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The invention relates to a thread storage and delivery device, more particularly for textile machines, having: a rotatably mounted storage drum having a number of elongate thread bearing elements which are uniformly distributed in the peripheral direction at identical radial distances from the drum axis and which extend substantially in the direction of the drum axis and are firmly and non-adjustably clamped at at least one end on a drum body and form in a thread bearing zone a thread bearing for a number of turns of a storage coil; thread feed and discharge elements associated with the storage drum on the thread feed and discharge sides respectively; and a drive system for producing a rotary movement of the storage drum.

known Thread delivery devices are known (German Patent C 2 461 746) whose storage drum takes the shape of a cylindrical squirrel-cage-like member on whose rods a thread coming from a storage bobbin can be wound tangentially to form the storage coil. The rods are disposed at a radial distance from the hub part of the cylindrical drum member, which has a top and bottom annular flange in which the rods are retained on the end side. In the thread bearing zone the turns of the storage coil are each borne (theoretically) at one point on the circular cylindrical rigid rods. The gaps between adjacent rods and the hub part of the drum member effectively prevent any fluff from being deposited and affecting the operation of the thread delivery device. On the other hand, however, such a storage drum constructed in the form of a solid squirrel-cage-like member is relatively heavy - i.e., it has a considerable inert mass. This does not matter much on condition that the storage drum is driven, as a rule jointly with the storage drums of other thread delivery devices



associated, for example, with a circular knitting machine, via an endless belt coupled to a drive source. Basically the belt drive cannot be suddenly stopped or started, so that start-stop operation of the storage drum is possible only by the engagement or release of a special positive clutch associated with the storage drum. However, due to its inert mass, even when such a clutch is released, the storage drum cannot stop at once although, however, this might be desirable in the case of circular knitting machines operating with striping attachments or a number of other applications. The construction of such a thread delivery device is also still relatively expensive.

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Basically the same thing applies to other similar thread delivery devices (German Patents A 2 308 203 and 1 635 899), wherein the elongate thread bearing elements are formed by rod-like or tooth-like parts of the appropriately slotted generated surface of the cup-shaped drum body itself.

Since the thread bearing elements of the storage drums of these thread delivery devices take the form of straight rods, teeth or the like, special feed devices are required to advance the continuously forming storage coil axially on the storage drum, so that the thread turns of the storage coil always remain retained in the predetermined thread bearing zone.

For this purpose it is known to provide on the storage drum between the individual parallel straight rods forming the thread bearing elements, radially projecting finger-like or bent feed elements which, controlled by cams, perform a limited axial horizontal reciprocating movement to advance the storage coil on the thread

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bearing elements. In a prior art device of the kind specified (German Patent A2 723 210) the feed elements are formed by resilient wire members which are anchored at one end on one side of the drum member projecting radially outwards on a hub of the drum member, and at the other end engage in a groove-like cam path, with which a fixed ring enclosing the rotating storage drum at a distance is formed. In another device of this kind (German Patent A 3 104 516) a triangularly bent member between the rods forming the thread bearing elements forms for the storage coil radially projecting subdividing elements rather after the fashion of bent wire members, which are each attached at one end to a thread feeding element which, controlled by a cam, can be axially reciprocated vertically on two adjacent thread bearing elements. A further example of a thread storage and delivery device having eccentric-controlled rockers for advancing the storage coil axially is known from German Patent A2 436 936.

Lastly, European Patent Application A 170 798 discloses as prior art a thread storage and delivery device which operates, however, with a fixed storage drum, from which the thread can be unwound overhead and to which the thread is supplied in the zone of a conical widened portion, webs being disposed which cross the angular throat of the conical widened portion and extend into slots in the zone of the conical widened portion of the storage drum element and are aligned with the corners of a polygon. The arrangement is such that each of the substantially L-formed webs, extending substantially over the axial length of the storage drum and longitudinally adjustable in the axial direction, forms at its end adjacent the angular throat its own angular throat, whose zone can be moved by the longitudinal

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displacement into the slot, so as to obtain adaptation to different threads or yarns. The webs are not firmly clamped axially non-adjustably to the storage drum member at at least one end, but are mounted pivotably adjustable by means of a special bearing arrangement.

It is an object of the invention to provide a thread delivery device whose storage drum has a particularly simple, reliable construction, the inert mass of which can be reduced to a minimum value so that, for example, when the device is driven by a stepping motor precise start-stop operation can be performed at low motor power, while ensuring the automatic feeding of the storage coil turns.

To solve this problem the thread storage and delivery device specified is characterized according to the invention in that the thread bearing elements are formed by narrow light-weight substantially L-shaped or U-shaped bent members or brackets which at the other end are guided on or attached to the drum body or a member connected thereto; associated with each bent member on the thread feed side is a zone which tapers radially inwards in the direction of the thread discharge side and is joined by a thread bearing zone on the bent member; and the tapering zone and the substantially straight zone of all the bent members each lie on an imaginary circular cylinder or cone coaxial with the drum axis.

The bent members can be produced at low manufacturing cost in practically any appropriate shape, the result being a very simply constructed storage drum having a low inert mass, combined with a light-weight drum body made of plastics. At the same time the bent members disposed at a distance in the peripheral direction

ensure an efficient slipless coupling between the thread turns of the storage coil and the storage drum, while on the other hand substantially preventing operations from being affected by deposits of fluff or the like.

In a preferred embodiment the bent members, preferably extending at least with their thread bearing zones at a radial distance from the drum body, are resilient at least in places and are guided with provision for limited radial movement in relation to the drum body at the other end. It should be noted that it is known (German OS 24 36 936) to give radially limited movement in relation to the drum body to thread bearing elements constructed in the form of resiliently retained sheet metal strips.

Conditions are highly simplified if the substantially L-shaped or U-shaped bent members each have in addition to the outwardly concavely curved or straight thread bearing zone a possibly resilient first bent member arm via which they are attached to the drum body. The first bent member arm can also be laterally guided adjacent the place of attachment on the drum body, to prevent the bent member from being deflected laterally by the thread running up on the thread supply side, more particularly if the thread is relatively highly tensioned. For the attachment of the bent members on the drum body, the first bent member arms can be embedded or in some other way incorporated in the material of the drum body. It has been found advantageous for the first bent member arm of each bent member to be inserted via a bent attaching portion into the drum body and retained by latching means.

To ensure that even if the bent members are made from a

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very thin and therefore lightweight material they maintain their alignment in relation to the drum axis in all operating conditions, conveniently the bent members have on the side of the thread bearing zone opposite the first bent member arm a second bent member arm which extends substantially radially in relation to the drum body and which is constructed in the form of a guide element cooperating with matching guide devices of the drum body or a member connected thereto. The bent members can be guided laterally and/or radially by their second bent member arms, something which can advantageously be done by the bent member being formed with slots in which the second bent member arms are guided. Such slots can advantageously be provided at least in the zone of the end wall of the substantially cup-shaped circular cylindrical drum body.

To enhance stability, the bent members can bear via their second bent member arms with prestressing in the direction of the drum axis against a bearing surface disposed in the zone of the drum body bottom.

Very conveniently on the side of the thread bearing zone remote from the first bent member arms, the bent members are borne radially outwards in relation to the drum body. As a result, the bent members can be forced resiliently by their thread bearing zones a short distance inwards from the thread turns applied, so as to automatically adapt themselves to the tensioning conditions of the thread turns. However, on the other hand this prevents the storage coil from being affected by the bent members being expanded radially outwards by centrifugal force if the thread turns are applied with only a very low tensioning. The bent members can advantageously be resiliently prestressed radially



outwards in the direction of their supports, so that they oppose a predetermined resistance to their radially inward escaping movement.

