(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 657 201 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.05.2006 Bulletin 2006/20

(51) Int Cl.:
B65H 75/22 *(2006.01)*

(21) Application number: **05110438.8**

(22) Date of filing: **08.11.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **10.11.2004 FI 20041450**

(71) Applicant: **Wirefinn OY**
18100 Heinola (FI)

(72) Inventor: **MUSSALO, Petri**
18300, Heinola kk (FI)

(74) Representative: **Tanhua, Pekka Vilhelm**
Berggren Oy Ab,
P.O. Box 16
00101 Helsinki (FI)

(54) SPOOL FOR LOOP METAL WIRE

(57) The invention relates to a spool (1) for thin loop metal wire comprising a hollow cylindrical body (2), at the ends of which there are detachably connected two end flanges (3) by fasteners (5), so that each end flange (3) is provided with recesses (6; 6") belonging to the locking elements (6) for locking the position between the end flange (3) and the fastener (5), located at the edges (3b) of the flange center hole (3a), and the body (2) is in the vicinity of the body ends (2c; 2c",2c') provided with apertures (4; 4") belonging to the locking elements (4) for locking the position between the body (2) and the fastener (5), and each spool fastener (5) has a cylindrical casing (5b), the bottom edge of which is connected to the bottom (5a) and the top edge is provided with a brim-like protrusion (5c), On the fastener casing (5b), immediately underneath the brim-like protrusion (5c) of the fastener, there is arranged a number of brackets (6; 6') belonging to the locking elements for locking the position between the flange (3) and the fastener (5) that can be fitted essentially completely in the recesses (6,6") provided at the edges of the aperture (3a) located in the center of the end flange. Near the top edge of the fastener casing (5b), there are arranged spring-like tongue elements (4; 4') belonging to the locking elements of the position between the spool body (2) and the fastener (5), which spring elements can be fitted at least partly from inside the hollow body (2) in the spool body apertures (4; 4") belonging to the locking elements of the position between said hollow body (2) and fastener (5).

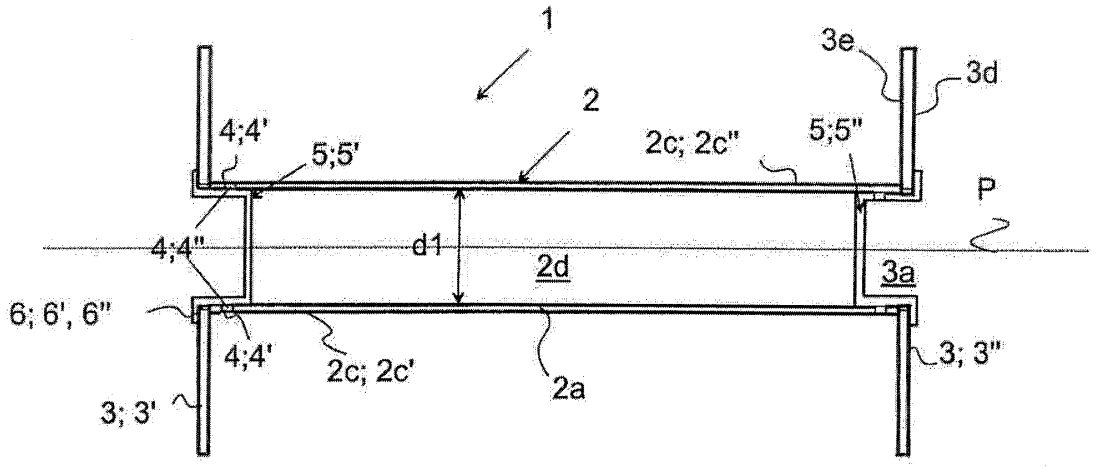

Fig. 5

EP 1 657 201 A2

Description

[0001] The invention relates to a spool defined in the preamble of claim 1, meant for loop metal wire.

[0002] Thin metal wires looped around a given assumed lengthwise axis, and particularly so-called double loop metal wires are generally used for example in the binding of books, calendars and exercise books. Thin loop metal wire is elastic in the sideways direction, and owing to its spiral loop, it is spring-like in the direction of the assumed lengthwise axis.

[0003] For usage and transport, metal wire is coiled on a spool, generally comprising an elongate body made of hollow chipboard or hardboard, the ends of said body being provided with end flanges likewise made of chipboard or hardboard, which end flanges are locked by a metal fastener to the shell body. In order to facilitate the uncoiling of the metal wire by automatic or semi-automatic uncoiling devices, the loop metal wire should be coiled evenly on the spool, wherefore the outer surface of the spool body, as well as that side of the planar flange that falls on the side of the spool body center, should be essentially even. The loop metal wire is taken into use by uncoiling the wire from the spool by an automatic uncoiling device and by cutting the wire into suitable lengths. The uncoiling of the metal wire from the coil is made by uncoiling elements that rotate the coil by gripping the flanges and by rotating the coil body arranged on a suitable suspension rod at the flanges. For a successful uncoiling process, the end flanges must naturally be fastened to the body.

[0004] In most cases, the coil manufacturer agrees to take care of the further treatment of the empty coils returned by the user. This means that after usage, the coils are either transported to be refilled, or they are disposed of. The latter solution is a burden to the environment and causes extra expenses for the manufacturer in increased dumping fees and expenses caused by the making of new coils. In case the coils should be refilled with metal wire, they should be easily taken to their building elements in order to reduce transport costs.

[0005] In the loop metal wire coils that are commercially available at present, where at the end of a shell made of chipboard or hardboard there are attached flanges likewise made of chipboard or hardboard, the joint between the shell and the end flanges is made by means of a crimped joint realized by intermediation of a metallic fastener. When making the crimped joint, the fastener is inserted through the ends of a body provided with end flanges, so that the brim remains on top of the end flanges, whereafter the fastener body is compressed against the inner shell surface by working the fastener wall with a suitable impact tool. A problem with the fastening between the spool body and flanges realized by this kind of crimped joint is that the fastening is difficult to be released without breaking the elements forming the spool. There also are known locking systems between a spool body and flanges realized by plastic fasteners, among them the system introduced in the US patent 3,521,833, but the problem with these is the weak holding capacity of the locking owing to the elasticity of the plastic; the fastening between the spool body and end flanges is gradually weakened and creates problems when uncoiling material from the spool, because the body may rotate in a different rhythm than the flanges.

