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Circular Knitting Machine

This invention relates to a circular knitting machine of the kind specified in the pre--characterizing part of claim 1.

In conventional circular knitting machines knitwear of hose form is initially produced as a
5 rule and is then put together as a double layer band and is fed in this form to a take-down
and/or winding-up device and is finally wound up on a winding-up roller or otherwise
taken off. In order to arrange that the hose goods are engaged and passed on by the
take-down and/or winding-up device free from distortion and creases, a fabric spreader is
as a rule arranged between the take-down device and the means producing the knitwear.
10 The spreader comes to lie in the interior of the hose and is so shaped that the knitwear
created essentially in a cylindrical form is pulled out wide in a radial direction at two
diametrically opposite sides and is thus transformed into a substantially flat, double layer
fabric band, before it gets into the region of action of the take-down and/or winding-up
device. A disadvantage is that longitudinal folds or creases result at the two longitudinal
15 sides of the double layer fabric band, which are permanently impressed in the fabric,
especially when fine, elastic yarns are used, and cannot be removed in the finishing, even
by specific finishing measures.

Circular knitting machines of the kind initially specified have therefore already been made
20 known which take down and wind up a fabric slit along its longitudinal side and then
opened out to double width, instead of the closed hose fabric coming from the machine
(DE-T2-069 121 291, US-A 5 566 558, WO-A 00/506 78). In such a case take-down and
optionally also winding-up rollers are provided which have approximately twice the
otherwise usual length and the machine diameter must in this case also be made sub-
25 stantially larger than is generally the case. An advantage of this form of machine is seen
in that the two creases are obviated which arise when hose-form knitwear is wound up.

However investigations with such circular knitting machines have shown that the cut and

spread-out knitwear, when it comes from the machine, is distorted to an intolerable extent and creases form. More detailed investigations indicate that curved loop courses or stitch rows, respectively, mesh rows in a middle region of the fabric are the cause of this distortion. The curving of the loop courses can for its part be caused by the fact that the
5 fabric - as regarded over its width - is transported and fed to the take-down and/or winding-up device with a non-uniform speed in the region V-rolls being part of the spreading out device, so that take-down free from distortion and folds is not possible.

The technical problem on which the invention is based consists in making possible
10 take-down free from distortion and folds and thus the production of knitwear free from faults, even in circular knitting machines of the kind initially specified.

The characterizing features of claim 1 serve to solve this problem.

15 The invention leads to the advantage that the previously observed warping and similar faults in the spread-out fabric is largely avoided. This is attributed to the fact that the knitwear is also guided in the region located between the fabric spreader and the junction point of the V-rolls and can for example be kept at a radial distance from the machine axis which corresponds substantially to the radial distance produced by the fabric spreader.
20 Thus the fabric is prevented from undesirable radial movements after leaving the fabric spreader up until the place where it runs on to the junction point of the V-rolls and transferred to the V-rolls without backing up.

Further advantageous features of the invention appear from the dependent claims.
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The invention will now be explained in more detail with reference to an embodiment, in conjunction with the accompanying drawings, in which:

Fig. 1 is a schematic, perspective view of a circular knitting machine for producing slit
30 and spread-out knitwear;

Fig. 2 is a plan view of the circular knitting machine according to Fig. 1;

Fig. 3 is a side view of the circular knitting machine in the direction of an arrow x in Fig. 2;

Fig. 4 shows a fabric spreader and a spreading out device of the circular knitting machine 5 according to Figs. 1 to 3 to a larger scale;

Fig. 5 is plan view of just the fabric spreader according to Fig. 4; and

Fig. 6 is an enlarged, perspective view of a detail Y in Fig. 4.

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According to Figs. 1 to 3 a circular knitting machine comprises a frame 1, which has in the embodiment three feet 2 to 4 projecting radially out from the machine at angular spacings of about 120° each. The foot 2 is a main foot and each of the feet 3 and 4 is a side foot. The main foot 2 serves to receive a drive motor and other electrical and
15 electronic assemblies, not shown in detail, as well as operating elements for the circular knitting machine, while the side feet 3,4 are free from such installed units, apart from a switch unit optionally present.

