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## (54) Apparatus for producing toweling in a circular knitting machine.

(57) Apparatus for producing toweling in a circular knitting machine, which consists of the fact that respective longitudinal guiding slots for pushers (6) are provided on the outer surface of the cylinder (2) in the regions located between the longitudinal needle guiding seats; the pushers (6) have a substantially saddle-shaped beak (7) at their top and, at their base, a heel (8) which is folded towards the outside of the cylinder (2).

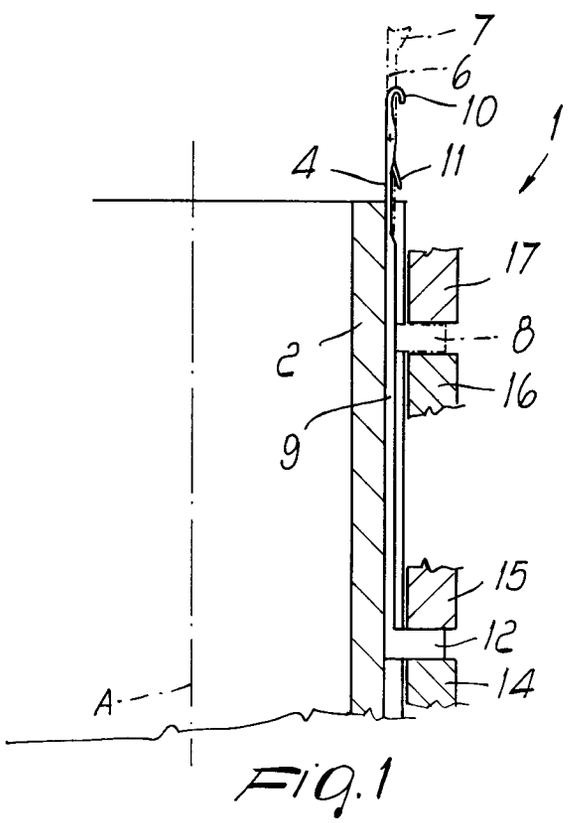


Fig.1

EP 0 668 384 A2

The present invention relates to an apparatus for producing toweling in a circular knitting machine.

In conventional circular knitting machines that produce toweling two threads, one for the ground stitch and one for the toweling stitches, also known as loops, are woven in a coordinated manner.

Most machines that produce this kind of knitting weave the toweling on the sinkers, which are accordingly provided with a lower casting-off plane to form the ground stitch and an upper one to form the loops; the sinkers are actuated in a radial direction by appropriately arranged cams and are inserted in radial millings formed on the cylinder. As an alternative, it is possible to insert two sinkers for each radial seat of the cylinder, each sinker having a single casting-off plane and being actuated independently of the other one.

In both cases, the sinkers that must weave in order to correctly manufacture the item are selected with the aid of movable cams in a rather complicated manner.

When the machine is also equipped with a platen which is provided with needles to produce corded knitting and must be kept very low and close to the casting-off plane of the ground stitch, it is difficult to produce toweling with the above described methods due to the additional casting-off plane for the loops, which hinders the correct arrangement of the needle platen by moving radially.

Some machines obviate the drawbacks described above by placing pushers between the needles of the cylinder so that they are laterally adjacent to the ground sinkers, replace the sinkers provided with an additional beak, are actuated parallel to the needles, and have saddle-shaped tops that form the casting-off surface for the loops.

In machines of this last type, the needle sliding seats are formed on the outer surface of the cylinder (as in machines that do not produce toweling) and the pusher sliding seats are formed on the internal surface of the cylinder: the actuation and selection of the pushers, however, is complicated as it is necessary to act on the internal surface of the cylinder, which cannot be accessed easily and is a confined space that is accordingly unsuitable for mounting complicated actuation devices.

The technical aim of the present invention is to obviate the above mentioned drawbacks, that it so say to provide an apparatus for producing toweling in a circular knitting machine which acts by means of pushers that are not mounted inside the cylinder so that they can be actuated easily with low-cost devices that can be installed without space problems.

Within the scope of this technical aim, an object of the present invention is to achieve said aim with a structure that is simple, relatively easy to produce in practice, safe in use, effective in operation, and relatively cheap.

This aim and this object are both achieved by the present apparatus for producing toweling in a circular knitting machine, characterized in that respective longitudinal guiding slots for pushers are provided on the outer surface of the cylinder in the regions located between the longitudinal needle guiding seats, said pushers having a substantially saddle-shaped beak at their top and, at their base, a heel which is folded towards the outside of the cylinder.

