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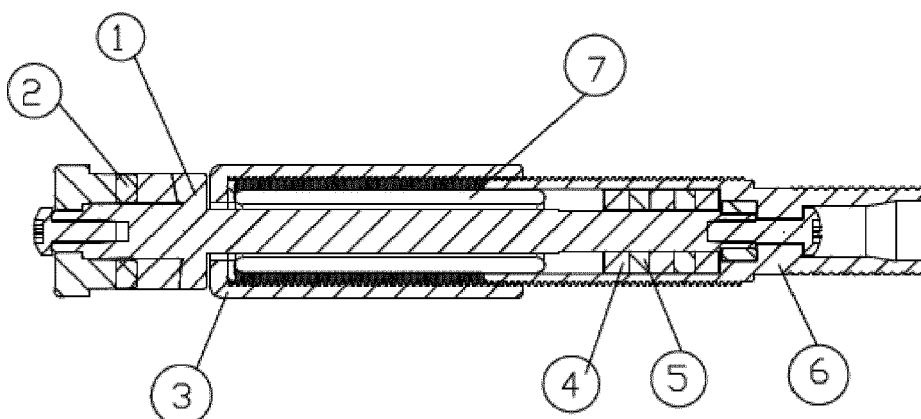
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(54) **A DECELERATION DEVICE WITH VARIABLE LOAD-BEARING CAPACITY FOR ROLLER-BLIND SYSTEMS**

(57) The present invention relates to the sector of so-called roller-blind systems, such as self-winding mosquito nets, self-winding blinds, etc.

In particular, it regards a decelerating device with variable load-bearing capacity for roller-blind systems of the type comprising a sheet or screen or mosquito net that can be rolled up/rolled down on a drum rotating about its own axis, as well as a preloading-spring system for enabling automatic rewinding of the roller-blind system, characterized in that it comprises: a drive shaft (1), which

rotates fixedly with respect to the drum; a floating capsule (3), which rotates fixedly with respect to the drum; one or more fixed disks (4); one or more rotary disks (5); a fixed capsule (6); and a compression spring (7); wherein the two capsules, namely, the floating one (3) and the fixed one (6), the compression spring (7), as well as the disks (4) alternating with the disks (5), are all coaxial with one another, and to the drum on which the sheet is rolled up/rolled down.



Section B-B

FIG. 2B

Description

[0001] The present invention relates to the sector of so-called roller-blind systems, such as self-winding mosquito nets, self-winding blinds, etc.

[0002] By "roller-blind system" is meant an apparatus basically formed by a windable panel of fabric, or of netting, or of some other nature with characteristics of flexibility, which for brevity in what follows will be referred to generically as "sheet" and by a rotary element - which in what follows will be referred to as "drum" - on which a side of the sheet itself is fixed. Consequently, said sheet is initially wound on the drum and then on itself. The drum is axially constrained at its ends and is free to turn about its own axis in either direction so as to enable rolling-down and rolling-up of the sheet.

[0003] When the drum is in the resting position, i.e., with the sheet wound thereon, it is subjected to a so-called "pre-loading", i.e., to a twisting force or moment via a spring system referred to as "tension spring" that enables the sheet to remain completely wound in a fixed position.

[0004] At the moment of extension - i.e., rolling-down - of the sheet by pulling it from its free side, which is opposite to the side fixed to the drum, the sheet itself impresses a rotary movement on the drum that further loads said tension spring, the twisting force or moment of which adds to that of pre-loading to cause the sheet to remain in tension between the drum and the point of end-of-travel engagement, or in possible intermediate positions (in the case of roller blinds, for example).

[0005] When the sheet is released, so that it can wind around the drum, the linear acceleration that inevitably is impressed on the sheet can be damped via the so-called decelerator, the purpose of which is to cause the sheet to roll up completely throughout its length, preventing it, however, from reaching an excessive speed.

[0006] Current commercially available systems envisage decelerator systems of a fluid-dynamic type that provide a resistance to rolling - in the re-winding step - which is substantially with a fixed load, i.e., a load that is constant for any one position of the sheet.

[0007] This entails the problem that, with the passage of time, the force of the pre-loading spring frequently decreases, and the last stretch of the sheet does not wind correctly and completely.

[0008] A first purpose of the present invention is to overcome the above drawbacks by providing a mechanical decelerator that is designed to oppose a resisting load of variable value, i.e., greater at the start and gradually decreasing, in a way proportional to approach of the sheet to the resting position, i.e., the position where it is completely rolled.

[0009] A second purpose of the present invention is to provide a mechanical decelerator capable of not applying any force of contrast in the last stretch of rolling-up of the sheet and preferably also in the first step of release thereof, the aim being to ensure - in any circumstance - both

complete and total re-winding of the sheet up to the last useful stretch of travel, thus guaranteeing that said sheet is rewound on the drum up to point zero, and perfect release of the sheet at the base and hence its free start.

[0010] A fuller understanding of the invention will be obtained from the ensuing detailed description, which illustrates, purely by way of non-limiting example, a preferred embodiment of the invention.

[0011] In the drawings:

Figure 1 is a graph of application of the forces;
Figures 2A and 2B show, respectively, a lateral view and a cross-sectional view according to the axial plane of trace B-B of the decelerating device according to the invention;
Figure 3 is a 3D view of one of the fixed disks;
Figure 4 is a 3D view of one of the mobile or rotary disks;
Figure 5 is a 3D view of the fixed capsule;
Figure 6 is a 3D view of the drive shaft with the ratchet mechanism applied for facilitating initial release of the sheet, which is to be rewound on the drum;
Figure 7 is a 3D view of the floating capsule;
Figure 8 is a 3D view of just the drive shaft;
Figure 9 is a lateral view of the ratchet assembly normal to the axis of rotation;
Figure 10 is an exploded view of the drive shaft, draw cap, and mobile ring;
Figure 11 shows the mobile ring;
Figure 12 shows the draw cap;
Figure 13 shows the drum for rolling up/rolling down the sheet;
Figure 14 is a see-through view of the decelerator during insertion into the drum;
Figure 15 is a 3D view of the decelerator during insertion into the drum;
Figure 16 is an exploded view corresponding to the representation of Figure 15; and
Figure 17 is a lateral view corresponding to the representation of Figure 16.

[0012] With reference to the figures listed above, the main constructional components of the invention are the following:

- 1) a drive shaft which rotates fixedly with respect to the drum;
- 2) a ratchet system;
- 3) a floating capsule, which rotates fixedly with respect to the drum;
- 4) a fixed disk;
- 5) a rotary disk;
- 6) a fixed capsule; and
- 7) a compression spring.

