

May 2, 1933.

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1,907,341

CIRCULAR KNITTING MACHINE

Filed Dec. 12, 1931

3 Sheets-Sheet 1

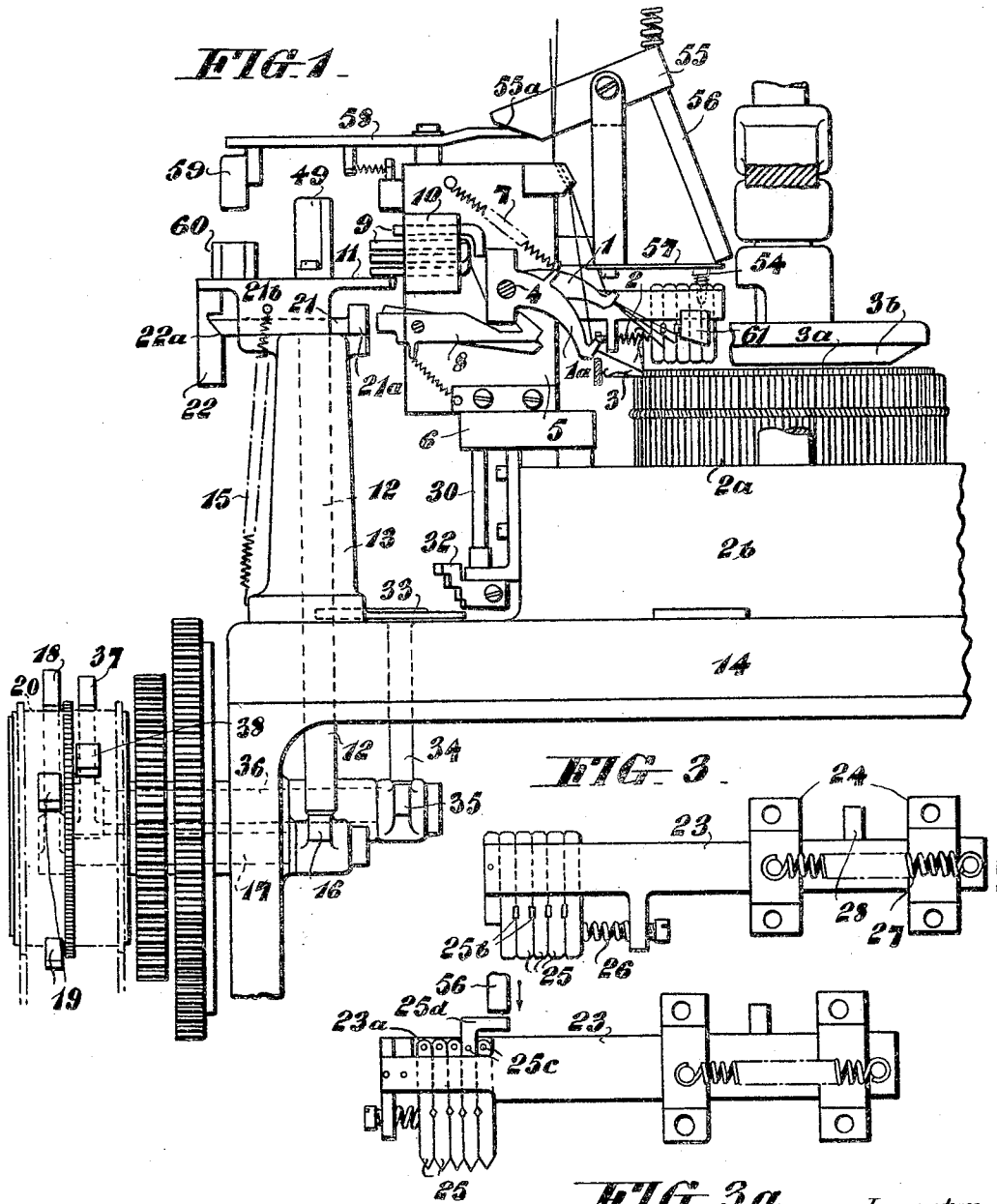


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3 Sheets-Sheet 2

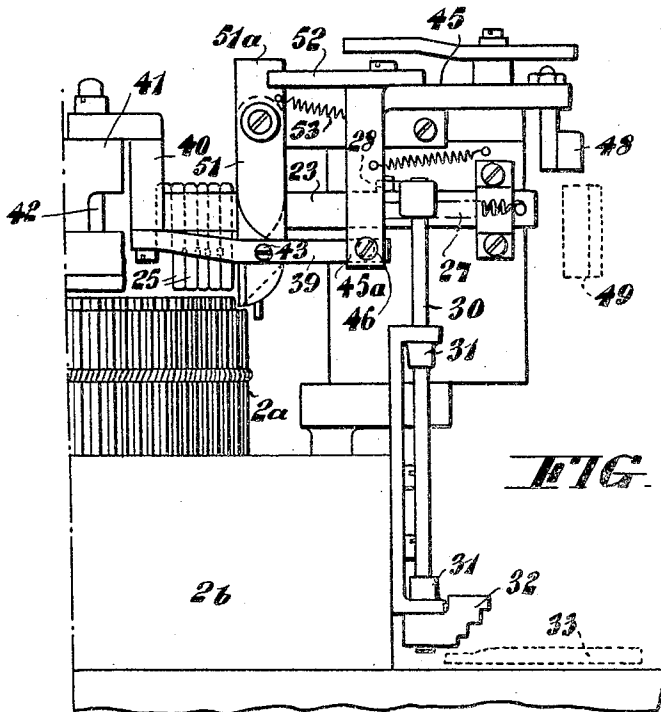


FIG. 2

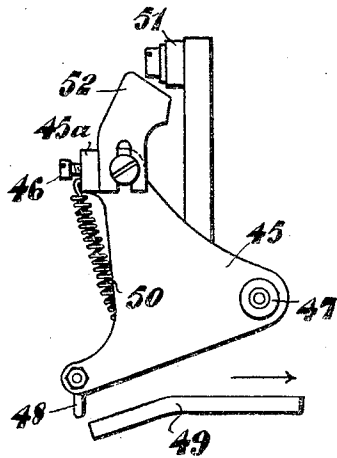


FIG. 6

