Aug. 2, 1966 F. H. CARROTTE ET AL 3,263,453

CIRCULAR KNITTING MACHINES

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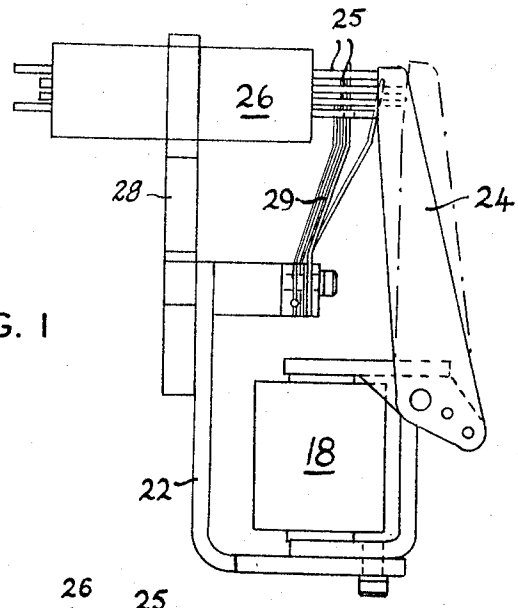



FIG. 1

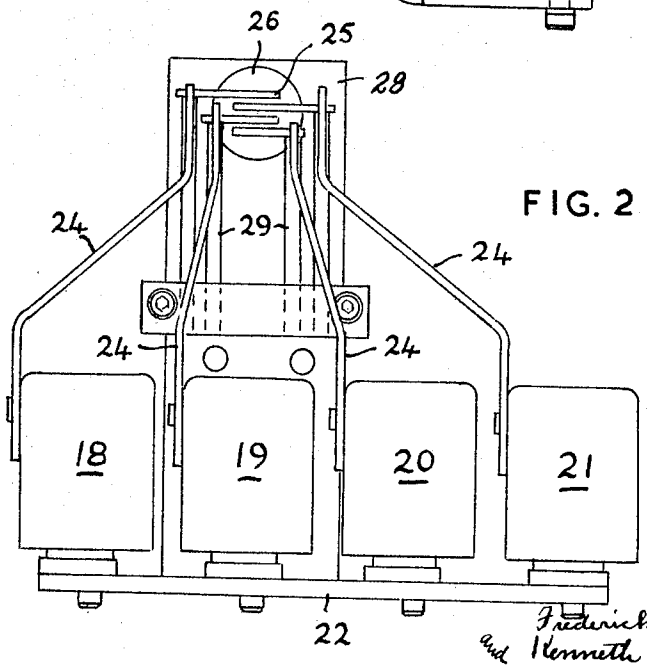