Further characteristics and advantages of the present invention will become apparent and evident from the detailed description of a preferred but not exclusive embodiment of an apparatus for producing toweling in a circular knitting machine according to the invention, illustrated only by way of nonlimitative example in the accompanying drawings, wherein:

figure 1 is a schematic sectional side view, taken along a vertical plane, of half of a cylinder equipped with an apparatus according to the invention;

figure 2 is a sectional plan view, taken along a horizontal plane, of a sector of the cylinder of figure 1;

figure 3 is a side view of a needle and of a pusher which are mutually aligned and also illustrates, in a flattened-out view, the shape of the corresponding actuation cams.

With particular reference to the above figures, the reference numeral 1 generally designates an apparatus for producing toweling in a circular knitting machine according to the invention.

The apparatus 1 comprises a cylinder 2 in which the axis is referenced by A; said cylinder has, on its outer surface, multiple radial and longitudinal seats 3 for guiding the needles 4; said seats are distributed with a constant spacing, and regions Z having a certain width remain between them; it is stressed that the invention is preferably applied to circular machines, in which the needles are somewhat spaced from each other.

Respective longitudinal slots 5 for guiding pushers 6 are formed preferably at the centerline of the regions Z in the outer surface of the cylinder 2.

Said pushers 6 have, at their top, a beak 7 which is substantially saddle-shaped and have, at their base, a heel 8 which is folded towards the outside of the cylinder; the heels 8 can have different heights, as shown in the figure by the indices a, b, and c, and can be actuated by three different sets of cams.

The stems 9 of the needles 4 have, in their upper part, hooks 10 and tabs 11 and, in their lower part, respective heels 12; said heels 12 can

have different heights, referenced in the figures with the indices a, b, and c, and can be actuated by different sets of cams located at a different level with respect to the cam sets of the pushers.

The stems 9 are longer than the stems 13 of the pushers, and the cams of the pushers are arranged above the cams of the needles: this solution allows to interrupt the millings for the pushers before reaching the working area of the heels of the needles and thus avoids weakening the cylinder in this region.

The cams 14 and 15, respectively for lifting and lowering the heels of the needles, and the cams 16 and 17, respectively for lifting and lowering the heels of the pushers, are mounted on the outside of the cylinder 2.

The cams 17 for lowering the heels of the pushers have rotating sectors 18 which allow to actuate the heels 8 in both of the machine rotational directions.

It is also possible to provide for a movement of the cam 16 that allows to select the needles a, b, and c of the pushers, thus choosing to form toweling or not in certain regions of the product.

The operation of the apparatus according to the invention is analogous to the operation of similar devices with pushers mounted inside the cylinder, but has the advantage that is allows to mount the heel actuation cams on the outside, without bulk problems: in practice, while one needle descends, the corresponding pusher is lifted, and the saddle-shaped beak 7 raises the loop thread from the ground thread and keeps it raised until the ground stitch and the toweling loops have formed: after forming the stitch, the pusher is lowered below the level of the sinkers to release the stitch and allow the sinker to cast it off.

It has thus been observed that the invention achieves the intended aim and object.

The apparatus for producing toweling according to the present invention is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

In practice, the materials employed, as well as the shapes and dimensions, may be any according to the requirements without thereby abandoning the protective scope of the claims that follow.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

## Claims

1. Apparatus for producing toweling in a circular knitting machine, characterized in that respective longitudinal guiding slots (5) for pushers (6) are provided on the outer surface of the cylinder (2) in the regions located between the longitudinal needle (4) guiding seats (3), said pushers (6) having a substantially saddle-shaped beak (7) at their top and, at their base, a heel (8) which is folded towards the outside of the cylinder (2).

2. Apparatus according to claim 1, characterized in that the cams (15,16) for the actuation of the heels (12) of the needles (4) and of the heels (8) of the pushers (6) are mounted on the outside of the cylinder (2).

3. Apparatus according to claim 1, characterized in that the stems (9) of the needles (4) are longer than those (13) of the pushers (6) and in that the cams (16,17) of the pushers (6) are arranged above the cams (15,16) of the needles (4).

4. Apparatus according to claim 1, characterized in that the pusher guiding slots (5) are arranged halfway within the regions (Z) that lie between the needle seats (3).

5. Apparatus according to claim 1, characterized in that the cams (16,17) for actuating the heels (8) of the pushers (6) have movable sectors (18) that allow to actuate the heels (8) in both of the machine rotation directions.