[0006] From the patent publication US 3,981,400 there is known the joining of a spool body and end flanges meant for textile yarn by means of a plastic center element inserted in a hollow tube, The center element is fastened to the end flanges by brackets inserted through the flanges, and the hold of said brackets is secured by nuts fastened from the inner surface of the flanges towards the brackets. When fastening the body tube to the center piece, there are utilized ridges arranged on the outer surface of the casing of the center piece, to be inserted in the tube. This kind of spool construction might be suited for textile yarn, but it is not suited for loop metal wire, because the bulges provided on the inner surface of the end flanges are obstructive for the metal wire coiling. In addition, it is fairly improbable that the spool shell should stay in the flanges, in case the spool is compiled and broken to pieces several times in succession, because the crimped joint between the center part ridges and the tube is gradually weakened.

[0007] From the patent application AU 67,213/81 there is known a cable coil where the end flanges are attached to the tubular center part of the coil by a plastic joining piece. The joining piece is cup-like in shape and provided with a round flange at the outer end of the collar to be inserted in the tubular part of the coil; in said round flange, there are attached spring-like legs that are thrust both into the holes arranged in the end flanges and from outside to the holes located at the ends of the tubular part of the coil. The spring-like legs remain in place in the apertures arranged in the tubular body owing to the pressure directed to the coil body by the coiled cable. This kind of joining piece, suited for cable coils for realizing the junction between the end flanges and the tubular body, can be used for any material to be coiled that keeps the spring-like legs in the apertures in place in the tubular body. On the other hand, this kind of coil is not suited for storing thin, spring-like metal wire according to the present invention owing to the elasticity of the metal wire, because the spring-like legs would not stay in place in the apertures arranged in the tubular body.

[0008] From the DE patent application 4,438,256 A1, there is known a bobbin designed mainly for textile yarn, comprising a hollow body tube, two end flanges that can be fitted at the ends of the body tube as well as fasteners (sleeves) connecting the end flanges and the body tube. The outer surface of the tube is provided with recesses 6 and grooves 7, 8, and also the flange has recesses. The fastener is provided with projections that can be fitted first in the tube recesses 6 and thereafter in the grooves 7 and 8. When the fastener is then wound, it is locked in the tube. The problem with this kind of fastening method

is that a) the flange is fastened to the fastener only by a crimped joint, which easily allows motion between the flange and the fastener and that b) the pin-groove joint between the fastener and the body tube in part allows motions between the fastener and the body tube. In case a spool with a construction like this would be used for storing thin metal wire, there would be problems both when coiling metal wire on the spool and when uncoiling wire from the spool, because the metal wire would easily be coiled in an uneven way on the spool axis, and when uncoiling the wire, the wire feed in the binding machine would easily be uneven, as the fastener and the flange could rotate at a different rhythm.

[0009] The object of the invention is to eliminate the drawbacks existing in the prior art and to realize a spool meant for thin loop metal wire that can be uncoiled and coiled for several times. At the same time the object of the spool is to be a spool that enables an easy coiling and uncoiling of loop metal wire on and off the spool by using currently available feed and uncoiling means.

[0010] The above enlisted objectives are achieved by a spool according to claim 1 and by a method according to claim 7 for assembling said spool.

[0011] More precisely the invention relates to a spool meant for thin loop metal wire, comprising a hollow cylindrical body, at the ends of which there are detachably connected two end flanges by fasteners. Each end flange is provided with recesses belonging to the locking means for locking a position between the end flange and the fastener, said recesses being located at the edges of the flange center hole, and the body is near the body ends provided with apertures belonging to the locking means for locking a position between the body and the fastener. Each spool fastener has a cylindrical casing, the bottom edge of which is connected to a bottom and the top edge of which is connected to a brim-like protrusion. Immediately underneath the brim-like protrusion of the fastener, the fastener casing is provided with a number of brackets that belong to the locking elements of the position between the end flange and the fastener, which brackets can be fitted essentially completely in the recesses located at the edges of the aperture arranged in the middle of the end flange. Near the top edge of the fastener casing, there are located spring-like tongue elements belonging to the locking means of the position between the spool body and the fastener, which tongue elements can at least partly be pushed from inside the hollow body into the spool body apertures belonging to the locking means of the position between said hollow body and fastener.

[0012] The basic idea of a spool according to the invention is to utilize separate plastic fasteners for locking the spool end flanges at the ends of the elongate hollow body. Each plastic fastener has the shape of a shallow cup, and the top edge of the fastener has a cylindrical brim element protruding from the body, which brim element is set on top of the outer edge of the end flange, and each fastener is provided with separate locking elements for the spool body and the end flange. Underneath the brim element that is left outside the fastener body, in the fastener body, there are arranged brackets that have corresponding recesses at the edges of the center hole of the end flange. The brackets located underneath the fastener brim can be fitted in the recesses located at the edges of the flange center hole, so that the fastener brackets remain inside the flanges. Generally immediately underneath the bracket rising up from the fastener body there is arranged a spring-like tongue element made of the body material, provided with a protrusion protruding outwards from the fastener. The body end in turn is provided with an aperture corresponding to the tongue protrusion. The fastener body can be pushed inside the hollow spool body, so that the spring-like tongue element is inserted in the aperture arranged at the end of the body from inside the body. The tongue element is held in the aperture either owing to its structure or to a separate locking element.

[0013] A spool having the structure described above can be taken to pieces and recompiled for several times, because the pneumatic tongue element made of the fastener material can be connected to the apertures located at the spool body ends from inside the body and held there either by a separate locking element and/or by the shape of the fastener. An advantage in comparison with the above described coil known from the patent publication AU-67 213/81 - which coil has a somewhat similar tongue element as in the present invention, but where the legs of the tongue element are inserted from outside the coil into apertures provided in the coil body - is that in the spool according to the invention, there is no need to use the specific pressure of the wire to be stored for strengthening the crimped joint between the tongue and the body aperture, but the crimped joint is strengthened owing to the pneumatic structure of the tongue provided in the tongue element and owing to a possible separate support element supporting the tongue.

[0014] The spool enables an easy coiling and uncoiling of loop metal wire on and off the spool by current feed and uncoiling devices. In the invention, the joint between the fastener and the flange is realized by brackets that can essentially completely be fitted in the center hole recesses of the end flange. As for the joint between the fastener and the spool body, it is realized by spring-like tongue elements, part of which can be inserted, from inside the hollow body, manually in apertures belonging to the locking elements of the position between the body and the fastener. Thus there is achieved the advantage, for instance in comparison with the arrangement known from the US patent 3,981,400, that neither the exterior surface of the spool body nor the interior surface of the flange has grooves or bulges obstructing the coiling or uncoiling of metal wire. The joints between the fastener and the spool body as well as between the fastener and the flange are solid and allow several cycles of usage for the spool (assembling and disassembling) and effectively prevent the fastener and the spool body as well as the fastener and the end flange from rotating with respect to

each other.

