Aug. 27, 1963 R. TENCONI 3,101,601

OPERATING MECHANISM FOR THE YARN CARRIERS OF CIRCULAR KNITTING MACHINES

Filed Nov. 15, 1960 2 Sheets-Sheet 1

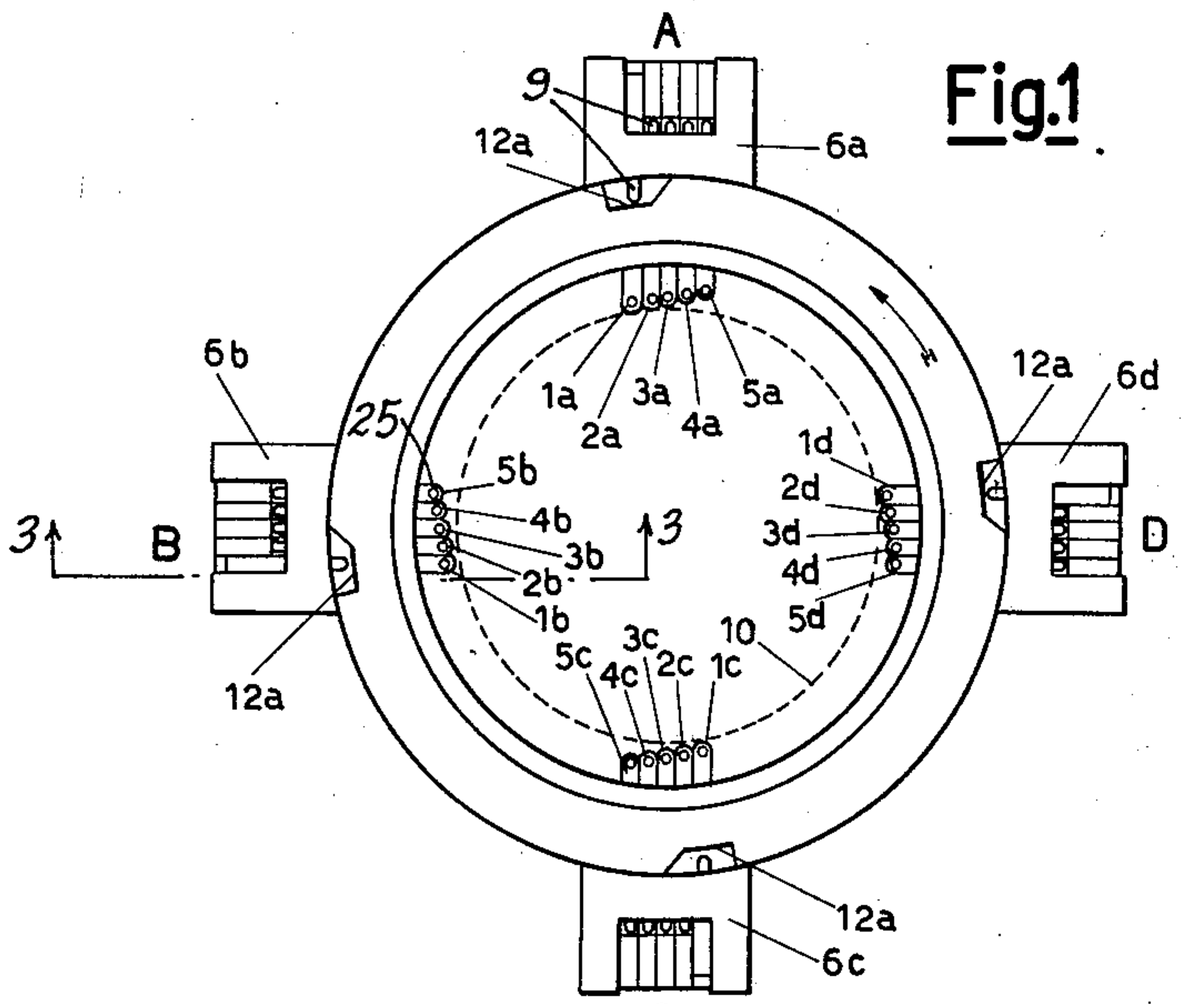


Fig.1

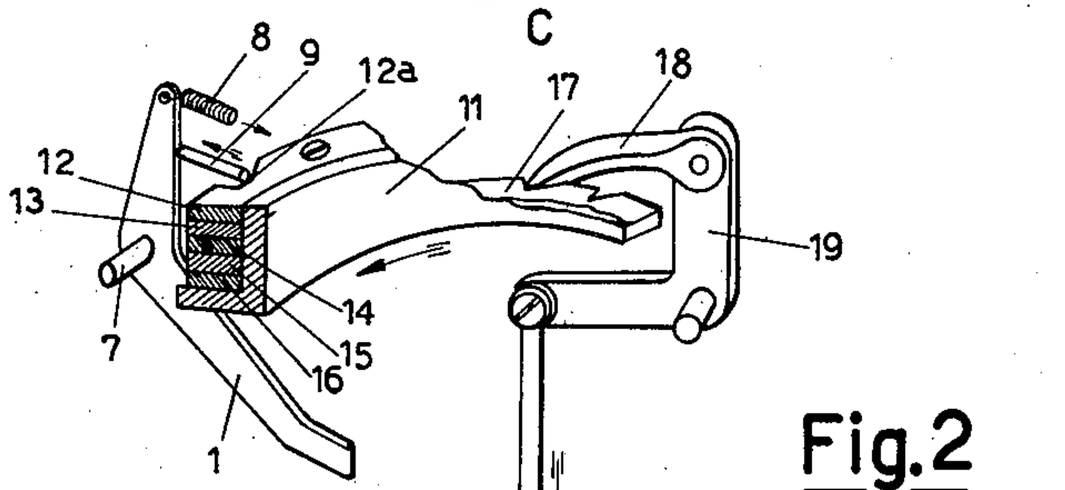
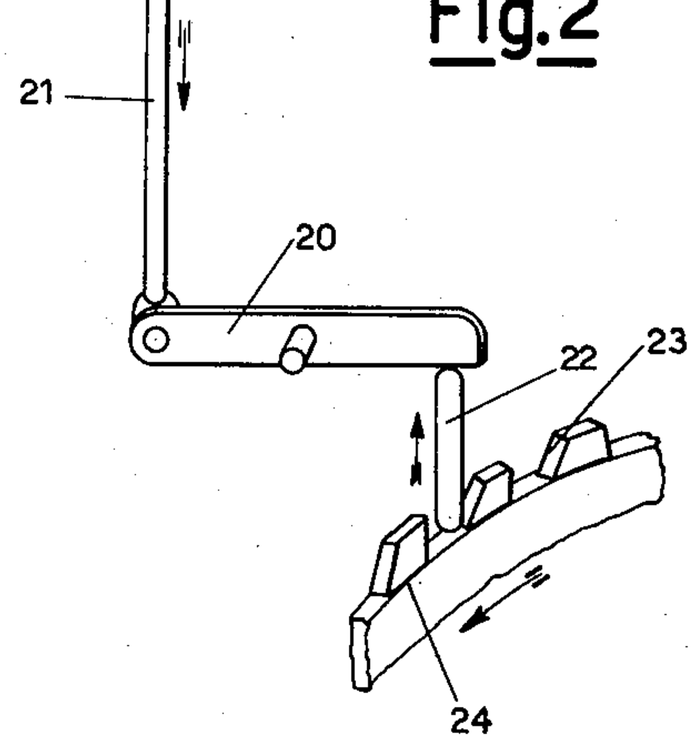


