March 15, 1966 F. H. CARROTTE 3,240,032

CIRCULAR KNITTING MACHINES

Filed Dec. 4, 1963 3 Sheets-Sheet 1

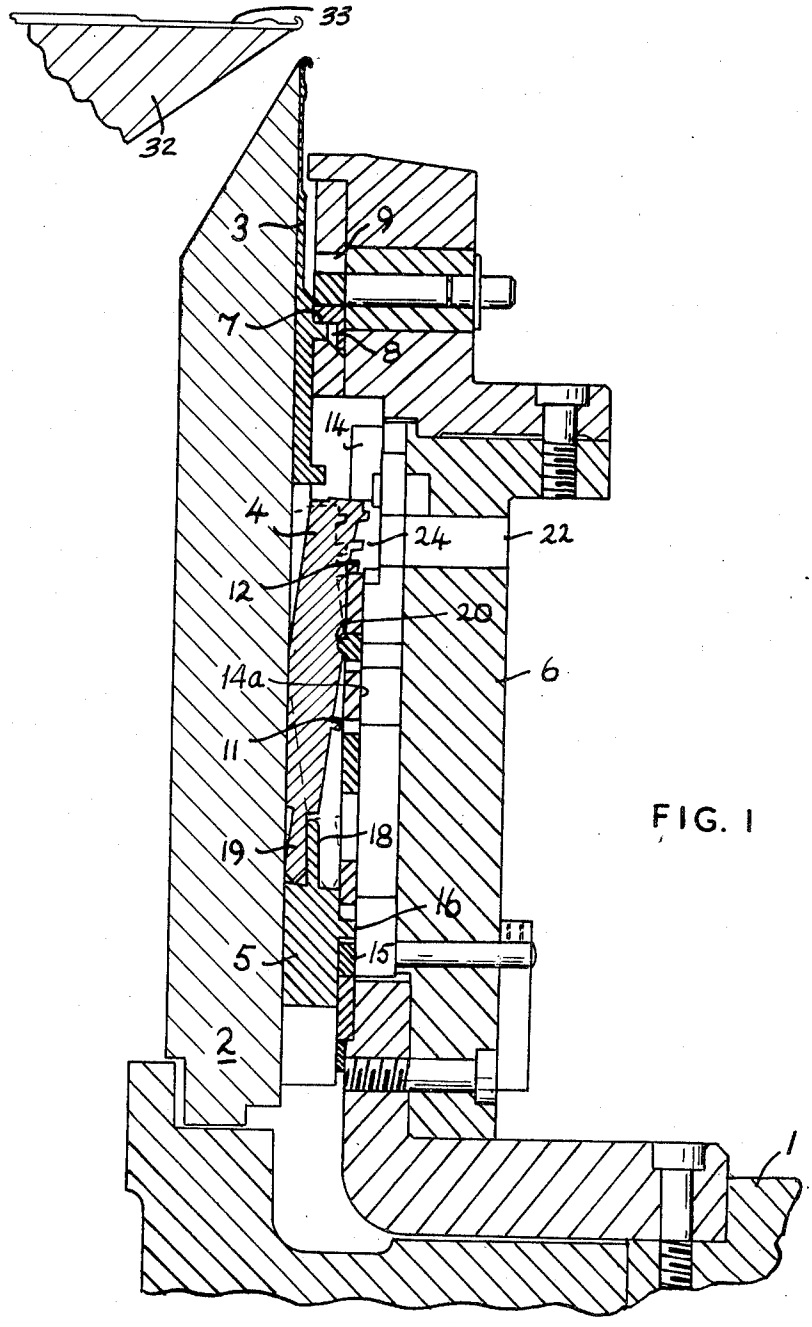


FIG. 1

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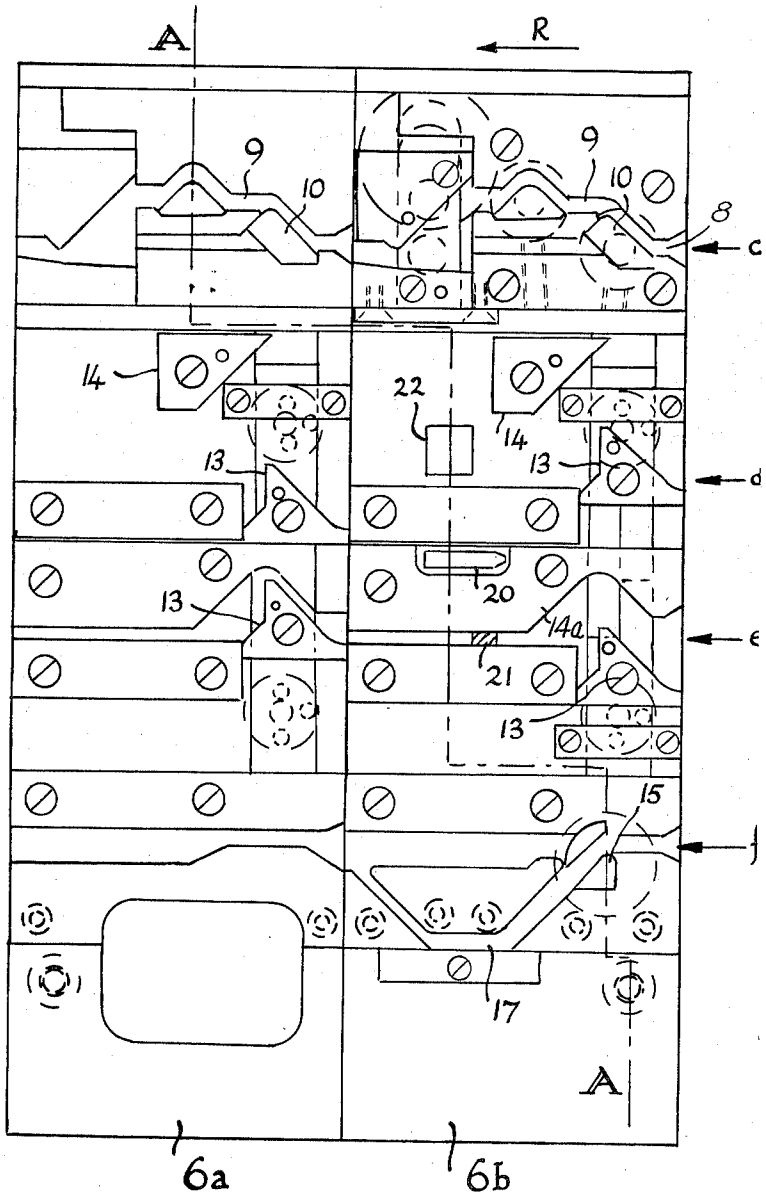


FIG. 2

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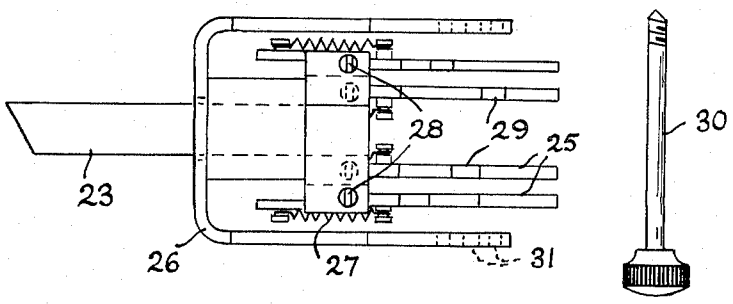


FIG. 4

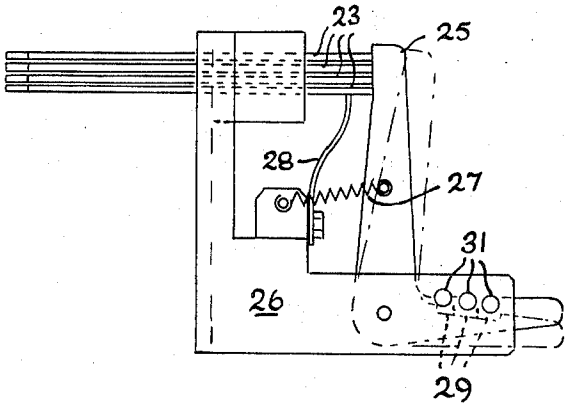


FIG. 3

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CIRCULAR KNITTING MACHINES

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14 Claims. (Cl. 66—20)

Circular knitting machines of the plain type can be made to produce simple patterns such as stripes and checks and stitch effects by providing needles with butts in different positions, for engagement by cam tracks at corresponding positions on the various cam segments. For example each needle may have a butt in one of two positions, the needles being known as "short" and "long" needles according to the distance of the butt from the needle tip. Alternate segments of the cam have cam tracks at appropriate positions for causing respectively the long and short needles to knit. Such an arrangement can be provided for the cylinder or dial needles, or for both. The pattern which can be produced on such a machine is determined by the order in which the needles are arranged, and if it is desired to change the pattern this order has to be changed appropriately. Thus it may be necessary to remove and replace in different positions all the needles in the machine, involving a considerable loss of production time.