[0015] In a preferred embodiment of the invention, the fastener tongue element is attached immediately underneath the body bracket located below the brim-like projection surrounding the top edge of the fastener.

[0016] In another preferred embodiment of the invention, each tongue element is provided with an elongate, elastic tongue made of the body material, which tongue bends at right angles with respect to the fastener casing, i.e. into the fastener and out of the fastener, and on that side of the tongue that faces the spool body when assembling the spool there is a bracket with such a size and shape that there is created a crimped joint between the bracket and the body aperture, when said bracket is inserted in the aperture provided at the end of said body.

[0017] In yet another preferred embodiment of the invention, the crimped joint between the tongue element and the spool body is strengthened owing to the structure of the tongue element; the tongue of the tongue element is fastened underneath the brim-like projection arranged at the top edge of the fastener, and the lower end remains free. In addition, the tongue element includes a separate support element that can be installed between that side of the tongue that is turned inside the fastener body and the fastener body, so that it prevents the tongue bracket from escaping from the spool body aperture, when said bracket is pushed in said body aperture.

[0018] In another preferred embodiment of the invention, the crimped joint between the tongue element and the spool body is strengthened owing to the shape of the tongue provided in the tongue element. In that case the upper end of the tongue is attached underneath the brim-like projection surrounding the top edge of the fastener, and the lower end is attached to the fastener bottom.

[0019] The invention is described in more detail below, with reference to the appended drawings.

Figure 1 illustrates the elongated, hollow body of the spool in a perspective view.

Figure 2 is a front-view illustration of the end flange.

Figure 3 illustrates the fastener in a perspective view.

Figure 4 illustrates the tongue element of a fastener according to figure 3, seen is perspective view.

Figure 5 is a side-view illustration of an assembled spool.

Figure 6 is a perspective-view illustration of part of a fastener provided with a tongue element according to the first embodiment of the invention.

Figure 7 is a perspective-view illustration of a fastener provided with a tongue element according to a second embodiment of the invention.

Figure 8 is likewise a perspective-view illustration of part of a fastener provided with a tongue element according to a third embodiment of the invention.

[0020] Figure 1 illustrates the elongated, hollow body 2 of a spool 1 according to the invention. In general form, the body 2 is a cylindrical tube made of cardboard, provided with identical end elements 2c; 2c', 2c" and with a center hole 2d passing from end to end through the body, said center hole being on one side defined by the inner body walls 2e and on the other side, in the end elements 2c of the tube, by the end edges 2b; 2b', 2b". The inner diameter d1 of the center hole 2d is essentially equal to the inner diameter D of the aperture 3a located in the middle of the end flange 3 described in more detail in figure 2.

[0021] Each end element 2c; 2c' and 2c; 2c" of the tube is provided with two round holes 4; 4" passing through the tube wall 2a. In the appended drawings, said holes 4; 4" located at the end are spaced at the mutual distance of roughly 180 degrees, all at the same distance from the end edges 2b' or 2b". Because of the view angle, the figure only shows one of the holes 4; 4"a and 4; 4"b arranged at the ends 2c' and 2c". The distance of the holes 4" from the end edge 2b of the tube end edge 2b is equal to the distance of the bracket arranged in the tongue element from the fastener brim (cf. figure 3). The (locking) holes 4; 4"a and 4; 4"b provided at the tube end 2c belong to a set of identical but separate locking elements 4, 4", the purpose of which is to lock the mutual position of the spool body 2 and the fastener 5, described in more detail in figure. 3, when the spool is in the assembled form. The size and shape of each locking hole 4; 4" is designed to be such that it can receive the protrusion arranged in the fastener tongue element 4; 4' so that a crimped joint is created between the locking hole and the protrusion.

[0022] The structure of the end flanges or plates 3 is described in figure 2. In the center of each essentially round end flange 3 made of cardboard, there is arranged a generally circular aperture 3a (below also called center hole 3a), and the inner diameter of the space 3a of this aperture, defined by the mainly regular, circular edge 3b, is D. Said end flange diameter D is equal to the inner diameter d1 of the center hole 2d of the body tube, so that the edge of the flange center hole 3a can be supported against the edges 2b of the body tube 2. In shape, the edges 3b of the end flange center hole 3a do not form completely regular circles, but they are provided with two recesses 6; 6"a and 6; 6"b directed away from the end flange center. The recesses 6"a and 6"b are located at a mutual distance of 180 degrees on the edge 3b of the center hole 3a. Said recesses belong to separate but identical locking elements 6; 6" that are used for locking the mutual motions of the end flange 3 and the fastener 5, described in more detail in figure 3, when assembling the spool. Each recess 6; 6" is designed, for the mutual locking of the end flange 3 and the fastener 5, so that the size and shape of said recess 6" correspond to the brack-

ets 6' rising upwardly from the casing of the fastener 5, so that the brackets are nested essentially completely inside the flange recesses, thus forming a tight fit (by intermediation of a crimped joint) that prevents a mutual rotary motion of the end flange 3 and the fastener 5. Here it is extremely important that the bracket 6' placed in the casing of the fastener 5 remains inside the end flange recess 6", at least on the side of the inner surface 3e of the end flange, i.e. on that side of the end flange that is turned towards the other end flange, when the spool 1 is in assembled form (figure 5).

