Jan. 9, 1940. E. J. TOWERS 2,186,506

CIRCULAR KNITTING MACHINE FOR PRODUCING ELASTIC FABRICS

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Fig. 1.

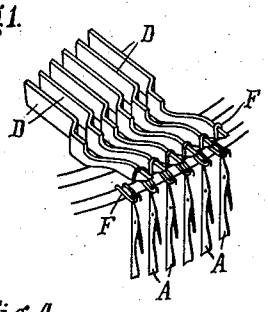


Fig. 2.

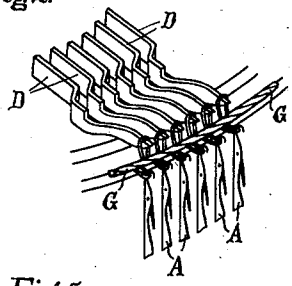


Fig. 3.

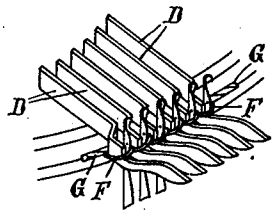


Fig. 4.

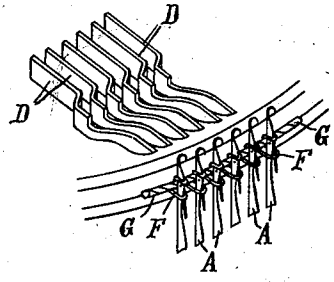


Fig. 5.

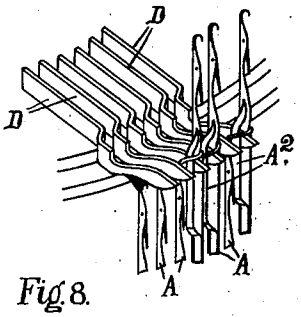


Fig. 6.

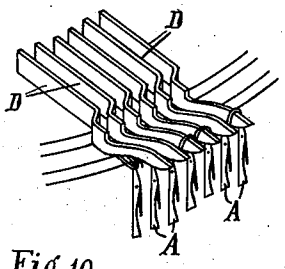


Fig. 7.

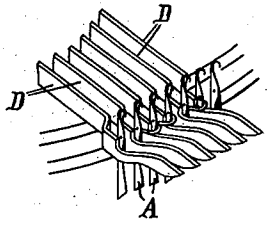


Fig. 8.

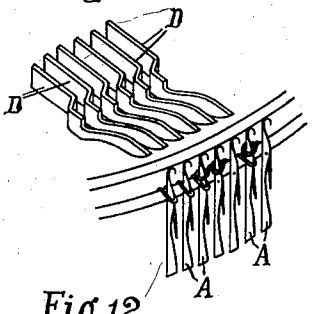


Fig. 10.

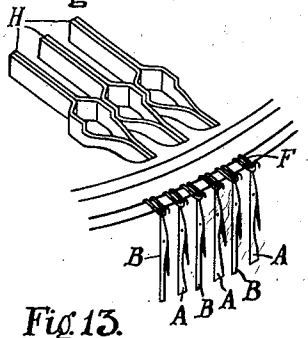


Fig. 11.

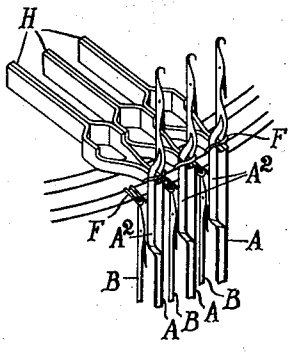


Fig. 12.

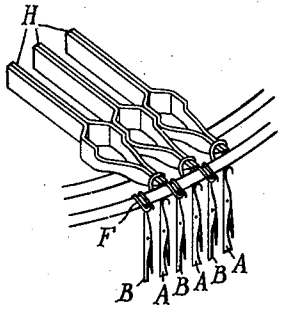
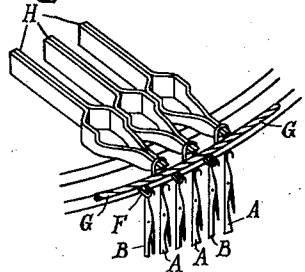


Fig. 13.