According to the present invention in a circular knitting machine having two sets of needles directed substantially radially and substantially longitudinally respectively of the machine and cam segments cooperating with each set for producing movement thereof as the machine is rotated, all the needles of one set are substantially identical, each having a single knitting butt, and each cam segment cooperating with the set has a first track permitting passage of the needle butts, as the machine is rotated, without causing substantial needle movement and a second track having an entrance out of line with the first track and shaped to cause knitting motion of any needle whose butt is aligned to move into its entrance as the machine is rotated, and two devices are associated with each needle, arranged so that either selectively will cooperate with complementary means, such as cam surfaces, on each of the cam segments as the machine is rotated for aligning the needle butt to enter the second track when desired.

The two devices associated with each needle thus constitute controls either one of which can be set to cooperate with the complementary means at any segment of the cam.

In conjunction with these devices, the complementary means on the cam segments are preferably also capable of being set in an inoperative position so that although a device associated with a needle may be set to cooperate with them no needle movement is produced. With this arrangement either of the devices associated with each needle can be set to cooperate or not to cooperate with the respective complementary means of each cam segment, and also the said means can be set either to produce needle movement or not to do so, as desired, when engaged by the respective devices.

This arrangement provides the same facility for producing patterns as the above-mentioned arrangement of "long" and "short" needles, but if it is desired to change the pattern produced by the machine all that is necessary is to reset the devices and complementary means as desired, which can be a quick and simple operation.

Preferably the first track of each cam segment also has a movable cam part capable of being set for engagement by the needle butt for causing it to enter the second track, thus providing an additional arrangement for producing knitting movement of the needle, independent of the said devices and complementary means.

The devices associated with each needle may for example be butts formed on a jack mounted slidably in each needle guide so as to engage the end of the needle, and the complementary means on the cam segments may be cam surfaces or tracks for engagement by these butts. Such a jack with two butts may be made rockable so that one or the other of its butts projects from the guide sufficiently to engage the appropriate tracks in the cam segments. The tracks may have movable parts such as swing, bolt or slidable cams capable of being set either to permit the jack butts to pass straight through without causing any needle movement, or to advance the jack butts and consequently advance the respective needle butts into the second cam track.

To set such a machine to produce a particular pattern all that is necessary is to rock each jack into the appropriate position, and set the movable parts of the cam tracks, as desired. Locking means may be arranged to retain all the jacks once they are set so that the machine will continue to produce the desired pattern until reset. The jacks may also have one or more additional butts for cooperating with a setting device for rocking each to the desired position before setting the locking means.

The invention is illustrated by way of example by the accompanying drawings in which:

FIGURE 1 is a sectional elevation of a portion of a circular knitting machine.

FIGURE 2 is a developed elevation of cylinder cams of the machine.

FIGURE 3 is an elevation, and FIGURE 4 is a plan of a setting device for the machine.

Referring first to FIGURE 1 the machine comprises a frame **1** in which is rotatable the cylinder **2** and the dial **32**. Needles **3** are mounted in slots or tricks in the side wall of the cylinder, and needles **33** are slidable in radial slots or tricks in the dial. In the machine illustrated the invention is applied to the cylinder needles **3**, and below each needle is a rocking jack **4** below which is a plain jack **5**. Secured to the frame, to cooperate with the needles and jacks in the usual way are a plurality of cylinder cam segments **6**. In operation the cylinder is rotated and the cams cooperate with the jacks **4**, **5** and the needles **3** to cause the needles to perform knitting operations as desired. The direction of movement of the cylinder, needles and jacks relative to the cams during rotation of the machine is indicated by the arrow R in FIGURE 2.

FIGURE 2 shows two cam segments in development, the left-hand segment **6***a* being similar to all other segments of the machine except the single segment **6***b* shown at the right-hand side of the figure. As shown each segment has four main cam track levels *c*, *d*, *e*, *f*, the uppermost of which is the knitting level in which there are two alternative tracks for cooperating with the single butts **7** of the needles. The lower of these tracks **8**, is a "straight through" track to permit the butts **7** to pass without causing a knitting action of the needles, and the upper track **9** is shaped to cooperate with the butts to cause knitting or tucking action. A radially slidable bolt cam **10** is provided in each segment to be inserted across the mouth of the track **8** to cause the butts to enter the track **9**.

