

[54] CIRCULAR KNITTING MACHINE

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[51] Int. Cl. **D04b 15/02**

[58] Field of Search 66/95, 97, 24, 26

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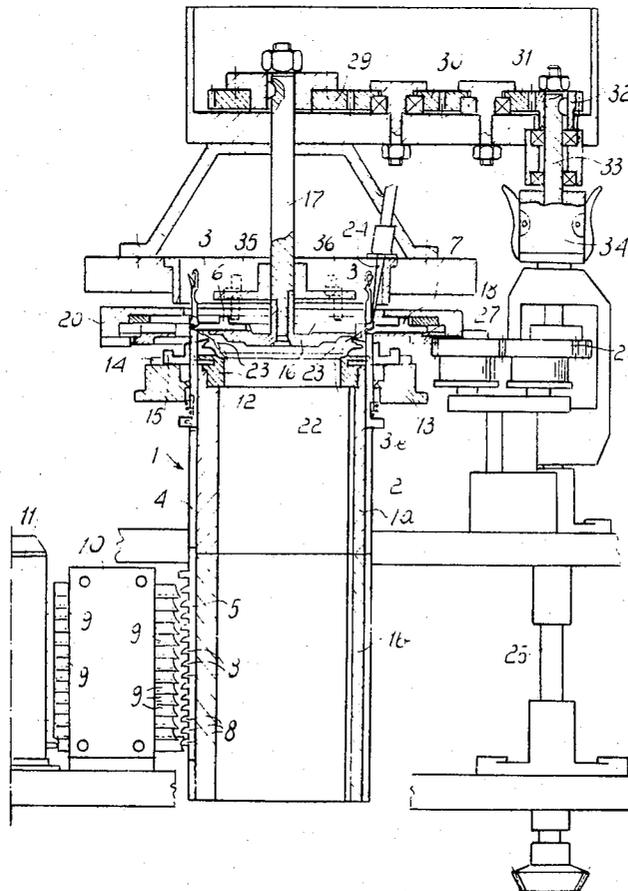
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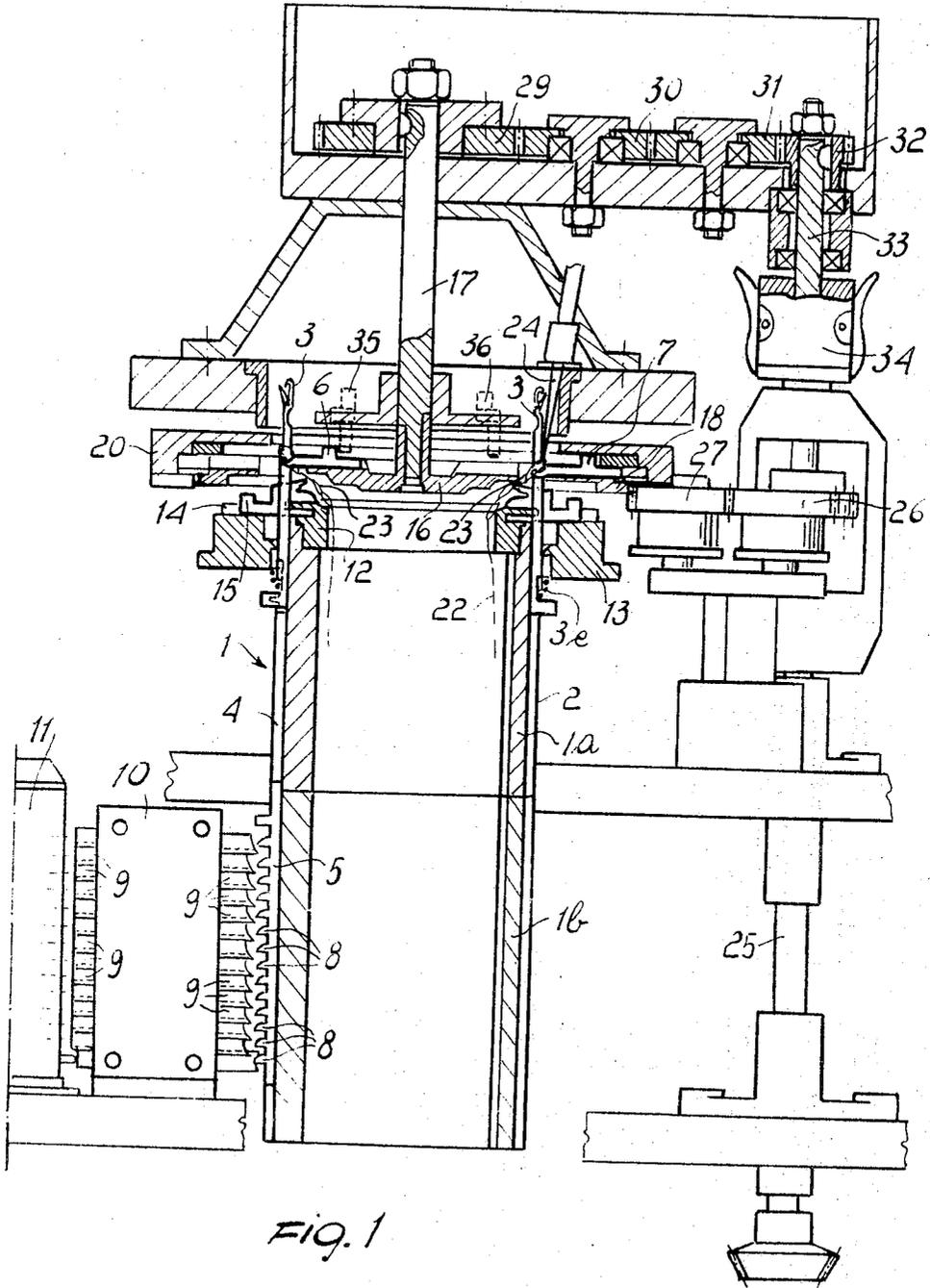
Attorney, Agent, or Firm—Dr. Guido Modiano; Dr. Albert Josif