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Fig. 9.

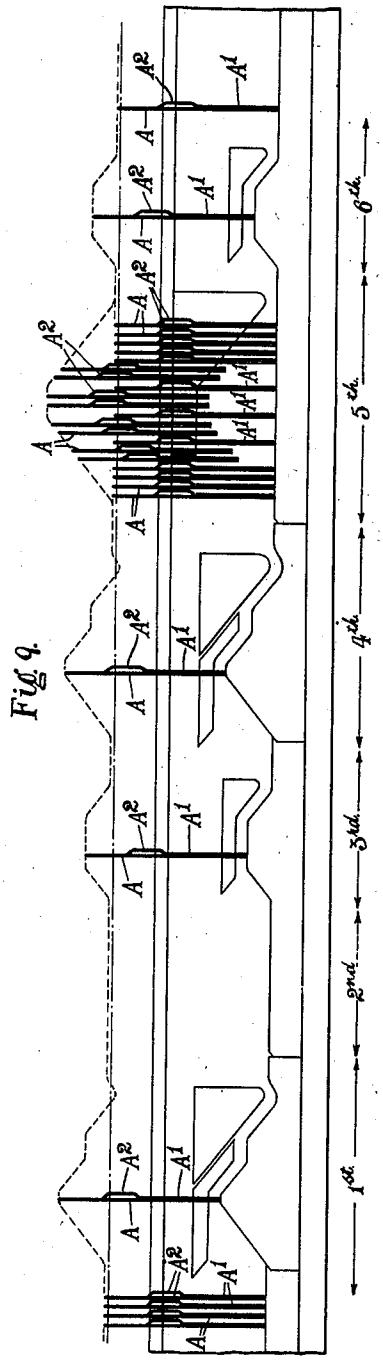


Fig. 18.

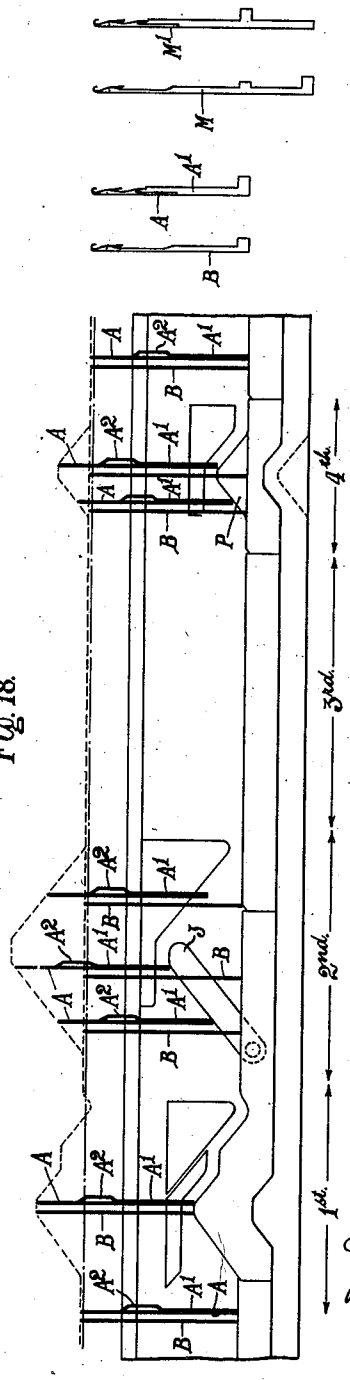
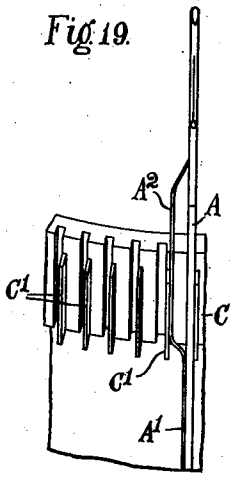


Fig. 19.



