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(71) Applicant: **SAVIO MACCHINE S.p.A.**
**Via Vincenzo Monti, 23**
**I-20016 Pero (Milan)(IT)**

(72) Inventor: **Capella, Angelo**
**Via Mascagni 12**
**I-46043 Castiglione Delle Stiviere(IT)**

(72) Inventor: **Beschi, Primo**
**Via Boschetti Mezzo**
**I-25018 Montichiari (Brescia)(IT)**

(74) Representative: **Giambrocono, Alfonso, Dr. Ing. et al,**
**Ing. A. Giambrocono & C. S.r.l. Via Rosolino Pilo 19/B**
**I-20129 Milano(IT)**

(54) **Device to be applied on circular knitting machines for making stocking elements with stretched cuffs and adapted for locking the cuff and reversing the stocking elements being formed.**

(57) The invention relates to a device to be applied to a circular knitting machine for making tubular elements with stretched cuffs or top edges to be used for making stocking articles. The device comprises a stem traversing a longitudinal cavity formed in the circular knitting machine plate supporting shaft, the shaft being rotatably coupled to the stem which may swing axially and the end of which projects under the machine plate and bears a rigid member provided with an annular edge which, between the two end of stroke positions of the stem, may be held removed from the plate lower face and held pressed thereon, so as to define a hollow chamber for holding the cuff between the plate and rigid member within the annular edge. The stem is coupled to a cam supported by the knitting machine cam main drum, in such a way as to hold the rigid element lowered at least during the first cuff making step and at the end of the forming of the tubular element and to hold that same rigid element raised during the intermediate steps. Thus, the just formed cuff is locked on the machine plate and the tubular element is reversed during the making thereof to be completely reversed at the end of the making step thereof.

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DESCRIPTION

The present invention relates to a device to be applied on circular knitting machines for making tubular stocking elements with stretched cuffs or top edges, the device being adapted for locking on the machine plate said stretched cuff and reversing each tubular element being formed.

As is known, stocking articles (in particular for man) having a stretched mouth or free end, the so-called cuff, are made, in the form of tubular elements, by using known circular knitting machines. In these machines there is firstly made the stretched cuff and then the remaining portion of each tubular element which, at the end of the making operation, after an automatic cutting from the textile yarns supplying each machine, is driven to a collecting vessel by means of a sufficiently strong air stream sucked to the inside of the needle cylinder of the circular knitting machine.

According to the presently used technique, air is caused to be continuously conveyed to the inside of the needle cylinder and the tubular element of each stocking article being formed, starting from the stretched cuff which represents the first portion of each tubular element which is made, is sucked downward into the needle cylinder in which the tubular element is formed. Thus, as is known to those skilled in the art, the finished tubular element presents outward turned that portion thereof provided for

forming the outer face of the stocking article.

Since, in order to obtain a finished stocking article, the stocking article toe is to be seamed and since the seam is to be arranged inside the finished stocking article, it is necessary to reverse each tubular element which has been made in the above mentioned way, in order to close, by a seaming operation, the free end of said tubular element opposite to the end thereat the stretched cuff is formed. Then the stocking article is straightened, packaged to be ready for selling.

The reversing operation of the tubular elements after the making of said elements on the circular knitting machine, to allow for the stocking article toes to be seamed, requires a lot of time and is very expensive.

## SUMMARY OF THE INVENTION

Accordingly, the main object of the present invention is to provide a device to be applied to circular knitting machines for making stretched-cuff stocking articles, which device is adapted for locking, on the knitting machine plate thereon it is mounted, the stretched cuff of each tubular element being formed, so as to cause said tubular element to be automatically reversed as it is made, to obtain a reversed tubular element, that is a tubular element having that portion provided for forming the outer face of the stocking article turned to the inside of said tubular element.

Another object is to provide a device of the above mentioned type which is structurally very simple, of low cost, of simple assembling and operation and adapted for being easily applied on any known types of knitting machines.