[0023] For locking the mutual position of the body 2 and the end flange 3 of the spool, the invention uses a fastener 5 that generally resembles a shallow cup in shape and is advantageously made of plastic; the structure of said fastener is described in detail in figures 3 - 4 and 6 - 8. The fastener 5 has a cylindrical casing or body 5b, and the bottom edge of said body is connected to a bottom 5a and a the top edge is provided with a brim-like protrusion 5c. Here the fastener bottom edge means that edge of the casing that is first pushed in the center hole 2d of the spool body 2 when assembling the spool, and respectively the fastener top edge means that edge of the fastener casing 5 that in the assembled spool 1 remains somewhat above the edge 2b of the tubular body 2 or on the same level with it. The planar, smooth bottom 5a attached to the casing 5b of the fastener 5, and the cylindrical casing 5b have a diameter d2 that is somewhat smaller than the inner diameter d1 of the center hole 2d of the tubular body 2 illustrated in figure 1, so that the fastener 5 can be smoothly slid inside the hollow body 2. In the middle of the fastener bottom 5a, there is a hole 7 by which the spool is rotated when uncoiling thread-like loop metal wire from the spool body 2. A brim-like protrusion 5c surrounds the fastener top edge on the same level with the edge; said brim is made of the same material (plastic) as the fastener, and it should be so wide that the fastener can be supported against the outer surface 3d of the end flange 3 at the brim. The outer surface 3d of the end flange 3 is that end of the end flange that is turned away from the end flange attached at the other end of the spool, when the spool is in its assembled form. Immediately underneath the brim-like protrusion 5c, partly connected to said brim 5c, the fastener casing is provided with upwardly rising brackets 6; 6'. In shape, each bracket 6' is roughly a rectangular prism, and one of its sides is integrated with the brim 5c. The shape and size of the brackets 6; 6' correspond to the shape and size of the recesses 6" provided at the center hole edge 3b of the end flange 3, so that each bracket 6' can be completely nested inside the recess 6". Figure 3 shows only one of the brackets 6', because the brackets are placed at 180 degrees from each other, on the cylindrical fastener body. The brackets 6' are made of the same material as the fastener casing itself. Immediately underneath each bracket 6', on the casing 5b of the fastener 5, there is arranged a tongue element 4; 4', by which the position between the fastener 5 and the body tube 2 is arranged to be non-rotating. Each fastener 5 has two identical tongue elements 4' that are located at 180 degrees from each other, on opposite sides of the casing 5b, and they are made of the same material as the fastener casing itself. The tongue element 4' provided in the spring-like tongue element 4' that locks the position of the spool body 2 and the fastener 5 to be mutually immovable can be realized in several different ways, some of which are illustrated in more detail in figures 6 - 8.

[0024] As is observed in figures 3 and 4 and 6, the tongue element 4; 4' includes an elongate tongue 4b made of the body material, which tongue element is at its top end connected to the fastener body 5b, immediately underneath the bracket 6'. The tongue 4b is made, owing to its pneumatic material (plastic) and structures, by removing some material of the casing 5b at the location of said tongue 4b, so that in the body there is created a rectangular aperture 4a behind the tongue 4b, and the tongue can be considered to be fastened at one edge of said aperture. The tongue 4b is provided with an protrusion 4c rising upwardly from the surface of the tongue, at the fastening point between the tongue 4b and the casing 5b, at the opposite end of the tongue 4b. Generally the shape of the protrusion 4c is cylindrical, and its diameter is essentially equal or somewhat smaller than the diameter of the circular locking hole 4; 4" arranged at the wall 2a of the tube 2, in order to make the protrusion fit in said aperture 4; 4" for realizing a crimped joint between the protrusion 4c and the aperture 4" (cf. figure 1). The protrusion 4c is placed on the outer side of the fastener casing 5b, which outer side of the casing 5b is turned towards the inner wall 2e of the body aperture 2; 2d, when the fastener is in the locking position, inserted in the body center hole 2d. In the rest position, the tongue 4b of the tongue element 4' is on the same level with the outer surface of the fastener casing 5b, whereas said protrusion 4c protrudes somewhat from the level of the outer surface of the casing 5b. When the spool 1 is assembled, the protrusion 4c remains inside the wall 2a of the body tube 2 in the aperture 4", in which case it does not obstruct the coiling of metal wire on or off the spool body.

[0025] Figure 5 illustrates a spool 1 in lengthwise cross-section, seen from the side. Two end plates (flanges) 3; 3' and 3; 3" are connected respectively to the end elements 2c; 2c' and 2c; 2c" of the tube 2 by using the fastener 5 for connecting said elements to be mutually non-rotating. Next we shall describe the locking mechanism of the locking element 4 between the fastener 5 and the spool body 2, which locking element comprises a tongue element 4' of the fastener 5 and a corresponding spool body aperture 4", as well as the locking element 6 of the locking mechanism between the fastener and the end flange, which locking element 6 comprises a bracket 6' provided in the fastener body and a recess 6" arranged in the center hole 3a of the end flange 3.

[0026] As was already maintained, the outer diameter of both the even, round bottom 5a that is seamlessly connected to the casing 5b of the fastener 5, and the outer

diameter of the cylindrical casing 5b is d2, which diameter is somewhat smaller than the diameter d1 of the center hole 2d of the tubular body 2 illustrated in than figure 1. The inner diameter d1 of the hollow body 2 of the spool 1 in turn is essentially equal to the inner diameter D of the aperture 3a provided in the center of each end flange 3. For assembling the spool, the fastener 5 can be slid through the aperture 3a provided in the center of the end flange 3 to inside the hollow spool body 2 by inserting the fastener bottom 5a first, so that the brim-like protrusion 5c of the fastener will at the end of the thrusting motion be supported against the outer side 3d of the end flange 3. At the same time, the inner side 3e of each end flange 3 is in turn supported against the edge 2b of the center hole 2d of the spool body 2. During the thrusting motion of the fastener into the aperture 2d of the body 2, the protrusion 4c protruding at right angles from the top of the tongue 4b of the tongue element 4' meets the inner surface 2e of the center hole 2d of the body 2, which motion pushes said pneumatic tongue towards the inside of the fastener 5. When the thrusting of the fastener 5 into the body tube 2 is continued, the protrusion 4c provided on the surface of each elastic, pneumatic tongue 4b fits in the round aperture 4; 4" provided at the end 2c of the body tube. In this position, said protrusion 4c is pushed, owing to the spring-like features of the tongue 4b, into said aperture 4", so that a friction-based crimped joint is created between the protrusion and the aperture, and this crimped joint locks the mutual position of the fastener 5 and the body tube 2. In the mutually locked position, all mutual motions of the fastener 5 and the body tube 2, particularly rotary motions, are prevented. The crimped joint between the tongue element 4; 4' and the round aperture 4" passing through the wall of the spool body 2 can be reinforced in many ways, some of which are described by way of example in figures 7 - 8. At the same time, when the crimped joint is created between the tongue element 4' and the aperture 4" provided in the wall of the body 2, each bracket 6; 6' provided in the fastener body gets into contact with the recess 6; 6" located at the edge 3b of the center hole 3a of the end flange. Each bracket 6' is pushed in a recess 6" corresponding to the size and shape of the bracket, so that said bracket 6' remains completely inside the recess 6", thus locking the mutual position of the fastener 5 and the end flange 3 to be non-rotating. These kind of brackets 6' do not create on the inner sides 3e of the flange 3 any formation obstructing the coiling of metal wire on or off the spool. In the mutual locking position, the mutual motions of the fastener 5 and the end flange 3, particularly rotary motions, are prevented.