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Fig. 14.

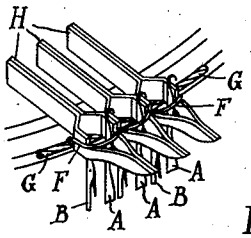


Fig. 15.

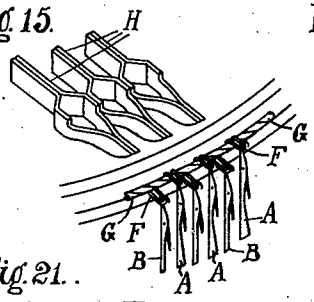


Fig. 16.

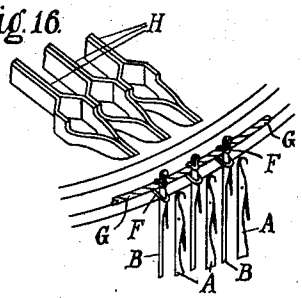


Fig. 17.

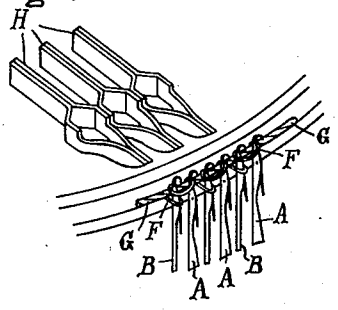


Fig. 21.

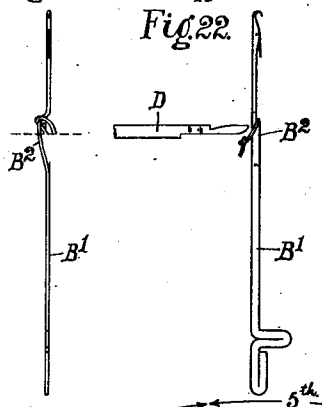


Fig. 22.

Fig. 23.

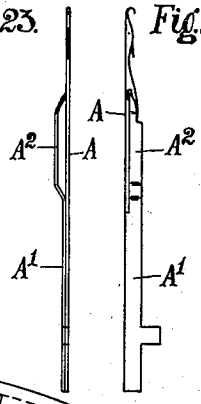
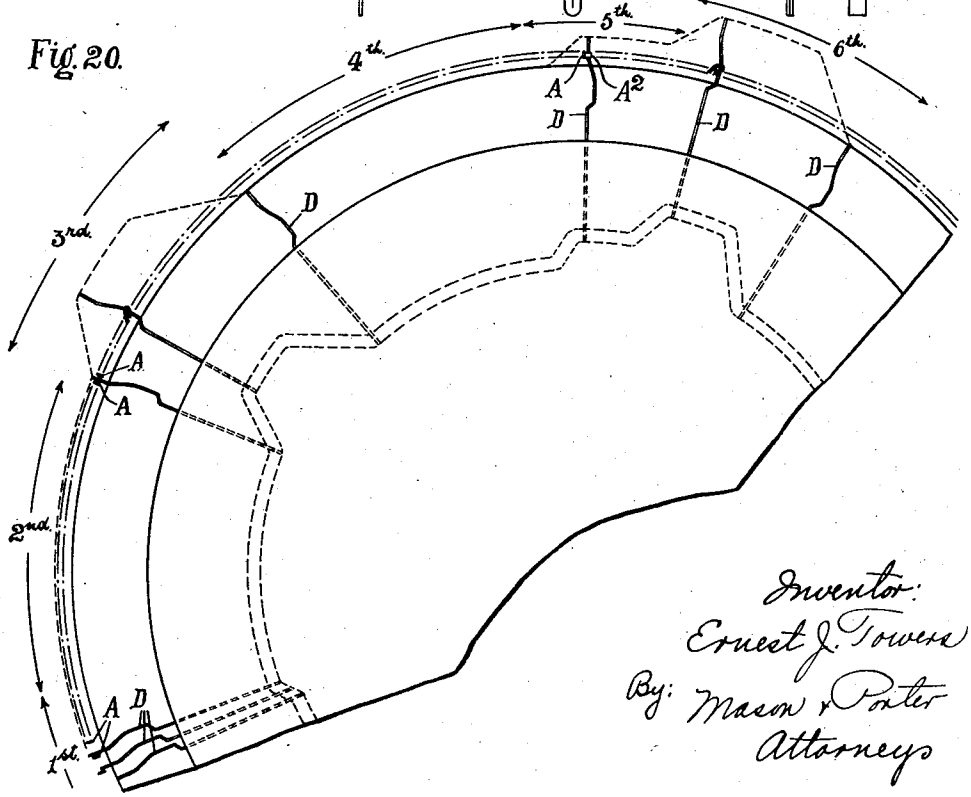


