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Angst et al.

[11] **3,768,242**

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[54] **SPINDLE FOR DRAW-TWISTING MACHINES**

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[52] **U.S. Cl.** ..... **57/34 PW**, 57/34 TT, 57/55.5, 242/18 PW

[51] **Int. Cl.** **D01h 1/38**

[58] **Field of Search** ..... 57/34 R, 34 TT, 129, 57/34.5, 55.5, 34 PW; 242/18 EW, 18 PW

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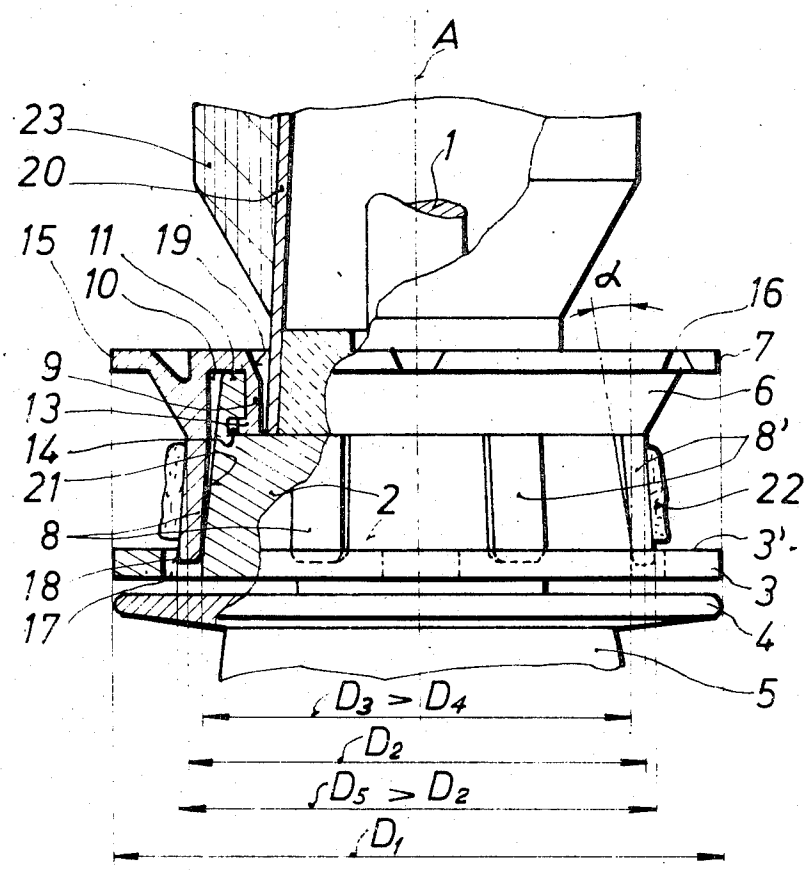
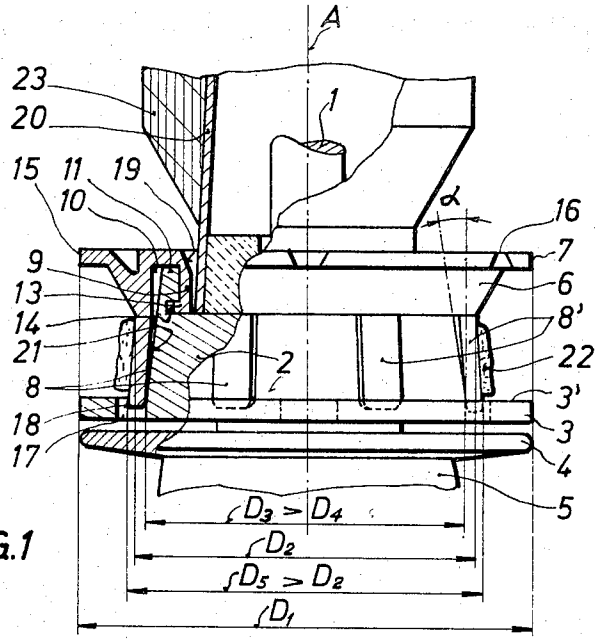
[57] **ABSTRACT**