[0013] The decelerating device with variable load-bearing capacity described is designed to be fitted into the drum, which, via setting points, transmits to some of

the elements that make up the decelerator a rotary movement in a specific direction during the step of descent or unrolling of the sheet, so that the decelerator itself, in the subsequent return step of rolling-up of the sheet restores a force, or rather a torque, opposite to the direction of rotation acting on the setting points themselves.

Detailed description of the operation

[0014] According to the present invention, it is envisaged that, during the step of descent or rolling-down of the sheet, the rotary motion imparted by the drum on the floating capsule 3 causes the latter to move also axially forwards, thanks to the presence of a thread provided on the inner surface of the capsule 3, which engages on the corresponding outer thread of the fixed capsule 6, on which said floating capsule 3 has been partially pre-screwed during assembly.

[0015] A first peculiar characteristic of the invention consists in the fact that, via this relative movement of roto-translation (i.e., screwing) of the floating capsule 3 on the fixed capsule 6, the compression spring 7 contained in the floating capsule 3 and fixed capsule 6 is compressed so that the spring 7 exerts a variable load - as a function of compression thereof - on a plurality of fixed disks 4 and rotary disks 5, which respectively alternate with one another and are pack-mounted within the fixed capsule 6.

[0016] The two capsules, namely, the floating one 3 and the fixed one 6, the compression spring 7, as well as the disks 4 alternating with the disks 5, are all coaxial with one another and with the drum on which the sheet is rolled up/rolled down.

[0017] A second peculiar characteristic of the invention is that the fixed disks 4 are fitted on the fixed capsule 6 and hence do not turn, whereas the rotary disks 5 are fitted on the drive shaft 1 and turn therewith and with the drum.

[0018] According to the invention, when the rotary motion of the drum is reversed for re-winding the sheet, there is brought about triggering of the ratchet mechanism 2 set on top of the drive shaft 1, which - after it has covered a first idle stretch in order to guarantee release of the free end of the sheet - activates rotation of the drive shaft 1 simultaneously with the rotary disks 5 fitted thereon and with the floating capsule 3, which, turning in an opposite direction with respect to that corresponding to the step of unrolling of the sheet, unscrews from the fixed capsule 6, moving axially backwards so as to unload gradually the compression spring 7 as the sheet approaches the rolling-up end-of-travel, until it is finally released in the last stretch.

[0019] With reference, by way of example, to the attached figures, in the preferred embodiment that is described, the ratchet mechanism 2 is set on top of the drive shaft 1 and is functional to use of the decelerator for two specific applicational peculiarities, which facilitate and optimise the action thereof, albeit not interacting in an

active way in the braking action imparted by the decelerator.

[0020] In other words, according to the present invention, it is possible to use the decelerator also without the ratchet mechanism 2, i.e., by fitting the deceleration system directly on the drum, obtaining, however, a system that - albeit functioning - would be much less practical and efficient for the user.

[0021] The purposes of the ratchet mechanism 2 described are substantially two:

- 1) release of the sheet with the first stretch that is idle, i.e., without any braking action; and
- 2) descent, i.e., unrolling, of the sheet without any braking action.

[0022] From the operative standpoint, the floating ring 2A, which is axially mounted on the drive shaft and triggered by the draw cap 2B, is free to turn in either direction of rotation, engaging, in one direction, and releasing - in this case, remaining idle - in the opposite direction, the front toothing present between said floating ring 2A and the corresponding shoulder provided on the drive shaft 1. This configuration serves to prevent any braking effect in the step of descent/rolling-down of the sheet in so far as a possible braking action would be useless and inconvenient for the user, who would have to apply a force higher than the one required for overcoming the return spring of the roller-blind mechanism.

[0023] The rotary movement is transmitted to the mobile ring 2A by the draw cap 2B, which is also axially mounted on the drive shaft 1. In particular, the draw cap 2B is free to turn with respect to the drive shaft 1, but is fixed in rotation with respect to the drum for rolling up/rolling down the sheet in either direction thanks to the presence of one or more circumferential grooves S designed to co-operate with corresponding longitudinal ribbings C present within the drum itself (Figures 12-13).

[0024] During the step of descent or rolling-down of the sheet, rotation of the mobile ring 2A is triggered by means of two projecting portions 10 present on the face of the cap 2B that faces the ring itself and is designed to act in contrast with the corresponding lateral contrast surfaces 11 that are present on the mobile ring 2A, which, as a result of the particular sawtooth shape of the front toothing with RH or LH engagement start, moves, axially sliding towards the cap 2B as a result of the friction between the inclined faces of said front toothing so as to disengage them from one another, thus causing the ring 2A to turn idle, while the shaft 1 remains stationary in such a way that the sheet can be unrolled without there being exerted any braking force.

[0025] Accordingly, during the disengagement and re-winding step, by reversing the direction of rotation of the drum, the cap 2B that turns fixedly with respect thereto comes to rest with the free end of the aforesaid projecting portions 10 on a corresponding frusto-helical surface that functions as slide, purposely provided on the side of the

mobile ring 2A opposite to the sawtooth front toothing. In this way, the rotation opposite to the previous one of the cap 2B with respect to the mobile ring 2A causes an axial displacement of the latter, which moves away from the cap until it engages with the front toothing of the shaft 1, which at this point starts to turn fixedly with the ring 2A, with the cap 2B, and with the drum.

[0026] According to a peculiar characteristic of the invention, the aforesaid rotation of the shaft 1 fixedly with respect to the drum occurs only after the drum has completed at least one third of a turn idle with respect to the shaft 1, thanks to the relative axial displacement between the ring 2A and the cap 2B, thus determining a length of travel (i.e., of rotation) free from the braking effect of the sheet, which proves particularly useful and functional at start of release and rewinding thereof.

[0027] It should be noted that the surface friction between the front faces of the rotary disks 5 and fixed disks 4 that rub against one another causes a part of the twisting force or torque applied by the pre-loading spring to be absorbed and dissipated in heat/friction, thus reducing its accelerating effect on the roller-blind system. Advantageously, as the floating capsule 3 moves back while the sheet is rolled up and the drum connected thereto turns, the load of the spring 7 on the disks 4-5 decreases until they are completely released in the last stretch in such a way that the pre-loading spring can act without any contrast, thus rolling the sheet right up.

[0028] In other words, the plurality of fixed disks 4 and rotary disks 5 acts, thanks to the action of the spring 7 that compresses them axially with respect to one another, as a disk clutch, the compressive load of which is variable as a function of the degree of rolling-up of the roller blind.