[57] **ABSTRACT**

A circular knitting and stocking making machine for the manufacture of perforated stockings with transfer stitch patterns having a dial plate eccentric with respect to the needle cylinder and defining therewith an enlarged loop transfer zone. On this plate there is provided a plurality of punches slidable in a radial direction and devices for the advancement and withdrawal of said punches so as to permit the taking up of the loop from determined needles and its discharge on to others substantially adjacent. The needles slidable along the cylinder are provided below their point with means adapted to retain the loop and shaped in such a manner as to facilitate the taking up by said punches. The needle cylinder is provided with cams for raising this means on the needles substantially to the level of the punches.

5 Claims, 21 Drawing Figures





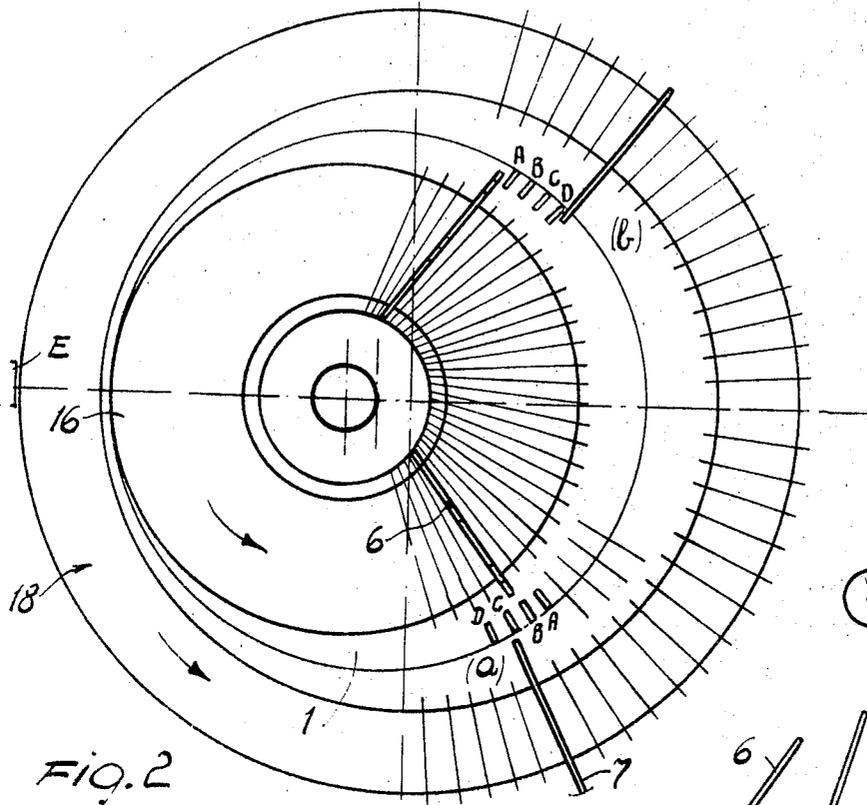


FIG. 2

FIG. 3

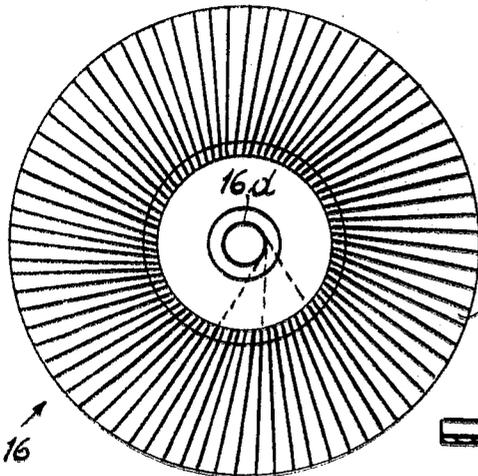


FIG. 5

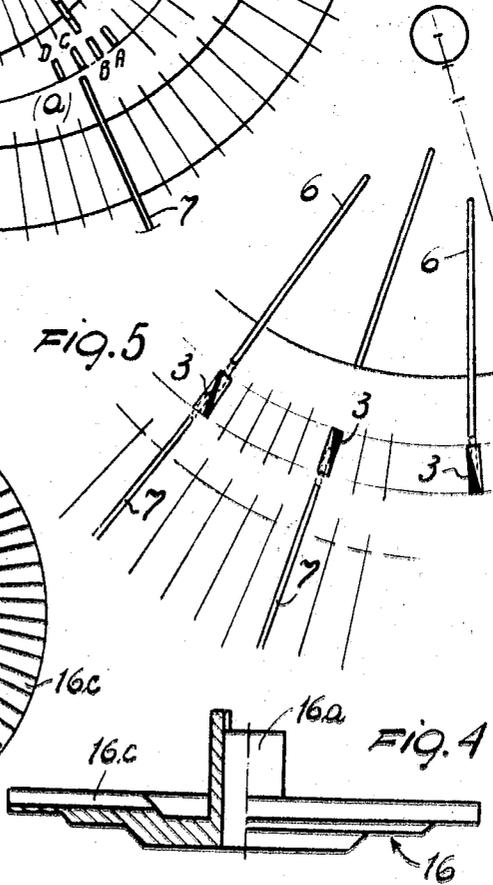
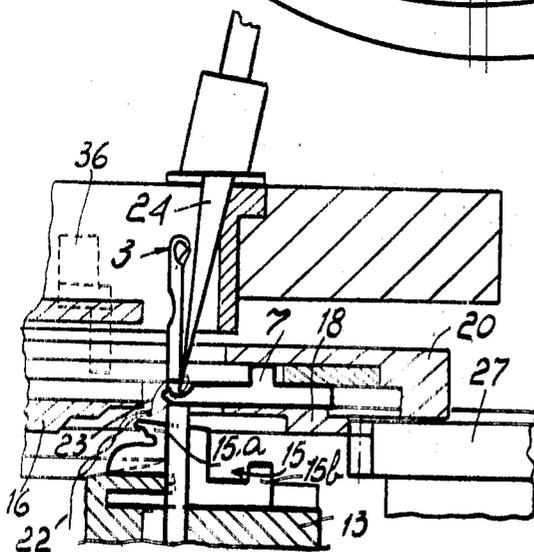
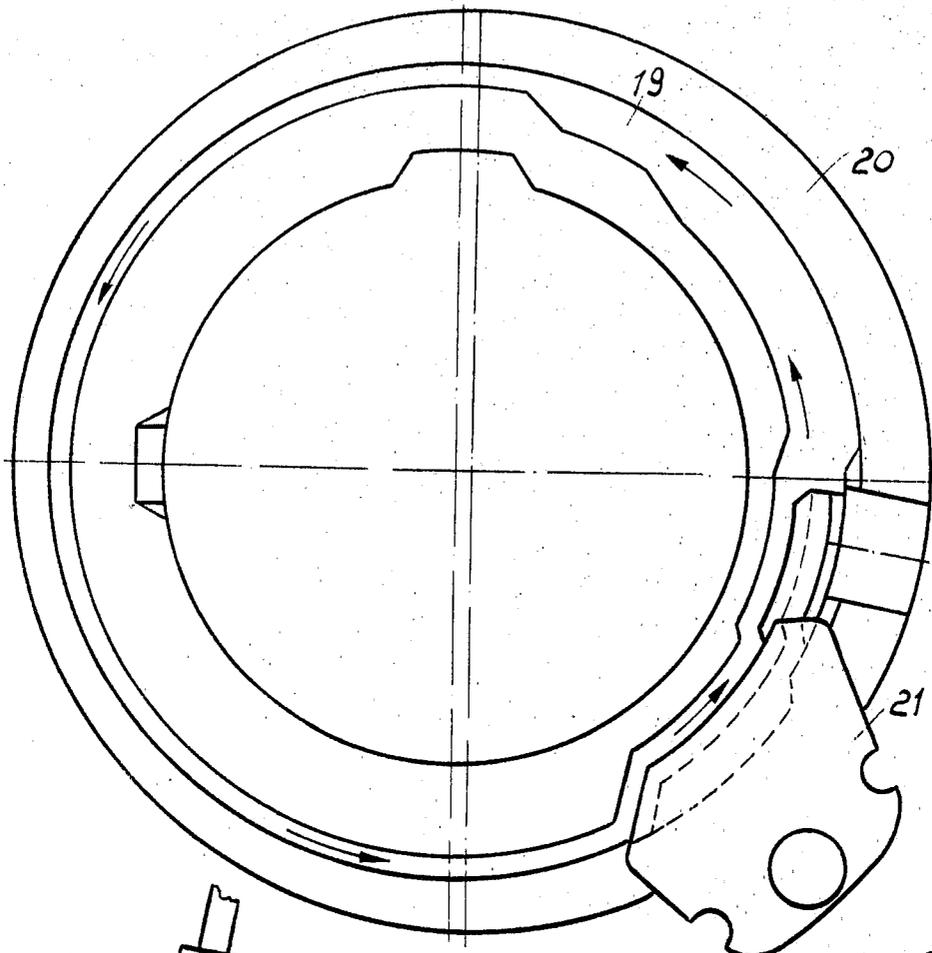