[0027] The uncoiling of the spool 1 takes place simply and rapidly; the fastener body 5b is subjected to an external (traction) force, by which the fastener body is pulled upwardly through the aperture 2d of the spool body 2, towards the aperture edge 2b' or 2b" and simultaneously the protrusions 4c belonging to the fastener elements 4 between the fastener 5 and the spool body 2 are pressed through the holes 4" provided in the walls of the body end 2c, so that they are pushed back into the aperture 2d passing along the inside of the spool body 2. Thereafter the fasteners 5 can be removed from the ends 2c of the tube 2, and the end flanges 3 can in turn be released from the body 2.

[0028] The locking element 4 locking the mutual motions between the body 2 and the fastener 5 can also be realized in other ways. In an embodiment of the invention (not illustrated in figures), the crimped joint created between the protrusion 4c of the elastic, spring-like tongue 4b and the aperture 4; 4" provided at the body end 2c is secured by a safety pin that is pushed through part of the protrusion 4c extending to the outer surface of the casing of the spool body 2, so that it prevents said protrusion 4c from being pressed back into the aperture provided inside the body 2.

[0029] In another preferred embodiment of the invention, the crimped joint between the protrusion 4c provided in a tongue element 4, 4' according to figures 3 and 6 and the aperture 4; 4" located at the end 2c of the body 2 is secured by a separate thin locking pad 4d included in the looking element 4, as is illustrated in figure 7. The locking pad 4d is pushed between the tongue 4b of the tongue element 4' and the inner surface 5b' of the fastener casing 5b through the aperture provided behind the tongue 4b, so that the locking pad is supported against inner surface 5b' of the body, simultaneously preventing the tongue 4b from moving back towards the inside of the fastener.

[0030] In a third preferred embodiment of the invention (figure 8), the tongue 4b of a tongue element 4; 4' made of the material of the casing 5b of the fastener 5, used as the locking element 4; 4', is at the top end connected to the top edge of the fastener casing 5b provided with a brim-like protrusion 5c, at the bottom end seamlessly to the round fastener bottom 5a. The elasticity of the tongue 4b of the tongue element 4' in the radial direction of the fastener 5 (= the direction of the radius of the circular bottom 5a and of the radius of curvature of the casing 5b) is achieved first of all by making the tongue 4b relatively long and thin in comparison with the vertical width and peripheral length of the cylindrical casing 5b of the fastener. Here the vertical width means the distance between the fastener bottom 5a and the brim 5c when proceeding along the surface of the casing 5b. Another factor connected to the spring-like quality is that the first part 4b' of the tongue is connected immediately below the brim-like protrusion 5c of the fastener and proceeds there on the level of the casing 5b at right angles towards the fastener bottom 5a. From around the first part 4b' of the tongue 4b, there is extracted material in order to make a clearance 4a between each lengthwise edge of the tongue and the fastener casing 5b. The second part 4b" of the tongue 4b is connected to the circular bottom 5a of the fastener, so that each lengthwise side of the second tongue part 4b" is separated by a gradually narrowing groove 4f arranged in the bottom 5a. The

grooves 4f proceed fairly far towards the center of the bottom 5a, when observed from the junction of the bottom 5a and the casing 5b. Now the junction point of said parts 4b' and 4b" of the tongue 4b is made inwardly elastic at the border of the bottom 5a of the fastener 5 and the casing 5b. When a fastener 5 according to figure 8 is now pushed, in the assembling step of the spool 1, bottom 5a first into the center hole 3d of the end flange 3, inside the tubular spool body 2, where the diameter of the inner aperture 2d is equal to the outer diameter of the fastener casing 5b, the protrusion 4c of the tongue element 4; 4' pushed at right angles outwardly from the tongue 4b gets into contact with the inner surface 2e of the body 2. Now said protrusion 4c creates a pressure that pushes the pneumatic tongues 4b to inside the fastener 5, as was already described, but in this case the tongue 4b is mainly flexible at the junction between its first part 4b' and second part 4b", not along the whole length as in the tongues 4b of the fastener illustrated in figures 6 and 7, where the other end of the tongue 4b is free. By using this kind of tongue 4b illustrated in figure 8, there is achieved the advantage that when the protrusion 4c is pushed into the aperture 4" provided in the end wall of the body 2 and has created a friction-based crimped joint with the aperture, said crimped joint need not be separately reinforced. This is due to the fact that when the second part 4b" of the tongue 4b is directly connected to the bottom 4c, it prevents the flexing motion of the tongue 4b towards the inside of the fastener 5 in the direction of the plane of the bottom 5a.

[0031] In the above specification, the invention is described with reference to exemplary embodiments of the invention, and for a man skilled in the art it is obvious that the invention can be realized also in many other ways within the scope of the appended claims.

[0032] Consequently, the outer wall of the casing 5b of the fastener 5, and/or the inner wall 2e of the center hole 2d of the spool body 2, can be provided with various control arrangements, such as grooves or shoulders that guide the fastener 5 inside the body 2 in a position where the protrusion 4c of the tongue 4b is pushed directly inside the aperture 4; 4" located at the end of the body. Likewise, the number and shape of the locking elements 4; 4', 4" and 6; 6', 6" used for locking the mutual positions between on one hand the fastener 5 and the spool body 2, and on the other hand between the fastener 5 and the flange 3, may vary. Thus for instance the end wall of the spool body 2 can be provided with 3 - 6 holes 4", and in shape they can be for example circular, quadratic or truncated cones, in which case respectively the shape of the protrusion 4c of the tongue 4b in the tongue element 4; 4' must correspond to the shape of said holes 4", and the number of the tongues 4b provided in the fastener 5 must correspond to the number of holes 4" provided at the ends 2c of the body 2. At the edges of the center hole 3a of the end flange 3, there may also be recesses 6" used as locking elements 6; 6" that are greater in number and different in shape than the ones shown in the above described examples. The number and shape of these recesses 6; 6" should correspond to the number and shape of the brackets 6; 6' rising upwardly from the outer surface of the casing 5b of the fastener 5. It is particularly important that said brackets 6' are such that they fit completely in the recesses 6" and do not form on the inner side 3e of the end flange 3 any obstructive formations that could hinder the coiling or uncoiling of the metal wire.