According to one aspect of the present invention, the above and other objects are achieved by a device to be applied to a conventional knitting machine for making stretched-cuff tubular elements, said machine comprising a needle cylinder and a machine plate supported by a shaft mounted above said needle cylinder near the needle hook ends, the device being characterized in that the machine plate supporting shaft is traversed by a longitudinal cavity therethrough a longitudinally swingable stem extends, said stem being rotatably coupled to said shaft, the lower end of said stem projecting under said machine plate and supporting a rigid element provided with an annular edge opposite and parallel to said machine plate lower surface and having a less diameter than the outer diameter of said machine plate and the inner diameter of said needle cylinder, a driving body abutting on said stem to cause said stem to lower during the making step of said cuff and respectively at the end of the making of said tubular element and for causing said stem to be raised after the making of at least a portion of the cuff and until the end of the making of said tubular element, said rigid element, in its raised position, being resiliently pushed toward the lower surface of said machine plate,

during which movement the annular edge of said rigid element contacts, for the overall extension thereof, said machine plate or stretched cuff, formed thereunder, while the remaining portion of the rigid element is held comparatively away from the adjacent surface of said machine plate.

## BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the structure and features of the device according to the invention, an exemplary embodiment thereof will be described thereinafter with reference to the accompanying drawings, where:

Fig. 1 is a partial schematic cross-sectional view illustrating the device applied on a circular knitting machine, said knitting machine being simply schematized by a cross-sectional view, the device and knitting machine being in their rest conditions, and

Figs. 2 to 6 illustrate the knitting machine and device associated therewith during the different steps for making a tubular element to be used for making a stocking article.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

As is known, the circular knitting machines, such as those adapted for making tubular elements for stocking articles, are rather complex machines which comprise a cylinder provided with a number of needles, selectors, a machine plate superimposed on the needle cylinder and bearing hook members, yarn guiding small

plates and a rotating drum bearing a plurality of cams which, through transmission members, drive all of the members pertaining to each machine, such as needles, the machine plate, yarn cutting blades, the members for supplying the yarns to the needle and so on.

These machines and the parts thereof are well known per se and accordingly they are not disclosed therein in any further details.

In the drawings there has been schematically illustrated a needle cylinder 1 in which there are formed a plurality of longitudinal grooves each of which houses a needle 2 the free end 3 of which is of hook shape and upward. turned.

Above the needle cylinder, there is provided a machine plate 4, which supports hook elements 5, said plate being supported by and coupled to a shaft 6 which is in turn rotatably supported on a rigid supporting member 7. By means of gears 8, 9, a rotating shaft 10 and gears 11, 12 said plate is simultaneously rotated with the same speed as the needle cylinder 1.

The driving of the needles 2, radial displacement of the plate hook members 5, driving of all of the members supplying to the knitting machines the textile yarns (which, for simplicity, have been not shown in the drawings) are obtained, through suitable transmission members, by means of cams which are mounted on a cam drum performing, for example, a complete 360°

revolution about its axis each time a textile tubular element is formed. The cam drum and members associated therewith are not illustrated herein and they have not been shown in the drawings, since they are well known and since they are not necessary for understanding the present invention.

As is known, air may be sucked inside the needle cylinder 1, in a downward direction, with reference to the drawings, which air downwardly drives the tubular elements being formed to convey them, after finishing, to a collecting chamber.

With reference to Fig. 1, the device according to the invention will be disclosed thereinafter. As is shown in Fig. 1, the machine plate 4 and shaft 6 are traversed by a central longitudinal cavity also extending through the gear 8: into this cavity there is inserted an elongated rectilinear axially swingable stem 13 the bottom end of which projects under the machine plate. With the lower or bottom end of the stem 13 there is rigid a rigid element 4 of substantially cup shape, with its cavity upward turned and the free edge of which is formed as a continuous annular shape laying in a parallel surface to the bottom surface of said plate in which there is formed a recess 15 so that, as the cup-shaped element 14 is raised as thereinafter disclosed, said annular edge simultaneneously contacts a corresponding annular surface of said plate: in these conditions, a collecting chamber 16 (Figs. 4, 5, 6) which will be illustra-

ted in a more detailed way thereinafter, is defined between the inside of the cup-shaped element 14 and the opposite surface of said plate.