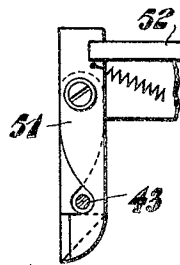


FIG. 5

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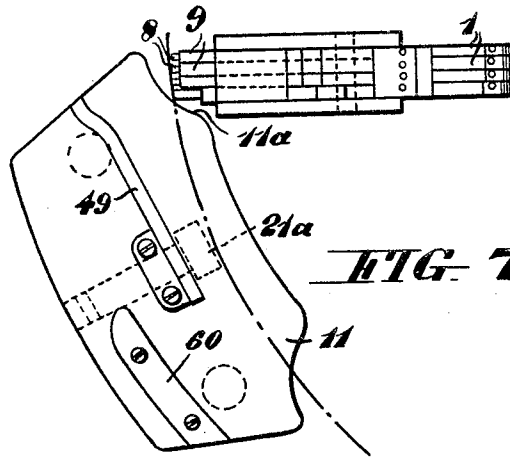


FIG. 7

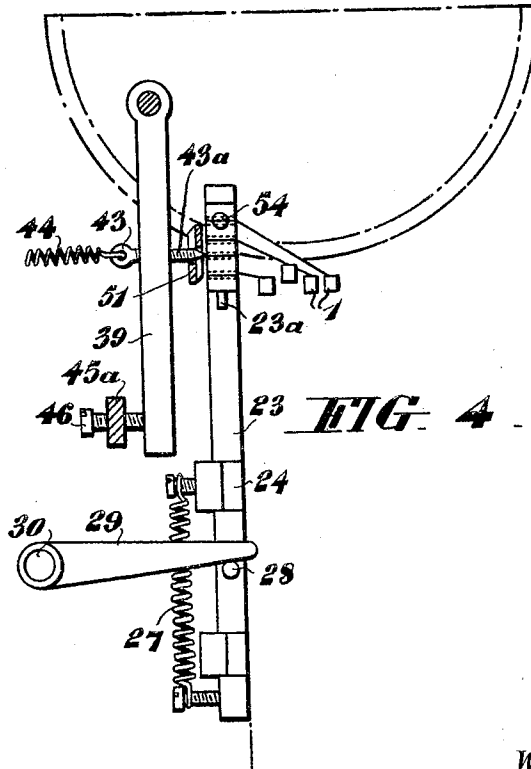


FIG. 4

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CIRCULAR KNITTING MACHINE

Application filed December 12, 1931, Serial No. 580,699, and in Great Britain December 16, 1930.

