Aug. 24, 1965 N. LEVIN 3,201,957

YARN FINGER OPERATING MEANS

Filed Jan. 19, 1961 2 Sheets-Sheet 1

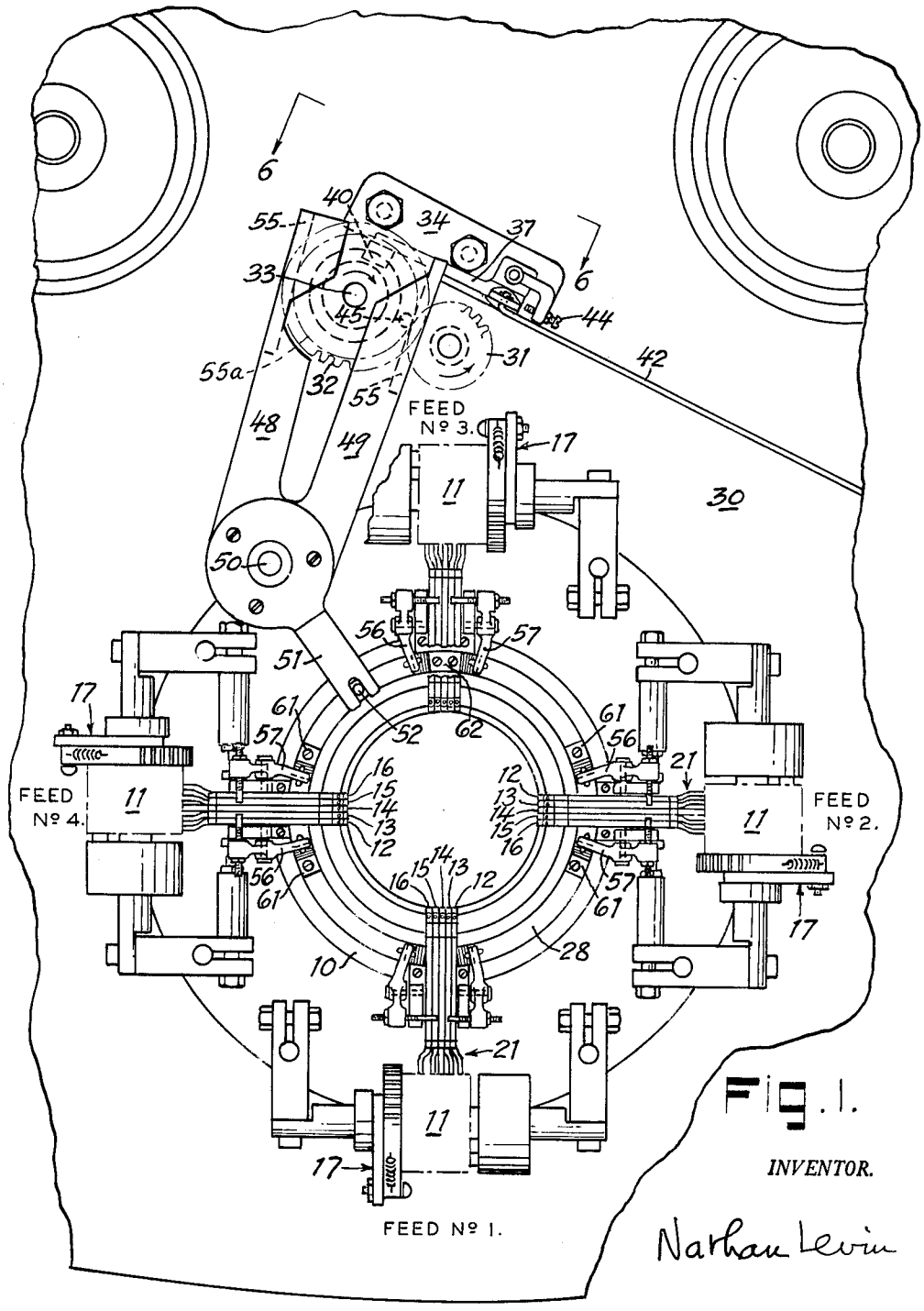


Fig. 1.