As clearly shown in Fig. 1, with the stem 13 there are rigid one or more radially extending pins 17 each of which extends in a longitudinally movable way within a respective longitudinal groove 18 formed in the shaft 6: accordingly the stem 13 is rotatably coupled to the shaft 6, and is free of axially moving with respect to said shaft. Fig. 1 also shows that on the pin 17 a spring 19 operates in such a way as to cause the stem 13, together with the cup-shaped element 14, to be upwardly displaced.

The top end of the stem 13 is free and bears a collar 20 thereagainst the free end abuts of a lever 21 which may swing on a pin 22 supported by the support member 7, the other end of said lever 21 being affected by transmission members which are mechanically coupled to a sensor member arranged in front of the knitting machine cam main drum; on said drum there is mounted a cam affecting said sensor member and accordingly said lever 21 so as to transmit to the stem 13 the axial movement which will be disclosed thereinafter. More specifically, since the cam drum is present on all of the circular knitting machines and since it should be obvious to apply thereto a cam and connect it to the lever 21 to transmit to said cam the thereinafter disclosed movements, said drum, as well as the means for coupling it to the lever, will

be not disclosed in any further details, the following description being sufficient to this end.

With reference to Fig. 1, in which the disclosed device is in a rest condition, before the start of the making of a new textile tubular element, it should be apparent that, in these conditions, the cam of the cam drum holds the lever 21 rotated to the position of Fig. 1, in which position said elever 21 holds downward pushed the stem 13 together with the cup-shaped element 14.

Supposing that the knitting machine operates, the machine plate 4 is caused to rotate together with the cup-shaped element 14 and needle cylinder.

Thus, the needles 2 begin to make the stretched cuff of a textile tubular element for making a stocking article: firstly a first cuff portion 30 (Fig. 2) is formed extending under the plate and having a nearly flat horizontal laying (comparable to a textile disc perforated at the center and slightly curved towards its center) because of the resilient yarns of the cuff, which resilient yarns are tensioned and tend to displace towards the needle cylinder axis the cuff portion being formed.

As the already formed cuff has a sufficient length (as shown at 31 in Fig. 3) to extend between the machine plate and cup-shaped element 14, the cam thereto the lever 21 is coupled operates on said lever so as to rotate it clockwise (as shown in Fig. 1) thereby causing the stem 13 to be raised by the

spring 19. Thus the cup-shaped element is pushed toward the machine plate (Fig. 4) in such a way as to resiliently lock against said machine plate the cuff portion 31 arranged between the thin top annular edge of the cup-shaped element 14 and the opposite surface of said plate.

The locking of the cuff 31 of the tubular element is very firm and stable if two basilar requirements are met, that is if between the cup-shaped element 14 and plate a chamber 16 is formed (Figs. 4, 5 and 6) to collect possible wrinkles or folds formed by the innermost portion (that is by the first formed portion) of the cuff, where the resilient yarns have lost all their tension and where said yarns are pushed toward the central axis of the needle cylinder by the outermost loops (that is the tensioned loops)of the cuff; and if the continuous annular edge of the cup-shaped element 14 is so sized as to contact an annular region of the cuff 31 where the loops are still tensioned toward the central axis, that is where the cuff forming knitted fabric is still tensioned and flat.

After the firm locking of the cuff 31 on the machine plate along a complete annular surface, the making operation of the textile tubular element is continued, a portion of said tubular element being shown in Fig. 5 and indicated by the referecne number 32: as shown in Fig. 5, while the cuff 31 is held locked on the machine plate, the tubular element

between said cuff and the hooks of the needles 2 assumes a U shape. In other words that portion of the textile tubular element provided for forming the outer surface of the stocking article will face the needle cylinder axis.

After having obtained the desired length of the tubular element, the textile yarns are cut and discharged from the needle hooks and the tubular elements, indicated at S in Fig. 6, will extend downward inside the needle cylinder and will remain, for a short period, bound to the machine plate through the cup-shaped element 14, as shown in Fig. 6: in these conditions, the inside surface of the tubular elements S will be the surface provided for forming the outer surface of the stocking article which can be made by seaming the free end, that is the end opposite to the cuff end, of the tubular element.