FIG. 4



6, 6a FIG. 6

7, 7a FIG. 7

FIG. 8

15.a, 15, 15b FIG. 9

FIG. 10

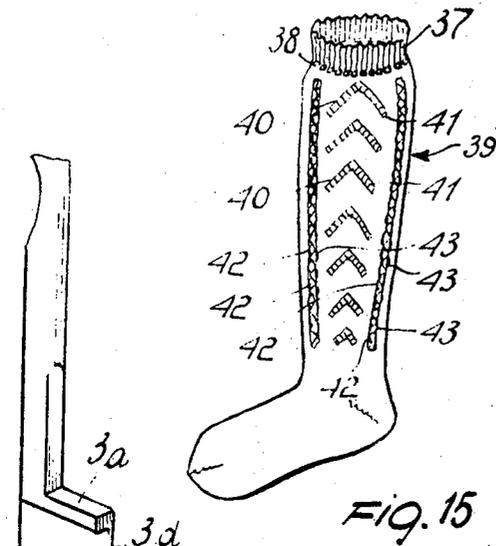


FIG. 15

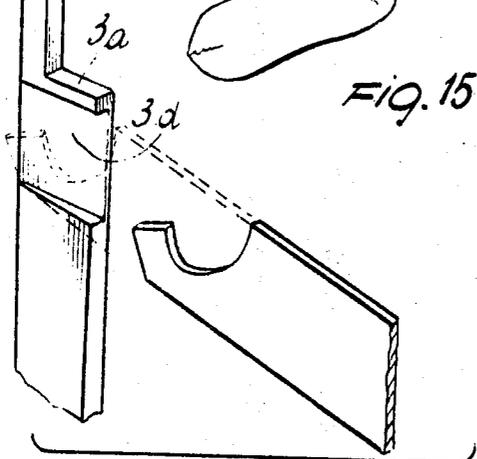


FIG. 14

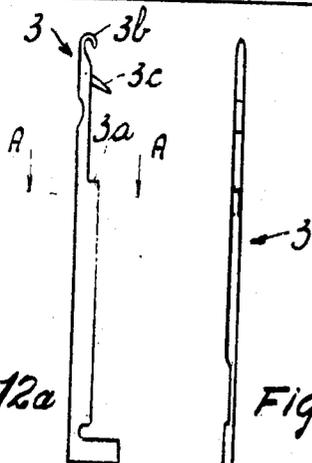


FIG. 12a



FIG. 12b

FIG. 12

FIG. 12c

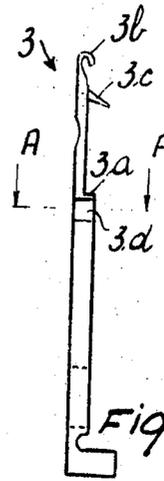


FIG. 11a



FIG. 11b

FIG. 11c

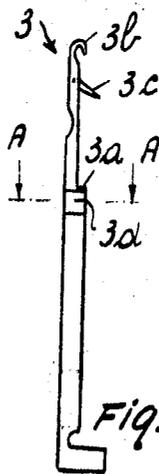


FIG. 13a

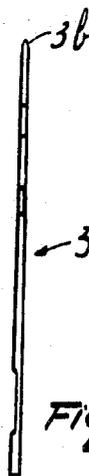


FIG. 13b

FIG. 13c

CIRCULAR KNITTING MACHINE

BACKGROUND OF THE INVENTION

The present invention relates to a circular knitting and stocking machine for the manufacture of perforated stockings with transfer stitch pattern.

At present this type of stocking is obtained by means of straight machines, which require considerable time for the manufacture of the tubular fabric. This fact leads to a limited production capacity for the machine, and consequently a considerable effect on the overall cost of the manufactured product.

SUMMARY OF THE INVENTION

The main object of the present invention is to provide a circular knitting machine which, in addition to its normal operations, permits the manufacture of perforated stockings with transfer stitch pattern, which up to the present time have only been obtainable from straight bar or flat bed machines.

A further object of the present invention is that a common circular knitting machine may be used adapted by particular modifications for this type of manufacture so as to guarantee reliability of operation and easy setting up.

A further object is to provide a machine which has a high rate of production with respect to those at present in use, so allowing manufacturing cost to be considerably reduced.

A further object of the invention is to be able to execute a wide range of transfer stitch pattern on stockings for women, men and children, with yarn of different types and thicknesses.