The frame 1 further comprises an upper support ring 5, in which a carrier support ring 6
20 is rotatably mounted. A needle carrier 7 in the form of a needle cylinder, only schematically indicated, is fixed on the support ring 6 and is mounted to rotate in the frame 1 together with the carrier support ring 6 about a central or machine axis 8 of the circular knitting machine. The support ring 5 serves inter alia to receive a customary cam box ring surrounding the needle carrier 7, only one segment 5a thereof being shown for simplicity.
25 The frame 1 moreover comprises a lower support ring 9, which can be rested on the ground with the aid of auxiliary feet 10. The lower support ring 9 serves to rotatably support a revolving plate 11, on which is fixed a frame 12 which carries a take-down and/or winding up device generally denoted by the reference numeral 14, by means of which knitwear 15 produced by the needle carrier 7 and indicated in Fig. 3 can be taken
30 down and wound up. It is immaterial in principle whether the knitwear 15 is only taken down by the take-down and/or winding-up device 14, is only wound up and/or taken down and wound up, as is generally known to the man skilled in the art.

In the embodiment the frame 12 includes in its upper region two fixed or rotatably mounted deflecting bars 16, two fixed or rotatably mounted V-rolls 17 directly below these bars, preferably arranged substantially horizontally in a V-shape, for spreading out the knitwear, and below these V-rolls, in a middle part of the frame 12, two or more 5 rotary take-down rollers 18 which rotate synchronously with the V-rolls 17, and finally a winding-up roller 19 mounted to rotate idly in the frame 12 in a lower section. At least one drive roller 20 bearing on its periphery is associated with the roller 19, in order to wind up knitwear 15 fed from the take-down rollers 18 on the winding-up roller 19 in known manner. Finally, the circular knitting machine comprises a cutting device 21 with a 10 rotatable blade mounted in the frame 1, for the purpose of cutting open the knitwear 15 coming from the needle carrier 7 along a side line, after or optionally before passing the deflecting bars 16. The cutting device 21 is preferably slidably mounted on a bar 21a, in order to make it possible to adapt to different fabric widths. The V-rolls 17 can selectively be stationary or rotate and optionally be driven independently of the take-down rollers 18 15 with the aid of a separate rotary drive, e.g. a drive shaft.

In operation of the circular knitting machine the knitwear 15 coming from the needle carrier 7 is spread out by means of the V-rolls 17 along the cut line, until it forms a single-layer, substantially flat band and is then fed with the aid of a deflecting roller 22 20 (Figs. 2 and 3) mounted rotatably in the frame 12 to the take-down rollers 18 and thence to the winding-up roller 19. It is then wound up by this with a width corresponding to twice the width of the double layer hose produced by the needle carrier 7 and normally folded along opposite side edges. It is immaterial whether the needle carrier 7 and the whole take-down and winding-up device 14 therewith rotate about the middle axis 8, with 25 the aid of a drive fitted in the main foot 2, or whether both stay stationary and the cam box ring is rotated instead.

In case of a circular knitting machine with a rotatable needle carrier 7, at least one entraining device 23 is preferably provided on the underside of the carrier support ring 6. 30 The entraining device 23 serves to rotate the frame 12 synchronously with the cylinder support ring 6 and is retained in a coupling receptacle 24 thereof.

As is shown in Fig. 3 in particular, a fabric spreader 25, also sometimes called "stretcher" is arranged within a tubular section 15a of the knitwear 15 produced by the means 5a, 6. The purpose of the spreader 25 is to transform the section 15a into a double-layer, flat fabric band 15b, which is fed in this form to the spreading out device 5 including the V-rolls 17.