FIG. 2

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FIG. 3

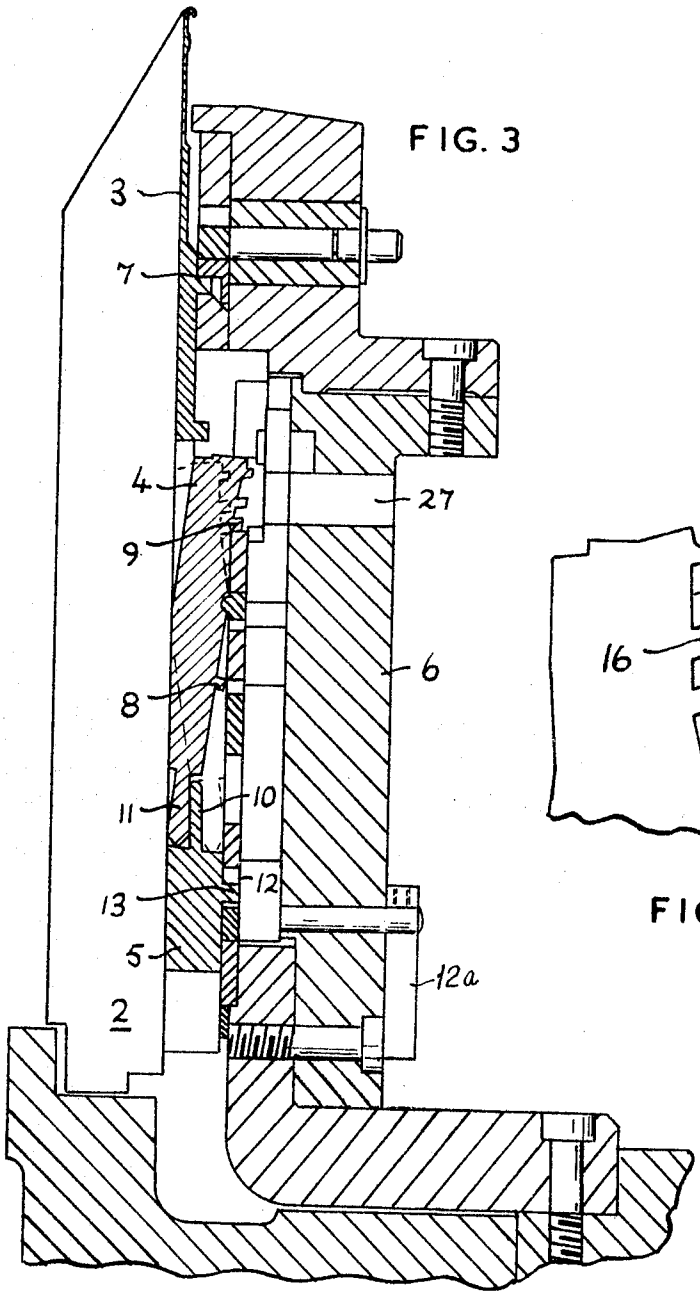






FIG. 4

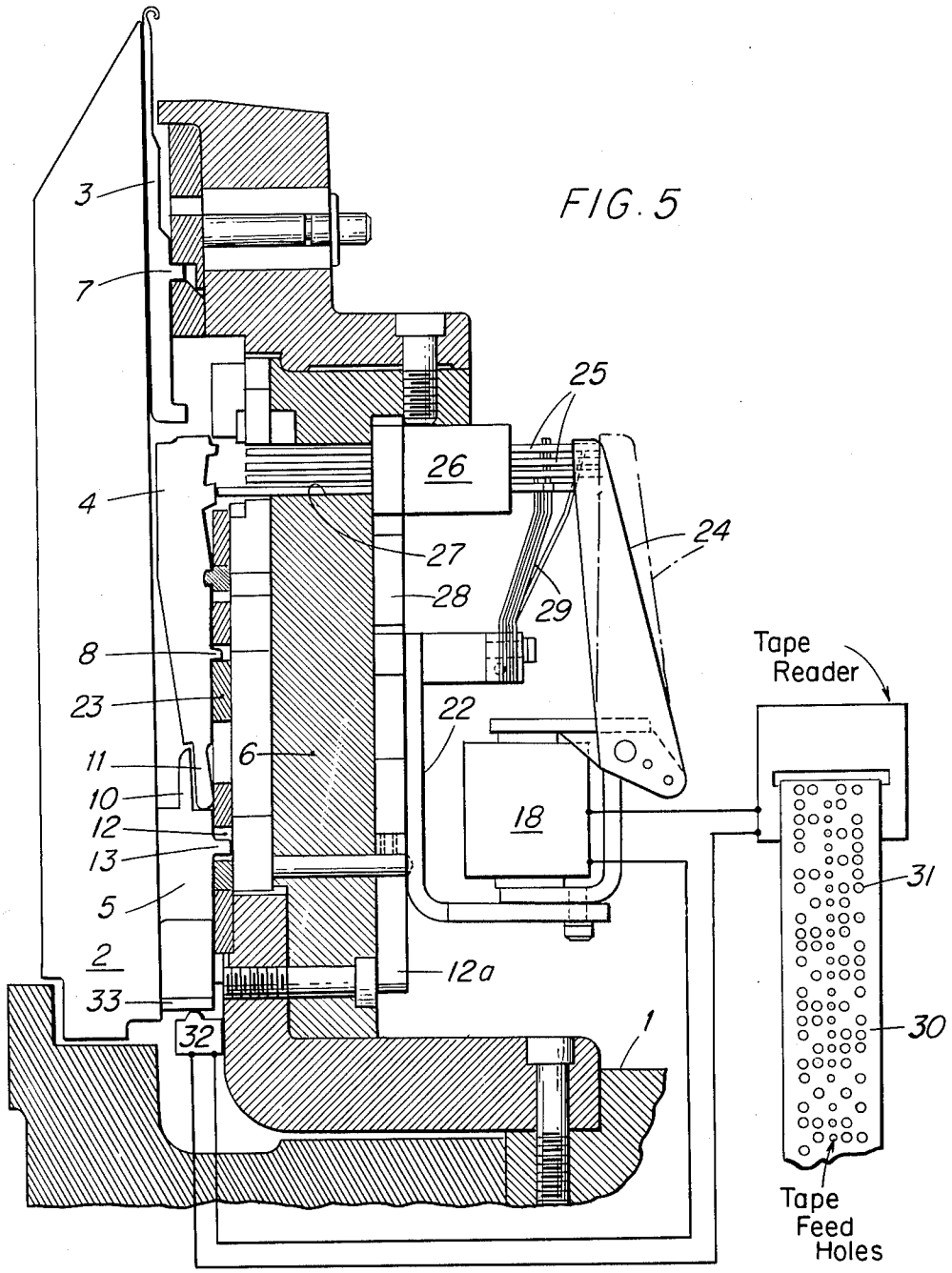
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FIG. 5