Fig.2



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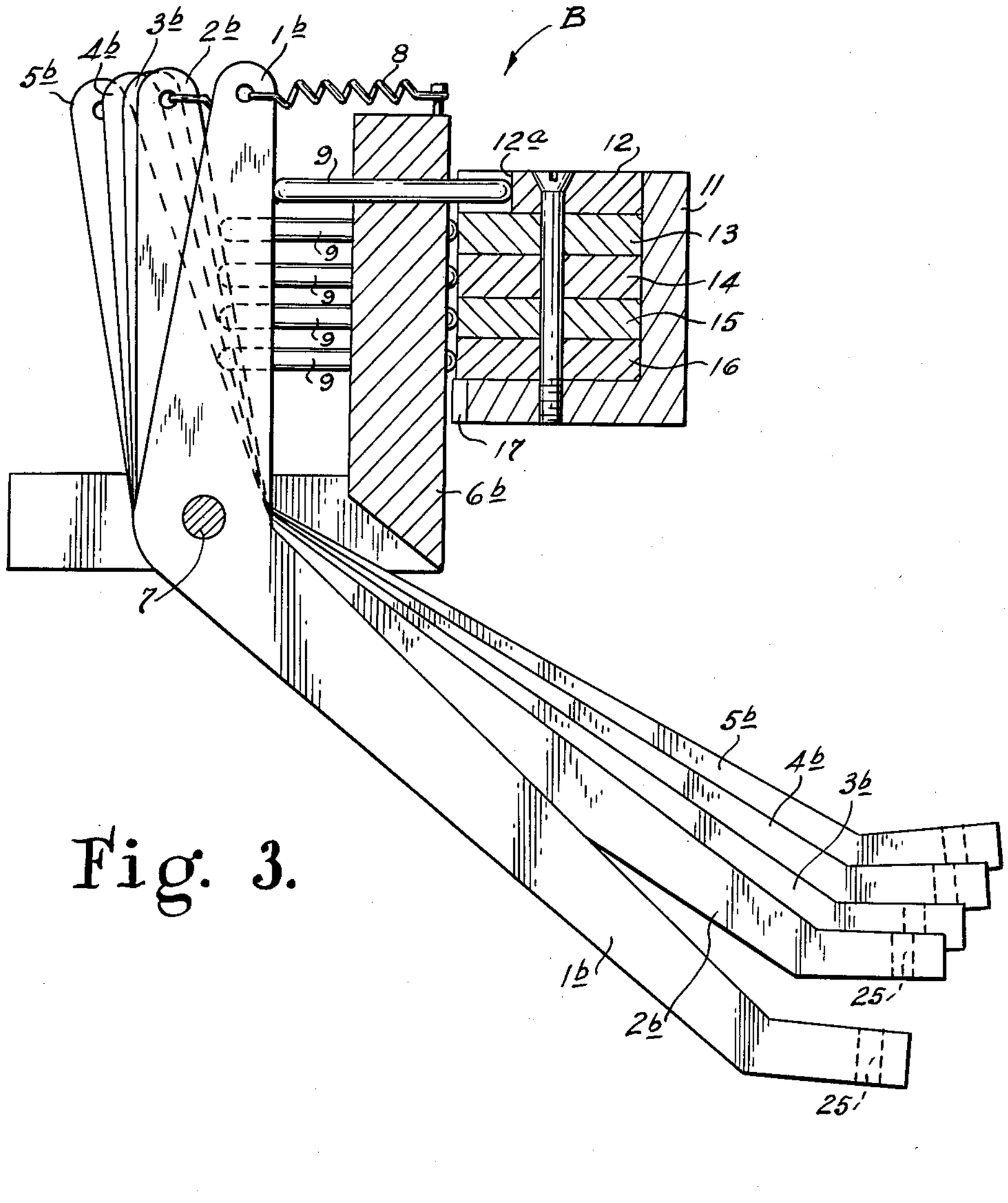

Fig. 3.