The jacks **4** provide alternative means for causing the needle butts to enter the knitting tracks **9**. Each jack **4** has a lower butt **11** and an upper butt **12**, and can be rocked between the two positions shown in FIGURE 1. In the position shown in full line the upper butt **12**, located at the level *d* is brought into position to engage the cam tracks whilst the lower butt **11**, at the level *e*, is swung clear of the cams. In the alternative position, shown in chain dotted lines, the lower butt **11** is in position to engage the cam tracks, whilst the upper butt **12**

is swung clear. Each segment has identical tracks at these levels *e* and *d*, comprising a lifting cam **13** which may either be raised (as shown in the level *d* of segment **6***b*) or lowered (as shown in level *e* of segment **6***b*). When lowered these cams will permit jack butts **11**, **12** respectively to pass over them without causing any movement of the butts, but when raised and engaged by a butt they will cause the jack **4** to rise as the machine is rotated, raising the respective needle **3** and causing its butt **7** to enter the knitting or tucking track **9**. Thus either of the butts **11**, **12** of the jack **4** associated with each needle can be set to cooperate with the cams **13** to cause the butt **7** of the needle to enter the knitting track **9** when desired. By setting the cams **13** appropriately in the various segments, in relation to the setting of the jacks **4**, each needle can be caused to knit, tuck or not to knit at each segment as desired. For example a needle with its jack **4** in the position shown in full line in FIGURE 1 will knit in segment **6***b* but will not knit in segment **6***a*. With the jack in the alternative position shown in chain dotted lines in FIGURE 1 the needle would not knit in segment **6***b* but would knit in segment **6***a*. Of course if the bolt cams **10** are "in" the needles will knit at both segments regardless of the positions of the jacks. It will thus be seen that the pattern knitted by the machine will be dependent upon the setting of the jacks **4** and cams **13**, and that pattern changes can be made by altering these settings, without any necessity to remove needles.

Each segment **6** also includes a cam **14** to engage the upper edge of any jack **4** which is rocked into the full line position of FIGURE 1 and is raised by the cams **13** and return it to the position shown in FIGURE 1 after the butt **7** of its needle has entered the track **9**. A similar function is performed for jacks which are rocked into the alternative position shown in chain dotted lines by the cam parts **14***a* which engage the top edges of the butts **11**.

FIGURES 3 and 4 show a setting device which can be used in conjunction with the special cam segment **6***b* for altering the setting of the jacks. This special cam segment has a rotary cam **15** in its track at level *f* which cooperates with the butts **16** of the plain jacks **5**. In all other segments, the track at level *f* permits straight through passage of this butt, and the rotary cam **15** can likewise be set to permit straight through passage, but in its alternative position, shown in FIGURE 3, it will cause depression of the butts **16** of the plain jacks **5** into the track **17** which will depress these jacks sufficiently for their tails **18** to fall clear of the tails **19** of the jacks **4**, so permitting the jacks **4** to rock between their two alternative positions. This segment **6***b* also has a pivot **20** to engage notches in the jacks **4** to provide an axis for this rocking, and a spring mounted presser cam **21** set in the track at level *e* to engage the lower butts **11** of any jacks **4** in the chain dotted line position of FIGURE 1 and swing them into the full line position. Beyond this presser cam **21** in the direction of rotation is an aperture **22** through which selectors **23** of the setting device can project.

For setting, each jack **4** has a butt **24** at one of four levels above its upper butt **12**, and to cooperate with these butts **24** the selectors **23** are arranged at four corresponding heights. As shown in FIGURES 3 and 4 each selector is operated by a bell crank lever **25**, the four bell crank levers being mounted in a U-shaped frame **26** for attaching to the special segment **6***b*. The bell crank levers are urged by springs **27** towards a normal "in" position shown in FIGURE 4 and in full line in FIGURE 3, in which their selectors will engage the butts **24** of the jacks **4**, but can be swung to an "out" position shown in chain dotted lines in FIGURE 3, in which the corresponding selectors **23** are permitted to be moved outwardly by blade springs **28** so that their ends will clear the butts **24** when the jacks **4** are in the position shown in full line in FIGURE 1. Thus when one of the bell crank levers **25** is in its "in" position its selector **23** will engage any jack in the position shown in full line in FIGURE 1 and having a butt **24** at the appropriate height and swing it into the position shown in chain dotted lines as the machine rotates, the rotary cam **15** being set to depress the plain jacks **5** as described. Jacks not so engaged will remain in the full line position. As the jacks move past this setting position the cam track **17** will raise the plain jacks and so lock the rocking jacks in the position into which they have been set.