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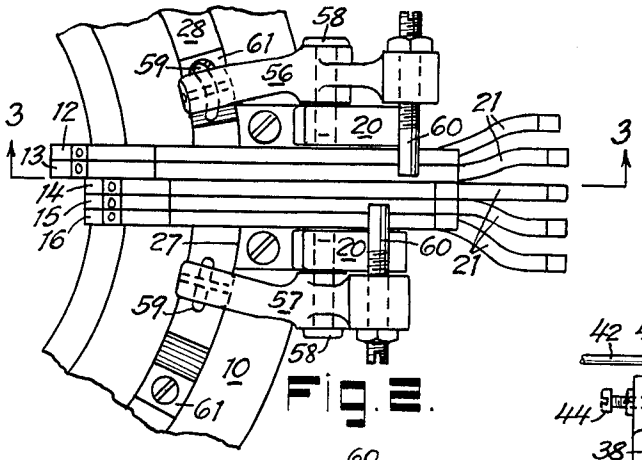


Fig. 2.

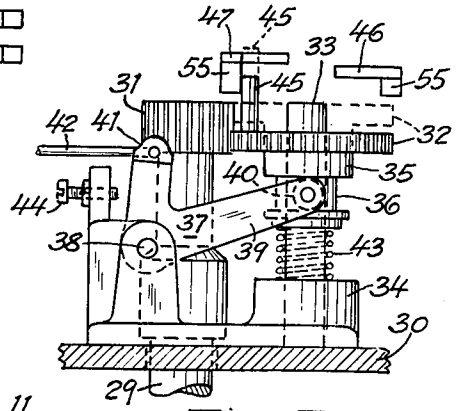


Fig. 6.

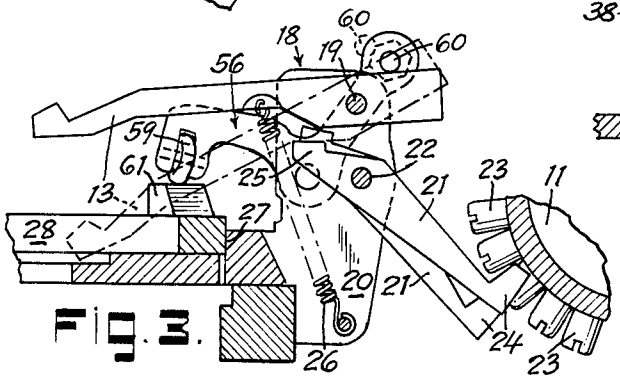


Fig. 3.

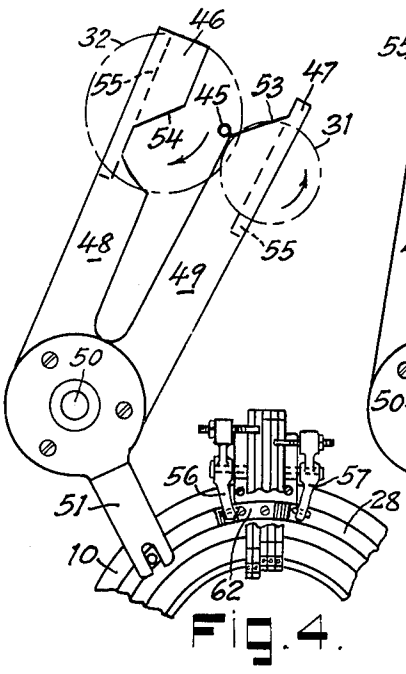


Fig. 4.