A spindle, particularly for draw-twisting machines, designed for taking-up a detachable underwinding crown which can be placed on the spindle so that no rotation relative to the spindle occurs. The underwinding crown is provided with vertically arranged fingers or rods forming envelope parts for taking up a thread during the underwinding phase and with an upper limiting ring surrounding a tube of a bobbin placed on the spindle. The outside diameter of the ring exceeds the envelope parts. The spindle is designed for taking-up the upper limiting ring of the underwinding crown which is provided with elastic snap-on holding means, and is further provided with spreading means for spreading the elastically deformable envelope parts. There is also provided a lower limiting ring the outside diameter of which exceeds the envelope parts and which contains at least one recess for taking-up the free lower ends of the fingers or rods forming the envelope parts.

22 Claims, 5 Drawing Figures

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D3 = D4
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FIG.1

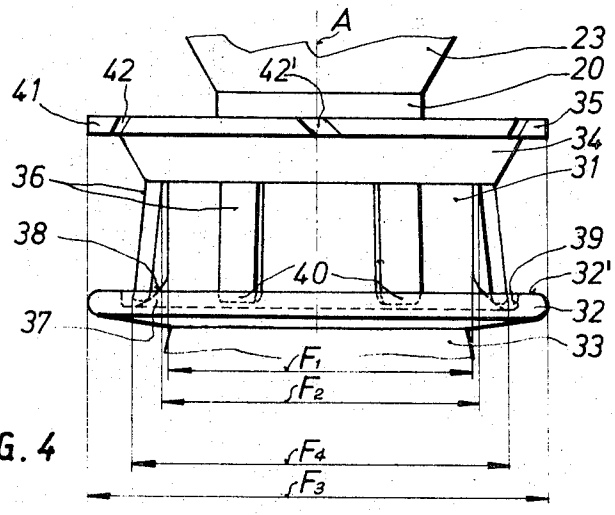
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FIG. 4

