plain or ribbed fabric on either latch or spring (i. e. bearded) needles, and tuck and colour designs striping and plating threads may be introduced by any suitable means. Where bearded needles are employed any suitable pressing means such as presser wheels or rings would be installed.

The invention is also intended to apply to circular machines adapted to produce socks and stockings, which by the means here proposed may be made capable of producing such articles with shaped or fashioned ankles or other desired parts.

I claim:

1. In a circular knitting machine for simultaneously producing a plurality of flat knit fabrics with selvedge edges, the combination of a stationary cylinder, needles supported by the cylinder and arranged in groups, those of each group serving to knit a complete piece of fabric, such groups being separated from each other by spaces void of needles, and each needle being formed with two butts that are spaced apart, rotary cam carriers supported concentrically with the needle cylinder, means for rotating the cam carriers simultaneously in opposite directions, needle operating cams carried by the carriers for engaging re-

spectively with the separated butts of the needles, the cams being located diametrically opposite each other so they pass one another when opposite the void spaces of the needle cylinder, and fixedly connected with their respective carriers so they move in circular paths only, guides for delivering threads to the needles arranged to move in synchronism with the knitting cams, radially movable sinkers supported above the needle cylinder and each formed with two recesses, a pair of cams rotatable in paths concentric with the needle cylinder for engaging respectively each with one set of the recesses of the sinkers and means for rotating the sinker-operating cams in opposite directions.

2. In a circular knitting machine for simultaneously producing a plurality of flat knitted fabrics with selvedge edges, the combination of a cylinder, needles supported by the cylinder arranged in groups each for knitting a separate piece of fabric, the groups being separated from each other by cylinder spaces void of needles, at least one group of needles including a set of needles arranged to be operated whenever the machine is in use and sets of fashioning needles at the sides of the first said set, each needle being formed with two butts spaced apart, rotary cam carriers supported concentrically with the needle cylinder, means for rotating the cam carriers simultaneously in opposite directions, needle-operating cams carried by the cam carriers for engaging respectively with the separated butts of the needles, and fixedly connected to their respective carriers so they move only in circular paths, means for bringing into operation the fashioning needles comprising a pair of needle-lifting cams supported concentrically with the needle cylinder, automatic means for rotatively shifting the cams to engage with the fashioning needles that are to be brought into operation, and means for lifting the said cams after they have been shifted to bring the needles into position to be operated by the needle cams.

3. The combination stated in claim 2 whereby the means for shifting the cams that operate the fashioning needles are simultaneuosly rotated in opposite directions each to an equal extent.

4. The combination stated in claim 2 wherein the means for rotatively shifting the cams that bring into operation the fashioning needles are operated from a part carried by one of the needle cam carriers.

5. The combination stated in claim 2 wherein the means for lifting the cams that bring into operation the fastening needles are operated from a part carried by one of the needle cam carriers.

6. The combination stated in claim 2 wherein both the means that rotatively shift the cams that bring into operation the fashioning needles and the means for lifting such cams after being shifted are successively operated from one of the needle cam carirers.

7. The combination stated in claim 2 wherein the means for rotatively shifting the cams to bring into operation the fashioning needles comprise a pair of clawkers adapted to engage respectively with rings connected with and carrying the said cams, means for reciprocating the said clawkers to cause rotative movement of the cams, and a cam projection carried by one of the knitting cam carriers for operating the said reciprocating means at each rotation of the said carrier.

8. The combination stated in claim 2 wherein the means for lifting the cams that bring into operation the fashioning needles comprise stationary inclines below the said cams, rollers adapted to move along the said inclines, operating as they move upwardly along the same to lift the cams, carriers for the rollers, reciprocating means for moving the carriers to cause the rollers to move up the incline, and a cam projection carried by one of the knitting cam carriers for operating the said reciprocating means at each rotation of the said carrier.

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