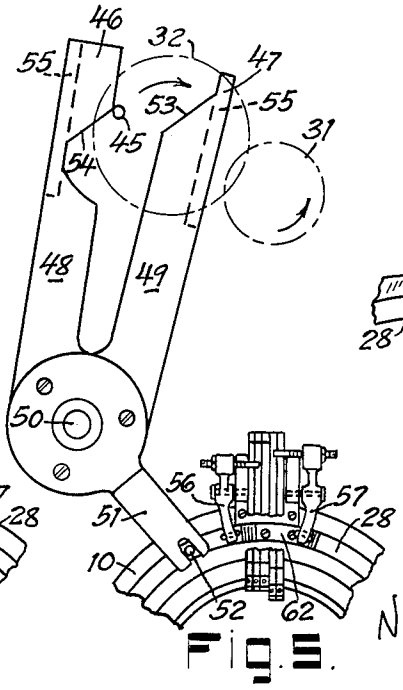


Fig. 5.

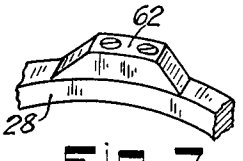


Fig. 7.

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3,201,957

YARN FINGER OPERATING MEANS

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19 Claims. (Cl. 66—138)

The present invention relates generally to the art of knitting and more particularly to apparatus adapted to cyclically operate selected yarn fingers at each feed of a multi-feed circular knitting machine.

The objects and advantages of the present invention will be readily apparent from the following detailed description of a preferred form thereof shown in the accompanying drawings, and from the appended claims.

In the drawings.

FIG. 1 is a top plan view of the cylinder portion and related parts of a four feed circular knitting machine and of the yarn finger operating apparatus of the present invention in position on said machine with the oscillatable ring of said apparatus in its neutral idle position midway between its terminal positions.

FIG. 2 is an enlarged top plan view of the portion of the yarn finger apparatus disposed at one of the feeds.

FIG. 3 is a side elevational view, partly in section, of the apparatus shown in FIG. 2 as taken on line 3—3 thereof and showing a portion of a finger control pattern drum.

FIG. 4 is a diagrammatic plan view of a portion of the present apparatus showing the oscillatable ring in one of its two terminal positions.

FIG. 5 is a view similar to FIG. 4 showing the ring in the other of its two terminal positions, corresponding to its position in FIGS. 2 and 3.

FIG. 6 is an elevational view of a portion of the apparatus of the present invention as taken on lines 6—6 of FIG. 1 showing the means for controlling the positions of the ring.

FIG. 7 is a perspective view of a cam detail of the apparatus.

The apparatus of the present invention, which may be termed an improvement upon the apparatus of United States Patent Number 2,948,131, to which reference may be made, is preferably associated with a multi-feed circular knitting machine of the Reading CK type.

In the machine shown in FIG. 1, a stationary sinker cap is indicated at 10, this sinker cap being associated with a needle cylinder which is adapted to rotate and to reciprocate, the extent of the reciprocation being generally 360 degrees in each direction. The machine is provided with four equally circumferentially spaced knitting stations or feeds, generally indicated as Feed No. 1, Feed No. 2, Feed No. 3 and Feed No. 4, and, as a portion of the component parts of each of the feeds, there is provided a plurality of individual yarn guide fingers pivotally mounted and movable into and out of yarn feeding positions under control of a yarn finger pattern drum 11. The yarn fingers, five in number at each of the feeds, are similarly indicated at 12, 13, 14, 15 and 16 and are under the control of the individual yarn control drums 11 associated therewith at each of the feeds. Each of the yarn drums 11 is adapted to be indexed at certain times by a suitable ratchet and pawl mechanism 17 under control of the main pattern drums (not shown) of the machine.