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3,263,453

# CIRCULAR KNITTING MACHINES

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Claims priority, application Great Britain, Dec. 6, 1962, 46,042/62
11 Claims. (Cl. 66—50)

In circular knitting machines of the plain type arrangements are sometimes provided to enable the needles to be caused to knit or tuck or not to knit or tuck in a variety of sequences at the knitting stations in order to produce simple patterns such as stripes and checks or stitch effects. For this purpose devices are associated with the needles which can be set selectively to co-operate or not to co-operate with complementary means on the cam segments at the different knitting stations. Such arrangements will hereinafter be referred to as "of the kind set forth," and may be provided for either the cylinder or dial needles, or separate arrangements may be provided for each set.

One such arrangement is described in the U.S. patent application S.N. 327,914 of Frederick Henry Carrotte filed December 4, 1963, simultaneously with this application and entitled "Improvements Relating to Circular Knitting Machines" in which all the needles of one set, in a circular knitting machine, are substantially identical, each having a single knitting butt, and each segment of the co-operating cam has a first track permitting passage of the needle butts, as the machine is rotated, without causing any needle movement and a second track, having an entrance out of line with the first track, shaped to produce knitting motion of any needle whose butt is caused to enter it as the machine is rotated, and two devices associated with each needle are arranged so that either selectively will co-operate with complementary means on the cam segments as the machine is rotated for causing the needle butt to enter the second tracks of the cam segments when desired.

In order to change the pattern to be knitted by a machine having an arrangement of the kind set forth, it is necessary to re-set some or all of the devices so as to cause the needles to knit in the desired sequence.

According to the present invention setting apparatus for a circular knitting machine of the kind set forth comprises an abutment for mounting on the machine in a position such that the devices associated with the needles will move past it as the machine is rotated, and movable into a position in which it will co-operate with one of the said devices adjacent to it when so mounted so as to set the device into one of its two conditions, and electrically-operated control means associated with the abutment for causing it to move into or out of the said position.

When it is desired to set the machine to produce a particular pattern the machine is rotated and a control pulse is fed to the control means as each device associated with a needle which is required to be set is passing the abutment, so causing the abutment to set that device to co-operate with the complementary means on the cam segment. When all the needles have passed the abutment the apparatus can be rendered inoperative or removed from the machine, which will then be ready to knit the desired pattern.

It will be appreciated that when it is subsequently required to change the pattern to be produced the devices so set will have to be returned to the condition in which they do not co-operate with the complementary means on the cam segments before the apparatus is again brought into operation for setting the machine for the new pattern. A cam is preferably provided on one of the cam segments to perform this action.