Claims

1. A spool (1) meant for thin loop metal wire, comprising a hollow cylindrical body (2), at the ends of which there are detachably connected two end flanges (3) by fasteners (5), so that each end flange (3) is provided with recesses (6; 6") belonging to the locking elements (6) for locking the position between the end flange (3) and the fastener (5), said recesses being located at the edges (3b) of the flange center hole (3a), and the body (2) is in the vicinity of the body ends (2c; 2c",2c') provided with apertures (4; 4") belonging to the locking elements (4) for locking the position between the body (2) and the fastener (5), and each spool fastener (5) has a cylindrical casing (5b), at the bottom edge of which there is connected a bottom (5a) and at the top edge a brim-like protrusion (5c),
   characterized in that

   - the fastener casing (5b) is immediately underneath the brim-like fastener protrusion (5c) provided with a number of brackets (6; 6') belonging to the locking elements for locking the position between the end flange (3) and the fastener (5), which brackets can be fitted essentially completely inside the recesses (6,6") provided at the edges of the aperture (3a) located in the center of the end flange,
   - in the vicinity of the top edge of the fastener casing (5b), there are arranged spring-like tongue elements (4; 4') belonging to the locking elements for locking the position between the spool body (2) and the fastener (5), which tongue elements can be fitted at least partly, from inside the hollow body (2), in the spool body apertures (4; 4") belonging to the locking elements of the position between said hollow body (2) and fastener (5).

2. A spool (1) according to claim 1, **characterized in that** each tongue element (4; 4') includes an elongate tongue (4b) made of the material of the cylindrical fastener casing (5b) that is elastic in the direction of the radius of curvature of the casing (5b), i.e. at right angles to the casing surface, that side of the tongue that is nearest to the spool body (2) being provided with a protrusion (4c), the shape and size

of said protrusion being such that a crimped joint is created between said protrusion (4c) and the aperture (4; 4") in the body (2), when the protrusion (4c) is pushed in said aperture (4").

3. A spool (1) according to claim 2, **characterized in that** the tongue (4b) of the tongue element (4; 4') is immediately fastened underneath the bracket (4; 4') provided in the casing (5b), and that said tongue (4b) is, with respect to the width and peripheral length of the fastener casing (5b) relatively long and thin and made of the material of the casing.

4. A spool (1) according to claim 3, **characterized in that** the upper end of the tongue (4b) of the tongue element (4; 4') is fastened underneath the brim-like protrusion (5c), and that the lower end is free and that said tongue element possibly also includes a separate support element (4d) such as a safety pin or a locking pad that prevents the protrusion (4c) of the tongue (4b) from escaping from the body aperture (4; 4") back towards the inside of the fastener (5).

5. A spool (1) according to claim 3, **characterized in that** the upper end of the tongue (4b) of the tongue element (4; 4') of the fastener is fastened underneath the brim-like protrusion (5c), and the lower end is connected to the fastener bottom (5a).

6. A spool (1) according to any of the preceding claims, **characterized in that** at the edges (3b) of the aperture (3a) provided in the center of the end flange (3), there are arranged two recesses (6; 6") that are arranged at angles of 180 degrees with respect to each other, and that the casing (5b) of the fastener (5) is provided with two brackets (6; 6') that are placed at angles of 180 degrees with respect to each other, immediately underneath the brim (5c), which brackets can be fitted in said recesses (6; 6").

7. A method for assembling a spool according to claim 9, **characterized in that** the end flanges (3) are supported at the opposite ends (2c) of the hollow spool body (2), so that the aperture (3a) provided at the center of each end flange (3) is aligned with the center hole (2d) of the body (2), whereafter at both ends of the body (2) there is fitted a fastener (5), so that said fastener (5) is inserted bottom (5a) first through the aperture (3a) provided in the center of the flange, and thereafter through the aperture (2d) provided in the center of the body, and the pushing of the fastener (5) is continued, until the fastener brim (5c) gets into contact with the outer surface (3d) of the spool end flange (3), whereafter the brackets (6; 6') arranged in the fastener casing (5b) are fitted essentially completely in the recesses (6; 6") of the edge of the aperture (3a) arranged in the center of the end flange, and the spring-like tongue elements (4; 4') or part of them (4c), belonging to the locking elements (4) of the body (2) and fastener (5), are fitted from inside the hollow body (2) in the apertures (4; 4") belonging to the locking elements (4) of the position between the body (2) and the fastener (5) for creating a crimped joint between said apertures (4") and tongue elements (4') or part (4c) of them.

8. A method according to claim 7, **characterized in that** the crimped joint of the locking element (4) for locking the position between the fastener (5) and the spool body (2) is supported by a separate support element (4d) belonging to the locking element, or by intermediation of the structure of the tongue element (4').

9. A method according to claim 8, **characterized in that** the crimped joint is supported by placing a separate support element (4d) between that side of the tongue (4b) that is turned away from the spool body and the spool body (2).

10. A method according to claim 8, **characterized in that** the crimped joint is supported so that the tongue (4b) of the tongue element (4;4') is at both ends arranged to be integrated in the general structure of the fastener (5).