The set of yarn fingers, 12 through 16, at each of the feeds, is pivotally supported within a housing 18 upon a horizontal pin 19 supported in and extending between the opposite side walls 20, 20 of said housing. Also supported within said housing is a set of five yarn-finger-lifters 21, the lifters being pivotally mounted upon a horizontal pin 22 supported in and extending between the opposite side walls 20, 20 of the housing. The lifters, individually associated with the yarn fingers, are adapted to selectively

move the latter under control of the drum 11, depending upon the location of buttons 23 upon the outer face of the drum, the buttons being placed in accordance with the yarn finger selections desired. There may be a row of buttons 23 for each lifter 21 and a button will depress one end 24 of such lifter to raise its other end 25, the latter in turn raising its associated yarn finger to inactive or non-feeding position, this being the position of fingers 12 and 13 in FIGS. 2 and 3. In the absence of a button 23, the associated yarn finger will be movable to its active or feeding position, this being the dotted line position of finger 13 in FIG. 3, by a suitably anchored tension spring 26, there being one of the latter operatively related to each of the yarn fingers.

In this manner, at each of the feeds, there is a pattern means 11 adapted to individually control the feeding and the non-feeding positions of each of the yarn fingers. Additionally, means is provided to cyclically move selected fingers, at each feed, alternately into and out of feeding positions, providing the control of drums 11 is such that the selected fingers may be placed in their feeding positions, that is, where the absence of buttons 23 on drums 11 permit the selected fingers to be moved to their feeding positions by springs 26.

The four yarn finger housings 18 are equidistantly spaced in relation to the top surface of sinker cap 10, the inner faces of a portion of the housings, indicated at 27, being suitably formed to provide peripheral bearing surfaces for a ring member 28 placed on said sinker cap and adapted to oscillate thereon within the said bearings. A mechanism is provided to intermittently move said ring from a suitable power source, such as the upright rotary shaft 29, FIG. 6, of the machine. This shaft is adapted to make one revolution of 360 degrees during the time that the needle cylinder makes two successive individual strokes of reciprocating knitting, that is, during the time that the needle cylinder travels 360 degrees in one direction and 360 degrees in the opposite direction.

The shaft 29 projects upwardly through the top plate 30 of the machine and is provided with a relatively small wide face gear 31 fixed thereto at the upper end thereof in spaced relation to said plate. A second gear 32, preferably of twice the pitch diameter of gear 31, engages and is driven by gear 31 in either its full line position or its dotted line position of FIG. 6. Gear 32 is apertured to rotate freely about upstanding shaft 33 fixed in bracket 34 which in turn is fixed to plate 30. To move gear 32 vertically on shaft 33, it is provided on its underside with an apertured collar 35 having circumferential groove 36 therein. A lever 37 pivotally mounted at 38 on bracket 34 has one arm 39 thereof provided with a roller 40 to be placed within groove 36. The other arm 41 of the lever is suitably connected to the main pattern drum (not shown) of the machine via connecting rod 42 by means of which the lever 37 may be rocked clockwise to lower its roller 40, the roller in turn positioning the collar 35 and gear 32 on shaft 33 in their full line positions. A compression spring 43 encircling shaft 33 between collar 35 and bracket 34 tends to move gear 32 upwardly and it may be so moved to its dotted line position when the pattern drum releases its action on rod 42, the lever 37 at the same time being rocked counter-clockwise, FIG. 6, to a position of rest against adjustable stop screw 44. Gear 32 is provided with off-center upstanding pin 45 which moves to its lower (full line) and upper (dotted line) positions when the gear is moved along shaft 33.

Since gear 31 rotates counterclockwise, the gear 32 and its pin 45 rotate in clockwise direction during which the pin is adapted to alternately engage the cam shaped ends 46 and 47 of a pair of adjustable yoke arms 48 and 49 operatively related to the ring 28. This yoke is rotatably journalled on upright shaft 50 and is provided with the

arm **51** the slotted free end of which extends over the ring **28** which is provided with a pin **52** positioned within said slot.