These and other objects are attained by the circular knitting and stocking making machine, comprising a dial plate internal to, and a planetary gear external to a needle cylinder, said plate and said planetary gear being eccentric on opposite sides with respect to said cylinder, on said plate there being provided a plurality of internal punches slidable in a substantially radial direction, on said planetary gear there being provided a plurality of external punches slidable in a radial direction, and devices for the advancement and withdrawal of said internal and external punches so as to permit the taking up of the loop from determined needles and its discharge on to others substantially adjacent, said needles slidable on said cylinder being provided appreciably below their point with means adapted to retain the loop and shaped in such a manner as to facilitate said taking up by said internal and external punches, said needle cylinder being provided with cam means for raising said means on said needles substantially to the level of said punches.

BRIEF DESCRIPTION OF THE DRAWING

Further characteristics and advantages of the invention will be more evident from the detailed description given hereinafter of a preferred but not exclusive embodiment of a circular knitting machine according to the invention, illustrated by way of example in the accompanying drawings in which:

FIG. 1 is a partially full and partially sectional view of the constituent members and driving means of the machine according to the invention;

FIG. 2 is a diagrammatic representation of the working positions of the needles and punches of the plate and planetary gear respectively;

FIG. 3 is a plan view of the dial plate according to the invention;

FIG. 4 is a half full and half sectional view of said plate;

FIG. 5 is an enlargement of FIG. 2 which illustrates the mode of operation of the punches and the position of the needles on the cylinder;

FIG. 6 is a diagrammatic view from above of the tracks and cams of the planetary gear support cover, which drive the external punches;

FIGS. 7 and 8 are lateral views of a plate punch and a planetary gear punch respectively;

FIG. 9 is a lateral view of a sinker of the machine according to the invention;

FIG. 10 shows the stitch discharge hook in the working position;