It should be apparent that at the time of cutting the yarns forming the tubular element S (Fig. 6) or during the subsequent step in which the cuff 31 is locked on the machine plate, the cam drum may drive, in a conventional way, a pneumatic pump adapted for providing a downward directed air flow inside the needle cylinder; this air will act to hold downward tensioned the tubular element and to convey it to a collecting vessel.

It should be also pointed out that in the above disclosed device, the pneumatic pump is operated exclusively during the second and last step of the

making of the textile tubular element, and not during the making of the stretched cuff.

At the end of the step shown in Fig. 6, the cam of the cam drum operates on the lever 21 to cause the cup-shaped element 14 to be lowered to clear the cuff 31, thereby the finished and reversed tubular element may be driven to the collecting vessel by the mentioned air flow, and the production of this air flow will be stopped before the making of a new tubular element.

From the above disclosure it will be apparent that the cup-shaped element 14 does not generate wrinkles or folds on the cuff 31, since said cup element 14 is synchronously rotated with the machine plate and needle cylinder.

It should be apparent that the chamber for collecting the cuff free end may be shaped as the chamber 16 shown in the drawings or it may be different therefrom. For example, the mentioned chamber may be formed completely on the lower surface of the machine plate, or it may be formed completely in the cup-shaped element, or a part of said chamber may be formed in the cup-shaped element and another part thereof in the machine plate, or the mentioned chamber may consist of an ideal chamber as it would occur in the case in which the cup-shaped element is replaced by a simple annular toroidal body coupled to the stem 13 by means of two, three or more rigid arms, of curved shape or downward bent so as not to interfere with possible folds formed by the cuff.

CLAIMS

1. A device to be applied to circular knitting machines for making tubular elements for producing stretched-cuff stocking articles and reversing said tubular elements being formed, in which said circular knitting machines comprise a needle cylinder and a plate machine supported by a shaft rotating above said needle cylinder near the hook ends of the needles, said device being characterized in that the shaft supporting said machine plate is traversed by a longitudinal cavity therethrough there extends an elongated longitudinally swingable stem rotatably coupled to said shaft, the bottom end of said stem projecting under said machine plate and supporting a rigid element having an annular edge opposite and parallel to the lower surface of said machine plate and having a less diameter than the outer diameter of said machine plate and inner diameter of said needle cylinder, a driving body abutting on said stem to cause said stem to be lowered during the making step of said cuff and respectively at the end of the making of said tubular element and which causes said stem to be raised after the making of at least a portion of the cuff and until the end of the making of said tubular element, said rigid element, in its raised position, being resiliently pushed toward the lower surface of said machine plate, with the annular edge of said rigid element contacting, along its overall extension,

said machine plate or stretched cuff, formed thereunder, while the remaining portion of said rigid element is held comparatively spaced from the adjacent surface of said machine plate.

2. A device according to Claim 1, characterized in that said rigid element is of substantially cup shape with its cavity upward turned.

3. A device according to Claims 1 and 2, characterized in that said driving body is coupled, through transmission members, to a cam mounted on the cam main drum of said knitting machine.

4. A device according to Claims 1 to 3, characterized in that it comprises means for causing air to flow downward into the needle cylinder, in an automatic way, exclusively after the locking of said cuff on said machine plate by said rigid element.

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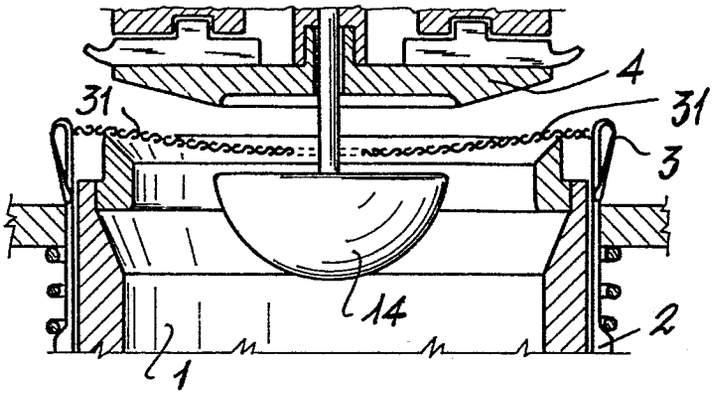
Fig. 3