[0029] Advantageously, the decelerator so far described acts with a variable braking force during the various steps of rolling-up/rolling-down of the sheet so as not to intervene in the initial and final stretches of rolling-up/rolling-down.

[0030] Finally, it should be noted that the decelerator is in effect adjustable simply by screwing it more or less - and hence pre-loading it - in the step of installation in order to vary the value of resistance as a function of the force that is actually necessary, as the dimensions in height and width of the roller-blind system vary.

Claims

1. A decelerating device with variable load-bearing capacity for roller-blind systems of the type comprising a sheet or screen or mosquito net that can be rolled up/rolled down on a drum rotating about its own axis, as well as a pre-loading-spring system for enabling automatic rewinding of the roller-blind system, said device being **characterized in that** it comprises:

- at least one drive shaft (1), which rotates fixedly with respect to the drum;

- at least one floating capsule (3), which rotates fixedly with respect to the drum;
- one or more fixed disks (4);
- one or more rotary disks (5);
- at least one fixed capsule (6); and
- at least one compression spring (7),

wherein the two capsules, namely, the floating capsule (3) and the fixed capsule (6), the compression spring (7), as well as the disks (4) alternating with the disks (5), are all coaxial with one another and with the drum on which the sheet is rolled up/rolled down.

2. The decelerating device with variable load-bearing capacity according to the preceding claim, **characterized in that**, during the step of descent or rolling-down of the sheet, the rotary motion imparted by the drum on the floating capsule (3) causes the latter to move also axially towards the fixed capsule (6), thanks to the presence of a thread provided on the inner surface of the floating capsule (3), which screws on a corresponding outer thread of the fixed capsule (6), on which said floating capsule (3) is partially pre-screwed during assembly of the device itself.
3. The decelerating device with variable load-bearing capacity according to the preceding claim, **characterized in that** via said relative movement of rotation, i.e., screwing, of the floating capsule (3) on the fixed capsule (6), the compression spring (7) contained in the floating capsule (3) and fixed capsule (6) is compressed so that said spring (7) exerts a variable load - as a function of its own compression - on a plurality of fixed disks (4) and rotary disks (5) that alternate with one another and are pack-mounted within the fixed capsule (6).
4. The decelerating device with variable load-bearing capacity according to the preceding claim, **characterized in that** the fixed disks (4) are fitted on the fixed capsule (6) and hence do not turn with the sheet, whereas the rotary disks (5) are fitted on the drive shaft (1) and turn with the latter and with the drum.
5. The decelerating device with variable load-bearing capacity according to the preceding claim, **characterized in that**, when the rotary motion of the drum is reversed in order to roll the sheet back up, rotation of the drive shaft (1), of the rotary disks (5) fitted thereon, and of the floating capsule (3), in an opposite direction with respect to the direction of unrolling of the sheet, causes unscrewing of the floating capsule (3) from the fixed capsule (6) and consequent axial recession so as to unload gradually the compression spring (7) as the sheet approaches its roll-

ing-up end-of-travel, until it is finally released in the last stretch.

6. The decelerating device with variable load-bearing capacity according to the preceding claim, **characterized in that** it moreover envisages a ratchet mechanism (2) set at the end of the drive shaft (1), which, when the rotary motion of the drum is reversed in order to roll the sheet back up, is triggered in such a way as to activate rotation of the drive shaft (1), of the rotary disks (5) fitted thereon, and of the floating capsule (3) only after it has covered a first idle stretch in order to guarantee release of the free end of the sheet.
7. The decelerating device with variable load-bearing capacity according to the preceding claim, **characterized in that** said ratchet mechanism (2) comprises a floating ring (2A), which is axially mounted on the drive shaft and fitted on a draw cap (2B) and is free to turn in either direction of rotation, engaging in one direction and releasing - in this case, remaining idle - in the opposite direction a front toothing present between said floating ring (2A) and a corresponding shoulder provided on the drive shaft (1); wherein the rotary movement is transmitted to the mobile ring (2A) by the draw cap (2B), which is also axially mounted on the drive shaft (1).
8. The decelerating device with variable load-bearing capacity according to the preceding claim, **characterized in that** the draw cap (2B) is free to turn with respect to the drive shaft (1), but is fixed in rotation with respect to the drum for rolling up/rolling down the sheet by means of one or more circumferential grooves (S), which are designed to co-operate with corresponding longitudinal ribbings (C) present within the drum itself.
9. The decelerating device with variable load-bearing capacity according to the preceding claim, **characterized in that**, during descent or rolling-down of the sheet, rotation of the mobile ring (2A) is triggered by means of two projecting portions (10) present on the face of the cap (2B) that faces the ring itself, said projecting portions (10) acting in contrast with the corresponding lateral contrast surfaces (11) that are present on the mobile ring (2A), which, as a result of the particular sawtooth shape of the front toothing with RH or LH engagement start, shifts axially sliding towards the cap (2B) as a result of the friction between the inclined faces of said sawtooth front toothings so as to disengage them from one another, thus causing the ring (2A) to turn idle, while the shaft (1) remains stationary in such a way that the sheet can be rolled down without any braking force being exerted thereon.
10. The decelerating device with variable load-bearing capacity according to the preceding claim, **characterized in that**, during disengagement and rewinding, by reversing the direction of rotation of the drum, the free ends of said projecting portions (10) of the cap (2B) that turns fixedly with respect to the drum come to rest on a corresponding frusto-helical surface that functions as slide, purposely provided on the side of the mobile ring (2A) opposite to the sawtooth front toothing; thus obtaining that the rotation opposite to the previous one of the cap (2B) with respect to the mobile ring (2A) causes an axial displacement of the latter, which moves away from the cap until it meshes with the front toothing of the shoulder of the shaft (1), which, at this point, starts to turn fixedly with respect to the ring (2A), the cap (2B), and the drum.
11. The decelerating device with variable load-bearing capacity according to the preceding claim, **characterized in that** the aforesaid rotation of the shaft (1) fixedly with respect to the drum occurs only after the drum has made at least one third of a turn idle with respect to the shaft (1), thanks to the relative axial displacement between the ring (2A) and the cap (2B), thus determining a stretch of travel - i.e., of rotation - free from the braking effect on the sheet, which proves particularly useful and functional at start of release and rewinding thereof.
12. The decelerating device with variable load-bearing capacity according to any one of Claims 3 onwards, **characterized in that** the surface friction between the front faces of the rotary disks (5) and fixed disks (4) that rub against one another when the compression spring (7) is compressed, causes a part of the twisting force or torque applied by the pre-loading spring to be absorbed and dissipated in heat/friction, thus reducing its accelerating effect on the roller-blind system.
13. The decelerating device with variable load-bearing capacity according to the preceding claim, **characterized in that**, as the floating capsule (3) recedes and turns, unscrewing from the fixed capsule (6) during rewinding of the sheet on the drum, the load of the spring (7) on the disks (4-5) decreases until they are completely released - in the last re-winding stretch - from the pressure that kept them axially pressed against one another, in such a way that the pre-loading spring can act without opposing any force, thus winding the sheet right up.
14. The decelerating device with variable load-bearing capacity according to Claim 12, **characterized in that** the plurality of fixed disks (4) and rotary disks (5) acts, thanks to the action of the spring (7) that axially compresses them against one another, as a

disk clutch, the compression load of which is variable as a function of the degree of winding of the roller sheet.