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OPERATING MECHANISM FOR THE YARN CARRIERS OF CIRCULAR KNITTING MACHINES

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The invention relates to circular knitting machines, for example stocking knitting machines, having a number of yarn supply stations or groups of yarn supply stations disposed at equal distances from one another, and relates to a central operating device for the yarn carriers associated with the individual yarn supply points.

It is well known that in such a machine a number of yarn carriers are provided at each yarn supply station, and their function is to supply different types of yarn for knitting in the different phases of production of the knitted fabric, for example a stocking. Thus, for example, in the production of a stocking it is necessary at the beginning to knit a number of courses with a thicker thread, and then the double welt is usually made with a lower grade of yarn and the outer part of the welt with a yarn of good appearance which, however, is of different quality from the yarn used for the stocking leg, and finally a strong yarn is again used for the heel, sole and toe of the stocking. It will be apparent that the requirements may differ according to the quality required for the knitted material, for example the stocking, and this also applies frequently from manufacturer to manufacturer.

It is thus necessary to control the yarn carriers at certain moments during the production of the knitted material in order to bring them closer to or farther away from the upper edge of the needle cylinder so that the corresponding yarns can be engaged or not engaged by the needle beards. This control process is effected in known machines by its own group of levers and rods which in turn are operated by a central control element of the machine. When the machine is equipped with a number of yarn supply or working stations, that is to say stations around the cylinder periphery at which the loop formation takes place, then a yarn carrier group with associated control means must be provided at each working station.

It is immediately apparent that these control elements occupy a considerable amount of space and render the construction of the machine very complicated, particularly in the case of a plurality of working stations.

The object of the invention is to simplify the control of the yarn carriers in knitting machines having a number of yarn supply or working stations or groups of such stations disposed at equal distances from one another.

In solving this problem, the invention makes use of the fact that the yarn carriers associated with the different working stations must always be controlled simultaneously since it is necessary for the yarn carriers to supply the same type of yarn at the different working stations at all times during the production of a knitted material. In other words, if, for example, a certain type of yarn is supplied at one working station by an associated yarn carrier, then the same type of yarn must also be supplied at the other working stations so that each yarn carrier of a working station has corresponding yarn carriers associated with the other working stations and all these yarn carriers corresponding to one another must be operated simultaneously.

Starting from this basis, the invention now proposes a centralized operating device for the yarn carriers, the said device being characterized in that it comprises a set of cam discs or rings which consists of as many cam discs

as there are yarn carriers associated with each working station, each cam disc being intended to simultaneously control the corresponding yarn carriers of all the working stations and, for this purpose, being divided into a number of equally long peripheral zones having the same profile and the number of said zones corresponding to the maximum number of working stations or groups of working stations provided on the machine and disposed at equal distances from one another. Under these conditions, suitable means are provided so that the set of cam discs disposed co-axially to the needle cylinder may be turned intermittently by a certain amount whenever the operative yarn carriers of the different working stations are to be altered.

After the set of cam discs has been turned through an angle corresponding to the angular distance between two adjacent working stations, further turning of the cam discs causes the sequence of control of the yarn carriers at each working station to be repeated.

The cam discs may advantageously comprise rings which are disposed co-axially above the needle cylinder, elements, such as, pins which directly control the yarn carriers co-operating with the peripheries of these rings which are sub-divided into a plurality of zones having the same profiles. The intermittent rotation of the set of rings can be produced by a pawl and ratchet drive, which is advanced by the main control element of the machine at the required intervals. On each rotational movement of the set of rings the position of the yarn carriers can be varied and when the set has been turned through an angle such that a complete peripheral zone of the corresponding ring has been moved past any one of the control elements of the yarn carriers, then this same zone begins to act on the control element of the corresponding yarn carrier associated with the following working station in the direction of rotation of the set of rings. Each zone of a cam disc or ring thus successively controls the mutually corresponding yarn carriers of all the working stations and generally each profile zone corresponds to a complete working cycle of the machine.