As may be seen in FIG. 4, when the pin **45** (in its upper dotted line position of FIG. 6) has moved in clockwise direction to the position shown, it has already engaged with and moved up the cam face **53** of the arm **48** to rock the arms **48, 49** and **51** in the same direction and to thereby move the ring **28** in counterclockwise direction to the position shown in this view. In doing this the arm **48** will be moved toward the center of gear **32**. As pin **45** continues to move and reaches the position of FIG. 5, that is, approximately 180 degrees later, it will have already engaged with and moved up the cam face **54** of the arm **48** to rock the arms **48, 49** and **51** in counterclockwise direction to thereby move the ring **28** in clockwise direction to the position shown in this view. In doing this, the arm **49** will be moved toward the center of gear **32** where its cam face **53** will be in position to be once again engaged by the pin **45** as the latter continues its rotary movement. Thus the rotating pin **45** will continue to impart intermittent oscillatory movements to the ring **28**, the latter in turn controlling the positions of selected yarn fingers at each of the feeds as will be explained.

It is desired that the ring **28** be idled at times in a neutral inactive position midway of its terminal oscillating positions, as indicated in FIG. 1. To this end each of the arms **48, 49** is provided along its outer edge with a downwardly extending lip or cam surface **55** so positioned as to be engaged by pin **45** when the latter is in its lowered full line position of FIG. 6 wherein its upper end is below the plane of arms **48, 49**. As the lowered pin rotates, the outer side thereof travels in the path of a circle indicated at **55*a*** which is tangent to the near faces of the two cam surfaces **55** to thus keep the arms **48, 49** and **51** and the ring **28** stationary in a position which is midway between their positions of FIGS. 4 and 5.

At each of the feeds of the machine, the yarn finger housing **18** is provided with means by which the movement of ring **28** may be utilized to place selected fingers into and out of yarn feeding positions. In FIGS. 2 and 3 the housing **18** (of Feed No. 2) is provided on the outer sides of side walls **20, 20** thereof with right and left hand rockers or finger lifters **56** and **57** each of which is pivotally supported on a pin **58** secured in each of said side walls. The forward ends of one of the arms of the rockers **56, 57** are provided with transverse rollers **59, 59** positioned over the ring **28** while the other arms of the rockers are provided with the threaded transversely adjustable pins **60, 60** which extend over the fingers to the rear of their supporting pin **19**. Each of the pins **60** may be adjusted to lie over one or more or none of the fingers, and in the present instance each pin is disposed over a pair of the outer fingers.

At Feeds Nos. 2 and 4 there is a spaced pair of cams **61, 61** on ring **28**, the spacing being such that when the ring is in the neutral position of FIG. 1, the inclined faces of these cams are outwardly of and are closely adjacent to but do not touch the rollers **59** of the rockers **56, 57** so that the latter may remain in their lower positions. At each of the Feeds Nos. 1 and 3 there is a double faced cam **62** (FIGS. 1, 7) of such a length that the spaced inclined faces thereof, when the ring **28** is in neutral position, are between and are closely adjacent to but do not touch the rollers **59** of the rockers **56, 57** so that the latter may remain in their lower positions.

When ring **28** is moved clockwise, FIGS. 2, 3, 5, one of the cams **61** at Feeds Nos. 2 and 4 will engage and raise rollers **59** of the right hand rockers **56** to cause their pins **60** to be lowered to raise one of the fingers **12, 13** (depending upon buttons **23** of drum **11**) controlled thereby to non-feeding positions. The rollers **59** of the left hand rockers **57** at Feeds Nos. 2 and 4 are not then engaged by the other of the cams **61** so that these rockers have their pins **60** in the dotted line position of FIG. 3 where they have no effect upon fingers **15, 16** one of which (depending upon buttons **23** of drum **11**) may then be in feeding position. At the same time, cams **62** at Feeds Nos. 1 and 3 will engage and raise rollers **59** of the left hand rockers **57** to cause their pins **60** to be lowered to raise one of the fingers **15, 16** (depending upon buttons **23** of drum **11**) controlled thereby to non-feeding positions. The rollers **59** of the right hand rockers at these Feeds Nos. 1 and 3 are not then engaged by the cams **62** so that these rockers may have their pins in the dotted line position of FIG. 3 where they have no effect upon fingers **11, 12** one of which (depending upon buttons **23** of drum **11**) may then be in feeding position.