In a convenient practical embodiment, the drum member can have or bear a disc-shaped or stellate bearing portion for the bent members which is formed with bearing and if necessary guide surfaces for the bent members.

The external peripheral surface of the disc-shaped bearing portion can also be beaded, to make possible efficient overhead unwinding of the thread, if this is required for the particular application for which the thread delivery or storage device is intended. Since the bearing portion is as a rule made of a relatively soft plastics, advantageously the external peripheral surface of the bearing portion bears a thread run-off ring of a wear-resistant material, for example, spring steel, which reliably prevents the thread from digging in. If the bearing portion is constructed in several parts, the thread run-off ring can at the same time hold the thread bearing portion together.

In another embodiment, however, the arrangement can also be that the bent members have on their second bent member arms bent retaining portions via which they can be borne on the bearing portion.

The free ends of the second bent member arms are covered by a cover element slipped on to or disposed on the drum body; this prevents any thread loops which form on the thread discharge side from getting caught on the ends of the bent member arms if the tensioning of the running-off thread is reduced.

The radially inwardly tapering zone on the thread supply side can be formed directly on each bent member. However, the arrangement can also be such that the tapering zone is formed on the thread supply side on at least a portion of the drum body or a member which is connected thereto and projects radially outwards beyond the bent members. The tapering zones lie on an imaginary circular cone. The inwardly tapering zones produce an automatic feed of the thread turns of the storage coil constantly forming on the thread supply side during operation, without the need of special feed devices for this purpose. For example, if there is no thread take-off from the storage drum, i.e., during malfunctions, the axial feed of the storage coil may occasionally be impeded, with the result that additional thread turns build up on the thread supply side. To prevent the thread from entering the narrow gap between the retaining member and the adjacent end face of storage drum and looping itself around the spindle bearing the storage drum, at least one thread repeller can be associated with the storage drum on the thread supply side, the thread repeller extending as far as the imaginary circular cone on which the tapering zones of the bent members lie. It has been found very effective for the thread repeller to have a substantially convex repelling edge or surface disposed laterally of the storage drum.

The bent members of the storage drum according to the invention are members which can be produced relatively simply and, as already mentioned, be very cheaply be given any required shape. For example, each bent member can readily have at least two thread bearing zones separated from one another by a radially projecting

bead-like separating zone. Each bent member can also have on the thread discharge side adjacent the thread bearing zone a zone widening radially outwards, the widening zones of all the bent members again lying on an imaginary body of rotation.

The thin-walled, preferably substantially cup-shaped drum body is as a rule made of plastics. In the zones between the bent members it can be formed with slot-like openings, so as to further reduce the amount of material used and the inert mass of the storage drum. The slot-like openings can also be used to ventilate radially outwards the turns borne on the storage coil, thus blowing off any fluff or the like. For similar reasons the bent members can also bear portions acting as fan blades.

In a preferred embodiment the bent members made from a thin spring wire material - i.e., they take the form of hardened, non-rusting shaped wires which as a rule means that no additional surface processing or coating is required, although these steps can of course be taken in individual cases. The bent members can also be hardened merely in limited zones of their longitudinal extension which are required to have resilient bending or special surface properties.

In another embodiment the bent members, taking the form of flat shaped, for example, punched-out members, can be constructed as fan blades in the thread bearing zone.

Equally suitable for right-hand and left-hand rotation is a storage drum in which the bent members lie in radial planes containing the drum axis. More particularly if it can be assumed that the storage drum



will be operated in only one direction of rotation, the bent members could lie in planes extending tangentially to a body of rotation, for example, a circular cylinder or a circular cone, coaxial with the drum axis.

Further advantageous features form the subject of subclaims.

The thread delivery and storage device described can basically be used for all thread-processing machines and purposes for which a uniform thread delivery is of importance. Its storage drum can be driven, in the manner conventional with circular knitting machines, by an endless drive belt via an appropriate pulley, but it is outstandingly suitable for an individual drive by means of a small electric motor since, as already stated, it can be constructed with an extremely low inert mass. This makes it possible to provide a self-contained thread delivery and storage device which delivers the thread under precisely maintained, predetermined conditions, without the need for monitoring from outside by special monitoring devices or the like.

Embodiments of the invention are illustrated in the drawings, wherein:

Fig. 1 is a plan view of a self-contained thread delivery storage device according to the invention,

Fig. 2 is a side elevation of the thread delivery and storage device shown in Fig. 1, sectioned along the line II-II in Fig. 1,

Fig. 3 is a side elevation in axial section to a different scale of a variant embodiment of the storage drum of the thread delivery and storage



- device shown in Fig. 2,
- Fig. 4 illustrates in a similar manner to Fig. 3 a second variant of an embodiment of the storage drum of the thread delivery and storage device shown in Fig. 2,
- Fig. 5 is a plan view to a different scale of the thread delivery and storage device shown in Fig. 1 with an associated thread repeller,
- Fig. 6 is a side elevation, partly showing the thread repeller to a different scale, of the storage drum of the thread delivery and storage device shown in Fig. 5, sectioned along the line VI-VI in Fig. 5,
- Fig. 7 is a side elevation with a partially sectioned storage drum of a further embodiment of the storage drum of the thread delivery and storage device according to the invention,
- Fig. 8 is a partial side elevation in axial section of a third variant embodiment of the storage drum of the thread delivery and storage device shown in Fig. 2,
- Fig. 9 is a partial plan view in the zone of the bearing ring of the storage drum shown in Fig. 8, sectioned along the line IX-IX in Fig. 8,
- Fig. 10 is a side elevation in axial section of part of the drum body of the storage drum shown in Fig. 8,
- Figs. 11 to 18 are each side elevations in axial section of part of further variant embodiments of the storage drum of the thread delivery and storage device shown in Fig. 2,
- Fig. 19 is a bottom end view of the storage drum shown in Fig. 18, in the direction of the arrow IXX in Fig. 18,
- Fig. 20 is a partially sectioned side elevation of a

detail of the storage drum shown in Fig. 18, and Fig. 21 is a side elevation in axial section of part of a further variant embodiment of the storage drum of the thread delivery and storage device shown in Fig. 2.

The thread delivery and storage device illustrated in Figs. 1 and 2 has a retaining member 1 in the form of a flat rectangular casing which is bounded by parallel sides and can be attached by means of attaching devices (not shown), for example, to a circular knitting machine. The flat bottom wall 2 of the retaining member 1 is formed on the outside with a circular cylindrical depression 3 into which a storage drum 4 extends which is disposed coaxially in relation to the depression 3. The storage drum 4 has a substantially cup-shaped drum body 5 made of plastics and slipped by means of a hub 6 on to the spindle 7 of an electric motor, more particularly a stepping motor 8, which extends outwardly through an aperture 9 in the bottom wall 2 and is rigidly connected via an attaching element 10 to the retaining member 1. The drum body 5 bears a number of bent members ^{or ribs} 12, disposed uniformly distributed in a peripheral direction at identical radial distances from the drum axis 11, which are bent from a thin spring wire having a smooth surface. The spring wire can be circular in cross-section or take the form of a profiled wire having an, for example, angular cross-sectional shape. It can have identical resilient properties throughout the whole bent member length, but constructions are also conceivable in which each bent member 12 is made resilient only in places by appropriate local hardening.