The means for producing electrical control pulses may itself be activated by a previously prepared master such as a punched tape or a pre-recorded magnetic recording tape. Such a tape may be prepared to produce sufficient pulses for a complete revolution of the machine, or may be prepared as an endless loop having signals for a whole fraction of the total number of needles in the machine, and will be fed through the means for producing the pulses at a speed synchronized with the rotational speed of the machine during setting.

Two or more devices capable of being set to co-operate with complementary means on the cam segments may be associated with each needle, providing alternative means of causing the needle to knit for producing different patterns. In such cases the setting apparatus will have abutments for setting each of the devices, and consequently control means for each abutment.

The device associated with each needle may be formed on a member aligned with the needle and arranged to be engaged by the abutment for setting the device. For example, as described in the above-mentioned application S.N. 327,914 of Frederick Henry Carrotte the member may be a jack slidable in the trick in which the needle is guided, and the device may be a butt on the jack. The abutment in such a case would be arranged to engage the jack, which may have a further butt for such engagement.

It will be appreciated that the speed at which a machine can be set will be limited by the speed at which the control means can operate. A machine may have several thousand needles, so that even if it was rotated at only one revolution per minute during setting, the time available for setting each needle would be only of the order of a few milliseconds.

In order to increase the speed at which the machine can be set several abutments may be provided, for setting the jacks of successive needles, for example there may be four abutments, each with its own control means, so that each operates only on every fourth needle. The time available for each individual setting operation at a given speed of rotation of the machine is thus multiplied by four, or conversely the overall setting time may be reduced by increasing the speed of rotation.

An embodiment of the invention is illustrated by way of example by the accompanying drawings, in which:

FIGURE 1 is a side elevation of setting apparatus for a knitting machine; and

FIGURE 2 is a front elevation of the apparatus of FIGURE 1.

The apparatus is designed for setting a machine as described in the above-mentioned application S.N. 327,914 of Frederick Henry Carrotte part of the mechanism of which is shown in sectional elevation in FIGURE 3 of the accompanying drawings. FIGURE 4 shows a detail of this mechanism, to a somewhat larger scale.

FIG. 5 is a view in vertical section through a circular knitting machine according to FIGS. 1 to 4 with a tape reader, cam and switch added, the selector bars being shown with only one arm **24** and bar **25** moved to the left to engage the jack **4** of one of the four needles adjacent the aperture **27** so as to cause that one needle to knit at stations having appropriate cams at the level of the lower butt **8**.

Referring first to FIGURE 3, the machine comprises a frame **1** in which is rotatable the cylinder **2**. Needles **3** are mounted in slots or tricks in the side wall of the cylinder, and below each needle is a rocking jack **4** below which is a plain jack **5**. Secured to the frame, to co-operate with the needle and jacks in the usual way are a plurality of cylinder cam segments **6**. In operation

the cylinder is rotated and the cams co-operate with the jacks **4**, **5** and the needles **3** to cause the needles to perform knitting operations as desired.

The jacks **4** provide means for causing the needle butts **7** to enter the knitting tracks of the cam segments **6**. Each jack has a lower butt **8** and an upper butt **9** and can be rocked between the position shown in full line in which the upper butt **9** engages a track of the cam segment and the position shown in chain dotted lines in which the lower butt **8** engages a track. The two tracks are identical and each includes a lifting cam which when raised and engaged by a butt will cause the jack to rise as the machine is rotated, raising the respective needle **3** and causing its butt to enter the knitting track, but when lowered will permit the jack butts to pass straight through the track.

The jacks **5** are provided for locking the jacks **4** in their desired positions. As shown, each jack **5** has a tail **10** which interengages with the tail **11** of the jack **4** above it, so preventing the jack **4** from rocking. When it is desired to alter the setting by rocking the jacks **4** the jacks **5** can be caused to move so that their tails **10** clear the tails of the jacks **4** as the corresponding needles approach the setting device by rotating the cam **12**, by means of the lever **12***a*, so as to alter the shape of the cam track engaged by the butts **13** of the jacks **5**.