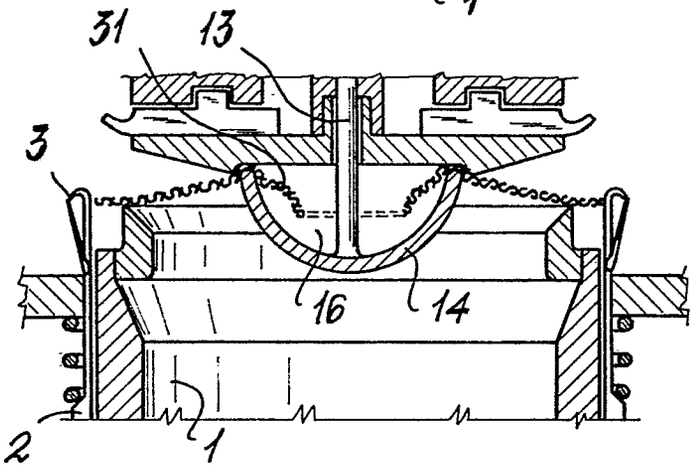
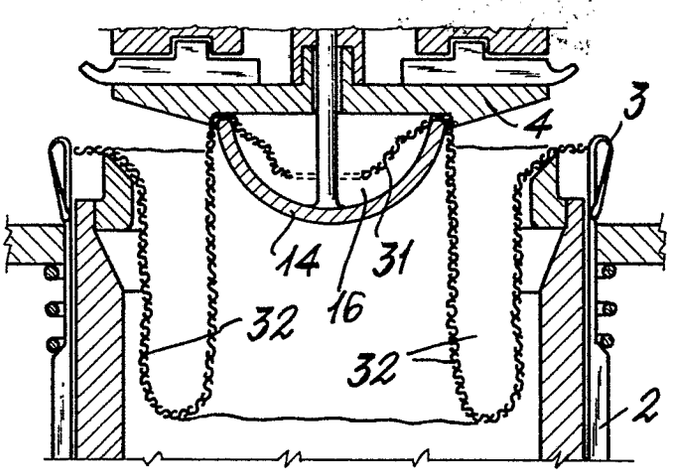




Fig. 4

Fig. 5



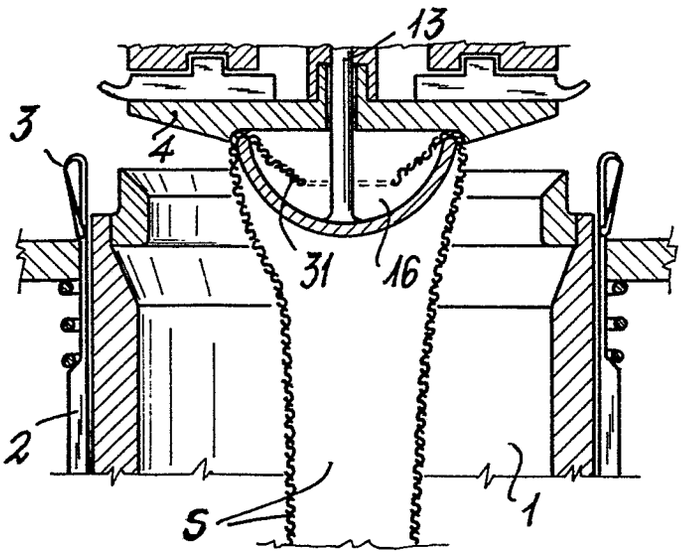
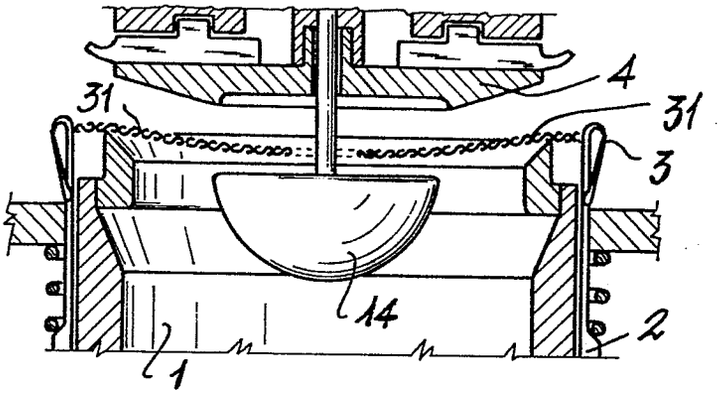