Each of the resilient bent members 12 is bent in a substantially U-shape; it has a substantially straight

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thread bearing zone 13, extending parallel with the drum axis 11, and adjoining such zone on the thread supply side - i.e., at the top as viewed in Fig. 2 - a radially inwardly tapering zone 14 which merges via a bend 15 into a first bent member arm 16 which extends substantially radially in relation to the drum axis 11 and is at least substantially horizontal. On the side of the thread bearing zone 13 opposite the first bent member arm 16 each bent member also bears a second bent member arm 17 which also extends substantially radially in relation to the drum axis¹¹. The first and second bent member arms 16; 17 of all the bent members 12 lie on common imaginary circular cones coaxial with the drum axis 11, while the thread bearing zones 13 of the bent member¹² lie on an imaginary, also coaxial circular cylinder.

Following their first bent member arms 16, the bent members 12 each have attaching portions 180 which are bent at right angles and via which the bent members 12 are so embedded in the generated surface 19, suitably widened in this zone, of the cup-shape drum body 5 as to ensure at the same time a lateral guiding of the first bent member arms 16 adjacent the attaching place.

By their second bent member arms 17, the bent members 12 lie in slots 18 formed in the bottom 20 of the drum body 5 and extending radially of the drum axis 11, their width being somewhat larger than the width of the bent members 12. The bent members¹² are therefore laterally guided in the slots 18 via their second bent member arms 17; they also bear with axial prestressing via their second bent member arms 17 against a supporting surface 21 with which the bottom wall 20 of the drum body 5 is formed. Each of the bent members 12 is therefore rigidly

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attached to the drum body 5 in the zone of its first bent member arm 16 - i.e., on the thread supply side -, while at its other end - i.e., in the zone of the second bent member arm 17 - each bent member 12 is guided with provision for limited radial movement on the drum body 5, while the walls of the slots 18 provide a lateral guide for the bent members 12 in this last-mentioned zone.

In the zone of its bottom wall 20, the drum body 5 is also formed with a frustoconical covering member 22 into which the slots 18 extend and which prevents threads from being caught by the ends of the second bent member arms 17.

A thread run-on eyelet 23 and a thread run-off eyelet 24 are each rigidly disposed on the retaining member 1 laterally alongside the storage drum 4. The retaining member 1 also has a thread brake 25 to be described in detail hereinafter and a thread run-on lug 26 disposed upstream of the thread brake 25.

A thread 27, drawn off a storage bobbin (not shown), runs through the run-on lug 26 via the thread brake 25 and the run-on eyelet 23 tangentially on to the inwardly tapering zones 14 of the bent members 12 of the storage drum 4 driven by an electric motor 8. The thread turns forming as a result are pushed, due to the inclination of the bent member zones 14, axially downwards referred to Fig. 2, on to the substantially straight thread bearing zone 13, where they form a storage coil 28 consisting of a number of thread turns. The thread 27 is then drawn off the storage coil 28 and fed via the run-off eyelet 24 to a thread consuming device (not shown).



As the result of the tensioning exerted by the thread turns of the storage coil 28, the bent members 12 can resiliently pivot by their bent portions 15 a short distance inwards, the prestressed second bent member arms 17, which lie at a slight inclination, sliding a short distance inwards on the bearing surface 21. As a result, the straight thread bearing zones 13 of the bent members 12 are somewhat inclined, so that they come to lie on a common cone generated surface which is coaxial of the drum axis 11 and boosts the axial feed of the storage coil 28.

The resilient resistance which the bent members 12 offer to this inward pivoting movement of their thread bearing zone 13 depends not only on the resilient properties of the bent members 12 in the zone of their "pivoting place" at the particular bent portion 15, but also on the prestressing with which the second bent member arms 17 are borne on the bearing surface 21. If necessary, special properties of the thread material to be wound on can be taken into account by suitable dimensioning of these values. Cases are also conceivable in which the bent members 12 are rigidly connected to the drum body 5, so that they are not capable of any resilient yielding movement.

Formed in the generated surface 19 and in the bottom wall 20 of the cup-shaped drum body 5, in each case lying between adjacent bent members 12, are slot-like openings 29 which on the one hand further reduce the already low mass of the storage drum 4 by saving material, and on the other hand act as fans when the storage drum 4 rotates, by which the electric motor 8 is cooled and the thread turns of the storage coil 28 are



ventilated radially outwards and fluff is blown off.

In the variant embodiments of the storage drum 4 illustrated in Figs. 3 to 7 like members to those of the storage drum shown in Figs. 1 and 2 have like references, so that any repeated explanation is therefore superfluous.

In the embodiment illustrated in Fig. 3, the U-shaped wire bent members 12 are inserted by their attaching portions 180 into matching bores parallel with the axial bores in the drum body generated surface 19. Their first bent member arms 16 are laterally guided in substantially radially extending channel-like depressions 30 in the end face of the drum body generated surface 19. Fixed locking is performed by a retaining ring 31 which is inserted by a flange 32 into the drum body 5 and latched against the drum body generated surface 19 by means of a circularly extending bead and an associated depression.

By their second, substantially horizontal arms 17 the bent members 12 extend into the slots 18, which provide a lateral guide for the bent members 12 in the zone of the bottom wall 20.

On the side of the thread bearing zone 13 remote from the first bent member arms 16, the bent members 12 are borne radially outwards in relation to the drum body 5. To this end slipped on to the bottom wall 20 of the drum body 5 is a coaxial plastics bearing disc 34 bearing on the outer peripheral surface an annular flange formed as a bead 35 which has on its inner side a substantially circular cylindrical bearing surface 36 against which the bent members 12 are borne at the bottom end of their

thread bearing zone 13. The bent members 12 are resiliently prestressed radially outwards and therefore bear with prestressing against the bearing surface 36. By suitable adaptation of the prestressing once again that resilient resistance can be determined which the bent members offer by the already explained slight inward pivoting of their thread bearing zones 13.

Inserted on the bead 35 of the bearing disc 34 is a spring steel thread run-off ring 37 whose surface can also be coated and which holds together the bearing disc 34 if it is constructed in several parts.

The storage drum 4 described (Fig. 3) is suitable for the overhead unwinding of the thread from the storage coil 28. The running-off thread runs over the thread run-off ring 37, which is made of a wear-resistant material and therefore ensures an efficient thread run-off.

In the further embodiment of the storage drum 4 shown in Fig. 4, the bent members 12 comprise substantially U-shaped flat pieces of punched-out sheet metal although; for example, they can also be made from plastics. In each bent member 12 the portion 38 whose outer, narrow end face corresponds to the thread bearing zone 13 takes the form of a fan blade which is adjoined on one side by the narrow, arm-like inwardly tapering zone 14 with the narrow first bent member arm 16, and on the other side by the narrow second bent member arm 17. While the bent member portion 38 is substantially rigid, at least in the zone of the bend 15 or adjacent the clamping place of the first bent member arm 16 there is a resilience which enables the bent member 12 to be so prestressed radially outwards that it bears against the

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supporting surface 36 of the supporting disc 34 with resilient prestressing and can be pivoted radially inwards around a pivoting place situated adjacent the bend 15 by the forces exerted by the thread turns of the storage coil 28.

The first arms 16 of the bent members 12 are in this case again inserted in matching channel-like depressions 30 in the end face of the drum body generated surface 19. They are retained captive in the zone of the channel-like depressions 30 by the welding of the plastics material.

The air stream conveyed from the bent member portions 38 acting as fan blades passes through openings 39 in the supporting disc 34, also forming the bottom wall of the drum body 5, into the drum body 5 and between the bent members 12 directed radially outwards, thus blowing through the thread turns of the storage coil 28. Since in this case, starting from the hub portions 6, the drum body generated surface 19 extends only in the zone above the bent member portions 38, there are no members impeding the passage of air between the bent member portions 38.