15. The decelerating device with variable load-bearing capacity according to any one of the preceding claims, **characterized in that** it acts with a braking force that is variable during the various phases of rolling-up/rolling-down of the sheet so as to not intervene in the initial and final stretches of rolling-up/rolling-down.

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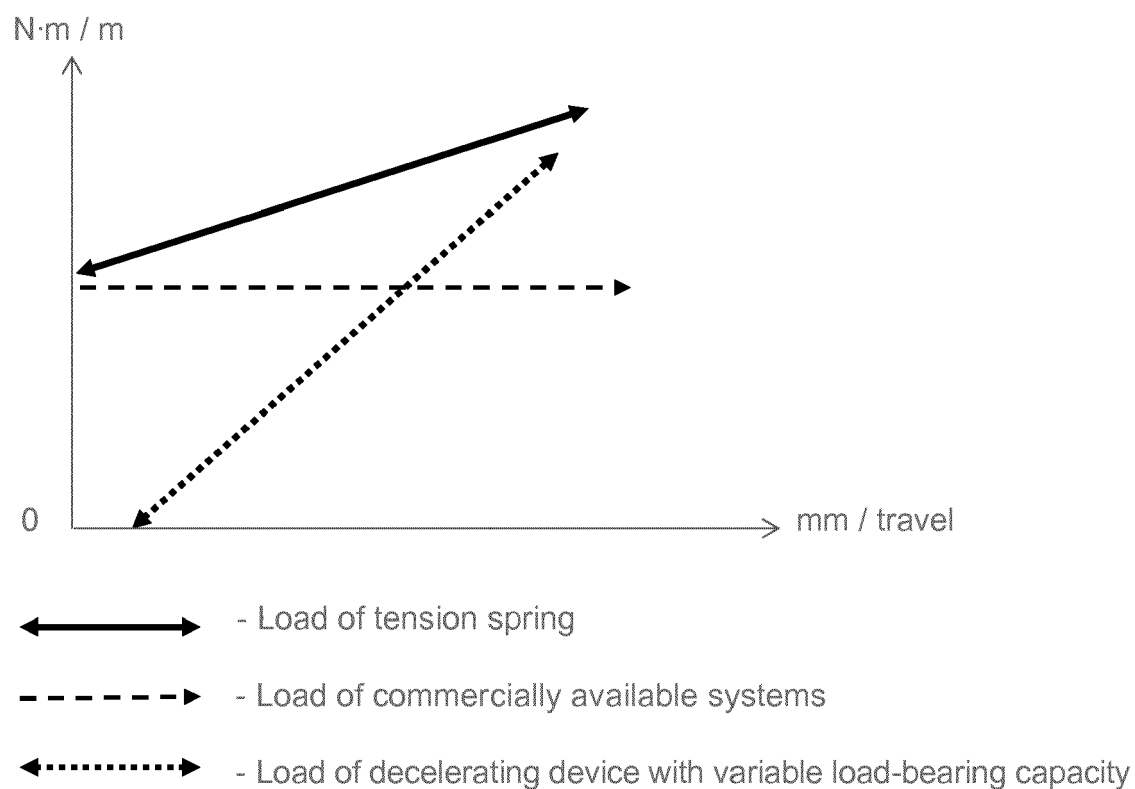
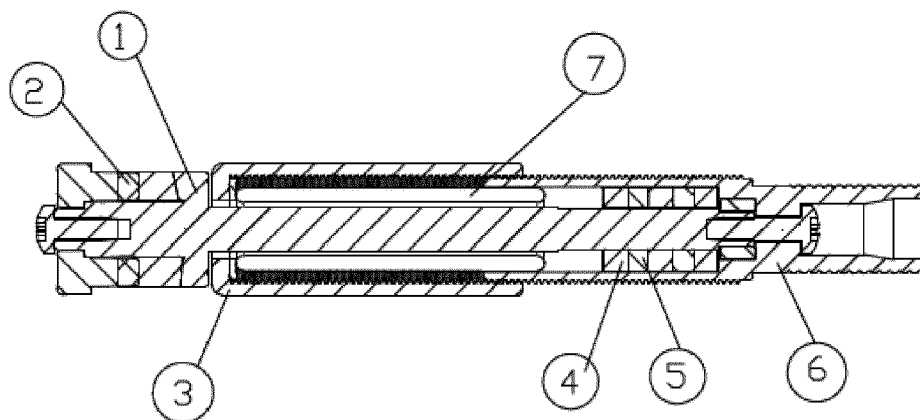