FIGS. 11a, 11b, 11c, 12a, 12b, 12c, 13a, 13b, 13c, are lateral, plan and sectional views on the line AA of a transfer needle of left discharge, right discharge and double discharge respectively;

FIG. 14 is an enlargement which shows indicatively the mode of operation of the external punch with respect to a needle;

FIG. 15 shows one of the possible transfer stitch patterns obtainable by the circular machine on stockings for men, women and children.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to said figures, the circular knitting machine according to the invention comprises a needle cylinder 1, either as a single piece or composed of two portions 1a and 1b, on the external surface of which there are grooves 2 which extend over the whole of the height of the cylinder 1, and in which the needles 3, the neutral elements 4 and the selectors or jacks 5 are slidable.

Said needles 3 are provided with a projection or shoulder 3a placed appreciably under the hook 3b and corresponding tongue 3c, and adapted to retain the loop. Suitable undercuts 3d are provided immediately below said projection to facilitate the coupling of the internal punches 6 and external punches 7. With the needles 3 a plurality of resilient rings 3e are engaged, inserted into a suitable groove and normally provided for maintaining the needles adhering to the cylinder shell. The selectors 5 are provided with teeth 8 which engage with a plurality of control means including slides 9 mounted horizontally slidable on a support 10 and arranged for driving by a drum 11 for the development of the pattern.

The cylinder 1 comprises an internal cylindrical crown 12 and an external cylindrical crown 13, in a conventional arrangement, on which the sinkers 15 are slidably mounted in appropriate radial grooves 14.

With reference to FIG. 9, said sinkers 15 are provided with an upper beak 15a, the purpose of which is to enlarge the loop carried by the needle so as to result in a successful transfer stitch. They also comprise a tooth 15b in a known arrangement, which driven by an appropriate cam moves said sinkers forwards and backwards radially.

The dial plate 16 is mounted above the needle cylinder 1 and eccentrically with respect to it to define

therewith a loop transfer zone, and is of substantially circular form. The dial 16 is eccentrically offset with respect to the axis of the needle cylinder 1 in the direction opposite to the transfer zone, so that the transfer zone includes an enlarged interspace extending for substantially a half of the circumference of the needle cylinder and the dial. The dial 16 is provided with a sleeve 16a by which it is locked on the shaft 17, and that side of it facing downwards is shaped so as not to interfere with the radial motion of said sinkers. The upper face of the plate is provided on its outside 16b with a plurality of grooves 16c for housing the punches 6, which are disposed not in the traditionally radial direction but inclined suitably in the direction contrary to the direction of rotation so as to constitute the envelope of the circumference 16d which has a radius substantially corresponding to the extent of eccentricity of said dial with respect to the needle cylinder (FIGS. 2 and 3). Advantageously said design gives greater reliability of operation in that it causes an inclination of the punches 6 which is particularly favourable to their insertion into the undercuts 3d in the needles 3 during the taking up of the loops.

In the same plane as the plate 16 and eccentric with respect to the cylinder 1, there is a planetary gear or annular member 18 of opposite eccentricity with respect to that of said plate. The punches 7 with projections 7a slide radially on it and engage in a corresponding track 19 provided on the cover 20, and provided with a cam 21 which drives said punches 7 forwards and backwards radially. During manufacture, the stocking 22 is suitably pulled downwards so as to generate a certain tension on its loops 23, by suction or mechanical traction means.

On the cover 20 (FIG. 1) is also fixed a device 24 of conical pointed form, adjustable from the outside, the function of which is to facilitate the unhooking of the loop from external or internal punches, and to eliminate any residual fibres which could remain hooked to them.

Said cover is also provided with fins (not visible in the figure) which allow it to be fixed to the frame of the machine.

In FIG. 1, the cylinder 1, the plate 16 and the planetary gear 18 rotate at the same rotational speed and in the same direction. They are rotated by a single driving unit which drives each of these members separately through different paths.

Thus whereas the needle cylinder is made to rotate in a conventional manner by gear members provided at its lower end, the planetary gear is driven by the main shaft 25 through the gears 26 and 27, this latter meshing with the teeth formed on the periphery of its lower face, and the plate supported by the shaft 17 is rotated in its turn by the gears 29, 30, 31 and 32, this latter keyed on the shaft 33, which is advantageously provided with a rapid clutch 34, so as to allow the cover 20 to be quickly removed.