This invention relates to circular knitting machines and has particular reference to that type of machine which embodies a plurality of yarn feeders controlling a plurality of yarns, which may differ from one another in nature and/or colour, and adapted to be moved into and out of yarn feeding positions to produce horizontal bands or stripes of differing appearances in the fabric.

This invention is concerned with circular knitting machines having a plurality of changeable yarn feeders as above and means for separately trapping the yarn appertaining to each feeder upon the feeder being withdrawn to an inoperative position.

In many types of circular knitting machines having changeable yarn feeders it has hitherto been customary to provide a device in which all of the yarns are trapped as they are withdrawn from being fed to the needles. The disadvantage of a trapper which is common to a plurality of feeders is, however, experienced when it is desired to release a yarn therefrom and re-introduce said yarn to the needles, since it frequently happens that when a yarn to be re-introduced is withdrawn from the said trapper, the said yarn inadvertently withdraws one or more of the other yarns from the trapper. The inadvertently withdrawn yarns fail to be knitted by the needles when their feeders are subsequently moved to the feeding position and the fabric is "pressed off" from the needles.

The primary object of this invention is to provide improved means for separately trapping the yarns appertaining to a plurality of changeable yarn feeders as above with a view to enabling an increased number of said feeders to be selectively moved into and out of thread feeding positions during the production of a knitted article and, consequently, an increased number of horizontal striped patterns to be produced in the said article.

A particular object of the invention is to provide means for enabling an increased number of horizontal striped patterns to be knitted into ribbed tops for stockings and socks, on a circular rib knitting machine.

According to the present invention in a circular knitting machine of the type set

forth a trapping element is associated with each or selected ones of the yarn feeders and means are provided whereby when a feeder is moved from its feeding to its inoperative position, the associated trapping element is automatically moved to a position to trap the thread or threads adapted to be fed by the said feeder.

Circular knitting machines embodying a plurality of changeable yarn feeders have hitherto been provided which incorporate a separate trapping member for the yarn of each feeder and means for operating the said trapping member to trap the yarn when its feeder is withdrawn from a feeding position. In such machines, however, the trapping members have had no movement relatively to the feeders, apart from their small opening and closing or trapping movement.

The yarn trapping device according to the present invention may be adapted to be moved radially in regard to the needle circle and the different yarns may be trapped between different contiguous faces of several adjacent trapping elements.

A further feature of the present invention consists in providing a plurality of adjacent spring pressed trapping members, one yarn being gripped between each trapping member and its neighbour, and mechanism to move the assembled trapping elements over the needle circle so that any given yarn raised from its feeding position by the operation of a yarn feeder is caused to be engaged by a particular pair of said trapping members.

Conveniently the mechanism for displacing the trapping member in relation to the needle circle operates in timed relation with the mechanism for moving the yarn feeders into and out of the feeding position.

In order to facilitate the individual trapping of the yarns means are provided for opening the selected trapping element to receive the withdrawn yarn.

A relatively stationary intermittently operating cutting device common to all of the said yarns is also provided.

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 front elevation of part of a circular rib knitting machine to which the present invention is applied.

Figure 2 is a rear elevation illustrating some of the principal parts of the invention.

Figure 3 illustrates in detail a composite yarn trapping member provided in accordance with this invention.

Figure 3a illustrates a modified construction of trapping member.

Figure 4 is a plan view of the said trapping member and certain of its associated operating members.

Figure 5 is a detail elevation of the yarn cutter.

Figure 6 is a detail plan view illustrating the yarn cutter operating mechanism, and

Figure 7 is a detail plan view of a cam plate and yarn feeder housing shown in elevation in Figure 1.

By way of example only, the invention will be described as applied to a circular rib knitting machine adapted for the production of rib tops for children's socks and stockings.

In this machine four yarn feeders or guides are provided and each of these feeders, when in its lowered position, is adapted to feed its yarn between the open hooks of the raised cylinder needles 2 and the forwardly projected dial or rib needles 3, in the well known manner. Means hereinafter described, are provided for moving selected of the said feeders 1 into and out of the feeding position to provide horizontal striped patterns in the sock or stocking top being produced, the said feeders controlling yarns of different colour or nature.