When the ring **28** is moved counter-clockwise, FIG. 4, the effect of the cams **61, 61, 62, 62** is reversed at each of the feeds. Cams **61, 61** raise the left hand rockers **57** at Feeds Nos. 2 and 4 to thereby raise one of the fingers **15, 16** to non-feeding positions while right hand rockers **56** permit one of the fingers **12, 13** to be lowered to feeding positions. Cams **62, 62** raise the right hand rockers **56** at Feeds Nos. 1 and 3 to thereby raise one of the fingers **12, 13** to non-feeding positions while left hand rockers **57** permit one of the fingers **15, 16** to be lowered to feeding positions.

When one of the fingers **12, 13** (or **15, 16**) is held in non-feeding position by drum **11**, and the other thereof is permitted to move to feeding position under the influence of its spring **26**, then such other finger may be alternately placed in feeding and in non-feeding positions by the action of the rocker arms and the ring **28**. The fingers to be influenced by the rocker arms and the ring **28** may thus be changed by indexing the drum **11** to change the fingers which are held in non-feeding positions by the drum.

If desired the rocker operating cams on ring **28** at each of the feeds may be the same, that is, each of the feeds may have a cam **62** thereat or each of the feeds may have a pair of cams **61, 61** thereat, in which case similarly disposed fingers at each of the feeds may then be similarly cyclically actuated by ring **28**.

While pin **45** has been shown on gear **32** driven by gear **31**, it is understood that the pin may be directly associated with the shaft **29** to actuate the ring **28**, the association being such that the pin may be vertically movable axially of the shaft **29** to position the same for contact with cam faces **53, 54** or with the surfaces of lips **55, 55** of the arms **48, 49**. With the gear **32**, the ring **28** is actuated once for each pair of knitting strokes while without the gear **32**, the ring **28** is actuated once for each knitting stroke.

In the above mentioned Patent Number 2,948,131, its oscillating ring may only be idled in one of its terminal positions with one of its ring cams acting to hold at least one finger in non-feeding position at each of the feeds. Thus when its ring is so idled during rotary knitting, or during reciprocating knitting, at least one of the yarn fingers at each of the feeds cannot be used and this reduces the yarn finger capacity of the machine to this extent. By means of the present invention, by idling the ring **28** in a medial non-acting position, midway of the positions of the FIGS. 4 and 5, wherein the cams **61, 62** are not in contact with rollers **59** of the rocker arms, all of the yarn fingers are available for general use (under control of the drums **11**) at each of the feeds when the cyclical action of selected fingers is not desired, and this may be during rotary as well as during reciprocating knitting.

I claim:

1. A circular knitting machine having a plurality of yarn fingers movable into feeding and into non-feeding positions at each of a plurality of feeds and having pattern means at each of said feeds adapted to control the movements of said fingers into both of said positions thereat, and additional means including a single actuat-

ing member operatively related to selected fingers at each of said feeds and adapted to be made active and inactive, the said selected fingers being positioned on opposite sides of said plurality of yarn fingers, said member when active being operable to cyclically control the movements of said selected fingers alternately into both of said positions at each of said feeds when the control exercised by said pattern means permits said selected fingers to be moved into their feeding positions and when inactive being inoperative to control the movements of said selected fingers whereby the latter are free of the influence of said member and whereby all of said plurality of yarn fingers are movable into both of said positions at each of said feeds under control of said pattern means.

2. A circular knitting machine as set forth in claim 1 wherein said machine has at least four feeds.

3. A circular knitting machine as set forth in claim 1 wherein said member is a ring, wherein said ring when active is intermittently oscillatable to control the movements of said selected fingers as set forth and wherein said ring when inactive is idled in an intermediate position between its terminal oscillating positions to free said selected fingers of its influence as set forth.

4. A circular knitting machine as set forth in claim 1 wherein said machine has at least four feeds, wherein said member is a ring, wherein said ring when active is intermittently oscillatable to control the movements of said selected fingers as set forth and wherein said ring when inactive is idled midway of its terminal oscillating positions to free said selected fingers of its influence as set forth.