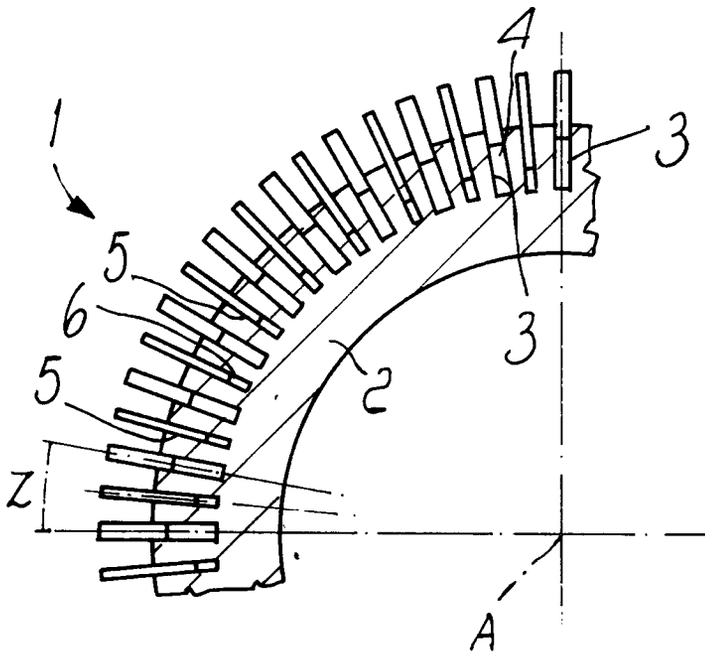


Fig. 2

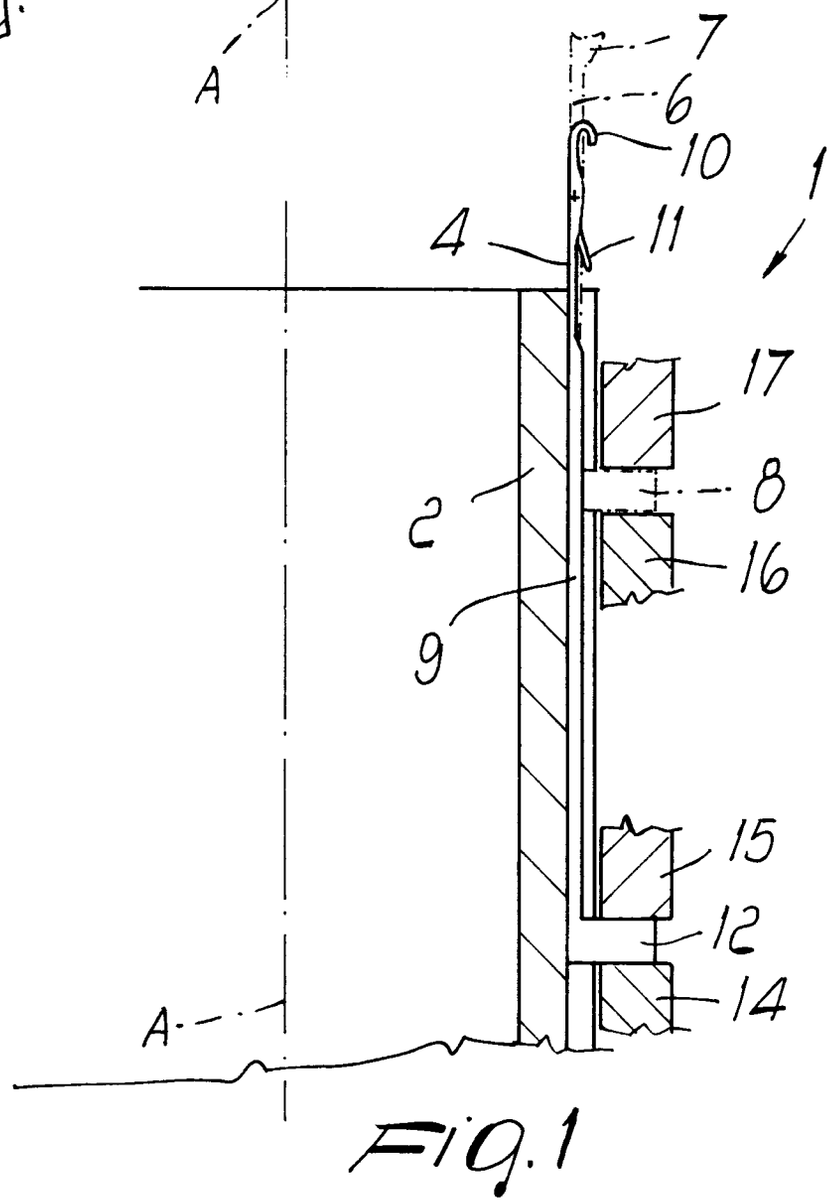