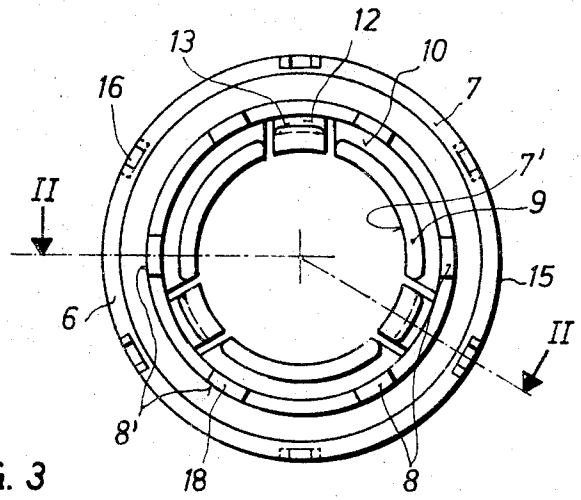

FIG. 3

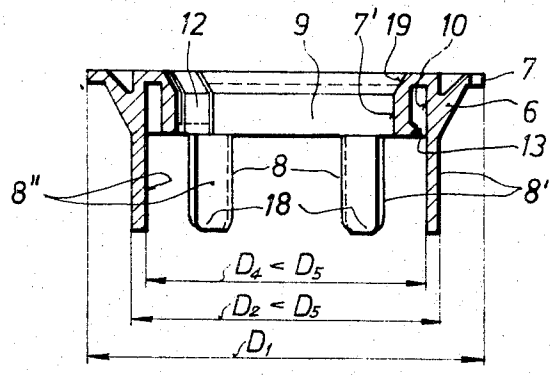

FIG. 2

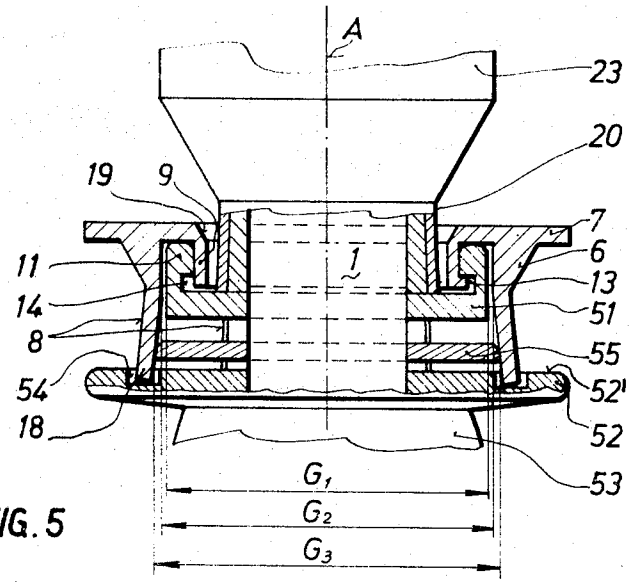

FIG. 5

SPINDLE FOR DRAW-TWISTING MACHINES

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved construction of spindle, particularly for draw-twisting machines, designed for taking-up or housing a detachable underwinding crown which can be placed on the spindle so that there does not occur any rotation relative to the spindle, the underwinding crown being provided with vertically arranged fingers or rods forming envelope parts for taking-up a thread during the underwinding phase and with an upper limiting ring surrounding a tube of a bobbin placed on the spindle, the outside diameter of which ring exceeds the envelope parts.

A state-of-the-art spindle of the general type discussed above which is employed for spinning and twisting machines wherein the bobbin is connected with the spindle by means of a tapered seat, is designed such that an underwinding crown provided with a high collar surrounding the bottom of the bobbin and with an envelope which can consist of envelope parts formed by rods, has the underwinding crown detachably pressed onto a cylindrical portion of the spindle with a ring-shaped clearance remaining free between the lower end of the collar and an upper flange of a spindle drive whorl. Apart from the inevitable variations of the spindle taper, there is avoided with this apparatus by means of the high collar, especially if the bottom of the bobbin is provided with a clamping ring, winding of thread material onto the bobbin bottom part during the underwinding phase, since undesirable thread accumulations on the bobbin bottom part disturb further operation of such bobbins, so that such accumulations thus must be first eliminated.

However, this known spindle construction is not suited for use on draw-twisting machines. On such machines if the connection of the underwinding crown on the cylindrical portion of the spindle is merely effected by the clamping seat of the envelope or the envelope part respectively, the danger can arise due to the high rotational speeds of the spindles of draw-twisting machines, which can reach 14,000 r.p.m., that the frictional forces of the clamping seat of the envelope or the envelope parts, is no longer sufficient to avoid rotation of the underwinding crown relative to the spindle, particularly if no thread is wound-on, so that under certain conditions the underwinding crown can lift off. With thread material, e.g. synthetic thread material wound onto the underwinding crown, due to shrinkage of such material which has a tendency towards shrinking, the envelope or the envelope parts respectively, can be pressed more intensively against the cylindrical portion of the spindle, so that the frictional force of the clamping seat is increased. Due to this action, however, detaching the underwinding crown e.g. by hand, not only can become more difficult, but also can become impossible. A further disadvantage which arises when using the known spindle construction on draw-twisting machines resides in the fact that the thread material shrunk onto the envelope or onto the rods can be only removed with difficulty after the underwinding crown has been detached from the spindle. This thread material, particularly after shrinkage, clings to the envelope, the outer diameter of which remains unchanged in its detached state. Also during the underwinding phase a thread can penetrate into the ring-shaped clearance and can cause undesirable lap formations at this location, which in turn can cause disturbances while the underwinding crown is removed since the thread can become caught.

SUMMARY OF THE INVENTION

Hence it is a primary object of the present invention to eliminate the disadvantages of the known spindle constructions and to devise a spindle, particularly for draw-twisting machines, wherein the underwinding crown is entrained without the occurrence of rotation relative to the spindle also if no thread is wound-on, such underwinding crown can be easily removed from the spindle if thread material is wound-on, and from which underwinding crown in its detached state thread material wound or possibly shrunk-on can be removed easily and without the use of tools.