Fig. 24.

Fig. 20.



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Patented Jan. 9, 1940 2,186,506

UNITED STATES PATENT OFFICE

2,186,506

CIRCULAR KNITTING MACHINE FOR PRODUCING ELASTIC FABRICS

Ernest John Towers, Ruddington, England, assignor to George Blackburn and Sons Limited, Nottingham, England

Application April 3, 1939, Serial No. 265,798
In Great Britain February 15, 1938

6 Claims. (Cl. 66—9)

This invention relates to improvements in circular knitting machines for producing knitted elastic fabrics, and its object is to produce on such machines, a non-ribbed fabric in which straight elastic weft threads are introduced therein in a manner which is somewhat similar to that adopted in hand frames or straight bar knitting machines, and thereby producing elastic fabrics very similar to those made on a hand frame.

In order to produce an elastic fabric according to this invention, the needle cylinder of a circular knitting machine is fitted with latch needles, the whole or part of which may be constructed or associated with means whereby the loops can be readily removed therefrom by means of transfer instruments disposed in the dial. These transfer instruments are equal in number to and cooperate with the transfer needles in the needle cylinder, and the manipulations of the loops in a course which are necessary to embody an elastic yarn in the knitted fabric as it is produced, are effected by the needles and transfer instruments at different points in the circumference of the machine, where the cams are adapted to actuate the said needles and transfer instruments in the required manner.

In one order of working, the ground thread is first taken on both the cylinder needles and the transfer instruments, the elastic weft thread is inserted between the loops disposed on the needles and those disposed on the transfer instruments, and then the loops on the latter are transferred on to the cylinder needles and the weft thread secured by knitting a course on the needles.

In an alternative order of working, the ground thread is taken on the needles, a portion of the loops are taken from the needles on to the transfer instruments, the elastic weft thread is inserted between the two sets of loops, and then the removed loops are returned back to the cylinder needles again before knitting the next course. In both cases the several operations entailed are effected at different points in the circumference of the machine.

The structure of the elastic fabric produced as described is not precisely the same as that produced on a hand frame or on a straight bar machine fitted with bearded needles, as this is not possible for the following reason. In a hand frame for instance the courses are drawn on the needles by the sinkers, and the weft thread is inserted between the divided loops in the course before it is knitted. In a circular knitting machine with latch needles, the ground thread is taken by the needles and simultaneously knitted, and the division of the loops in order to embody a weft thread in a course, must take place after instead of before the course is knitted.

The invention will now be more particularly described with reference to the accompanying drawings, in which

Figs. 1 to 8 inclusive are diagrams illustrating the series of operations which are necessary in order to embody a weft thread in a knitted fabric in the process of manufacture according to our invention.

Fig. 9 is a development of the cams in the cam case which are adapted to actuate the needles as is required to effect the different operations shown in Figs. 1 to 8.

Figs. 10 to 17 inclusive are diagrams showing an alternative order of working which is adapted to embody a weft thread in a knitted fabric according to our invention.