Fig. 6

Fig. 3



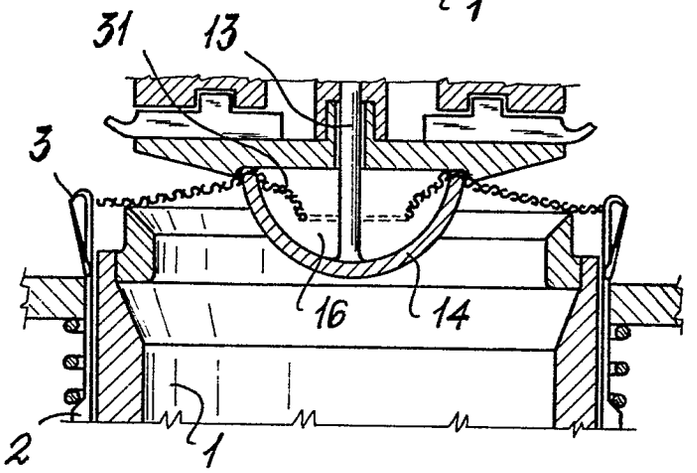
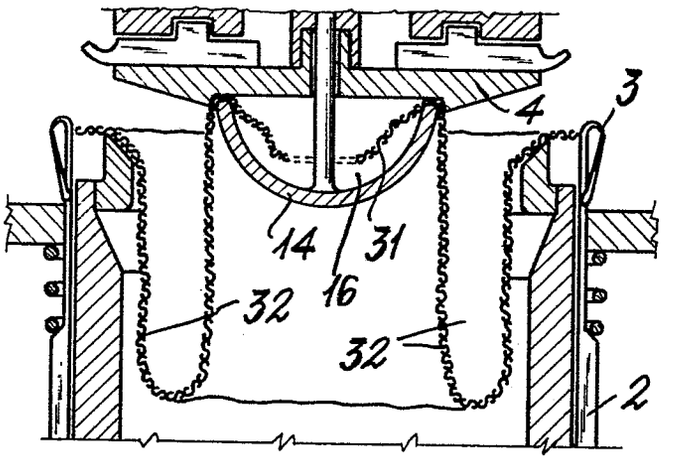




Fig. 4

Fig. 5



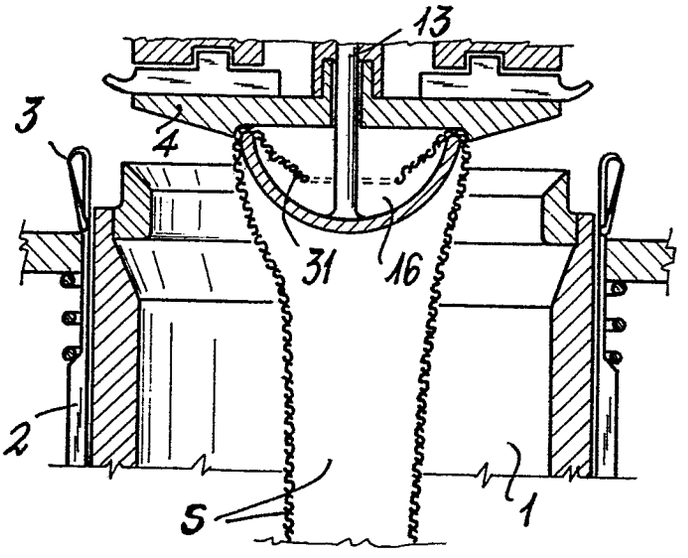




Fig. 6