In accordance with the invention the spindle, particularly for draw-twisting machines, designed for taking-up a detachable underwinding crown which can be placed on the spindle so that no rotation relative to the spindle occurs, has the underwinding crown provided with vertically arranged fingers or rods forming envelope parts for taking up a thread during the underwinding phase, and, an upper limiting ring surrounding a tube of a bobbin placed on the spindle, the outside diameter of such ring exceeding the envelope parts. According to important aspects of the invention, the spindle is designed for taking-up the upper limiting ring of the underwinding crown provided with elastic snap-on holding means, and is further provided with spreading means for spreading the elastically deformable envelope parts. There is also provided a lower limiting ring, the outside diameter of which exceeds the envelope parts, and which contains at least one recess for taking-up the free lower ends of the rods forming the envelope parts.

On the spindle there can be provided a support member connected with the spindle shaft and surrounding the spindle in ring-shaped fashion and which can be designed for taking-up the upper limiting ring of the underwinding crown made e.g. from an elastically deformable synthetic material and which can be arranged on the lower limiting ring. The upper limiting ring can be a flange which can be placed onto and removed from the support member without the use of tools. The flange member is provided with a central bore and elastically deformable clamps arranged along the circumference of the bore which are provided for fitting or snapping-on in a corresponding recess in the support member.

The support member can be a hub or a ring on the spindle shaft possessing for instance a cylindrical outer surface, the outer diameter of which is preferably smaller than an inside diameter of the envelope formed by the rods, so that the rods, the cross-section of which can be circular, semi-circular or rectangular, clear the hub or the ring on the spindle shaft. The hub can be also a cone, the diameter of which at the top can be smaller than the inner diameter of the envelope parts and increases towards the lower limiting ring so that it exceeds the inside diameter of the envelope parts. In the first case mentioned above the cylindrical hub at its end facing the lower limiting ring in the area of the free ends of the envelope rods can be provided with the spreading means in the form of a conical extension, the diameter of which increases in the direction of the

lower limiting ring so that it exceeds the inside diameter of the envelope parts, the contour of which conical extension can be straight or curved, e.g. a convex or concave line. If e.g. there is provided a cylindrical ring on the spindle shaft then between such ring and the lower limiting ring there can be coaxially inserted a further ring as a spreading device, the outside diameter of which preferably exceeds the inside diameter of the envelope parts. In the other case, the rods are spread according to the taper of the hub, i.e., the spreading means is a portion of the conical hub. The lower limiting ring can be a flange which can be arranged on the upper flange of a drive whorl of the spindle. The lower limiting ring also can be the upper flange of the drive whorl itself with which the support member can be connected.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a partial front view of a spindle which is partially broken away to expose internal structure;

FIG. 2 is a cross-section of an underwinding crown taken substantially along the line II—II of FIG. 3;

FIG. 3 illustrates the underwinding crown according to FIG. 2 as seen from below;

FIG. 4 is a front view of another embodiment of the spindle part shown in FIG. 1; and

FIG. 5 is a sectional view of a further embodiment of the spindle part of FIG. 1 again partially broken away.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings as shown in FIG. 1, on a spindle shaft or blade 1 rotatable about its vertical central axis A a hub 2 with a flange 3 serving as a lower limiting ring is arranged directly above an upper flange 4 of a drive whorl 5. The hub 2 conically enlarges towards the flange 3 and can be pressed onto the spindle shaft 1. Into the hub 2 forming a support member there is placed from above an underwinding crown 6. Underwinding crown 6 is provided with a flange 7 forming an upper limiting ring with a central bore 7' (FIGS. 2 and 3), and with means in the form of fingers or rods 8, hereinafter simply generally referred to as rods, vertically arranged along the circumference of the hub 2. The rods 8 form jacket or envelope parts or a partially interrupted envelope respectively of the underwinding crown 6. The circumference of the central bore 7' is formed by a ring 9 protruding parallel to and in the same direction as the rods 8, so that a recess 10 is formed into which there can be inserted a head or rim 11 of the hub 2. By suitably partitioning the ring 9 a number of elastical clamps 12 are formed (FIGS. 2 and 3) which possess stops or cams 13 protruding radially into the recess 10 and engaging with a suitable groove 14 provided in the upper rim 11. By means of the clamps 12 with the stops 13 the underwinding crown 6 is secured axially and radially upon the hub 2, and thus is secured on the spindle shaft 1. Further, by means of the stops 13 engaging into or out of the groove 14 the underwinding crown 6 can be placed onto or removed from the spindle shaft or blade 1.