Fig. 18 is a development of the cams for actuating the needles in the manner described and shown in Figs. 10 to 17.

Fig. 19 is a view showing part of the upper end of the needle cylinder.

Fig. 20 is a plan of the dial cams for actuating the transfer instruments as described and shown in Figs. 1 to 8.

Figs. 21 and 22 are front and side views of one form of transfer needle.

Figs. 23 and 24 are front and side views of another form of transfer needle.

Like letters indicate like parts throughout the drawings.

In carrying out this invention, transfer needles of any well known construction may be employed, for example the needles B^1 shown in Figs. 21 and 22 each of which is formed with a crank B^2 to expand the loops may be adopted, but the objection to this type of needle is that owing to the space taken up by the crank B^2, the needle tricks or gates have to be omitted from the upper end of the needle cylinder, and the upper ends of the needles are therefore unsupported.

In order to overcome this defect, straight needles A shown in Figs. 23 and 24 are employed, and a jack A^1 with a crank A^2 for expanding the loops, is disposed at the side of and in the same trick as each transfer needle. The crank A^2 on each jack A^1 can in this case be located outside the tricks or gates in which the needles are disposed, and the upper end of the needles A are not only as shown in Fig. 19 efficiently supported in gates which extend up to the top

of the needle cylinder C, but the latter can as shown in Fig. 19 be formed with extensions C^1 which hold the upper ends of the jacks A^1 close up to their needles A. The jacks A^1 it will be understood are actuated by the same cams as the needles A.

The transfer instruments D in the dial of the machine are of the usual cranked type and two of them placed together as shown in Figs. 10 to 17, form an ordinary pelerine instrument, which is usually employed to take a loop off one needle and place it on two.

In the order of working shown in Figs. 1 to 9 inclusive, a full set of transfer needles A with a transfer jack A^1 associated with each, is preferably disposed in the needle cylinder, and elastic weft threads G are embodied at the required intervals in courses in the fabric in the following manner. A ground thread F is fed to the needles A at one point in the circumference of the machine and is taken by both the needles A and transfer instruments D as shown at Fig. 1. At a second point in the circumference of the machine an elastic weft thread G is introduced between the loops on the needles A and those on the instruments D as shown in Fig. 2. At a third point the loops on the instruments D are transferred to the needles A, and this is effected by projecting the instruments D until the loops thereon are extended, and then raising the needles A up through the loops and subsequently retracting the instruments D so as to leave the loops on the needles A. The loops will now be all on the needles A, and the elastic weft thread G will be embodied in the course as shown in Fig. 4 when the next course is knitted.

Another weft thread can now be inserted by repeating the operations described, but if one or more ordinary courses are to be knitted between each weft thread course, extra yarn feeders and knitting cams are provided, and openwork ornamental effects can be produced in these courses, by transferring loops by means of the transfer needles A and instruments D already provided for introducing the elastic weft thread G into the fabric.

In transferring loops, the needles A on which the loops which are to be transferred are disposed, are first raised until the loops on the needles are expanded by the cranked portions A^2 on the jacks A^1 and the transfer instruments D are projected until their outer ends are disposed between the raised needles A and their associated jacks A^1 as shown in Fig. 5, and the needles A are then lowered leaving the loops on the transfer instruments D as shown in Fig. 6.

The loops are then returned but not to the same but to adjacent needles so as to form eyelet holes, and this is effected by projecting the transfer instruments D until the loops are expanded by their cranked ends, then raising the needles A up through the expanded loops as shown in Fig. 7, and finally retracting the instruments D, leaving the loops disposed in a new order on the needles A as shown in Fig. 8. The transfer instruments D will not return the loops to the same needles from which they were removed, but to needles on the right or left of the latter, according to the position of the cranks on the transfer instruments D.