Independently of whether they are bent from wire, as in the embodiments illustrated in Figs. 2 and 3, or take the form of punched parts as in the embodiment shown in Fig. 4, the bent members 12 can be given any required shape without increasing production costs. For example, in each bent member the straight thread bearing zone can in the manner shown in Fig. 6 be subdivided into two thread bearing zones 13a, 13b by a bead-like projecting separating zone 40, or, as shown in Fig. 7, each bent member 12 can have a radially outwardly widening zone 41



adjoining the thread bearing zone 13 on the thread run-off side. The outwardly widening zones 41 of all the bent members 12 again lie on a common imaginary circular cone or some other suitable body of rotation. If this is required having regard to the thread processed or the working conditions, the zones 41 prevent the bottom turns of the storage coil 28 from falling down from the storage drum 4.

The drum body 5 of the storage drum 4 shown in Figs. 5 and 6 is similar to that illustrated in Fig. 4. However, since in this case the bent members 12 are bent from wire, to ventilate the yarn turns of the storage coil 28 special fan blades 42 are provided which lie in the annular space enclosed by the bent member zones 13 and are moulded extending substantially radially on the drum body generated surface 19 projecting after the fashion of an annular flange from the hub portion 6.

If the thread consuming device takes no thread from the storage coil 28 when a malfunction occurs, or if the axial feed of the coil 28 is impeded for other reasons, when the storage drum 4 continues to rotate, turns may build up on the inwardly tapering zones 14 of the bent members 12 and finally, unless the thread delivery device is stopped in good time, enter the space between the bottom wall 2 of the retaining member 1 and the adjacent end face of the drum body 5 and loop themselves around the shaft 7 at that place.

To prevent this, in the embodiment illustrated in Figs. 5 and 6, disposed on the underside of the retaining member 1 alongside the storage drum 4 is a thread repeller 43 which extends, in the manner shown more particularly in Fig. 6 by a convex thread-repelling edge

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44 into the zone of the imaginary circular cone described by the inwardly tapering bent member zones 14. The thread repeller 43 has an inclined surface 45 which extends from the thread-repelling edge 44 substantially parallel with the bent member zones 14 at a small distance therefrom and intersects along the thread repelling edge 44 a gently curved repelling surface 46, the result being the wedge-shaped cross-section shape shown in Fig. 6.

If thread turns should build up on the bent member zones 14, they are guided via the thread repelling edge 44 on to the thread repelling surface 46 and thereby prevented from rising further along the bent member zones 14.

The thread delivery device illustrated in Figs. 1 and 2 has its own electric motor 8 for driving the storage drum 4. However, it is also basically possible to rotate the storage drum 4 in the conventional manner via a drive belt, such as is used on circular knitting machines for driving all the thread delivery devices disposed along the periphery of the machine. Fig. 7 shows an example of such a thread delivery device:

NOTE
The shaft 7 bearing the storage drum 4 is rotatably mounted in the retaining member 1 and bears on the top side of the retaining member a pulley ⁴⁷ slipped on for co-rotation.

In this case the storage drum 4 is combined with a conventional plate-type thread brake 25a. A thread run-on and a thread run-off feeler are shown together with a loop-repelling bent member (references 49, 50 and 51).

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In this case the basic structure of the storage drum 4 corresponds to that of the embodiment shown in Figs. 1 and 2. However, apart from the outwardly extending lower bent member zones 41, the bent members 12, unlike the embodiment shown in Figs. 1 and 2, are also borne radially outwards. To this end each of the second arms 17 of the bent members 12 has a hook-like bent retaining member 52 which engages behind a matching circular cylindrical retaining surface 53 of a covering member 22a slipped on to the bottom 20 of the drum body.

Of course, the other embodiments of the storage drum 4 already described can also be used. The bent members 12 can lie in the radial planes containing the drum axis 11 or, if a storage drum is to be rotated in one direction only, the arrangement can be such that the planes containing the bent members 12 extend tangentially to a circular cylinder or circular cone coaxial with the drum axis 11.

As already pointed out, the thread delivery device illustrated in Figs. 1 and 2 is self-contained - i.e., independent of an outside drive source. Since the electric motor 8 must be designed only for a relatively low rated power, the associated electric circuit can readily be accommodated in a casing-like retaining member 1. As a result, however, the circuit arrangement can also comprise additional information by which the thread delivery device becomes a self-contained thread delivery apparatus, which can not only supply thread continuously or in precise start-stop operation, but also automatically maintain a predetermined tensioning for the delivered thread during delivery and ensure that the thread coming from the storage bobbin is wound on the storage drum with an always constant tensioning, the

result being an efficient build-up and feed of the storage coil 28.

The electric thread brake 25 has a d.c. motor 70 which is inserted in a matching bore in the retaining member 1 and bears a second storage drum 4a which is basically similarly constructed to the storage drum 4 already described with reference to a number of embodiments thereof. It merely has a smaller diameter. Its bent members 12 and drum body 5 are indicated merely diagrammatically in Figs. 1 and 2.

The thread 27 supplied via the run-on lug 26 is looped in a number of turns around the second storage drum 4a, so that it is sliplessly coupled thereto. The associated electric motor 70, which acts as a braking motor, tends to drive the second storage drum 4a in the opposite direction of rotation from the storage drum 4; but its torque is substantially lower than that of the stepping motor 8, so that it is driven oppositely to its direction of rotation by the thread 27 when the stepping motor 8 is operating. During this it develops a braking torque which acts on the thread 27 via the second storage drum 4a and ensures that the thread 27 always runs on to the storage drum 4 with a predetermined thread tensioning.

The value of the brake torque of the electric motor 70 can be controlled by taking appropriate action on one of the electric input values (current, voltage) of the electric motor.

The circuit members of the associated control circuit take the form of printed circuits whose associated circuit boards 86, 87 are accommodated together with the

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casing 600 of a signal transmitter in the retaining member 1, whose interior is closed by a slipped-on cover 88 (cf. Fig. 2).

draw
The thread running off the storage ~~run~~ 4 is scanned by a spring-loaded feeler 55 which correspondingly rotates a shaft 56 delivering via the rotary angle transmitter 600 a thread tensioning signal which is fed into the control circuit and controls the electric motor₈ for constant thread tensioning.

Modified
In the storage drums 4 described, the bent members 12 are each substantially U-shaped. Embodiments are also conceivable in which the bent members 12 are substantially L-shaped - i.e., the second bent member arms 17 are eliminated. The bent members can then be laterally and radially guided, for example, solely in matching slots 860 (Fig. 6) in the bearing disc 34 or the bottom wall 20 of the drum body 5, as will be further explained hereinafter.

In any case, it is essential to ensure a slip-free coupling between the thread turns of the storage coil 28 and the thread bearing zones 13 of the bent members 12 disposed at a radial distance from the adjacent parts of the drum body 5.

In the embodiments of the storage drums 4, 4a shown in the drawings, the bent members 12 lie in planes containing the drum axis 11. As a result, the storage drums can be equally effectively used in both direction of rotation. However, basically for particular applications an embodiment might also give advantages in which the bent members 12 lie at a slight "inclination" referred to the drum axis 11 - i.e., in planes which

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intersect the drum axis 11 at a small acute angle. This angle might be, for example, between 3° and 5° , although other angular values are also conceivable. Similarly, the bent members with their thread bearing zone 13 might also be constructed following a spiral. Such an inclined position of the bent members can, for example, prevent the storage coil 28 from dropping downwards.

However, even in these cases the bent members 12 are retained on the drum body 5 in the sense of the Claims extending substantially in the direction of the drum axis.