FIG. 1



Section B-B

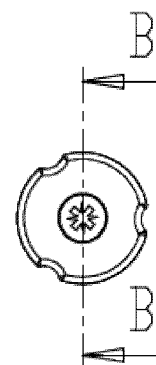


FIG. 2B

FIG. 2A

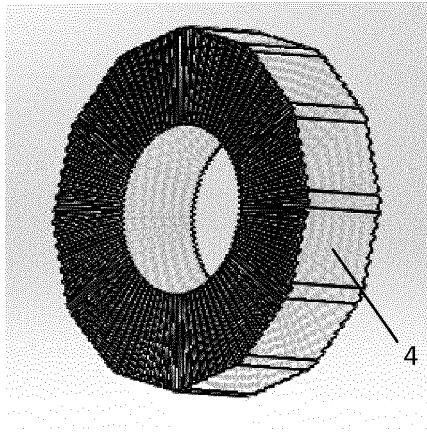


FIG. 3

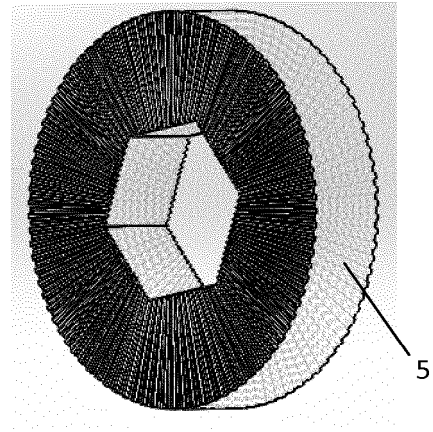


FIG. 4

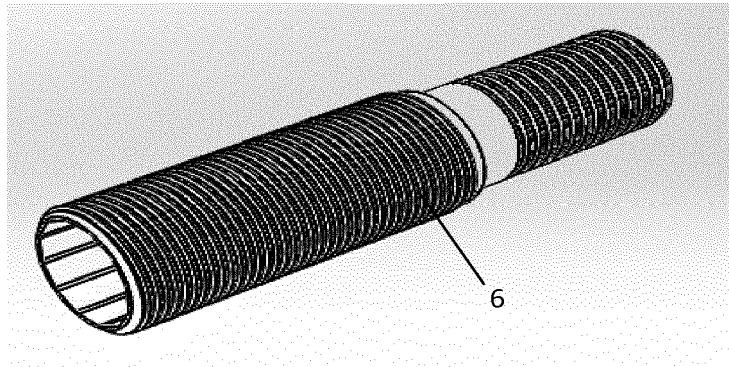


FIG. 5

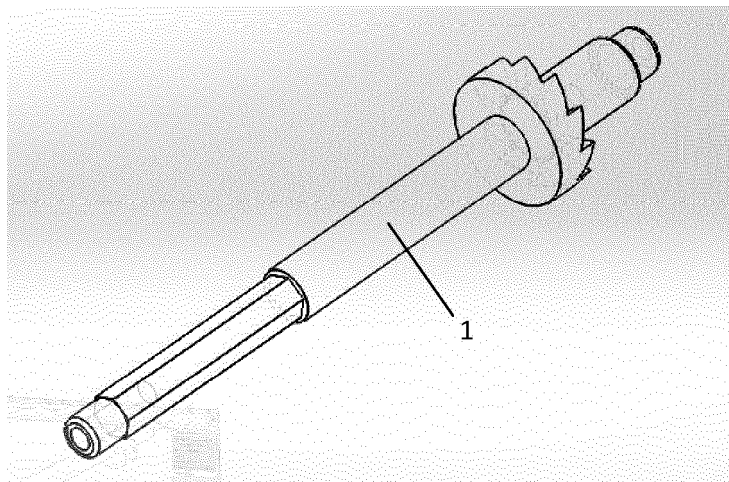


FIG. 6

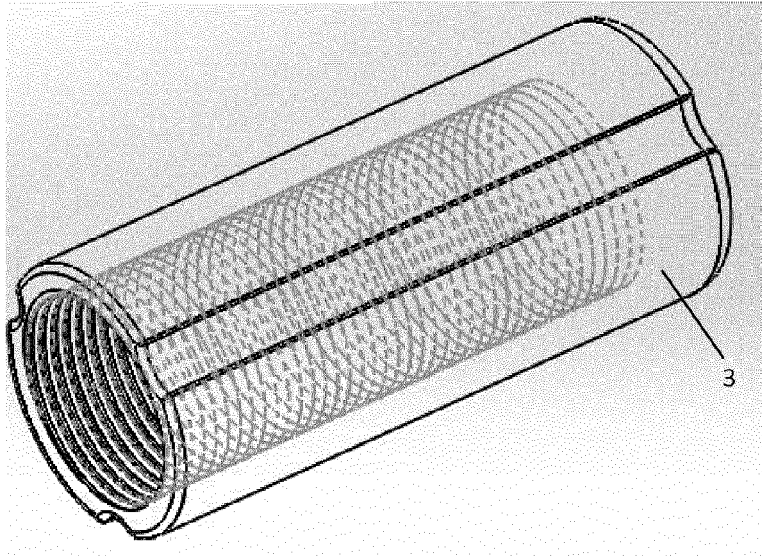


FIG. 7

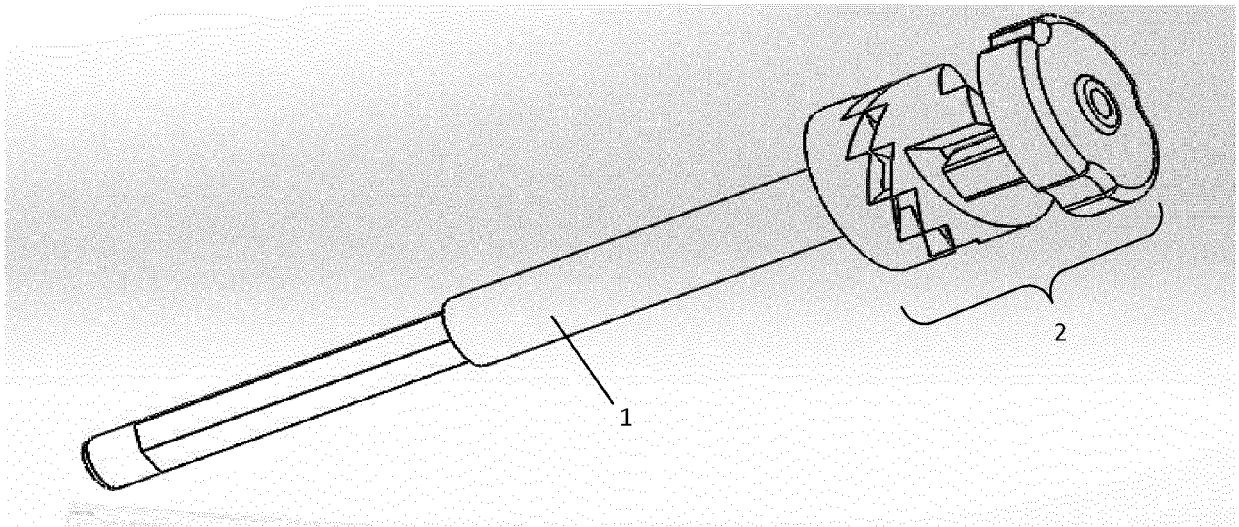


FIG. 8