The needle cylinder 2a and the rib dial 3a are stationary and the yarn feeders 1, mechanism directly associated therewith, needle operating cams 2b and 3b and the yarn supplies, rotate.

The yarn feeders are pivoted upon a horizontal spindle 4 which has its extremities located in side plates 5 of a rectangular housing supported by a bracket 6 from the cylinder needle cam box 2b. The said feeders are normally retained in their raised inoperative position by coiled springs 7, but when lowered to the feeding position, are engaged by spring influenced pivoted catch levers 8 and retained in the feeding position until the said levers 8 are pivotally displaced.

The movement of the feeders into the operative position is effected through horizontal thrust rods 9 one of which is provided for each feeder. These rods are positioned at different heights and are slidably supported in a block mounting 10, the inner extremity of the said thrust rods being bent, where nec-

essary, to engage with the upper parts of the pivoted extremities of the feeders.

The selection of the feeders is effected by a non-rotating but vertically adjustable cam plate 11 mounted upon the upper extremity of a vertically slidable spindle 12 which is supported in a bracket 13 and passes below the frame 14 in which the cam box 2b is rotatably mounted. The cam plate 11 is normally retained in its lowermost position, whereat it will not engage the thrust rods 9, by a coiled spring 15 and the lower extremity of the spindle 12 rests upon the forwardly projecting extremity of an arm 16 secured to a shaft 17 rotatably mounted at the rear and side of the machine. A second arm 18 projects forwardly from and is secured to the shaft. This latter arm 18 is adapted to be engaged by studs 19 of different heights carried by an intermittently traversing chain 20 at the side of the machine, to rotate the said shaft 17 and raise the arm 16 and spindle 12. The arrangement is such that according to the particular height of stud 19 which engages the lever 18, the spindle 12 and cam plate 11 is raised to a predetermined height whereat the cam plate is in the path of a selected thrust rod 9 and, as the said rod is carried around, it engages with the cam plate, is slid thereby and lowers its feeder into the operative position to be retained by one of the catch levers 8.

Slidably mounted upon the upper part of the bracket 13 is a horizontal bar member 21 having at its inner extremity a cam portion 21a and at its other extremity a bevelled surface 21b. This surface is adapted to be engaged by a bevelled surface 22a provided on a member 22 extending vertically downwards from the cam plate 11, and when the said cam plate is raised to a predetermined height to select a feeder for operation, as above described, the relative movement of the bevelled surfaces 21a and 22a causes the member 21 to slide towards the needle cylinder and positions the cam 21a in the path of the rotating feeder catch levers 8. By this means the catch levers 8 are pivoted to release the feeder which is in operation. The sequence and timing of operations in the introduction and withdrawal of the yarn feeders will be hereinafter described.

Mechanism for selectively trapping and for cutting the withdrawn yarn and for releasing and cutting the introduced yarn, in accordance with this invention, will now be described.

A composite yarn trapping member 23 is mounted for horizontal sliding movement in guides 24, see Figs. 2, 3 and 4, on the rear side of the feeder housing 5 and is carried around the machine with the said housing. This trapping member comprises a bar of rectangular section and supports at or near its inner extremity a plurality of vertically dis-

posed adjacently positioned plates 25. These plates are accommodated in a slot 23a in the trapping member and are pressed together by a short compression spring 26, see Fig. 3.

5 Each pair of the plates 25 constitutes a trapping element for one of the yarns appertaining to the feeders 1, each of the said yarns being adapted to be received and retained between a pair of the adjacent plates 25.

10 The trapper member 23 is normally retained in its innermost position by a coiled spring 27. On the upper surface of the said trapper member, at a position substantially midway in its length, an upwardly projecting pin 28 is provided adapted to be engaged by an arm 29, carried at the upper extremity of a vertical rotatably mounted spindle 30.

15 The bracket 31 in which the spindle 30 is mounted is secured to and rotates with the cam box 2a and at the lower extremity of the said spindle a stepped projecting member 32 is secured, the said member being adapted to engage with a second non-rotating cam plate 33. The cam plate 33 is normally positioned below the stepped member 32 and is adapted to be raised to predetermined heights, to engage with selected of the stepped portions of the said elements. The arrangement is such that as the cam plate 33 is raised to engage with the higher stepped portions of the member 32, the spindle 30 is rotated to a greater extent and effects, through the arm 29, comparatively extensive sliding displacement of the trapper member 23. When the cam plate 33 engages with the lower projections on the member 32 reduced sliding displacement of the trapper member is effected.