In order to better clarify the invention, one practical application of the device for the operation of the yarn carriers of a circular knitting machine having four working stations disposed at equal distance from one another, will be described by way of an example hereinafter with reference to the drawings, which illustrate only those parts of the machine required for an understanding of the invention, and wherein:

FIGURE 1 is a diagrammatic plan view of a circular knitting machine having yarn carriers or fingers arranged at a plurality of stations and actuated by a set of control rings,

FIGURE 2 shows the elements for operation of the set of rings, and

FIGURE 3 is an enlarged sectional view taken along the line 3—3 on FIG. 1.

As will be apparent from FIGURE 1, brackets or housings *6a*, *6b*, *6c* and *6d* for the yarn carriers at four working stations are disposed around the needle cylinder **10**, which is indicated only diagrammatically by a broken circle, said housings or brackets being arranged in the positions A, B, C, D which are each offset by 90° to one another. Each yarn carrier or finger group comprises five angle levers identified by the numerals **1**, **2**, **3**, **4** and **5** with the letters *a*, *b*, *c* or *d* appended thereto at the positions or stations A, B, C and D, respectively, and which are adapted to pivot freely about a horizontal pin **7** mounted in the related bracket *6a*, *6b*, *6c* or *6d*. The end of the upper arm of each angle lever is subject to the action of a spring **8** (FIGURE 2) in such a manner that it lowers the bottom arm of the related angle lever, which

at its end has a hole 25 (FIGS. 1 and 3) through which is guided the corresponding yarn. Inside the four yarn carrier groups an annular bearer 11 is disposed coaxially with the needle cylinder 10 and above the same, and carries a set or axially arranged stack of five rings 12, 13, 14, 15 and 16, the peripheries of which are profiled and which are joined fast to the annular bearer 11. The bearer 11 and the five rings are mounted in the machine frame (not shown) to be rotatable about the perpendicular axis of the cylinder 10.

The periphery of each ring is sub-divided into four equally profiled zones and each ring is intended to control simultaneously the four corresponding yarn carriers of the four working stations. Thus the ring 12 controls all the yarn carriers 1*a*, 1*b*, 1*c* and 1*d*, ring 13 controls all the yarn carriers 2*a*, 2*b*, 2*c* and 2*d* and so on.

Between the upper arm of each angle lever or yarn carrier and the corresponding ring 12, 13, 14, 15 or 16 pins are provided, such as the bar 9 in FIGS. 2 and 3, and is pressed against the periphery of the related ring by the action of the corresponding spring 8 on the related angle lever.

In the position of the set of rings illustrated, four notches 12*a* disposed at equal distances from one another in the ring 12 are situated opposite the bars 9 associated with the four yarn carriers 1*a*, 1*b*, 1*c*, 1*d* and these yarn carriers are turned by their springs 8 so that the lower ends are depressed to bring the corresponding yarns into the vicinity of the periphery of the cylinder 10. All the other yarn carriers are lifted, on the other hand, by the action of the peripheries of the rings 13, 14, 15 and 16 on the corresponding pins or bars 9 and hence on the corresponding angle levers which are thus out of operation, as shown in FIG. 3.

When the lower arms of the angle levers, which form yarn carriers, are lowered, the yarns passing therethrough are placed in the range of the needles at the related working positions, while the lower arms of the angle levers which are elevated raise the related yarns out of the range of the needles.

The annular bearer 11 has teeth 17 at its periphery engageable by a pawl 18 which, by means of levers 19, 20 and rods 21, 22, is made to reciprocate by teeth 23 on the central control element 24 of the machine. The effect thus achieved is that on each forward advance of the control element 24 the annular bearer 11 is advanced with the profile or cam rings 12—16 by one step so that other regions of the profiles of the rings come to lie opposite the or pins 9 at each working station, the position of the yarn carriers being varied accordingly.