5. A circular knitting machine as set forth in claim 1 wherein said fingers are movable into both of said positions during rotary and reciprocating knitting, wherein said member when active is operable to control the movements of said selected fingers as set forth during reciprocating knitting and wherein said selected fingers when free of the influence of said member when the latter is inactive as set forth are movable as set forth during rotary and during reciprocating knitting.

6. A circular knitting machine having a plurality of yarn fingers movable into feeding and into non-feeding positions at each of a plurality of feeds, and means including a single actuating member operatively related to selected fingers at each of said feeds and adapted to be made active and inactive, the said selected fingers being positioned on opposite sides of said plurality of yarn fingers, said member when active being operable to cyclically control the movements of said selected fingers alternately into both of said positions at each of said feeds and when inactive being inoperative to control the movements of said selected fingers whereby the latter are free of the influence of said member and whereby all of said plurality of yarn fingers are movable into both of said positions at each of said feeds.

7. A circular knitting machine as set forth in claim 6 wherein said machine has at least four feeds.

8. A circular knitting machine as set forth in claim 6 wherein said member is a ring, wherein said ring when active is intermittently oscillatable to control the movements of said selected fingers as set forth and wherein said ring when inactive is idled in an intermediate position between its terminal oscillating positions to free said selected fingers of its influence as set forth.

9. A circular knitting machine as set forth in claim 6 wherein said machine has at least four feeds, wherein said member is a ring, wherein said ring when active is intermittently oscillatable to control the movements of said selected fingers as set forth and wherein said ring when inactive is idled midway of its terminal oscillating positions to free said selected fingers of its influence as set forth.

10. A circular knitting machine as set forth in claim 6 wherein said fingers are movable into both of said positions during rotary and reciprocating knitting, wherein said member when active is operable to control the movements of said selected fingers as set forth during reciprocating knitting and wherein said selected fingers when free of the influence of said member when the latter is inactive as set forth are movable as set forth during rotary and during reciprocating knitting.

11. A circular knitting machine as set forth in claim 6 wherein said member is an annular ring, wherein said ring when active is intermittently oscillatable to control the movements of said selected fingers as set forth and wherein said ring when inactive is idled in an intermediate position between its terminal oscillating positions to free said selected fingers of its influence as set forth, a rotary member, a rockable member interposed between and operatively related to said ring and to said rotary member whereby the latter is adapted to so intermittently oscillate said ring, and means to idle said ring in said intermediate position thereof.

12. A circular knitting machine as set forth in claim 6 wherein said member is an annular ring, wherein said ring when active is intermittently oscillatable to control the movements of said selected fingers as set forth and wherein said ring when inactive is idled in an intermediate position between its terminal oscillating positions to free said selected fingers of its influence as set forth, a rotary member, a rockable member interposed between and operatively related to said ring and to said rotary member whereby the latter is adapted to so intermittently oscillate and to so idle said ring.

13. A circular knitting machine as set forth in claim 6 wherein said member is an annular ring, wherein said ring when active is intermittently oscillatable to control the movements of said selected fingers as set forth and wherein said ring when inactive is idled in an intermediate position between its terminal oscillating positions to free said selected fingers of its influence as set forth, a rotary member having an off center pin, a rockable member interposed between and operatively related to said ring and to said pin whereby the latter is adapted to so intermittently oscillate and to so idle said ring.

14. A circular knitting machine as set forth in claim 6 wherein said member is an annular ring, wherein said ring when active is intermittently oscillatable to control the movements of said selected fingers as set forth and wherein said ring when inactive is idled in an intermediate position between its terminal oscillating positions to free said selected fingers of its influence as set forth, a rotary member having an off center pin, a rockable member interposed between and operatively related to said ring and to said pin, said rockable member having a pair of arms straddling said pin, each arm of said pair of arms having a pair of pin-engaging surfaces thereon, said pin being adapted to alternately engage one of said pin-engaging surfaces on said arms to so intermittently oscillate said ring, and said pin being adapted to alternately engage the other of said pin-engaging surfaces on said arms to so idle said ring.