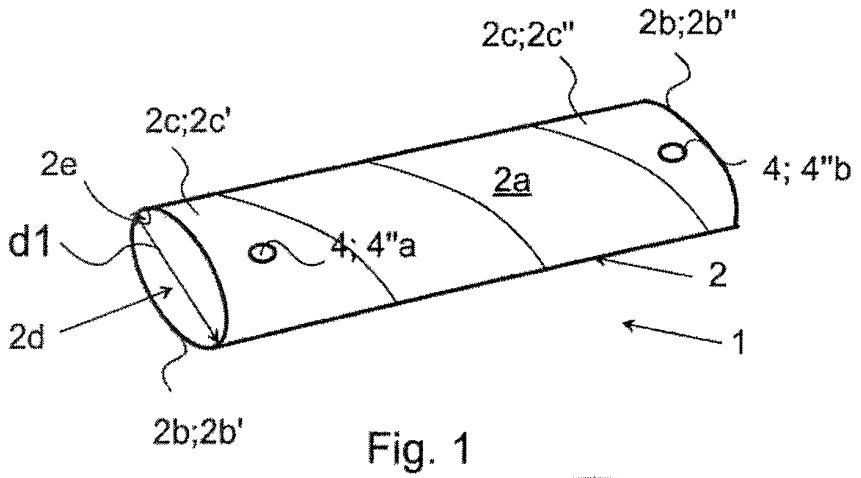

Fig. 1

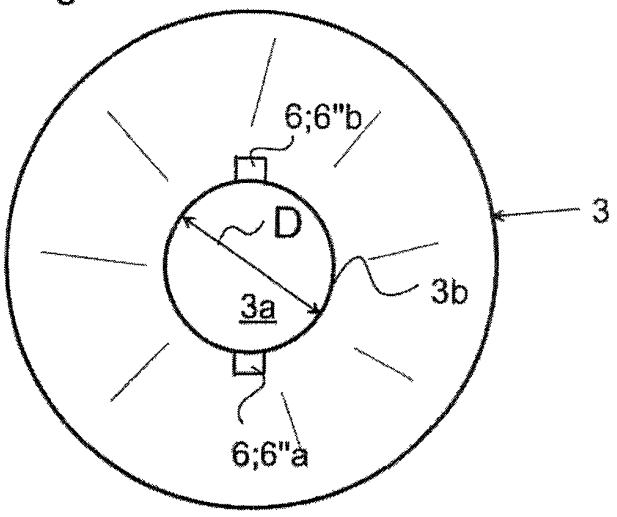

Fig. 2

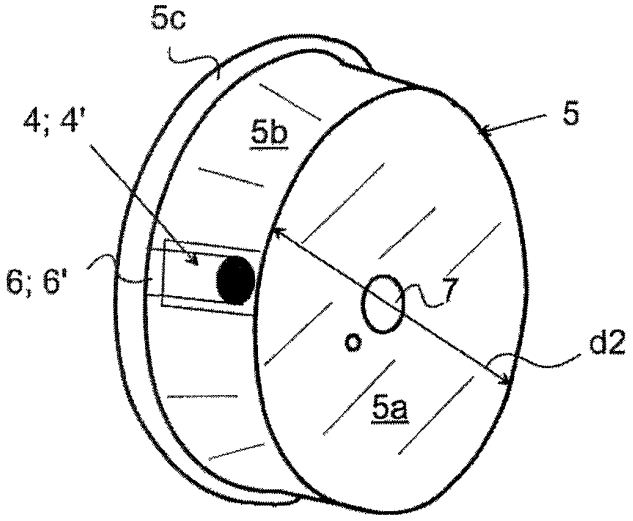

Fig. 3

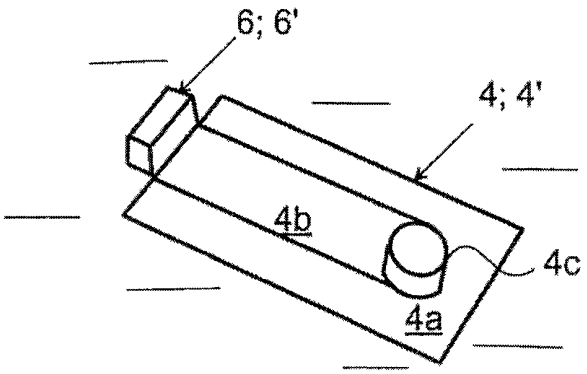
6; 6'
4; 4'
4b
4c
4a

Fig.4

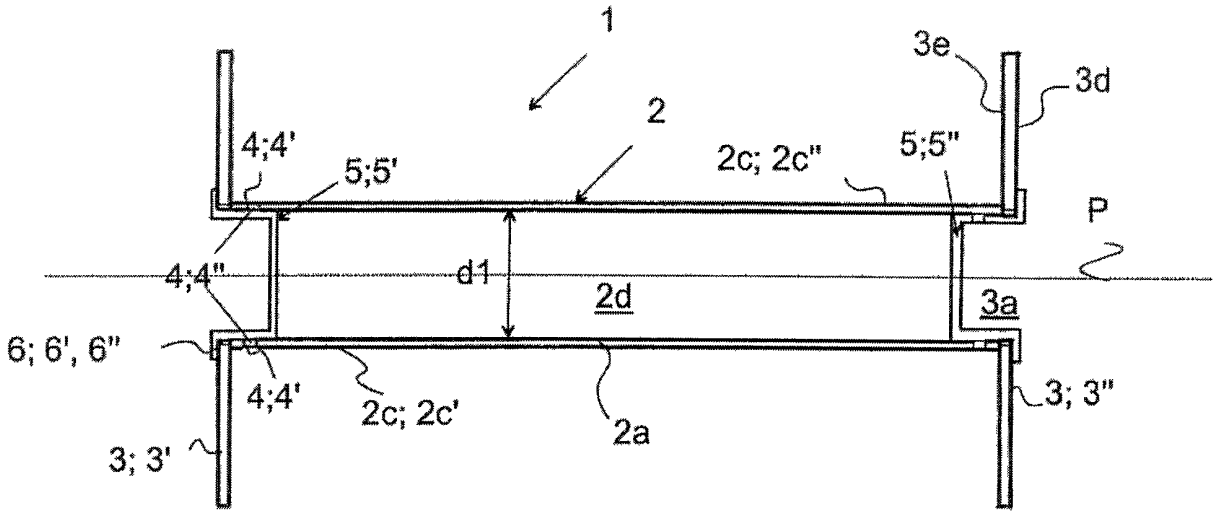
1
3e
3d
2
4;4'
5;5'
2c; 2c"
5;5"
P
4;4"
d1
2d
3a
6; 6', 6"
4;4'
2c; 2c'
2a
3; 3"
3; 3'