The upper flange 7 has an outside diameter D_1 exceeding the outside diameter D_2 of the envelope or jacket parts formed by the rods 8 of the underwinding crown in its dismantled or removed state, as best shown in FIG. 2. Along the periphery or upper rim 15 of the upper flange 7 there are equally spaced radial recesses 16, the base of each of which is trapezoidal, and which serve to entrain the thread to be wound onto the underwinding crown 6. Each recess 16 is suitable for both directions of spindle rotation. The lower flange 3, the outside diameter of which is equal to the outside diameter D_1 of the flange 7 (FIG. 1), is provided with radial recesses which extend in ring form as axially penetrating slots 17 suitable for receiving or taking-up the free rod ends 18.

Having now had the benefit of the foregoing discussion the mode of operation is as follows:

The underwinding crown 6 with its inner bore 7', the upper rim of which forms an inclined surface 19, is placed on the head or top (not shown) of the spindle shaft or blade 1 and is permitted to drop downward. By pressing down the underwinding crown 6 and because of the elasticity of the clamps 12 the stops or cams 13 snap into the groove 14 and the underwinding crown 6 is centered on the rim 11. During this last-mentioned operation the rods 8 with the rod ends 18 are slidingly guided on the cone 21 of the hub 2 and according to its taper angle α are spread at least at the hub base, the outside diameter D_3 of the hub at the base of the cone 21 exceeding the inside diameter D_4 of the envelope or jacket parts. The envelope parts formed by the rods 8 of the underwinding crown 6 placed on the hub 2 at least in the area facing the flange 3 possess an outside diameter D_5 which exceeds the diameter D_2 of the envelope parts if dismantled or removed (FIG. 2). A thread (not shown) is placed onto the spindle shaft 1 by means of a few wraps, whereupon a tube 20 is donned so that the thread is clamped between the tube 20 and the spindle shaft 1. Now the spindle brake (not shown) is released and the spindle 1 starts rotating slowly. During the threading-up process for all the spindles of the machine, which runs at crawling speed, in the underwinding phase thread which is delivered undrawn or not regularly drawn can be wound onto the outer sides 8' of the envelope parts formed by the rods 8 of the underwinding crown 6 where it forms a waste bunch 22. Since the rod ends 18 extend down into the slots 17 they are located below the top surface 3' of the flange 3 facing the underwinding crown 6, so that during the underwinding phase thread material is caught by the surface 3' and can not be trapped beneath the rod ends 18. As the spindle 1 speeds up to normal operating speed, winding is shifted over to the tube 20 and the thread is wound into a bobbin 23. Upon completion of the build-up of the bobbin 23 the spindle 1 is stopped, whereupon first the bobbin 23 is doffed and then the underwinding crown 6 is dismantled or removed. As the underwinding crown 6 is removed the rods 8, owing to their elasticity, move back as they no longer are spread by the conical hub 2 and again assume the original diameter D_2 of the envelope parts as shown in FIG. 2. Since the thread material, possibly after shrinkage, of the waste bunch 22 can not follow the reduction in size of the outside diameter D_5 to the diameter D_2 it is loosened at the rods 8 and can easily be removed without the use of tools, whereupon the

underwinding crown is ready to be again placed onto the spindle.

Another embodiment of the invention is shown in FIG. 4, wherein parts identical with the arrangement shown in FIG. 1 are indicated with the same numbers as in FIG. 1. As a support member instead of the conical hub 2 shown in FIG. 1, there is here provided a cylindrical hub 31 which, directly above an upper flange 32 of a drive whorl 33, is pressed onto and connected to the spindle shaft or blade 1. An underwinding crown 34, which in the manner indicated in the embodiment depicted in FIG. 1, can be placed onto and detached from the hub 31, is provided with a flange 35 serving as an upper limiting ring and with rods 36 vertically arranged along the circumference of the hub 31. These rods 36 again form a partially interrupted envelope or envelope parts respectively for taking up thread material during the underwinding phase. In this arrangement the outside diameter F_1 of the hub 31 is smaller than the inside diameter F_2 of the envelope parts formed by the rods 36 which extend freely down along the hub 31. Adjacent the end of the hub 31 facing the drive whorl 33 there is provided as a spreading device a cone 37, the diameter of which is enlarged in the direction of the flange 32, so that it exceeds the inside diameter F_2, the generatrix or contour of the cone 37 constituting a convex line with respect to the central axis A.