Fig. 1

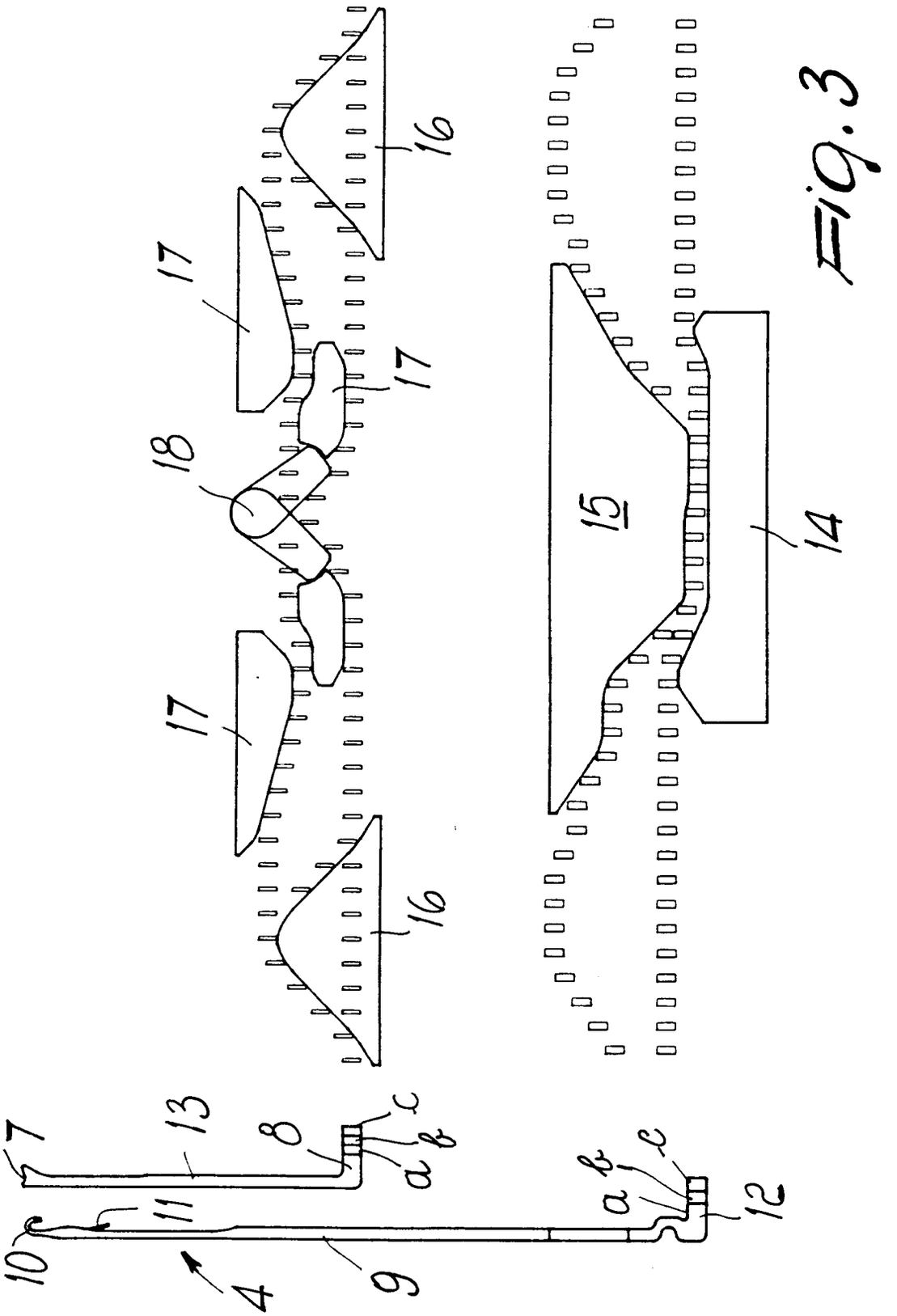


Fig. 3