For setting, which can be carried out when the jacks **5** are so lowered, each jack **4** has a setting butt in one of four positions, **14**, **15**, **16** and **17** (see FIGURE 4), successive jacks having the butt in successive positions.

The setting apparatus shown in FIGURES 1 and 2 operates on these setting butts.

The apparatus comprises four solenoids **18**, **19**, **20**, **21** mounted on a frame **22** for attachment to a cam segment **23** of the machine. On the armature of each solenoid is mounted an arm **24**, the arms extending upwardly and being bent to bring their ends close together so that each will engage one of four selector bars **25** mounted in a guide **26** to extend through an aperture **27** in the cam segment. The selector bars have heads of different widths (see FIG. 2), for engagement by the respective arms **24**, and stem parts of the selector bars **25** to project above each other through the aperture **27**. The bars terminate close to the cylinder of the machine, when the apparatus is in position on the cam segment **23**, respectively at the levels of the four positions, **14**, **15**, **16**, **17** of the setting butts of the jacks **4**, and the end of each is formed into an abutment for engaging these butts at the appropriate level.

The arms **24** normally rest in the position shown in chain dotted lines in FIGURE 1, and the selector bars **25** are correspondingly urged outwardly by blade springs **29**, as shown in the case of the two middle bars in FIGURE 1. When a solenoid is energised, however, its arm **24** is caused to swing inwardly, pushing the corresponding selector bar **25** inwardly as shown in the case of the uppermost and lowermost bars in FIGURE 1. The abutment end of a bar so moved inwardly will engage the butt **14**, **15**, **16** or **17** at the appropriate height of a jack **4** in the full line position of FIGURE 3 and in alignment with the aperture **27**, and, its locking jack **5** having been lowered by the cam **12**, cause it to rock into the position shown in chain dotted lines in that figure.

Thus, to set the machine, the solenoids are supplied, as the machine is rotated, with a succession of pulses energising them in the order in which the needles are desired to knit. A cam (not shown) swings each jack **4** to the position shown in full line in FIGURE 2 after its plain jack **5** has been lowered and before it reaches the aperture **27**. As mentioned above, the jacks are set in fours, the pulses for each group of four jacks (having setting butts in the successive positions **14**, **15**, **16** and **17**) are supplied simultaneously to the solenoids, and the pulses are synchronised with the speed of rotation of the machine by means of a synchronising switch mounted on the machine frame **1** with means for operating it as every fourth cylinder trick passes the aperture **27**. For example every fourth cylinder wall between tricks may be extended to form a cam **33** to engage the movable contact member of a switch **32** (see FIG. 5). This switch will control the means for producing control pulses, causing it to produce simultaneously the pulse or pulses required for one or more of the four jacks then immediately in front of the selector bars **26**. The selector bars connected to the solenoids energised by these pulses will be moved inwardly, so that their abutments engage the setting butts of the appropriate jacks **4**, so moving those jacks into the position shown in chain dotted lines in FIGURE 3, in which their lower butts **8** are in position to engage a knitting track, whilst the jacks **4** not so engaged remain in the full line position of FIGURE 3 in which their upper butts **9** are in position for engaging a knitting track.



The operation of setting the machine thus comprises fitting the bracket **22** to the appropriate cam segment **23** of the machine, rotating the cam **12** to its position for depressing the jacks **5**, and rotating the machine. The switch is operated as every fourth trick passes the aperture **27** so causing the desired pulses to be transmitted to the solenoids for moving the selectors desired for the four jacks immediately in front of the aperture **25**. The needles are thus set in fours as the machine is rotated and when a whole revolution has been completed the apparatus can be removed and the movable cam **12** returned to its position which permits straight through passage of the butts **13** of the jacks **5**, so locking the jacks **4** in the positions in which they have been set.

The apparatus may be a separate attachment as described, capable of being mounted on any one of several machines, or may be a permanent fitting on the machine.

For the particular embodiment described and illustrated in FIGURES 1 and 2 a suitable pulse producing device is a punched tape reader for a tape having four tracks of perforations, thus producing up to four pulses in any position, such a pulse producing device is shown in FIG. 5. The tape **30** is caused to advance by one perforation **31** position at each operation of the switch **32** and cam **33** on the machine.