The cone 37 merges into a ring-shaped groove 39 of the flange 32 provided for taking-up the free rod ends 40 which thus again are located below an upper surface 32' of the flange 32 facing the underwinding crown 36, so that no thread material can be trapped beneath the rod ends 40 during the underwinding phase. Along the circumference 41 of the flange 35, the outside diameter F_3 of which exceeds the outside diameter F_4 of the spread envelope parts formed by the rods 36, there are provided equally spaced recesses 42 and 42' for entraining the thread, the recesses extending at an inclination towards the left and right and being suitable for either direction of spindle rotation. Operation is effected in the same manner as described for the embodiment considered with reference to FIG. 1. In this embodiment, with the underwinding crown 34 mounted the rods 36 are spread according to the contour 38 of the cone 37. Since the rods 36 also with their ends 40 do not touch the cylindrical hub 31 when the underwinding crown 34 is mounted or dismantled, owing to the smaller outside diameter F_1 of the hub 31, the mounting and removal of the underwinding crown 34 is thus facilitated since no friction of the rods 36 on the hub 31 need be overcome, there need be only undertaken disengagement of the clamping of the flange 35 from the hub 31 (cf. FIG. 1). Moreover, the shape of the hub 31 can provide manufacturing advantages as its cylindrical surface must not be smoothed, particularly for reducing friction forces.

As a support member there can be used a cylindrical ring 51 on the spindle shaft instead of the hubs 2 and 31 shown in FIGS. 1 or 4 respectively, and such has been shown in a further example illustrated in FIG. 5, wherein parts identical to those shown in FIG. 1 being generally indicated with the same reference characters as used in FIG. 1. The ring 51 can be pressed onto the spindle shaft or blade 1 and contains a head 11 formed in the same manner as shown in FIG. 1, this head serving for taking-up the underwinding crown 6. As a lower limiting ring there is provided a ring-shaped flange 52 of a drive whorl of the spindle 1, which flange 52 on its upper surface 52' facing the ring 51 contains a ring-shaped groove 54 extending along the full circumference. The rod ends 18 extend into such recessed groove 54. The outside diameter G_1 of the support ring 51 is smaller than the inside diameter G_2 of the envelope parts formed by the rods 8 of the underwinding crown 6. Between the ring 51 and the flange 52 there is provided on the spindle blade 1 a spreading ring 55 serving as a spreading device for the rods 8, the outside diameter G_3 of which exceeds the inside diameter G_2 of the envelope parts of the underwinding crown 6. The rods 8, if the underwinding crown 6 is mounted, are then spread according to the outside diameter G_3 of the spreading ring 55. Also in this example for placing or removing the underwinding crown 6 substantially only the frictional force of the clamps 12 with their stops 13 must be overcome since the rods 8 frictionally slide only along ring 55. In operation, as described before with reference to the embodiment of FIG. 1, if the underwinding crown 6 is removed, the rods 8 elastically swing back so that the thread wound onto the rods 8 is loosened.

The inventive spindle presents the advantage that not only is the underwinding crown securely entrained if the spindle is rotated, but also mounting and removal of the underwinding crown can be facilitated. It is a further advantage that owing to the spreading device the spread rods form a waste cone, the envelope parts of which after removal of the underwinding crown elastically swing back to a smaller outside diameter, so that the thread material taken-up during the underwinding phase is loosened and can be easily removed by hand. In this manner not only the elimination of thread waste can be simplified but also operating time can be saved, since for instance for eliminating the waste bunch no additional tools must be prepared and used, so that the underwinding crown can be readied for re-use within a very short period of time.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced with the scope of the following claims. ACCORDINGLY,

What is claimed is:

1. A spindle construction, particularly for draw-twisting machines, comprising a spindle means for receiving a tube of a bobbin, a detachable underwinding crown which can be placed on the spindle means such that there does not occur any rotation relative to said spindle means, said underwinding crown being provided with substantially vertically arranged means forming elastically deformable envelope parts for taking-up a thread during the underwinding phase, an upper limiting ring provided for said underwinding crown and surrounding the tube of a bobbin placed upon the spindle means, the outside diameter of said upper limiting ring exceeding the diameter of said envelope parts, said upper limiting ring of said underwinding crown being provided with elastic snap-on holding means and said spindle means having means cooperating with said holding means for mounting said detachable underwinding crown at said spindle means such that no relative rotational movement occurs between said underwinding crown and said spindle means, spreading means for spreading said elastically

deformable envelope parts, a lower limiting ring having an outside diameter exceeding the diameter of the envelope parts, said lower limiting ring being provided with at least one recess for taking-up the free lower ends of said substantially vertically arranged means forming said envelope parts.

2. The spindle construction as defined in claim 1, wherein said substantially vertically arranged means comprises fingers.

3. The spindle construction as defined in claim 1, wherein said substantially vertically arranged means comprises rods.

4. The spindle construction as defined in claim 1, wherein said spindle means comprises a spindle shaft, a support member connected with said spindle shaft in substantially ring-shaped fashion about said spindle means for connecting said underwinding crown, said spreading means being arranged within said envelope parts in ring-shaped fashion about said spindle means, said spreading means having an outside diameter exceeding an inside diameter of said envelope parts.

5. The spindle construction as defined in claim 4, wherein said upper limiting ring comprises a flange having a central recess, said support member being provided with a substantially ring-shaped upper part shaped substantially in accordance with the central recess of said upper limiting ring, said support member being provided with a recess, said elastic snap-on holding means comprising clamps distributively arranged about said central recess, said clamps having stop means engaging with said recess of said support member.

6. The spindle construction as defined in claim 4, wherein said support member is arranged at said lower limiting ring.

7. The spindle construction as defined in claim 1, wherein said spindle means comprises a spindle shaft, a substantially conical hub connected with said spindle shaft for mounting said underwinding crown, the diameter of said conical hub enlarging towards said lower limiting ring provided with said recess, said spreading means constituting a portion of said conical hub, the diameter of which exceeds an inside diameter of said envelope parts.

8. The spindle construction as defined in claim 7, wherein the generatrix of said conical hub with respect to a vertical rotational axis of said spindle means comprises a curved line.

9. The spindle construction as defined in claim 8, wherein the generatrix of the conical hub is concave.

10. The spindle construction as defined in claim 8, wherein the generatrix of the conical hub is convex.

11. The spindle construction as defined in claim 7, wherein the generatrix of the conical hub is a straight line.

12. The spindle construction as defined in claim 7, wherein said conical hub merges with said recess of said lower limiting ring.

13. The spindle construction as defined in claim 1, wherein said spindle means comprises a spindle shaft, a substantially cylindrical hub for mounting the underwinding crown, the outside diameter of said cylindrical hub being smaller than an inside diameter of said envelope parts, said spreading means comprising a cone, the diameter of which in the direction of said lower limiting ring provided with said recess exceeds an inside diameter of said envelope parts.

14. The spindle construction as defined in claim 13, wherein the generatrix of said cone with respect to a vertical rotational axis of the spindle comprises a curved line.

15. The spindle construction as defined in claim 14, wherein the generatrix of the cone is concave.

16. The spindle construction as defined in claim 14, wherein the generatrix of the cone is convex.

17. The spindle construction as defined in claim 13, wherein the generatrix of the cone is a straight line.

18. The spindle construction as defined in claim 13, wherein said cone merges with said recess of said lower limiting ring.

19. The spindle construction as defined in claim 1, wherein said spindle means comprises a spindle shaft, a ring connected with said spindle shaft for mounting said underwinding crown, the outside diameter of said ring being smaller than an inside diameter of the envelope parts, said spreading means comprising a spreading ring connected with said spindle shaft between said ring and said lower limiting ring, the outside diameter of said spreading ring exceeding an inside diameter of said envelope parts.

20. The spindle construction as defined in claim 1, wherein said lower limiting ring comprises a flange of a drive whorl of said spindle means.

21. The spindle construction as defined in claim 1, wherein said underwinding crown is formed from an elastically deformable synthetic material.

22. The spindle construction as defined in claim 21, wherein said synthetic material is a plastic.

* * * * *