20 The cam plate 33, see Fig. 1, is carried at the upper extremity of a spindle 34 which rests upon an arm 35 carried by and projecting forwardly from a second horizontal shaft 36 extending at the rear and side of the machine, the said shaft also carrying a second forwardly projecting arm or lever 37 adapted to be engaged by a second row of studs 38 of varying height provided on the chain 20 from which selection of the feeders 1 is effected, as before described. The engagement of the varying heights of studs 38 with the arm 37 effects rotation of the shaft 36 and, through the arm 35 and spindle 34, raises the cam plate 33 to engage with the different stepped portions of the member 32.

25 In order to facilitate the passage of a withdrawn yarn between its appointed trapping element the lower edges of the trapper plates 25 may be slightly bevelled as shown and means may be provided for opening the said trapping element simultaneously with the raising of the corresponding yarn feeder.

30 To effect this a horizontal lever 39, Figs. 2 and 4, may be pivotally mounted at its one extremity to a bracket 40 conveniently secured to a boss 41 encircling the vertical

shaft 42 which carries the dial needle cams 3b. At a position substantially midway in the length of the lever 39 a screwed pin 43 is secured, the one extremity 43a of the said pin being pointed and adapted to be forced between the plates 25 adapted to trap the withdrawn yarn. The pin 43 is normally retained withdrawn by a suitably anchored coiled spring 44 and the lever 39 and pin 43 are adapted to be forced inwardly, to separate the trapping plates against the influence of the said spring, by a pivoted substantially triangular plate 45, Figs. 2 and 6, a downwardly extending portion 45a of the said plate carrying an adjustment screw 46 which bears against the said lever 39. The plate 45 is pivoted at 47 and carries a projecting element 48 adapted to engage with an upstanding cam 49 mounted on the vertically adjustable cam plate 11. The plate 45 is normally retained outwardly extending by a coiled spring 50.

35 A cutting device 51, which is common to all of the yarns and is retained stationary relatively to the trapping element, is positioned at the rear of the trapper member 23, the blades of the device being in the nature of scissors and shaped to allow the pin 43 to pass therebetween, see Fig. 5. The operation of the cutter at the required time is effected by an inclined cam portion 52 adjustably secured to the pivoted plate 45, the said inclined cam, upon pivotal displacement of the said plate by the cam 49, imparting pivotal movement to the cutter blade 51a against a spring 53.

40 The sequence of operations in the withdrawal, selective trapping and severing of a yarn and the selective introduction and the severing of another yarn will now be described.

45 A stud 19 of a predetermined height raises the cam plate 11 to a height whereat it is in the path of that rod 9 which appertains to the feeder 1 selected for introduction. Simultaneously the bar 21 carrying the cam 21a is slid forwardly into the path of the catch levers 8. Upon reference to Fig. 7, however, it will be seen that the selected rod 9 is engaged by the forward edge 11a of the cam plate 11 to lower its feeder to the operative position, prior to the catch levers 8 riding over the cam 21a to release the feeder in operation, and thus the usual overlap of the introduced and withdrawn yarns is obtained.

50 Simultaneously with the displacement of the cam plate 11 by a stud 19, one of the studs 38 of a predetermined height engages with the arm 37 and raises the cam plate 33 into the path of the appropriate stepped portion of the member 32. Consequently, upon the rotation of the member 32 around the machine, it engages with the positioned cam plate 33 and rotates the spindle 30 and arm 29 to cause the trapper member 23 to slide

rearwardly and position the trapping element 25 appertaining to the yarn being withdrawn, directly above the needle circle, so that the withdrawn yarn, as it extends from the raised feeder to the point at which it is connected to the needle circle, and as the feeder and trapper continue to travel around the machine, passes into the said trapping element and is retained ready to be engaged by the needles when the said feeder is again lowered to its operative position.