Circular knitting machines of this kind are generally known and therefore do not need to be explained to the man skilled in the art in more detail (DE-T2 691 21 291, US-A 5 566 558, WO-A 00/506 78). The same applies to the numerous possible embodiments of the fabric spreader and its arrangement in the circular knitting machine (e.g. DE-A 2 130 660, DE-A 2 443 067, DE-A 3 112 181, DE-A 199 09 207), for which reason all these documents are, for the avoidance of repetition, made part of the present disclosure of the subject matter by reference.

The shape of the fabric spreader 25 used according to an embodiment of the invention deemed to be the best one up to now, appears in particular from Figs. 4 and 5. The fabric spreader 25 includes two parallel, comparatively long bars 26 and 27 arranged in an upper plane, at whose ends are fixed comparatively short rods 28 to 31 respectively extending obliquely downwards. The rods 28, 29 and 30, 31 moreover converge in pairs in a triangular shape and are so connected together in pairs at their free ends that the points of connections form respective first and second ends 32, 33 which lie in a lower plane of the fabric spreader 25 parallel to the upper plane. The spacing of the ends 32, 33 characterizing the length of the fabric spreader 25 is therefore comparatively large in relation to the spacing of the upper rods 26, 27 measured perpendicular to the length and corresponding to the width of the fabric spreader 25.

The two ends 32, 33 are moreover joined by a rod 34. The rod preferably consists, like the rods 26, 27, of e.g. three sections slidable relative to one another telescopically, which can be fixed relative to one another by means of adjusting screws 35. The length of the fabric spreader 25 can thus be altered by loosening the adjusting screws 35, sliding the sections and then tightening up the adjusting screws 35 again. A rotary bearing 36, e.g. in the form of a sleeve, is moreover arranged in the centre of the fabric spreader 25 and is fixed with the aid of connecting arms 37 to the rods 26, 27 and optionally 34 and serves

to receive a support rod 38 rotatably. This can be fixed in a manner known per se to a positionally fixed part of the circular knitting machine, coaxial with the machine axis 8 (Fig. 3), e.g. on a central, middle bar which passes through the needle carrier 7 and is fixed on a spider supported on the support ring 5, above the needle carrier 7. The fabric spreader 25 is thereby mounted rotatably on the support rod 38. Means, not shown, are preferably also provided for adjusting the height of the fabric spreader 25.

The rods 30, 31 at the left end in Figs. 4 and 5 of the fabric spreader 25 preferably end short of a conceptual triangle apex. They are connected at their free ends by a transverse rod 39 which forms the end 32 in this case and is fixed in a middle section by an angled piece 40 aligned radially inwards and downwards. A recess 41 thus results at the first end 32, in which the cutting device 21 also shown in Figs. 2 and 3 can at least partially project. Alternatively, the end 32 can be formed just like the end 33 and the cutting device 21 be arranged entirely below the fabric spreader 25. Moreover the blade of the cutting device could project between the bars 30, 31.

In Fig. 4 the relative position of the deflecting bars 16 and V-rolls 17 described with reference to Figs. 1 to 3 can also be seen to a larger scale, their axes lying substantially in planes which are arranged parallel to the upper and lower planes of the fabric spreader 25. Accordingly the hose or tubular section 15a of the knitwear 15 fed to the region of the upper bars 26, 27 is stretched by the fabric spreader 25 in the direction of the ends 32, 33 and is simultaneously drawn together transverse to this direction, so that it is laid flat on leaving the fabric spreader 25 and forms a fabric band 15b which consists of two layers connected along lateral longitudinal folds. This fabric band 15b is then fed, as described, through a narrow gap formed between the deflecting bars 16, slit continuously at a lateral longitudinal fold by the cutting device 21 and spread out with the aid of the V-rolls 17. The deflecting bars 16 are fixedly or rotatably mounted.