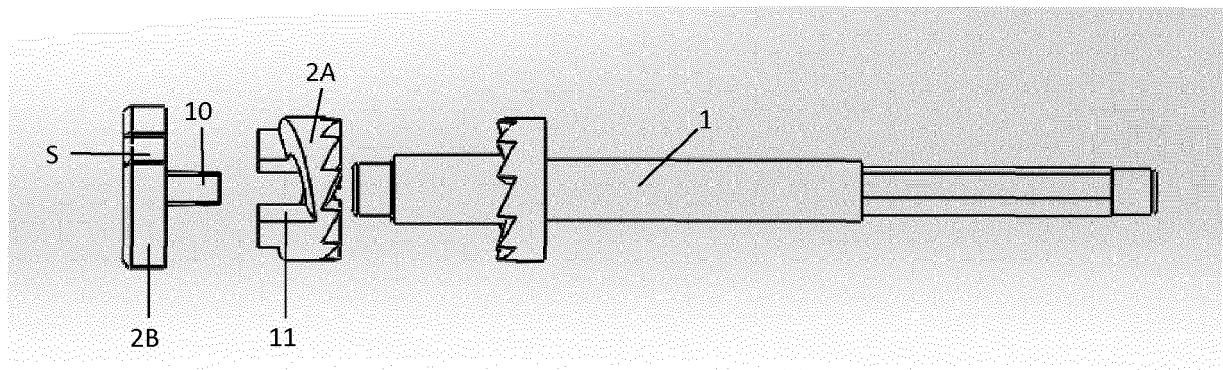


FIG. 9

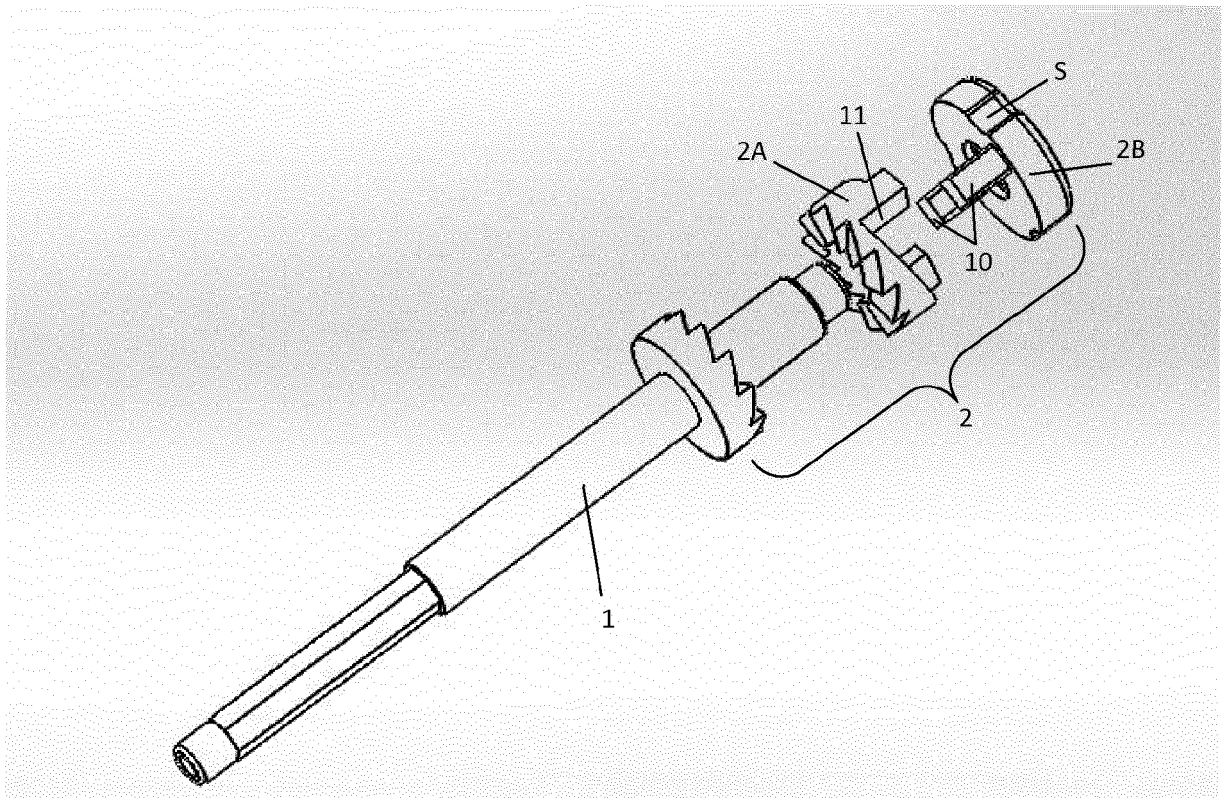


FIG. 10

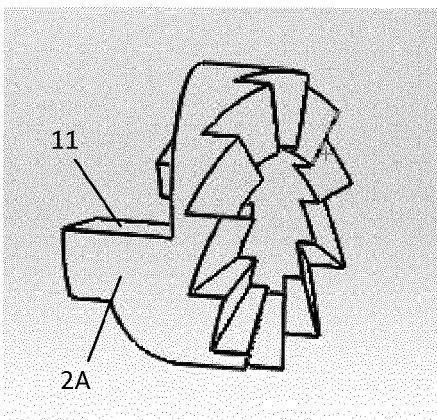


FIG. 11

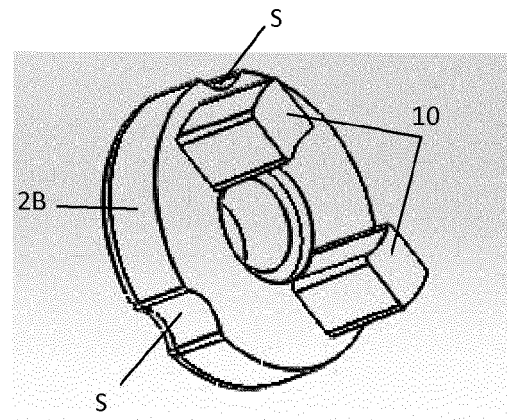


FIG. 12

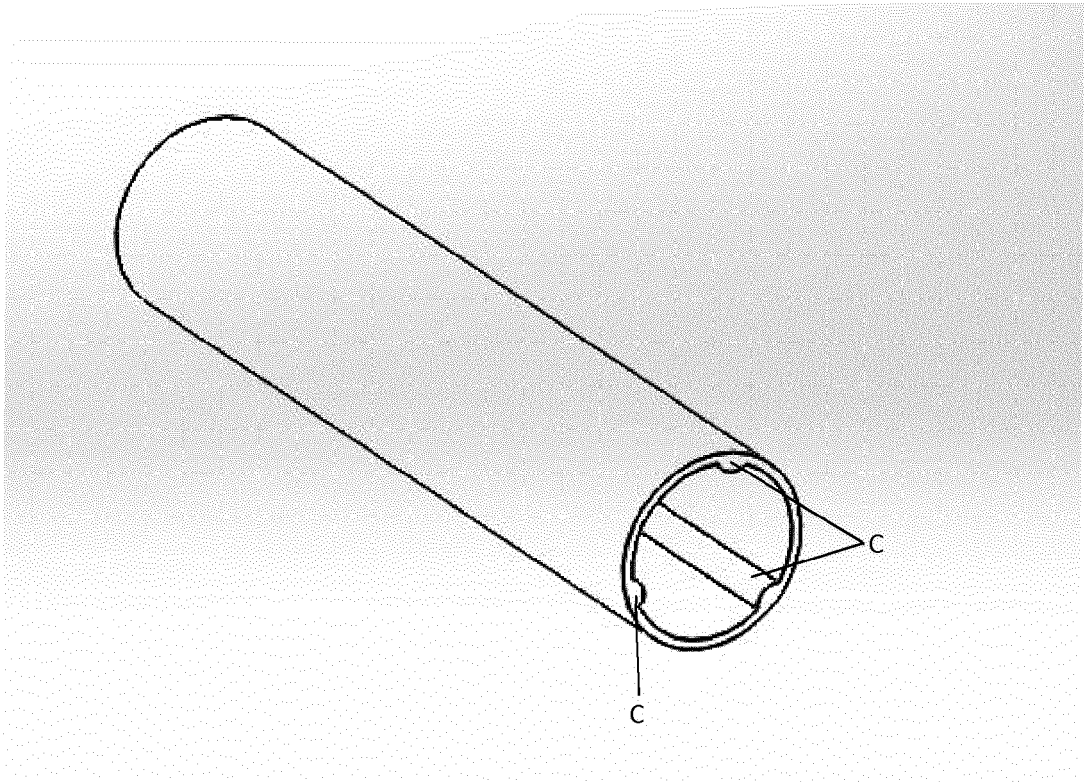


FIG. 13

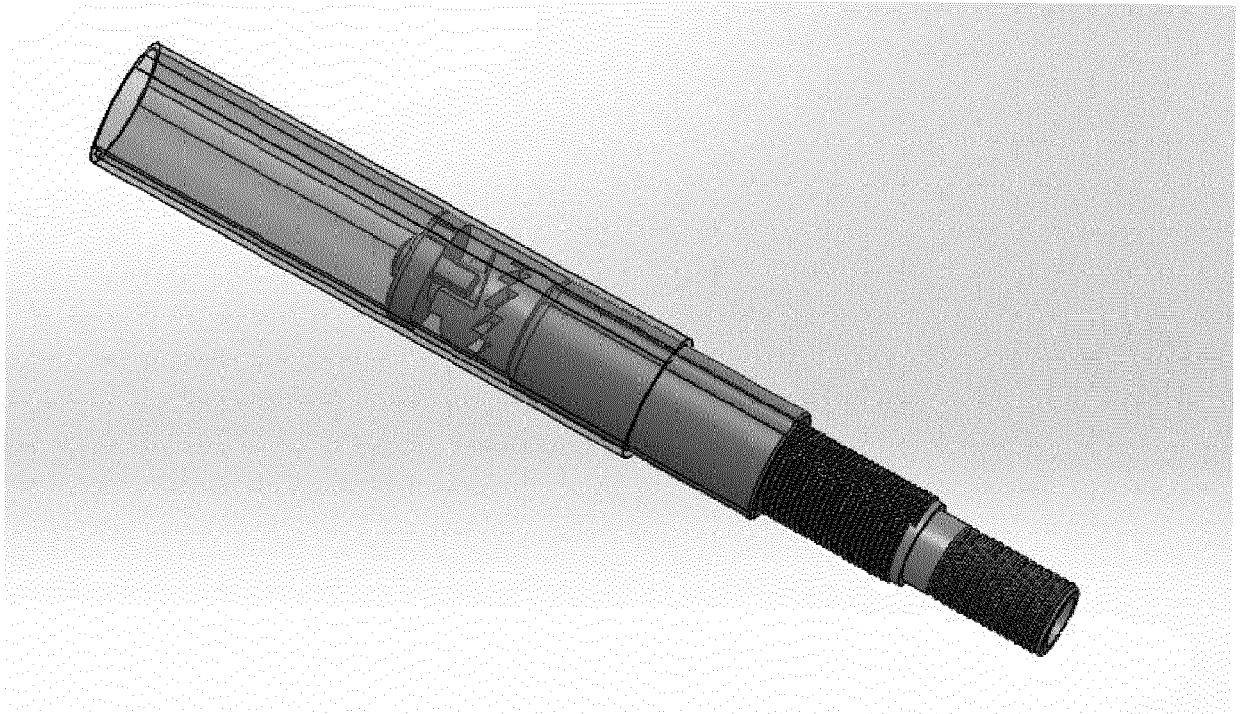


FIG. 14

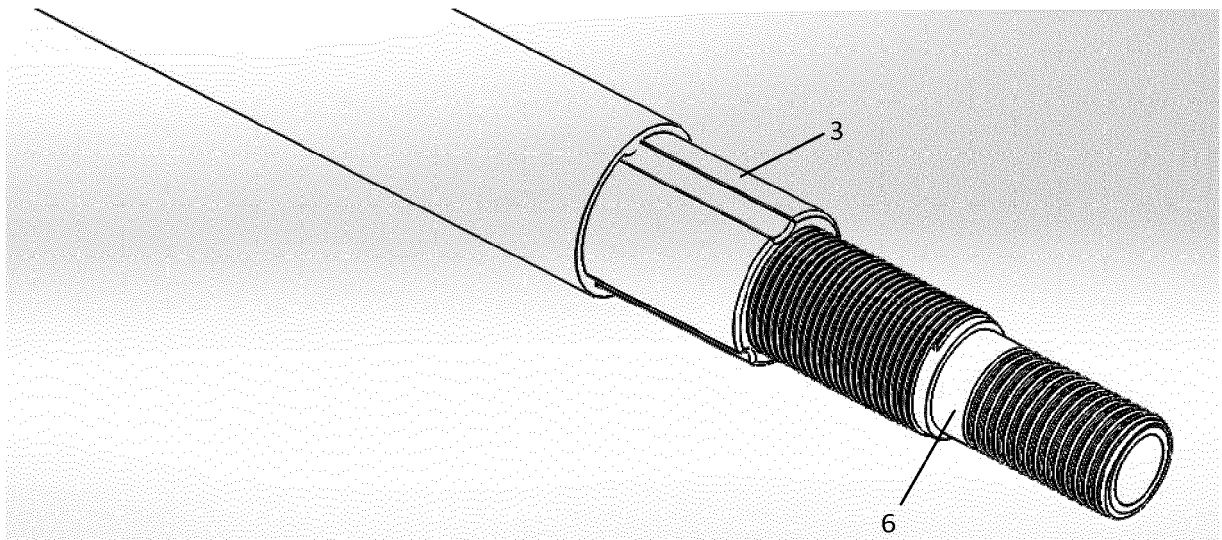


FIG. 15

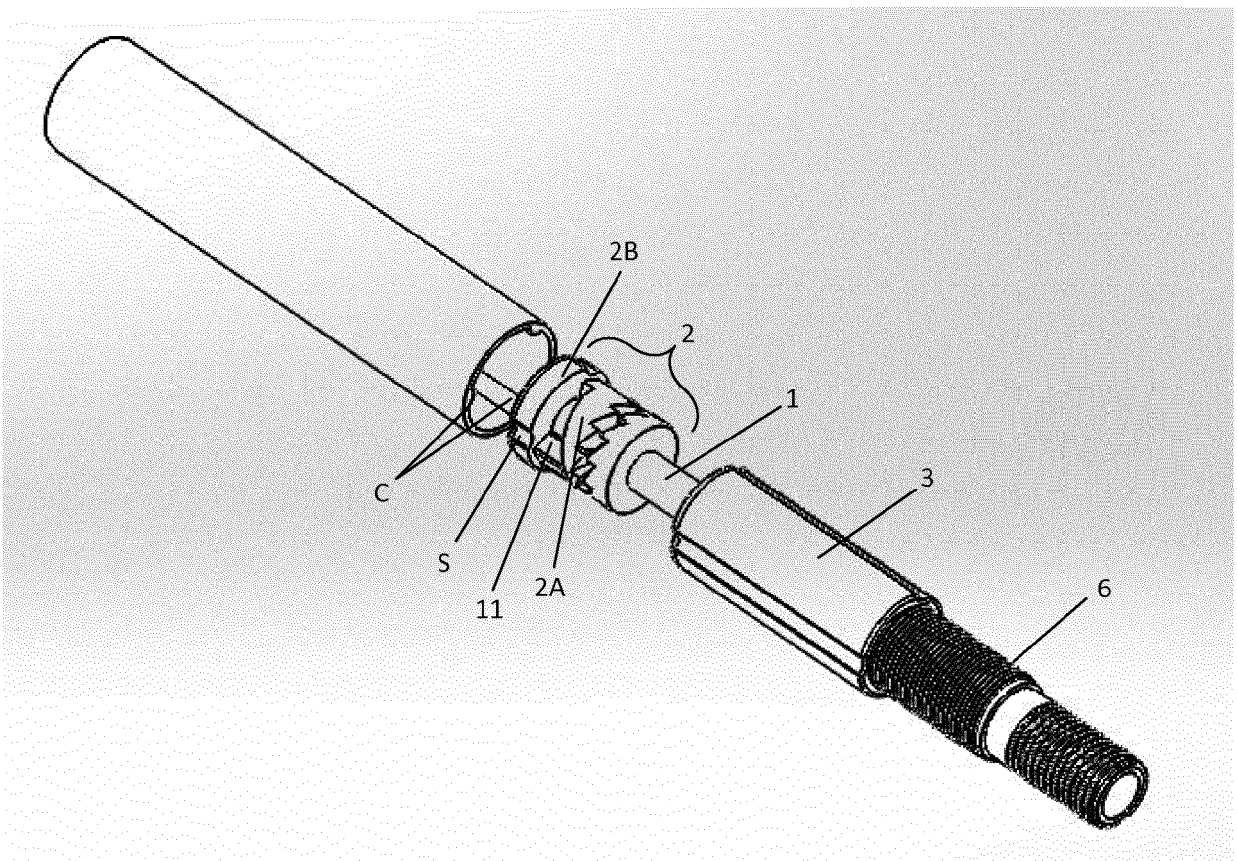


FIG. 16