In the development of the needle cams shown in Fig. 9, the cams at the first point for actuating the needles A, are adapted to draw a course on the needles A and transfer instruments D as described and shown in Fig. 1. The cams at the second point are adapted to retain the needles A as is required when the weft thread is being fed-in as described and shown in Fig. 2. The cams disposed at the third point are adapted to raise the needles A so as to take the loops from the instruments D as described and shown in Figs. 3 and 4. The cams at the fourth point are adapted to actuate the needles A so as to knit an ordinary course.

At the fifth point pattern or jacquard mechanism is provided to raise selected needles A, so that loops can be removed therefrom by the transfer instruments D as described and shown in Figs. 5 and 6. The cams at the sixth point are adapted to raise the needles A high enough to take the loops from the instruments D as described and shown in Figs. 7 and 8.

In the alternative order of working which is shown in Figs. 10 to 17 inclusive, the needle cylinder C is fitted with ordinary needles B in alternate tricks or gates, and with transfer needles A associated with loop expanding jacks A^1 in the remaining tricks or gates, and the dial is fitted with loop transfer instruments H to work in conjunction with the transfer needles A in the needle cylinder.

The transfer instruments H in this case are ordinary pelerine instruments which are generally used for placing one loop on two needles, and thus forming eyelet holes in the work. The advantage of using these instruments is that by using them as hereinafter described, a loop removed from one needle A can be replaced on the same or on an adjacent needle, or it can be replaced on two needles and form a larger eyelet hole when required.

In this case the ground thread F is fed to the needles A and B as shown in Fig. 10, and then the needles A are raised and the loops removed therefrom by the transfer instruments H as shown in Figs. 11 and 12. The elastic weft thread G is now inserted between the loops on the needles B and instruments H as shown in Fig. 13, after which the loops are returned from the instruments H to the needles A again.

This is effected by projecting the transfer instruments H so that they expand the loops and then raising one needle A through each of the expanded loops as shown in Fig. 14. As shown in Fig. 15 the loops have been returned to the same needles from which they were removed, while as shown in Fig. 16, the loops have been returned to different needles.

The transfer instruments H are wide enough to place a loop on two needles A as shown in Fig. 17, and will do this if two needles A are raised, or it will place the loop on either of the needles which are raised.

In the development of the cams (see Fig. 18) for actuating the needles in the manner described and shown in the diagrams Figs. 10 to 17, the cams at the first point are adapted to actuate the needles A and B as is required to draw a course on the needles as described and shown in Fig. 10. At the second point the cams are adapted to actuate the transfer needles A in order to transfer the loops thereon to the instruments H as shown in Figs. 11 and 12, and for this purpose the said needles have longer butts than the ordinary needles B and these longer butts are engaged by the clearing cam J. The elastic weft thread G is introduced at the third point where the needles A and transfer instruments D are holding the loops as shown in Fig. 13, and at the fourth point the needle cams are adapted to actuate the needles as

is required to effect the return of the loops to the needles A again as shown in Figs. 14 and 15.

If the single butted needles A and B are employed, the loops will be taken from the needles A and returned to the same needles again, as the needles raised by the cam P at the fourth point are the same as those raised by the cam J at the second point.

If the long needles M and M^1 shown on the right of Fig. 19 are employed, the needles M^1 will be raised to deliver the loops at the second point and the needles M will be raised to receive the loops at the fourth point. The cam P is in this case disposed in the lower dotted position.

The cams for actuating the transfer instruments D as described and shown in Figs. 1 to 8 are shown in Fig. 20 and it will be seen that the cams at the first point are adapted to position the instruments D so as to take the loop of ground thread as shown in Fig. 1.

The elastic weft thread G is inserted at the second point. At the third point the cams are adapted to operate the instruments D as is required to transfer the loops from the said instruments to the needles, as shown in Figs. 3 and 4.

At the fourth point the cams are adapted to withdraw the instruments D from action while the next ordinary course is being knitted. At the fifth point the cams are adapted to project the instruments D far enough to take the loops from selected needles A which are raised as shown in Fig. 5 and at the sixth point the cams are adapted to operate the jacks so that they return the loops to the needles A as shown in Figs. 7 and 8.