If, as already explained, the bent members 12 are made from a resilient material, for example, spring wire, and are rigidly connected to the drum body 5 only at their first bent member arms 16 - i.e., on one side -, practical experience has shown that during operation they are somewhat oscillated by the entering and discharged threads. This is due to the fact that the bent members are disposed with their thread bearing zones 13 distributed along the periphery of the storage drum 4; 4a, so that precisely speaking the thread is borne not on a smooth cylindrical surface, but on the corner edges, formed by the thread bearing zones 13, of a polygonal rotating body. This dynamic behaviour of the bent members 12 is adapted to substantially facilitate and boost the axial feed of the storage coil 28.

Further variant embodiments of storage drums 4 are illustrated in Figs. 8 to 21.

In the embodiment illustrated in Figs. 8 and 9 the drum body 5 is slipped on to a two-part hub 6a, 6b whose lower hub portion 6b bears a moulded-on, radially

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outwardly projecting annular flange 60, while a cover-like annular disc 61 is slipped on to the upper hub portion 6a. In the zone of their places of attachment and guidance on the drum body 5, the annular flange 60 and an annular disc 61 engage over the second and first arms 17; 16 of the U-shaped wire bent members 12 in the manner shown in Fig. 8. The resilient bent members 12 are again each formed with a radially inwardly tapering zone 14 which merges via a bend 15 into the first bent member arm 16. On the other side of the straight thread bearing zone 13, each bent member 12 has a bead-like, outwardly extending bent member zone 41 which is adjoined by the second bent member arm 17. The two bent member arms 16, 17 each bear on the end side an attaching portion 180 bent substantially at right-angles, the arrangement being such that the two attaching portions 180 of a bent member 12 are aligned coaxially with one another. The two attaching portions 180 of a bent member 12 are each inserted in coaxial recesses, taking the form of coaxial bores 181, 182, in the drum body 5 and are retained therein by the annular flange 60 and the annular disc 61 engaging over them. While the cylindrical recess 181 corresponds precisely to the diameter of the associated attaching portion 180, so that the latter is retained fixed in position, the other recess 182 is constructed with a larger diameter, so that the lower attaching portion 180 and therefore also the second arm 17 of each bent member is guided with provision for limited radial and lateral movement. The bent members 12 bear via their arms 16, 17 against bearing surfaces 62, 63 of the drum body 5 in the axial direction of the drum; they are so prestressed that their two arms 16, 17 bear with ^{resilience} ~~spring force~~ against the bearing surfaces 62, 63. A radial bearing 64 of short axial length in relation to the drum body 5 is also

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provided in the zone of the upper end of the thread bearing zone 13 - i.e., at the transition to the zone 14.

For assembly, the bent members 12 can simply be latched by their attaching portion 180 into the recesses 181, 182.

Disposed inside the bend 15 and that zone 41 of the bent members 12 which is bent in bead shape is an endless thread repelling ring 65; 66 which is coaxial with the drum axis, and can be made, for example, from a plastics material, and is adapted to prevent threads from entering between the individual wire bent members 12 and getting caught there, something which might lead to ruptures of the thread. The two repelling rings 65, 66, or at least one of them, can also form a supporting and stabilizing function for the bent members 12, if this should be necessary in individual cases.

As shown in Fig. 9, the edge of the lower repelling rings 66 is formed in the zone of the bent members 12 with radially outwardly open slots 67 in which the individual bent members 12 partially engage by their zones 41. The width of the slots 67 corresponds to the diameter of the bent members 12 made from cylindrical steel material; the depth of the slots 67 is substantially equal to half the thickness of the wire of a bent member 12; this means that the bent member 12 is embedded up to about half its diameter in such a slot 67.

The upper repelling ring 65 can be constructed in a corresponding manner; however, the arrangement can also be such that the repelling ring 65 is rigidly connected

(67)

illustration to the bent members 12, which are, for example, embedded in the rings 65.

According to the

Since the bent members 12 made of a resilient wire material have moved radially to a limited extent by their lower attaching portions 180 in the recesses 182 and such mobility is not adversely affected by the length of the slots 67 in the lower repelling ring 66 (an air gap of several tenths of a millimetre is left in each case at a place 68 between the annular flange 60 and the second bent member arms 17, to prevent any such effect on mobility), the bent members ¹² can taper downwards by their straight thread bearing zone 13, if the radial force exerted by the thread coil on the thread bearing zone ¹³ 16 becomes greater than the prestressing of the bent members. Such tapering is limited by the fact that the lower attaching portion 180 bears against the inner edge of the recess 182. In a condition deformed in this way, the straight thread bearing zone 13 of all the bent members 12 lie on the generated surface of an imaginary circular cone whose apex lies on the drum axis on the thread discharge side.

Since each of the bent members 12 is radially borne at a place 64, the aforescribed inward pivoting movement of the lower portions of the bent members 12 remains substantially confined to their thread bearing zones 13 and the adjoining bead-like zones 41. The radial bearing points 64 can lie not only on reinforcing ribs, as shown in Fig. 8, but also each lie on a fan blade 69 which is moulded on the drum body 5 and shown bounded against the drum body 5 by chain lines in Fig. 8.

In the basic unloaded position of the bent members 12 shown in Fig. 8, their straight thread bearing zones 13

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will as a rule lie on a circular cylinder. With a full storage coil and more particularly in the case of a poorly conveyable yarn, as already explained, the bent members 12 may be so resiliently deformed against their prestressing that the yarn is conveyed axially from one initially larger winding diameter to a smaller winding diameter, thus readily relieving the storage coil and also facilitating thread transport.

Basically the same results can also be achieved by the bent members 12 being constructed without inherent resilient prestressing, while the lower repelling ring 66 is made of a flexible material and is rigidly connected to the bent members 12. As a result, the resilient deformation of the repelling ring 66 produces a corresponding radial springing of the bent members 12.

It is however also conceivable for the bent members 12 to lie in their basic unloaded position with their thread bearing zone 13 on a circular cone, whose apex lies on the drum axis on the thread supply side. This means that the coil diameter slightly increases from the thread entry side to the thread exit side. Such an arrangement may be advantageous, for example, if smooth, non-resilient yarns are to be processed which can by their very nature obtain very little grip on the thread bearing zones 13 of the bent members 12, so that the turns tend to drop down. A certain compensation is provided, within the limits of resilience of the thread material, by the aforementioned continuous increase in coil diameter over the length of the thread bearing zones of the bent members 12.

In this embodiment the arrangement can advantageously be such that when the attaching portion 180 bears against

(69)

the radially inner wall of the recess 182, the thread bearing zone 13 of each bent member 12 lies on a circular cylinder coaxial with the drum axis.

The bead-like outwardly bent zones 41 of the bent members 12 cooperate with the lower repelling ring 66 to form a thread rewinding edge such as is present, for example, in the embodiment illustrated in Fig. 3 in the form of the thread run-off ring 37 and also has the purpose of retaining loose thread turns which drop down. As practical experience has shown, the thread re-coiling edge at the same time exerts on the thread a certain entraining function, so that surplus thread is as it were constrainedly entrained, without being violently dragged along. The external diameter of the imaginary bead-like body of rotation described by the zones 41 of the bent members 12 conveniently stands in a predetermined ratio to the external diameter of the lower repelling rings 66. The best results were obtained if, as already explained, the bent members 12 are embedded in the bead zone 41 about as far as half the wire thickness in the slots 67 of the repelling ring 66. This at the same time also ensures that if the thread is manually unwound overhead from the storage drum (for example, with a thread surplus on the storage drum), the thread can be drawn off in a problem-free manner without burr or thread rupture.

Due to the open construction of the storage drum, produced by the bent members 12 disposed at a distance one beside the other and the repelling ring 65, 66, the air can pass freely along the storage coil disposed on the thread bearing zones 13 of the bent members 12. In addition to their reinforcing function for the drum body 5, its rib-like mouldings, taking the form of fan blades

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69, also convey air.