FIG. 1 also shows cams 35 and 36 which cause the punches 6 of the plate to advance and return by acting on their projection 6a.

The circular knitting machine according to the invention operates in the following manner.

Having suitably set the pattern drum 11, the needles 3 can be raised. As a slide 9 driven by the drum 11 approaches, a certain number of selectors 5 are raised by way of the teeth 8, with consequent raising of the corre-

sponding neutral elements 4 and the needles 3. (All or a part of the needles may be made to rise.)

The needles 3 on being raised pass from a normal working position to a position for effecting the transfer stitch, which is appreciably above the usual position.

Assuming that this manufacturing process on flat bed machines is known and that the said stitch is obtained by transferring the loop from one needle to the other, it is emphasised that with the circular machine according to the invention, the passage of the loop (and not only of the yarn) from one needle to the adjacent one is carried out in such a manner as to effect said transfer stitch.

It should also be noted that with said machine two or more loops can be transferred simultaneously with two or more consecutive needles. With reference to FIG. 2, the succession of operations necessary for creating the transfer stitch takes place over about 120° opposite the feeding zone E, and is as follows.

The initial stage, which takes place slightly before the zone marked with a, consists of raising the required needles so that the loop is disposed and rests hooked on the projection or shoulder 3a or on some other notch provided on them.

When the needle has arrived in said position appreciably above the usual position, the sinker 15 advances and its hook 15a enters the loop, causing it to enlarge. Immediately afterwards one of the two plungers relative to said needle, either the internal or external one respectively, is made to advance. It enters the loop at the level of the undercut 3d provided on said needle and hooks it so that when the needle is successively returned to the normal position, the punch transports it.

Before arriving at the zone indicated by b, that needle which precedes or follows that considered initially, according to whether the internal or external punch was used, is raised and thus enters the loop (zone b) so allowing the punch to abandon it. As the needle returns successively to its normal working position, the transfer stitch is formed.

In conclusion, if four successive needles are indicated at A, B, C and D (FIG. 2) and the loops are to be taken from the needles B and C by the internal and external punches respectively, when said four needles arrive in the zone b, said loops will be located on needles A and D respectively because of the eccentricity of the plate and planetary gear with respect to the cylinder.

On utilising the internal punches 6 relative to the plate 16, the stitch is transferred in the forward direction from the needle B to the needle A, because the eccentricity of the plate with respect to the cylinder causes a lateral movement component so that in rotating from zone a to zone b the needles 3 become staggered with respect to the punches 6 by approximately one step. Vice versa when the external punches 7 relative to the planetary gear 18 are used, the stitch is moved in the backward direction from the needle C to the needle D because of the opposite eccentricity of the planetary gear 18 with respect to the cylinder 1, which in rotating the cylinder 1 from zone a to zone b caused the needles 3 to become staggered with respect to the punches 7 by about one step in the opposite direction to the preceding stagger between the needles 3 and punches 6.

The passage of stitches from the needles to the punches 6 and 7 is facilitated by the undercuts 3d in the

needles 3 which are formed by cross grooves inclined to the lateral surfaces of said needles, substantially as shown in FIGS. 11 to 14.

In this manner it is possible to transfer the loop or a number of loops respectively from one or more needles to the preceding or successive needles, an operation which allows the punched perforated stitch usually made only with flat bed machines to be obtained.

Advantageously the machine according to the invention permits rhomboidal cross Jacquard patterns or others to be obtained.

FIG. 15 shows diagrammatically for demonstration purposes one of the possible patterns which can be made with said machine. It comprises a first section 37 obtained by known processes, and constituting the edge of the stocking, then a complete turn 38 of transfer stitches in the course of which all the needles concerned work alternately with the external and internal punches in transferring the loop, and then the tubular portion 39 of the stocking with an inverted V motif of transfer stitches, the branches 40 and 41 of which are obtained by making different needles operate in successive turns, said needles operating always with the external punches or internal punches according to whether the branch 40 or 41 is considered. Vertical lines are also included, each comprising two series of holes 42 and 43 obtained respectively by the external and internal punches.

The invention so conceived is susceptible to numerous modifications, all of which fall within the scope of the invention idea.