When two or more courses are knitted between the weft thread courses, tuck stitches may be formed on certain selected needles and when making openwork effects by transferring loops, tuck stitches may be made on the previous course on the needles from which the loops are transferred, so that in this case two loops will be transferred and the opening will extend over two courses.

What I claim as my invention is:

1. In a circular knitting machine, the combination of a needle cylinder, needles therein, a cam case associated with the cylinder, a dial, loop transfer instruments in the dial, a dial cam cap associated with the dial, and cams in the cam case and dial cam cap which are adapted to actuate the needle and transfer instruments and effect the following operations at different points in the circumference of the machine, divide the ground thread loops between the needles and transfer instruments at one point so that an elastic weft thread can be introduced between them, restore the loops to the needles at another point, and knit an ordinary course on the needles at another point, substantially as described.

2. In a circular knitting machine, the combination of a needle cylinder, needles therein with loop transfer means, a cam case associated with the cylinder, a dial, loop transfer instruments in the dial, a cam cap associated with the dial, and cams in the cam case and dial cap which are adapted to actuate the needles and transfer instrument and effect the following operations at different points in the circumference of the machine, that is, take the ground thread loops on the needles and transfer instruments at one point so that an elastic weft thread can be introduced between them, transfer the loops from the transfer instruments to the needles at another point, and knit an ordinary course on the needles at another point, substantially as described.

3. In a circular knitting machine the combination of a needle cylinder, needles therein with loop transfer means, a cam case associated with the needle cylinder, a dial, loop transfer instruments therein, a cam cap associated with the dial; and cams in the cam case and cam dial cap which are adapted to actuate the needles and transfer instruments and effect the following operations at different points in the circumference of the machine, that is, take a course of the ground thread on the needles at one point, transfer alternate loops from the needles to the instruments at another point so that an elastic weft thread can be introduced between them, return the loops to the needles at another point, and knit an ordinary course on the needles at another point, substantially as described.

4. In a circular knitting machine, the combination of a needle cylinder, needles therein with loop transfer means, a cam case associated with the cylinder, a dial, loop transfer instruments in the dial, a cam cap associated with the dial, and cams in the cam case and dial cam cap which are adapted to actuate the needle and transfer instruments and effect the following operations at different points in the circumference of the machine, that is, take the ground thread loops on the needles and transfer instruments at one point so that an elastic weft thread can be introduced between them, transfer the loops from the transfer instruments to the needles at another point, knit an ordinary course on the needles at another point, transfer selected loops of this course from one needle to another at another point and subsequently knit a plain course at a following point, substantially as described.

5. In a circular knitting machine, the combination of a needle cylinder, needles therein with loop transfer means, extensions on the needle cylinder for closing the loop transfer means, a cam case associated with the needle cylinder, a dial, loop transfer instruments therein, a cam cap associated with the dial, and cams in the cam case and dial cam cap which are adapted to actuate the needles and transfer instruments and effect the following operations at different points in the circumference of the machine, that is, take a course of the ground thread on the needles at one point, transfer alternate loops from the needles to the instruments at another point so that an elastic weft thread can be introduced between them, return the loops to the needles at another point, and knit an ordinary course on the needles at another point, substantially as described.

6. In a circular knitting machine, the combination of a needle cylinder, needles therein with loop transfer means, a cam case associated with the cylinder, a dial, loop transfer instruments in the dial comprised of two blades both of which are cranked, a cam cap associated with the dial, and cams in the cam case and dial cap which are adapted to actuate the needles and transfer instruments and effect the following operations at different points in the circumference of the machine, that is, take a course of the ground thread on the needles at one point, transfer alternate loops from the needles to the transfer instruments at another point so that an elastic weft thread can be introduced between them, transfer the loops from the transfer instruments to one or more needles at another point, and knit an ordinary course on the needles at another point, substantially as described.

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