The drum body 5 in the embodiment illustrated in Fig. 8 is again shown without bent members 12 in Fig. 10. Fig. 10 shows how lateral guide ribs 70 are associated with the first bent member arms 16 of the bent members 12 in the zone of the upper bearing surface 62, the ribs 70 extending to the associated recess 181 and forming a lateral guide for the bent member arms 16. While the diameter of the upper cylindrical recess 181 corresponds substantially to the wire diameter of a bent member 12, the diameter of the associated lower cylindrical recess 182 is about 0.15 mm larger than the wire diameter.

The embodiment illustrated in Fig. 11 basically corresponds to that shown in Figs. 8 to 10, but with the difference that the bent members 12 are borne throughout the length of their first arms 16, their bends 15 and their inclined zones 14 on the if necessary rib-like subdivided portion 69 of the drum body 5.

On both sides the bent members 12 are also retained non-displaceably radially by their attaching portions 180 in cylindrical recesses 181, 182; this means that the two cylindrical recesses 181, 182 of a bent member 12 each has the same diameter, which corresponds to the diameter of the wire. The annular flange 60 is borne directly on the second bent member arms 17. The repelling ring 65 also present is not shown.

In its zone 69, shown in cross-section in Fig. 11, the drum body 5 extends as a solid body over the whole periphery, so that no thread can enter between adjacent bent members 12 in this zone.

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modified
Lastly, however, the construction shown in Fig. 11 can so be viewed together with that shown in Fig. 8 that it illustrates a different represented sectional representation of an embodiment according to Fig. 8, wherein a bent member 12 corresponding to Fig. 8 is guided by its lower second arm ¹⁷27 with provision for limited radial movement, the next bent member 12 being retained rigidly on the drum body 5 at both ends, corresponding to Fig. 11.

change
The embodiment shown in Fig. 12 is also similar to that illustrated in Figs. 8 to 11, although the bent members 12 are constructed more simply, since each bent member 12 is substantially U-shaped only in the portion given by its first arm 16, the adjoining bend 15 and the downwardly inclined zone 14. The bent attaching portion ¹⁸⁰181 adjoining the first arm 16 is coaxial with the portion forming the straight thread bearing zone 13, which adjoins the zone 14 and is retained in a matching recess 182 in the lower annular flange 60. As shown in Fig. 12, the diameter of the recess 182 can be equal to the diameter of the associated wire bent member 12, so that the bent member 12 is rigidly retained at both ends.

Alternatively, however, the arrangement can also be such that either all the recesses 182 or alternately each second recess 182, similarly to what is shown in Fig. 8, have a larger diameter than what corresponds to the wire diameter of the bent members 12. As a result, the resilient bent members 12 are guided at their lower ends with provision for limited radial movement.

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Above the thread bearing zone 13, each of the bent members 12 is borne on a circularly extending bead-like portion 69 of the drum body 5 which has in the edge for each bent member 12 an open groove 71 in which the associated bent member 12 is laterally guided. The upper attaching portions 180 of the bent members 12 is retained radially between the aforementioned bead-like portion 69 and a cylindrical flange 72 which is moulded onto the annular disc 61 and engages over the attaching portions 180 of the bent members 12, in the manner shown in Fig. 12. Moulded on the outside of the cylindrical flange 72 is a toothing 730 into which a toothed driving belt (not shown) can engage.

Fig. 13 shows an embodiment having even more simply designed wire bent members 12. The wire bent members 12 are simply bent in L-shape, each of them bearing via their first arm 16 against the bearing surface 62 of the drum body 5 extending at right-angles to the axis of rotation of the drum, or (as shown) of a moulded member 73 connected to the drum body 5. The bent members 12 are retained by the slipped-on annular disc 61; if necessary, lateral guide ribs for the first bent member arms 16 can be provided either in the annular discs 61 or in the zone of the bearing surface 62.

By their arms forming the straight thread bearing zone 13, the bent members 12 extend through the circularly extending bead-like zone 69 which, by its if necessary wear-resistant conical surface 140, forms that zone of the storage drum (comparable with the zone 14 shown in Fig. 8) which tapers radially inwards in the direction of the thread discharge side. The conical surface 140 can also be interrupted by grooves, just as it is also conceivable to subdivide the whole bead-line zone 69

into radial planes by slots, so that the zone 69 consists of individual registering ribs disposed at a distance one beside the other.

Again the bent members 12 are retained by their end side attaching portions 180 in cylindrical recesses 182 in the drum body 5, the diameter of the recesses 182 being either equal to or greater than the wire diameter, as already explained in detail with reference to the other embodiments.

Above the bead-like zone 69 the bent members 12 are exposed by a portion 74 forming a mangle gear in which a toothed driving belt (not shown) can engage.

Figs. 14 to 16 show embodiments in which the thread bearing zone 13 is not straight, but concavely curved in the direction of the outside of the storage drum. The curvature of the bent members 12 is uniform over the whole thread bearing zone, which also comprises the inwardly tapering zone 14 of the embodiment illustrated in Fig. 8. The advantage over prior art solid storage drums, which are basically constructed after the fashion of a capstan, is that the bent members 12 have only point contact with the thread turns, so that the coiling body forms a kind of "polygon". This reduces to a minimum the risk that threads may stick to the storage drum. Since in any case the bent members 12 are bent from a hard resilient material in a very simple manner, as a rule there is moreover no need for any further wear-reducing surface treatment, such as required with a solidly constructed storage drum in the zone of the thread supply and discharge and the thread bearing surface.

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Apart from the curved construction of the thread bearing zone 13, the embodiment illustrated in Fig. 14 corresponds to that shown in Fig. 11, so that further explanation is superfluous. The bent members 12 are rigidly retained by their attaching portions 180 to the drum body 5 at both ends; they are also radially borne substantially in the centre of the thread bearing zone 13 on a supporting disc 75 which is moulded onto the drum body 5 and whose outer periphery is formed with grooves 76 open at the edge, in which the bent members 12 are laterally guided. The upper annular disc 61 is widened after the fashion of a cover, so that the first arms 16 of the bent members 12 register over the whole length and even substantially cover the bend 15 of each of the bent members 12.

In this embodiment also the bent members 12 might be guided in the zone of their lower attaching portions 180 with provision for limited radial movement in recesses 182 of larger diameter, in the manner shown in Fig. 8. It would also be conceivable to retain the bent members 12 rigidly on the drum body 5 only in the zone of their lower second arms 17 and to design them with provision for limited radial movement in the zone of their top first arms 16, for example, by constructing the recesses 181 with a larger diameter than the corresponding attaching portion 180 and disposing the annular disc 61 at a certain distance from the first bent member arm 16.

Embodiments having bent members 12 guided with provision for limited radial movement at one end are shown in Figs. 15 and 16:

In the embodiment illustrated in Fig. 15 the substantially L-shaped bent members 12, similarly to

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Fig. 14, are rigidly retained by their second arms 17 and their attaching portions ¹⁸⁰181 on the drum body 5, and the zone of the lower bearing surface 63 can also be formed for each bent member arm 17 with a groove open at the edge which guides such bent member arm laterally. The lower bearing surface ⁶³23 is moreover formed on a disc-shaped moulded portion 76 of the drum body 5 which projects radially by a bead-like portion 77 beyond the bent members 12 and therefore forms the thread re-winding edge. In the zone of each bent member 12, the bead-like portion 77 can have an edge-side incision 78, the result being an arrangement comparable with the lower repelling ring 66 shown in Fig. 8.

Each bent member 12 engages by its upper attaching portion 180 in a corresponding recess 181 in the circularly extending bead-like portion 69 of the drum body 5. The diameter of each recess 181 is larger than the diameter of the associated wire bent member 12.