15. A circular knitting machine as set forth in claim 6 wherein said member is an annular ring, wherein said ring when active is intermittently oscillatable to control the movements of said selected fingers as set forth and wherein said ring when inactive is idled in an intermediate position between its terminal oscillating positions to free said selected fingers of its influence as set forth, a rotary member having an off center pin, a rockable member interposed between and operatively related to said ring and to said pin, said pin being movable into a pair of positions relative to said rockable member, said rockable member having a pair of arms straddling said pin, each arm of said pair of arms having a pair of pin-engaging surfaces thereon, said pin in one of its positions being adapted to alternately engage one of said pin-engaging surfaces on said arms to so intermittently oscillate said ring, and said pin in the other of its positions

being adapted to alternately engage the other of said pin-engaging surfaces on said arms to so idle said ring.

16. A circular knitting machine having a plurality of yarn fingers movable into feeding and into non-feeding positions at each of a plurality of feeds, a pair of finger actuating members at each of said feeds operatively related to and movable to control the movements of selected fingers into both of said positions thereat, an oscillatable ring having cam surfaces thereon for each of said feeds for engagement with said finger actuating members thereat to control the movements thereof, means to intermittently oscillate said ring to cause said cam surfaces to control the movements of said finger actuating members to cause the latter to control the movements of said selected fingers alternately into both of said positions at each of said feeds, and means to idle said ring in a position wherein said cam surfaces are not in operating engagement with said pairs of finger actuating members whereby said selected fingers are free of the influence of said ring and of said finger actuating members and whereby all of said plurality of yarn fingers are movable into both of said positions at each of said feeds.

17. A circular knitting machine as set forth in claim **16** wherein there is a circumferentially spaced pair of fingers actuating members at each of said feeds, wherein there is a circumferentially spaced pair of cam surfaces on said ring for each of said feeds for each pair of said finger actuating members thereat, wherein the cam surfaces of one of said feeds may be disposed between the pair of finger actuating members thereat, and wherein the cam surfaces of another of said feeds may be disposed exteriorly of the pair of finger actuating members thereat.

18. A circular knitting machine as set forth in claim **16** wherein said machine has four circumferentially spaced feeds, wherein there is a pair of circumferentially spaced finger actuating members at each of said feeds, wherein there is a circumferentially spaced pair of cam surfaces on said ring for each of said feeds for each pair of said finger actuating members thereat, wherein the distance between the cam surfaces of each of an opposite pair of said feeds is greater than the distance between the finger actuating members thereat, and wherein the distance between the cam surfaces of each of the intervening pair of said feeds is less than the distance between the finger actuating members thereat.

19. A circular knitting machine having a plurality of

yarn fingers movable into feeding and into non-feeding positions at each of four circumferentially spaced feeds, a pair of circumferentially spaced similarly disposed right and left hand finger actuating members at each of said feeds operatively related to and independently movable to control the movements of selected fingers into both of said positions thereat, an oscillatable ring having a circumferentially spaced pair of cam surfaces thereon for each of said feeds for alternate engagement with said finger actuating members thereat to control the movements thereof, the cam surfaces of an opposite pair of said feeds being reversely disposed in relation to the cam surfaces of the intervening pair of said feeds in such manner that cam surfaces of said opposite pair of said feeds engage said right hand finger actuating members thereat when cam surfaces of said intervening pair of said feeds engage said left hand finger actuating members thereat and that cam surfaces of said opposite pair of said feeds engage said left hand finger actuating members thereat when cam surfaces of said intervening pair of said feeds engage said right hand finger actuating members thereat, means to intermittently oscillate said ring to cause said cam surfaces to control the movements of said fingers actuating members as described to cause the latter to accordingly control the movements of said selected fingers into both of said positions at each of said feeds and to idle said ring.

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