The selected trapping element is opened to facilitate the entry of the withdrawn yarn therebetween, by virtue of the projecting portion 48 engaging with the cam 49, rotating the plate 45 and causing the extension 45a to force the pointed pin 43 between the plates 25 comprising the said element. Simultaneously, the rotation of the plate 45 causes the cam 52 carried thereby to operate the cutter 51 and sever the portion of withdrawn yarn which extends from the needles to the trapper. By suitably positioning and operating the trapper 23 and cutter 51, the loose severed end of yarn may be made so short that it will be drawn into the fabric and rendered invisible.

As the feeder appertaining to the newly introduced yarn is lowered into the operative position by the selected rod 9, the yarn, which having been previously trapped extends between the feeder and the trapper 23, is taken by the cylinder needles and is drawn over the open projected hooks of the dial needles. The end portion of the introduced yarn, which now extends from the needle circle to the trapper, passes beneath and to the rear of the trapper, as the said trapper continues to travel around the stationary needles, and the said end of yarn passes between the cutters, which have been opened to receive the withdrawn yarn, and the ends of both the withdrawn and re-introduced yarns are severed at the one operation of the cutter.

It may be found desirable, particularly in connection with those trapping elements which are positioned a considerable distance from their feeders, to provide means for opening the said trapping elements to release their yarns when their feeders are lowered into the operative position. Such means are shown in connection with the trapper element 25a which appertains to the furthest removed feeder 1a, see Figs. 1 and 4. A spring pressed pointed pin 54 is adapted to be thrust downwardly between the trapper element 25a to separate the blades 25 thereof against the resistance of the spring 26 when a lever 55 and peg 56 is pivoted to deflect a flat spring 57 which bears against the said pin 54. An inclined surface 55a at the one extremity of the lever 55 is adapted to be engaged by a horizontal pivoted lever 58 to pivot the said lever 55, and the horizontal lever 58 is itself pivotally displaced about

a pin 58a by virtue of a lower projecting part 59 at the outermost extremity of the said lever 58 engaging with a further cam 60 secured to the vertically adjustable cam plate 11. The arrangement is such that the projecting part 59 will only engage with the cam 60 to open the trapping element 25a, when the cam plate 11 has been raised to its highest position to engage with highest thrust rod 9 and lower the feeder 1a into its operative position.

It will be understood that upon the severing of each introduced yarn, a short length of yarn is left in the trapping element. These lengths of loose yarn gradually work their way upwardly between the plates 25 until they reach apertures 25b provided by side grooves at the upper parts of the said plates, the said ends then fall away from the trapper and may be collected by the brush customarily provided to sweep the latches of the dial needles.

Further, a plate, such as 61 in Fig. 1, conveniently secured to the bar 23, may be provided in connection with all or certain of the trapping elements to determine the height at which the yarns are trapped and cut.

In a modified form of trapping member, see Fig. 3a, each of the spring-pressed plates 25 which constitute the trapping elements, is independently pivoted at its upper extremity 25c to a part 23a carried by the bar 23. One of the advantages of this construction is that when the pin 43 is forced between the selected trapping plates 25 the said plates are opened wider at their lower parts to receive the withdrawn yarn than are the plates in the construction illustrated in Fig. 3 and the reception of the yarn between the said plates is therefore more definite. In this construction one or more of the trapping plates 25 may have an upper cranked extension 25d adapted to be engaged by a descending member such as 56 to open one or more of the trapping elements for the purpose of receiving or releasing one or more of the yarns.

Whereas, as previously stated, it has hitherto only been possible to provide a very limited number of yarn changes in a circular rib knitting machine, it will be appreciated that the number of changes rendered possible by the present invention is limited only by the size of the various parts of the invention and the parts of the machine with which they co-operate.

It is of importance to note that the present invention is not limited to circular rib machines, but may with advantage be applied to plain circular knitting machines, in connection with which the present practice of trapping, cutting and accumulating changed yarns at the centre of the machine has long been considered a great disadvantage.

I claim:—

1. In a circular knitting machine, a plu- 130

5 rality of yarn feeders, mechanism for lowering and raising said feeders into and out of yarn feeding position, a yarn trapping member embodying a plurality of trapping elements pressed towards one another by means of a spring and between adjacent ones of which a yarn is adapted to be trapped, means for moving the trapping member as a whole radially of the needle circle, and said means operating in timed relation with the mechanism controlling the movement of the yarn feeders in order that when a particular feeder is raised to the non-feeding position the yarn trapper is adjusted radially to trap the yarn fed by said feeder.