In the embodiment illustrated in Fig. 16, the bent members 12 on the thread entry side are, basically similarly to the embodiment shown in Fig. 13, retained by their first bent member arms 16, so that to this extent further discussion is superfluous. The bead-like zone 69 of the drum body 5 projects in the zone of its inwardly inclined peripheral surface 140 radially beyond the bent members 12 and is formed with longitudinal slots 141 in which the bent members 12 are guided in their zones 14 laterally, but with provision for radial movement. By their attaching portions 180 the bent members 12 are received in recesses 182 in the drum body 5 whose diameter is larger than the diameter of the wire bent members 12.

Fig. 17 shows a particularly simple embodiment of a storage drum 4 which has a very low inert mass. The substantially U-shaped wire bent members 12 are inserted by the attaching portions 180 of their second arms 17 directly into corresponding recesses 182 of the same diameter in the drum body 5 reduced to the hub 6. At the other end they are looped by their attaching portions 180 around a wire thread-repelling ring 66, which also acts as a supporting ring, and are connected to the ring 66. The other thread-repelling ring 65 also takes the form of a wire ring and is attached in the same manner to the bent members 12 in the zone of their second arm 17. If required, the end members 12 can also have a bead-like zone 41.

Lastly, Figs. 18 to 20 show an embodiment similar to that shown in Figs. 8 to 10, to the explanation of which reference can be made.

Differing from the embodiment shown in Figs. 8 to 10, the spring wire bent members 12 are not radially borne in the thread bearing zone 13. The upper bearing surface 62 of their first arms 16 is constructed with a smaller diameter, thus ensuring that the spring action can extend over a larger zone of the bent members 12. Provided for the lateral guiding of the bent members 12 on the inside of the upper annular disc 61, radially enlarged similarly to Fig. 14, are grooves 760 in which the bent members 12 engage in the zone of their bends 15 and the ends of their first arms 16. The annular disc 61 engages radially over the bent members 12; their outer edge 770, which partially covers each of the bends 15, acts at the same time as a thread repeller, thus boosting thread entry. This feature also provides protection against fibre fly from above.

The lower annular flange 60 is also radially advanced to beyond the straight thread bearing zone 13 of the bent members 12. It is shell-shaped on the outside, its inside being formed with grooves 780 in which the bent members 12 are so laterally guided that the bent members 12 continue to have provision for free radial movement. In each bent member 12 the thread bearing zone is bent at an angle at the transition place to the second arm 17, as shown in Fig. 18. Moreover, radially forwardly projecting cams 79 are moulded on the outer peripheral surface of the annular flange 60 in the manner shown more particularly in Fig. 19, the cams 79 extending in the form of a garland between adjacent bent members 12. The bent members 12 are exposed by their thread bearing zone substantially over half the wire cross-section, as shown at a place 80, in Fig. 19.

The cams 79 can either extend after the fashion of an outwardly convex arc of a circle between two adjacent bent members 12 or, as shown at a place 81, be formed between two adjacent members 12 by two convex radii with an interposed "notching", embodiments also being conceivable in which the cams are bounded by straight chords, as shown at place 82. Alternatively or additionally, they can also have their own tooth-like or finger-like projections 83, which are disposed in the zone between adjacent members 12.

To prevent thread loops from getting between the bent members 12 and the annular flange 60 in the zone of the cams 79, conveniently the cams 79 are situated, in the manner shown in Fig. 20, in the axial direction at a place 84 higher than the inclined bending of the thread bearing zones 13 at their transition to the second bent

member arms 17.

Lastly, Fig. 21 illustrates an embodiment in which the substantially L-shaped bent members are each constructed with two first bent member arms 16 which diverge in fork-shape, lie in the upper annular flange 61 in a radial plane in relation to the drum axis and are retained in a corresponding recess 181a. Adjoining the straight thread bearing zone 13, each bent member 12 on the opposite side is inserted by its attaching portion 180 into a corresponding recess 182 in the lower annular flange 60.

In this embodiment the bent members 12 can also be constructed in the form of sleeves or rotary members, so that the two first bent member arms 16 are formed by the generation of a moulded-on cone.

CLAIMS

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1. A thread storage and delivery device, more particularly for textile machines, having: a rotatably mounted storage drum (12) having a number of elongate thread bearing elements (14) which are uniformly distributed in the peripheral direction at identical radial distances from the drum axis and which extend substantially in the direction of the drum axis and are firmly and non-adjustably clamped at at least one end on a drum body (12d) and form in a thread bearing zone a thread bearing for a number of turns of a storage coil; thread feed and discharge elements (23, 41) associated with the storage drum on the thread feed and discharge sides respectively; and a drive system (2) for producing a rotary movement of the storage drum, characterized in that the thread bearing elements are formed by narrow light-weight substantially L-shaped or U-shaped bent members or brackets (12) which at the other end are guided on or attached to the drum body (5) or a member

connected thereto; associated with each bent member (12) on the thread feed side is a zone (14) which tapers radially inwards in the direction of the thread discharge side and is adjoined by a thread bearing zone (13) on the bent member (12); and the tapering zone (14) and the substantially straight zone (13) of all the bent members (12) each lie on an imaginary circular cylinder or cone coaxial with the drum axis.

2. A device according to claim 1, characterized in that at least the thread bearing zone (13) is concavely curved in the outward direction.

3. A device according to claim 1, characterized in that the thread bearing zone (13) is substantially straight.

4. A device according to one of the preceding claims, characterized in that the bent members (12) are resilient at least in places and are guided with provision for limited radial movement in relation to the drum body (5) at the other end.