We claim:

1. A circular knitting machine for the manufacturing of fabrics such as stockings having transfer stitch pattern, comprising a rotatably grooved needle cylinder, a plurality of needles each having a loop retaining shoulder and slidable within the grooves of said needle cylinder, a rotatable dial arranged above said needle cylinder and having a plurality of substantially radial grooves, said dial defining with said needle cylinder a loop transfer zone and being arranged eccentrically with respect to said needle cylinder, transfer elements slidable within the grooves of said dial for cooperation with the needles of said needle cylinder to transfer a loop from a needle to another needle in said loop transfer zone, and control means for operating said needles and said transfer elements, wherein, according to the improvement, said dial is eccentrically offset with respect to the axis of said needle cylinder in the direction opposite to said transfer zone, whereby said transfer zone includes an enlarged interspace extending for substantially a half of the circumference of the needle cylinder and the dial, and wherein the machine further comprises driving means for rotating said dial and said needle cylinder at substantially the same rotational speed during the loop transfer operation, said control means comprising cam means for operating said transfer elements substantially radially to said dial after reaching said enlarged interspace to take up a loop of fabric from a needle and to discharge said loop of fabric on another needle because of a lateral movement component caused by the eccentricity of said dial relative to said needle cylinder, and cam means for raising the needles to a level at which said loop retaining shoulder is arranged substantially at the level of said transfer elements.

2. A circular knitting machine for the manufacturing of fabrics such as stockings having transfer stitch pattern, comprising a rotatable grooved needle cylinder, a plurality of needles each having a loop retaining shoulder and slidable within the grooves of said needle cylinder, a rotatable dial arranged above said needle cylinder and control means for operating said needles, the machine further comprising a grooved annular member having a diameter substantially greater than that of said needle cylinder and arranged substantially on the same plane than said dial eccentrically with respect to said needle cylinder, said annular member having transfer elements slidable within the grooves thereof and each having hooked ends at the inside of said annular member, said circular knitting machine further comprising cam means for actuating said transfer elements of said annular member and driving means for rotating said annular member synchronously with said dial and said needle cylinder.

3. A circular knitting machine for the manufacturing of fabrics such as stockings having transfer stitch pattern, comprising a rotatable grooved needle cylinder, a plurality of needles each having a loop retaining shoulder and slidable within the grooves of said needle cylinder, a rotatable dial arranged above said needle cylinder and having a plurality of substantially radial grooves, said dial defining with said needle cylinder a loop transfer zone and being arranged eccentrically offset with respect to the axis of said needle cylinder in the direction opposite to said transfer zone, whereby said transfer zone includes an enlarged interspace extending for substantially a half of the circumference of the needle cylinder and the dial, transfer elements slidable within the grooves of said dial for cooperation with the needles of said needle cylinder to transfer a loop from a needle to another needle in said loop transfer zone, driving means for rotating said dial and said needle cylinder at substantially the same rotational speed during the loop transfer operation, and control means for operating said needles and said transfer elements, said control means comprising cam means for operating said transfer elements substantially radially to said dial after reaching said enlarged interspace to take up a loop of fabric from a needle and to discharge said loop of fabric on another needle because of the lateral movement component caused by the eccentricity of said dial relative to said needle cylinder; and cam means for raising the needles to a level at which said loop retaining shoulder is arranged substantially at the level of said transfer elements, the machine further comprising a grooved annular member having a diameter substantially greater than that of said needle cylinder and arranged substantially on the same plane than said dial eccentrically to said needle cylinder, the axis of said dial and said annular member being arranged at opposite sides of the axis of said needle cylinder, the said annular member having transfer elements slidable within the grooves thereof and each having hooked ends at the inside of said annular member, said circular knitting machine further comprising cam means for actuating said transfer elements of said annular member and driving means for rotating said annular member synchronously with said dial and said needle cylinder.

4. A circular knitting machine as claimed in claim 3, wherein said grooves of said dial are slightly inclined with respect to the radial direction of said dial in a di-

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rection opposite that of rotation of said dial, said grooves being each tangent to a circumference having the center corresponding to the center of said dial and a radius substantially corresponding to the extent of eccentricity of said dial with respect to said needle cylinder.

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5. A circular knitting machine as claimed in claim 3, further comprising an adjustable device for removing the yarn and any residuous from said transfer elements, said device including a pointed element projecting into said loop transfer zone.

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