Fig. 5

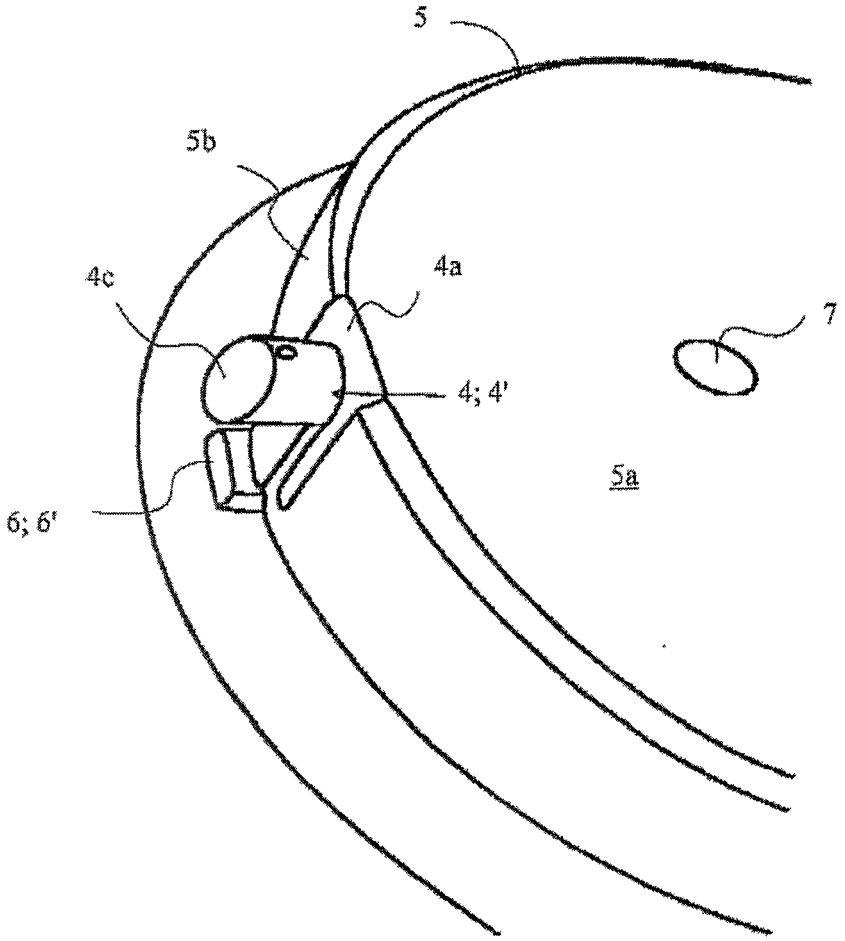

Fig. 6

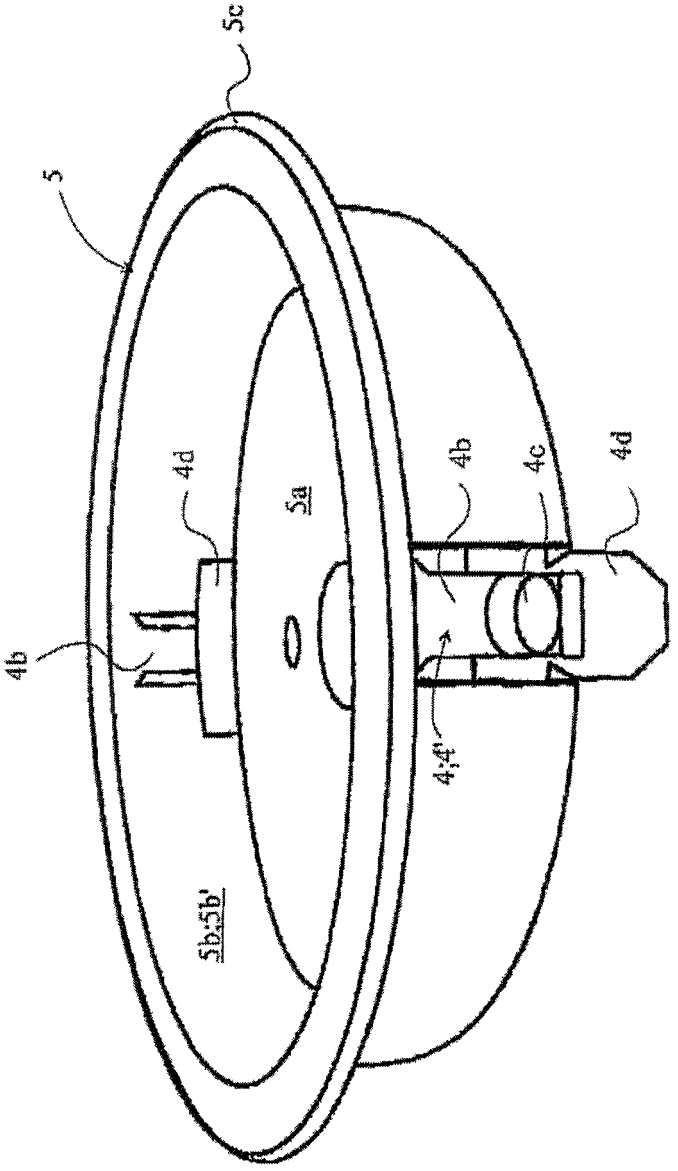

Fig. 7

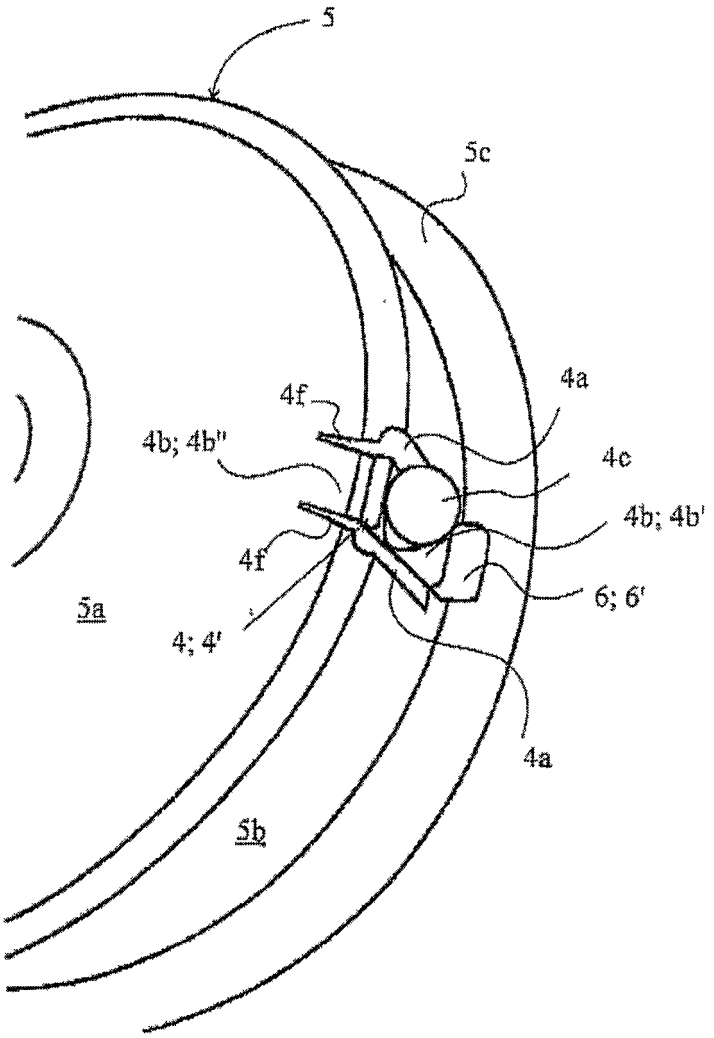

Fig. 8.