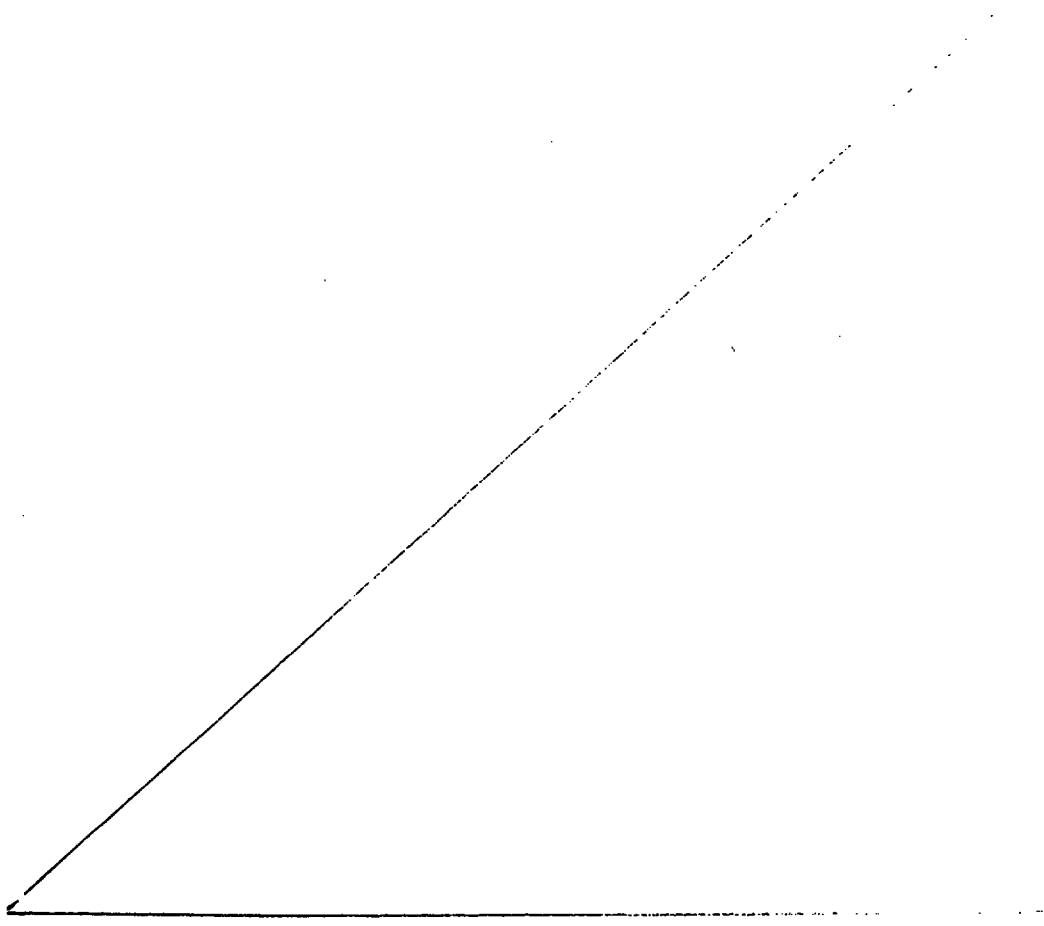


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5. A device according to claim 4, characterized in that the bent members (12) each have an if necessary resilient first bent member arm (16) which extends substantially radially in relation to the drum body (5) and via which they are attached thereto.

6. A device according to claim 5, characterized in that each first bent member arm (16) is laterally guided adjacent the place of attachment on a drum body (5) or a member (61, 69) connected thereto.

7. A device according to claim 5 or 6 characterised in that each first bent member arm (16) is inserted via a bent attaching member (120) into the drum body (5) or a member connected thereto and is retained therein.



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8. A device according to one of claims 5 to 7, characterized in that the bent members (12) have on the side of the thread bearing zone (13) opposite the first bent member arm (16) a second bent member arm (17) which extends substantially radially in relation to the drum body (5) and which is constructed in the form of a guide and/or retaining element cooperating with matching guide and/or retaining devices (18, 36) of the drum body (5) or a member (34, 60, 76) connected thereto.

9. A device according to claim 8, characterized in that the bent members (12) are guided laterally and/or radially by their second bent member arms (17).

10. A device according to claims 6 or 9, characterized in that the drum body (5) or a member connected thereto is formed with slots (18; 141) in which the bent member arms (16; 17) are guided.

11. A device according to claim 10, characterized in that at least the zone of the end wall of the substantially pot-shaped circular cylindrical drum body (5) is formed with slots (18) in which bent member arms are guided.

12. A device according to claim 8, characterized in that each second bent member arm (17) is inserted by a bent attaching portion (180) into the drum body (5) or a member connected thereto and retained therein.

13. A device according to claim 12, characterized in that the attaching portions (180) of the two bent member arms (16, 17) are aligned coaxially with one another and inserted into matching recesses (181, 182) of the drum body (5) or a member connected thereto.

14. A device according to claim 13, characterized in that the attaching portion (180) of the first or second arm (17) is guided with lateral clearance in the associated recess (181, 182).

15. A device according to one of claims 8 to 14, characterized in that the bent members (12) bear with prestressing in the direction of the drum axis via at least one of their arms (16, 17) or a portion of the thread bearing zone (13)



against an associated bearing surface (21; 62, 63) of the drum body (5) or a member connected thereto.

16. A device according to one of claims 5 to 15, characterized in that on one side of the thread bearing zone (13) the bent members (12) are borne radially outwards in relation to the drum body (5).

17. A device according to one of claims 3 to 16, characterized in that the bent members (12) are resiliently prestressed radially outwards.

18. A device according to claim 17, characterized in that the bent members (12) with provision for limited radial movement at the other end bear via their thread bearing zone (13) against a circular cone coaxial with the drum axis.

19. A device according to claims 16 or 17, characterized in that the drum body (5) has or bears at least one disc-shaped or stellate bearing portion (34) for the bent members (12) which is formed with bearing and if necessary guide surfaces (36; 86) for the bent members (12).

20. A device according to claim 19, characterized in that the external peripheral surface (35) of the disc-shaped bearing portion (34) is beaded.

21. A device according to claim 20, characterized in that the external peripheral surface (35) of the bearing portion (34) bears a thread run-off ring (37) of a wear-resistant material.

22. A device according to claims 16 and 19, characterized in that the bent members (12) have on their second bent member arms (17) bent retaining portions (52) via which they can be borne on the bearing portion (53).

23. A device according to one of claims 5 or 8 to 22, characterized in that the first and/or second bent member arms (16; 17) are covered at least in portions by a cover element (22; 60, 61) slipped on to or disposed on the drum body (5).



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24. A device according to one of the preceding claims, characterized in that each bent member (12) has at least two thread bearing zones (13a, 13b) separated from one another by a radially projecting, bead-like separating zone (40).

25. A device according to one of the preceding claims, characterized in that each bent member (12) has on the thread discharge side adjacent the thread run-on zone (13) a zone (41) widening radially outwards, the widening zones (41) of all the bent members (12) lying on an imaginary body of rotation.

26. A device according to one of the preceding claims, characterized in that each of the bent members (12) bears radially inwards at at least one place at least one thread-repelling ring (65, 66) coaxial with the drum axis which is retained on the bent members (12).

27. A device according to claims 25 and 26, characterized in that a thread-repelling ring (66) is disposed in that zone (41) of the bent members (12) which widens radially outwards after the fashion of a bead.

28. A device according to claims 26 or 27, characterized in that the substantially U-shaped bent members (12) are connected to two thread-repelling rings (65, 66) on both sides of the thread bearing zone (13).

29. A device according to one of claims 26 to 28, characterized in that the bent members (12) are laterally guided on at least one of the thread-repelling rings (65, 66).

30. A device according to one of the preceding claims, characterized in that the thin-walled, substantially pot-shaped drum body (5) is made of a plastics material.

31. A device according to claim 30, characterized in that the drum body (5) is formed with slot-like openings (29) in the zones between the bent members (12).



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32. A device according to one of the preceding claims, characterized in that the bent members (12) are made from a thin spring wire.

33. A device according to one of the preceding claims, characterized in that the bent members (12) bear portions (38) acting as fan blades (42).

34. A device according to claim 33, characterized in that the bent members (12) taking the form of flat shaped members are constructed as fan blades (42) in the thread bearing zone (13).

35. A device according to one of the preceding claims, characterized in that the bent members (12) lie in planes extending tangentially to a body of rotation coaxial with the drum axis (11).

36. A device according to one of the preceding claims, characterized in that the tapering zone (14) is formed on each bent member (12) on the thread feed side.

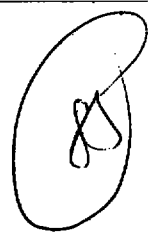
37. A device according to one of claims 1 to 35, characterized in that the tapering zone is formed on the thread feed side on at least one portion (69) of the drum body (5) or on a member (73) connected thereto which projects radially outwards beyond the bent member (12).

38. A device according to one of the preceding claims, characterized in that the bent members (12) are attached alternately at both ends and only one end to the drum body (5) or a member connected thereto, and the bent members (12) attached at only one end are at the other end radially and/or laterally guided on the drum body (5) or a member connected thereto.

39. A device according to one of the preceding claims, characterized in that associated with the storage drum (4) on the thread feed side is at least one thread repeller (43) which extends as far as the imaginary circular cone on which the tapering zones (14) of the bent members (12) lie.



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40. A device according to claim 39, characterized in that the thread repeller (43) has a substantially convex thread-repelling edge or face (44, 46) disposed laterally of the storage drum (4).



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