When the annular bearer 11 has been advanced by one quarter revolution, the peripheral zones of the rings 12—16 which previously controlled for example the yarn carriers of the working station A, are rendered operative in the same way for the yarn carriers of the working station B.

It will be apparent that, in the present case with four working stations disposed at equal distances from one another and having associated yarn carrier groups, each control ring has four equal zones and the same sequence of control of the yarn carriers is repeated after each quarter revolution of the rings.

It will be apparent that the number of four working stations has been chosen purely by way of indication and that the device according to the invention can be applied to any desired number of working stations compatible with the construction of the machine. The only prerequisite to the application of the device according to the invention is that the working stations should be at equal distances from one another.

However, it should be pointed out that in certain cases it may be expedient and advantageous to apply the device according to the invention even if one or more working stations are absent from the equidistant stations.

With reference to the exemplified embodiment described, for example, one yarn carrier group could be absent from one of the four points A–D without this having the slightest effect and without thus impairing the use of the device.

In some cases it may also be required that the yarn carriers of one or more working stations should be completely put out of operation in certain phases of operation, and this can readily be achieved if the brackets 6 are mounted so as to be radially slidable, in which case they can be brought closer to or farther away from the control rings to either effect engagement of pins 9 with the related control rings or to remove the pins 9 from engagement with the control rings.

I claim:

1. In a circular knitting machine having a needle cylinder and a plurality of yarn supply stations spaced apart equally around the needle cylinder and each including an equal number of yarn carriers movable between operative and inoperative positions in relation to the needle cylinder; the combination of a set of cam rings mounted for turning coaxially with respect to the needle cylinder, the number of said rings being equal to said number of yarn carriers at each yarn supply station, each of said cam rings being intended to control a corresponding one of the yarn carriers at each of the yarn supply stations, means operatively associated with each of the yarn carriers at each of the yarn supplying stations and being actuated by the outer peripheries of the corresponding cam rings to control the selective disposition of the associated yarn carriers at said operative and inoperative positions of the latter, said outer periphery of each of said cam rings being divided into identically shaped profiled zones of equal length each occupying an angular extent of the related ring equal to the angular spacing between said equally spaced apart yarn supplying stations so that the corresponding yarn carriers at all of said stations are simultaneously and selectively disposed at said operative and inoperative positions, said profiled zones of the cam rings being angularly disposed relative to each other to effect the selective disposition of the yarn carriers at each yarn supplying station in the operative and inoperative positions thereof in accordance with a predetermined control sequence during turning of said set of cam rings through an angular extent equal to said angular spacing between the equally spaced apart stations, so that said control sequence is repeated during successive turnings of said set of cam rings through said angular extent, and means for intermittently turning said set of cam rings to repetitiously effect the movements of the yarn carriers at the yarn supplying stations between their operative and inoperative positions in accordance with said control sequence.

2. A circular knitting machine as in claim 1; wherein said yarn carriers at each station are in the form of bent levers rockable on a common axis and having upper arms disposed outwardly with respect to said outer peripheries of said rings; and wherein said means operatively associated with each of the yarn carriers to control the selective disposition of the latter includes spring means urging the bent lever to rock in the direction moving said upper arm toward said outer periphery of the related ring, and a slidable pin engaging, at its opposite ends, said upper arm of the related bent lever and said outer periphery of the related ring.

3. A circular knitting machine as in claim 2; wherein said means for intermittently turning said set of cam rings includes a ratchet fixed relative to the latter, an oscillatable pawl engageable with said ratchet to advance said set of cam rings with said ratchet upon each osciliation of the pawl, a moving central element for the knitting machine, and mechanism operated by said control element to oscillate said pawl.

4. A circular knitting machine as in claim 2; wherein said bent levers forming the yarn carriers at each of said yarn supplying stations are mounted in a common bracket

which is movable radially toward and away from said rings, so that all the yarn carriers at a particular station can be rendered inoperative by radial displacement of the related bracket away from said rings.

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