Thus by turning the rotary cam **15** into the position shown in FIGURE 2 and attaching the setting device of FIGURES 3 and 4 and by depressing appropriate bell crank levers **25** the needles can be set to produce the desired pattern. To provide for setting certain standard patterns the bell crank levers have notches **29** in their short limbs set in different positions, to be engaged by a pin **30** which can be passed transversely through appropriately positioned holes **31** in the limbs of the bracket **26**. This provides a quick means of setting the levers, after which a single rotation of the machine will set all the needles to their desired positions, whereupon the setting device can be removed and the rotary cam **15** can be turned back to its straight through position to enable the machine to commence knitting.

What I claim is:

1. A circular knitting machine having two sets of needles directed substantially radially and substantially longitudinally respectively of the machine and cam segments cooperating with each set for producing movement thereof as the machine is rotated wherein all the needles of one set are substantially identical, each having a single knitting butt, and each cam segment cooperating with the set has a first track permitting passage of the needle butts, as the machine is rotated, without causing substantial needle movement and a second track having an entrance out of line with the first track and shaped to cause knitting motion of any needle whose butt is aligned to enter its entrance as the machine is rotated, and two devices are associated with each needle, arranged for selection so that either will cooperate with complementary cam surfaces on each of the cam segments as the machine is rotated for aligning the needle butt to enter the second tracks when desired, locking means being provided for retaining the two devices in their selected condition.

2. A circular knitting machine as claimed in claim **1** wherein the complementary cam surface on each of the cam segments is capable of being rendered inoperative so that no needle movement is caused even when it cooperates with one of the devices associated with a needle

3. A circular knitting machine according to claim **1** wherein a part of the complementary cam surface is movable to permit those devices associated with the needles which are selected to cooperate with the complementary cam surface to pass without causing needle movement.

4. A circular knitting machine according to claim **1** wherein the two devices associated with each needle are butts on a member mounted adjacent to the needle and movable selectively between positions in which one or the other of the butts will cooperate with the complementary cam surfaces on the cam segments.

5. A circular knitting machine according to claim **4** wherein the members are mounted in the guides in which the needles are slidable.

6. A circular knitting machine according to claim **5** wherein each member is rockable about a point between its butts for positioning the butts selectively to cooperate with the complementary cam surfaces on the cam segments.

7. A circular knitting machine according to claim **6** including an element mounted in each guide with each rockable member, having an extension arranged to overlie the end of the rockable member on one side or the other according to its selective position so as to lock the member in that position.

8. A circular knitting machine according to claim 7 in which each element has a projection and in which at least one cam segment includes a part arranged to be engaged successively by the said projections and shaped and arranged to be positioned so that rotation of the machine will cause each element successively to be moved so that its extension clears the rockable member.

9. A circular knitting machine according to claim 8 wherein the said cam segment having a part for engagement by the projections includes means for mounting upon it a setting device to cooperate with each rockable member when its associated locking means is released for setting the rockable member in one of its selective positions.

10. A circular knitting machine according to claim 9 wherein the said cam segment includes a presser cam arranged to move all the rockable members successively to one of their selective positions when their locking means have been moved clear, and the setting device comprises a selector rod arranged to move radially in the cam segment between a radially outer position in which it will clear the rockable members, allowing them to remain in the position set by the presser cam, and a radially inner position in which it will engage the rockable members and move them to their alternative positions.

11. A circular knitting machine according to claim 10 in which the setting device includes a plurality of selector rods superimposed upon one another in a direction parallel to the needles in the said cam segment and each rockable member has a butt in one of a number of positions which are equal in number to and aligned with the ends

of the selector rods so that the butt can be engaged by only the selector rod with which it is aligned when the latter is in its inner position.

12. A circular knitting machine according to claim 11 wherein the selecctor device includes means for setting the selector rods.

13. A circular knitting machine according to claim 1 wherein at least one cam segment includes a part arranged to be engaged successively by the locking means associated with each needle as the machine is rotated and capable of being set to release the locking means, thereby permitting the devices, whilst they are adjacent to that segment, to be moved between their selective conditions.

14. A circular knitting machine according to claim 13 wherein the said cam segment including a part to be engaged by the locking means includes means for mounting upon it a setting device to cooperate with each pair of devices when the locking means associated with the pair is released, for setting the devices in one of their selective conditions.

References Cited by the Examiner

UNITED STATES PATENTS

2,025,465	12/1935	Lombardi	66—50
3,012,423	12/1961	Lyster	66—50
3,030,785	4/1962	Lunak	66—50

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