15 2. In a circular knitting machine, a plurality of yarn feeders, means for moving said feeders into and out of yarn feeding position, a composite yarn trapping member embodying a plurality of yarn trapping plate members, spring means for pressing the said plate members together, each adjacent pair of the said plate members constituting a separate trapping element for a withdrawn yarn, and means for moving the said trapping member to position a particular trapping element so that it will trap the yarn appertaining to a feeder with which it is associated when the said feeder is withdrawn from a feeding position.

25 3. In a circular knitting machine, a plurality of yarn feeders, means for moving said feeders into and out of yarn feeding position, a composite yarn trapping member embodying a plurality of yarn trapping plate members, spring means for pressing the said plate members together, each adjacent pair of the said plate members constituting a separate trapping element for a withdrawn yarn, apertures between the said plate members at predetermined positions to assist in clearing accumulated yarn between said plate members, and means for moving the said trapping member to position a particular trapping element so that it will trap the yarn appertaining to a feeder with which it is associated when the said feeder is withdrawn from a feeding position.

35 4. In a circular knitting machine, a plurality of yarn feeders, means for moving said feeders into and out of yarn feeding position, a composite yarn trapping member embodying a plurality of yarn trapping plate members, spring means for pressing the said plate members together, means for moving the said trapper member to position a selected trapping element so that it will trap the yarn appertaining to the feeder with which it is associated when the said feeder is withdrawn from a feeding position, and means for forcing a member between the spring-pressed plates constituting the selected trapping element to open the said element and facilitate the reception of the yarn

therebetween or the release of yarn therefrom.

5. In a circular knitting machine according to claim 4, pivoted lever mechanism for operating the member which opens the selected trapping element to receive or release the yarns, relatively rotating cam means for operating said lever mechanism, and a yarn feeder controlling member which also controls the said cam means.

6. In a circular knitting machine, a plurality of yarn feeders, means for moving said feeders into and out of yarn feeding position, a composite yarn trapping member embodying a plurality of yarn trapping plate members, spring means for pressing the said plate members together, each adjacent pair of the said plate members constituting a separate trapping element for a withdrawn yarn, pivoted lever mechanism for moving the said trapping member to predetermined variable extents to position a particular trapping element so that it will trap the yarn appertaining to a feeder with which it is associated, an adjustable relatively rotatable cam for operating said pivoted lever mechanism and a patterning member, which also moves the yarn feeder into and out of operation, for controlling the said cam.

7. In a circular knitting machine, a plurality of yarn feeders, means for moving said feeders into and out of a yarn feeding position in any order, a plurality of yarn trappers one allocated to each feeder, means for moving all of said trappers bodily and in unison in relation to the feeders, when a feeder is moved to a non-feeding position, to a position whereat the appropriate trapper is placed to receive the yarn from that feeder.

8. In the combination of claim 7, a trapper opener that is common to all of the trappers and is operable upon any trapper that is brought to trapping position by the said trapper-moving means.

9. In a circular knitting machine, a plurality of yarn feeders, patterning means for moving said feeders in any desired sequence into and out of yarn feeding position, a plurality of yarn trappers one for each feeder that are movable en masse in relation to the needle circle and the feeders, and pattern-controlled means, operable when any feeder is moved to a non-feeding position, to move said trappers and thereby bring the appropriate one to a location at which the yarn from such feeder is caught in it.

10. In a circular knitting machine, a plurality of yarn feeders, means for moving said feeders into and out of yarn feeding position, a trapper unit comprising a plurality of trappers, one for each feeder, which unit is movable in a rectilinear path through variable distances to bring one or other of them to a trapping position, and means, operable when any feeder is moved out of feeding po-

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sition, to move said trapper unit through the required distance to bring the appropriate trapper to trapping position.

11. In a circular knitting machine, a plurality of yarn feeders, means for lowering and raising said feeders into and out of yarn feeding position, a yarn trapping element associated with each of said feeders, means for movably mounting said elements above the needle circle, and means for moving said elements across the said needle circle so that when a feeder is raised from a feeding to a non-feeding position its yarn will automatically be engaged by the trapping element associated with the said feeder.

In witness whereof I have signed this specification.

WILFRED BREWIN.

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