In order that the knitwear 15 is constantly guided in a controlled manner in the region between the second end 33 and a junction point 43 of the two V-rolls 17, a guide element 44 is arranged in this region in accordance with the invention. The guide element 44 is a rod for example, especially a round rod, and is fixed at one end to the underside of the second end 33 of the fabric spreader 25. The guide element 44 preferably projects down

from this substantially parallel to the machine axis 8 (Fig. 3), its outer radial spacing from the machine axis 8 preferably being the same as the radial spacing of the outer surface of the end 33 from the machine axis 8, down to close to the junction point 43. At the height of the junction point 43 the guide element 44 is bent or curved radially inwards along a section 44a and extends up to the junction point 43, so that a radially outer guide surface of the guide element 44 there forms a gentle transition region, free from steps, up to the start of the V-rolls 17. In principle it is immaterial whether the two deflecting bars 16 are additionally present or not. If the deflecting bars 16 are present, which is advantageous, then the guide element 44 is to be made at least thin enough to be able to project through the gap between the deflecting bars, as Fig. 4 shows.

The junction point 43 between the V-rolls 17 is formed by an end-piece 45 according to a preferred embodiment of the invention (Fig. 6). This has two extensions 46 on a radially inner side facing the machine axis 8, each of which can receive an end of an associated V-roll 17. The V-rolls 17 can be fixed as required rotatably and/or pivotally and/or non-rotatably, with the aid of fixing screws, not shown, on the extensions 46. The end-piece 45 moreover preferably has a recess 47 on a radially outer side for reception of the associated, radially inwardly bent end 44a of the guide element 44. This results in the additional advantage that the guide element 44 is formed as an entraining device, which transmits to the fabric spreader 25 rotary movement of the whole spreading-out device about the machine axis 8, which is necessary with use of a circular knitting machine with a rotating needle cylinder, so that the spreader does not have to be rotated about the support rod 38 by the knitwear 15 itself or by an additional coupling element.

The end-piece 45 is preferably fixed according to Fig. 6 on the free end of a stable rod or tubular element 48, which is fixed to a radially opposite part of the frame 12, as Fig. 1 shows. It is particularly advantageous if the rod or tube element 48 and the end-piece 45 have associated connecting elements which can be brought into engagement, e.g. in the nature of hinge connections having a substantially horizontally disposed tilting axis and a clamping screw 49. It is then possible, after slackening the clamping screw 49, to adjust the angle of tilt of the V-rolls 17 rollers relative to the rod or tube element 48, depending on the current requirements, and then to tighten the clamping screw up again. It would further be possible to mount the V-rolls 17 by means of the extensions 46 in a correspon-

ding manner, such that the angle subtended by them can be altered. Finally the V-rolls can be arranged so that they can turn and/or pivot according to requirements in a different way.

5 A particularly significant advantage of the guide element 44 lies in that it can be made comparatively thin. Best results have been achieved up to now for example with a round rod of 9 mm maximum thickness, whose bent over end 44a has a length of 77 mm. However diameters of the guide element 44 from 2 mm to 40 mm for example can also be used. Because of this construction it is possible to make the end-piece 45 formed as a knee
10 comparatively wide transverse to the gap between the deflecting bars 16, even when this gap is chosen very narrow. As Fig. 4 for example shows, the fabric laid flat is, in accordance with the invention, spread not by the end-piece 45 but by the thinner guide element 44 and is only then transferred to the V-rolls 17. This avoids the danger that the knitwear 15 folded closely together by the fabric spreader 25 and optionally also by the
15 deflecting bars 16 has to run abruptly on to the wide end-piece 45 or any other construction used to join the V-rolls 17 together, and is thereby under some circumstances prevented from a uniform advance taking place under the action of the take-down and/or winding-up device 14. The thinner or narrower the guide element 44, the more uniformly the spreading out operation will presumably take place. This applies especially when the
20 straight section of the guide element 44 depending from the fabric spreader 25, in accordance with Fig. 6, is arranged radially substantially at a place which corresponds to a conceptual point of intersection of the two central axes of the V-rolls 17, such that there is a sufficiently large radial spacing from thence up to the junction point 43 or up to the end-piece 45. The folded knitwear 15 can then be spread out gradually over a longer path,
25 without undesirable backing-up or other changes in speed in the running of the knitwear 15 on to the junction point 43.