The reason for using four separate solenoids and selector bars, and producing pulses in groups of four for simultaneous setting of four adjacent jacks **5** will be appreciated from the previous remarks on the speed at which the setting apparatus can operate in relation to the speed of rotation of the machine during setting. If the machine were rotated more slowly, or if a quicker-acting setting apparatus were used, a single selector bar and solenoid would be sufficient with a pulse producing device arranged to operate to produce a pulse or not as each individual needle passed the setting station. The arrangement described, however, has been found most convenient from the point of view of practicability and cost, and is conveniently supplied with pulses by a commercially available tape reader reading four tracks of perforations.

What we claim is:

**1.** Setting apparatus for a circular knitting machine having two needle beds, one being a dial and the other being a cylinder, needles in the dial and needles in the cylinder, a plurality of knitting stations, cam segments at each station to cooperate selectively with the dial and cylinder needles, devices associated with the needles of one bed and complementary cams which cooperate with the needles of that bed, said devices being capable of being adapted to be set selectively into and out of position to cooperate with the complementary cams comprising an abutment for mounting on the machine in such position that the devices associated with the needles will move past it as a machine is rotated, said abutment being movable into position in which it will cooperate with one of the said devices adjacent to it when so mounted as to set the device into one of its two conditions, in combination

with electromagnetically operated control means associated with such abutment for causing it to move in or out of the said position.

2. A circular knitting machine comprising two needle beds, a dial and a cylinder, needles in the dial and needles in the cylinder, a plurality of knitting stations and devices associated with the needles of one bed and cam segments attached to the other bed at the different knitting stations to control said needles by said devices, in combination with means on the cam segments complementary to the said device comprising an abutment for mounting on the machine in a position such that the devices associated with the needles will move past it as the machine is rotated, and movable into a position in which it will co-operate with one of the said devices adjacent to it when so mounted so as to set the device into one of its two conditions, and electrically operated control means associated with the abutment for causing it to move into or out of the said position.

3. Setting apparatus as claimed in claim 1 including spring means normally urging the abutment out of the said position the control means being arranged to move the abutment into the said position against the action of the spring means.

4. Setting apparatus as claimed in claim 1 including means for producing electrical pulses for actuating the control means in predetermined synchronism with the movement of the devices past the abutment when the machine is rotated for setting the devices.

5. Setting apparatus as claimed in claim 4 in which the means for producing electrical pulses is a tape reader for reading a tape prepared to initiate pulses at desired intervals, a switch on the machine controlling the reader so as to advance the tape in synchronism with the movement of the devices past the abutment.

6. Setting apparatus as claimed in claim 1 including means for setting all the devices, prior to their passing the abutment as the machine is rotated, into the opposite condition to that into which the abutment can set them.

7. Setting apparatus as claimed in claim 6, for a machine in which the devices are formed on rockable members aligned with each of the needles to be controlled, each having two alternative positions providing the two conditions of the devices, in which the abutment is arranged, when caused to move into its said position, to engage the rockable member and rock it into one of its alternative positions, means being provided for rocking all the members into the opposite alternative position as they approach the abutment during rotation of the machine.



8. Setting apparatus as claimed in claim 1 wherein the abutment is the end of a bar arranged so as to be substantially perpendicular to the needles being controlled, and the devices have complementary parts for engagement by the end of the bar.

9. Setting apparatus as claimed in claim 1 including four abutments to co-operate with groups of four successive devices.

10. A circular knitting machine including setting apparatus as claimed in claim 1.

11. A circular knitting machine as claimed in claim 10 wherein two devices are associated with each needle of one bed and are formed on a rockable member aligned with the needle and having two alternative positions in which alternate devices will be set to co-operate with complementary means on the cam segments, the other devices in each case being simultaneously set so as not to co-operate with the supplementary means.

**References Cited by the Examiner**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,927,016 | 9/1933 | Adler et al. | 66—154 |
| 2,158,536 | 5/1939 | Fisher et al. | 66—50 |
| 2,970,461 | 2/1961 | Hoffmann | 66—154 |


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