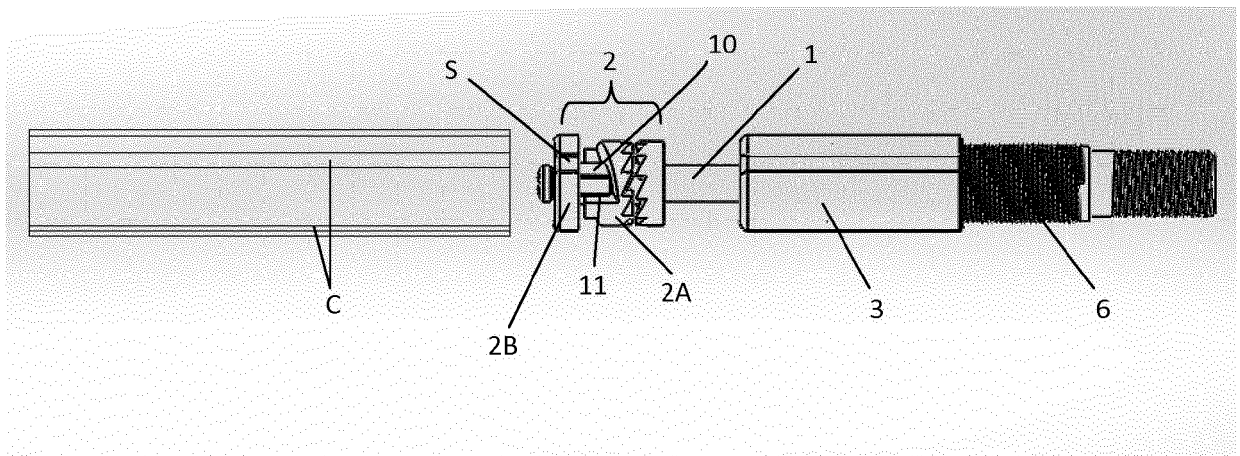


FIG. 17



EUROPEAN SEARCH REPORT

Application Number
EP 17 16 1438

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 746 245 A2 (VARITIS EMMANOUEL [GR]; SAGRIS DIMITRIOS [GR]; VARITIS DIMITRIOS [GR]) 24 January 2007 (2007-01-24)	1	INV. E06B9/80
A	* figures 1,2 * -----	2-15	
A	DE 42 39 507 A1 (BENTHIN MANAGEMENT GMBH [DE]) 26 May 1994 (1994-05-26) * figures 1-3 * -----	1-15	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			E06B
Place of search		Date of completion of the search	Examiner
Munich		25 July 2017	Merz, Wolfgang
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 16 1438

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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25-07-2017

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82