The invention is not limited to the described embodiments, which can be modified in numerous ways. This applies especially to the design and arrangement of the guide
30 element 44 from which an embodiment deemed to be the best one up to now is shown in Figs. 4 to 6. This can for example be formed as a rod which has a preferably round or oval fabric guide surface on its radially outer side only. It would further be possible for the guide element 44 not to maintain exactly the maximum width of the knitwear 15

created by the fabric spreader 25 right up to the vicinity of the junction point 43. Such arrangements in particular are advantageous as make it possible to adjust the guide element 44 in the radial and/or axial direction and thus facilitate production of a position of the guide element 44 which is found to be the most favourable, depending on the specific case. Furthermore it is clear that the guide element 44 should be made from a material which ensures good friction properties in relation to the yarn used for the production of the knitwear 15. The invention is furthermore not limited to the described indications of dimensions for the guide element 44, which are only to be regarded as examples. The needle carrier 7 could be in the form of a dial instead of a needle cylinder or have a dial in addition to the needle cylinder. Finally it will be understood that the various features can be used in combinations other than those illustrated and described.

Claims

1. A circular knitting machine with means (5a, 7) for producing circular knitwear (15), a fabric spreader (25) with first and second ends (32, 33) arranged below said means (5a, 7), a take-down and/or winding-up device (14) and a spreading out device which is arranged between the fabric spreader (25) and the take-down and/or winding-up device
5 (14) and which includes V-rolls (17) connected to one another at a junction point (43) in V shape and a cutting device (21) associated with said V-rolls (17), such that a tubular section (15a) of the circular knitwear (15) is laid flat by the fabric spreader (25), is slit by the cutting device (21) along a longitudinal fold formed by the first end (32) of the fabric spreader (26), is spread out by means of the V-rolls (17) along a second longitudinal fold
10 formed by the second end (33) of the fabric spreader (25) and is taken down in the spread out state by the take-down and/or winding-up device (14), characterized in that a guide element (44) is arranged between the second end (33) and the junction point (43) for transferring a region of the knitwear (15) including the second longitudinal fold to the V-rolls (17).
- 15 2. A circular knitting machine according to claim 1, characterized in that the guide element (44) comprises a rod.
3. A circular knitting machine according to claim 2, characterized in that the rod is given
20 a fabric guide surface of round or oval shape.
4. A circular knitting machine according to claim 1, 2 or 3, characterized in that the guide element (44) is fixed on the second end (33) of the fabric spreader (25) and is arranged by this substantially parallel to a machine axis (8) and at a radial distance therefrom which
25 corresponds to the radial distance of said second end (33) from the machine axis (8).
5. A circular knitting machine according to claim 1, 2, 3 or 4, characterized in that the guide element (44) runs approximately at the height of the junction point (43) along a radially incurved arc (44a), up to the junction point (43), for forming a transition without a step.

6. A circular knitting machine according to any of claims 1, 2, 3, 4 and 5, characterized in that the guide element (44) is in the form of an entraining device which transfers rotary movements of the V-rolls (17) about a machine axis (8) to the fabric spreader (25).

5 7. A circular knitting machine according to any one of claims 1 to 6, characterized in that the junction point (43) is formed by an end-piece (45) which has two extensions (46) on a radially inner side for reception of ends of the V-rolls (17).

8. A circular knitting machine according to claim 7, characterized in that the V-rolls (17)
10 are mounted rotatably and/or able to pivot in the end-piece (45).

9. A circular knitting machine according to claim 7 or 8, characterized in that the end-piece (45) is provided on a radially inner side with a receptacle (47) for an associated end of the guide element (44).

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10. A circular knitting machine according to any one of claims 1 to 9, characterized in that two deflecting bars (16) forming a gap for passage of the knitwear (15) are arranged between the fabric spreader (25) and the V-rolls (17) and in that the guide element (44) projects through the passage gap.

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11. A circular knitting machine according to any one of claims 1 to 10, characterized in that the first end (32) of the fabric spreader (25) has a recess (41) into which the cutting device (21) projects.