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## (54) DISRUPTING DEVICE OF BIOLOGIC SUBSTANCES

(57) A disrupting device (1) of biologic substances is described, comprising at least one external hollow body (10) defining at least one internal chamber; at least one fixed disrupting grid (20) housed inside the internal chamber to define at least one loading chamber of biologic substances to be disrupted and at least one collecting chamber of disrupted biologic substances; at least one rotor (30) rotating inside the internal chamber to take the biologic substances in contact with the fixed disrupting grid (20) and to cooperate with the fixed disrupting grid (20) to allow a disruption and a passage from the loading chamber to the collecting chamber of the disrupted biologic substances through the fixed disrupting grid (20).

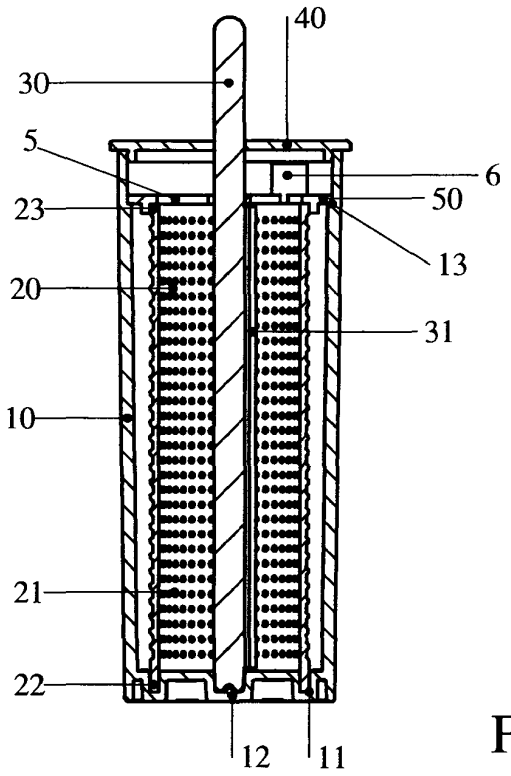


FIG. 4

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## Description

**[0001]** The present invention refers to a disruptor of biologic substances.

**[0002]** In general, the present invention is in the field of preparing samples for physical, biophysical, bio-chemical assays, with mechanical working, for example, cutting, disintegrating, compacting, homogenizing.

**[0003]** In particular, the present invention deals with the disintegration of biologic tissues, the dissociation of cells and micro-grafts, with knives or other cutters which cut the material into fragments, with rotary knives inside vertical containers, with actuation arranged above the container.

**[0004]** For example, IT-B-0001320860 discloses a disrupting device, preferably of the disposable type, suitable for treating disruptions of biologic samples and, in particular, for preparing homogenized samples, comprising a container shaped as a plastic glass, equipped with a cover with a central hole and a peripheral hole, a central rotating shaft connected to a mincing member, for example, of the type with one or more blades, supported by the bottom of the container through a spherical coupling and equipped with an engagement member to be able to join a drive shaft, and means to allow sucking the disrupted sample.

**[0005]** Moreover, WO-A2-2016097960 discloses a disrupting device for biologic material, comprising an external hollow body, defining an internal chamber, a fixed disrupting grid having a plurality of micro-holes equipped with cutting edges and transversally housed in the internal chamber in order to define an upper loading chamber adapted to be loaded with biologic material to be disrupted and a lower collecting chamber adapted to collect the biologic material after it has been disrupted, a blade-type rotor rotating in the internal chamber, adapted to cooperate, when rotating, with the fixed disrupting grid, in order to supply and take the biologic material from the upper loading chamber in contact with the microcells of the disrupting grid and thereby generate the disruption of the biologic material through these micro-holes. The microcells of the disrupting grid have sizes or a diameter included between 70 and 80 μm and are obtained through a molding process of the bit type, using a conical or polygonal punch to draw and distort a metal sheet made of stainless steel, or through a laser light source, in order to make an edge with different cutters, for example six. The configuration of the microcells allows operating without the help of chemical reagents, to obtain cellular suspensions and micro-grafts of tissues, keeping the characteristics and the functions of the original, non-disrupted biologic material intact and unaltered, and therefore can be advantageously used in several medical, veterinary and cosmetic applications.

**[0006]** The disrupting device according to IT-B-0001320860 solves the problem of the construction easiness, through the disposable device and the definition of the single internal chamber, but does not solve the problem of the axial load pressing on the axial bearing of the rotor, axial load following the necessary action to be able to disrupt the biologic substances.

**[0007]** The disrupting device according to WO-A2-2016097960 solves the problem of the disruption efficiency of the biologic cells, through the definition of the two chambers for loading biologic substances to be disrupted and for collecting disrupted biologic substances, but does not solve the problem of the axial load pressing on the axial bearing of the rotor.

**[0008]** Therefore, object of the present invention is solving the above prior art problems, by providing a disruptor which allows the efficient disruption of the biologic substances, through the definition of two chambers for loading biologic substances to be disrupted and for collecting disrupted biologic substances, but at the same time removing the axial load of the rotor.

**[0009]** A further object of the present invention is providing a disruptor of biologic substances which allows keeping the advantages of a disposable solution and simplifying the assembling of parts composing a device chosen to satisfy the above problems.

**[0010]** The above and other objects and advantages of the invention, as will result from the following description, are obtained with a disrupting device of biologic substances as claimed in claim 1. Preferred embodiments and non-trivial variations of the present invention ae the subject matter of the dependent claims.

**[0011]** It is intended that all enclosed claims are an integral part of the present description.

**[0012]** It will be immediately obvious that numerous variations and modifications (for example related to shape, sizes, arrangements and parts with equivalent functionality) can be made to what is described, without departing from the scope of the invention, as appears from the enclosed claims.

**[0013]** The present invention will be better described by some preferred embodiments thereof, provided as a non-limiting example, with reference to the enclosed drawings, in which:

- Figures 1 and 2 show perspective views, respectively from the bottom and the top, of an embodiment of the disrupting device of biologic substances according to the present invention;
- Figure 3 shows a front view of an embodiment of the disrupting device of biologic substances according to the present invention;
- Figure 4 shows a sectional view along line IV-IV of Figure 3;
- Figure 5 shows a sectional view along line V-V of Figure 3;
- Figure 6 shows a top perspective view of a first meaningful component of an embodiment of the disrupting device of biologic substances according to the present invention;
- Figure 7 shows a front view of the first meaningful component of Figure 6;

- Figure 8 shows a sectional view along line VIII-VIII of Figure 7;
- Figure 9 shows a sectional view along line IX-IX of Figure 7;
- Figure 10 shows an enlarged part X of Figure 9;
- Figure 11 shows a top perspective view of a second meaningful component of an embodiment of the disrupting device of biologic substances according to the present invention;
- Figure 12 shows a front view of the second meaningful component of Figure 11;
- Figure 13 shows a plan view of the second meaningful component of Figure 12;
- Figure 14 shows a top perspective view of a third meaningful component of an embodiment of the disrupting device of biologic substances according to the present invention; and
- Figure 15 shows a top perspective view of a fourth meaningful component of an embodiment of the disrupting device of biologic substances according to the present invention.

**[0014]** With reference to the Figures, it is possible to note that the disrupting device 1 of biologic substances according to the present invention comprises:

- at least one external hollow body 10 defining at least one internal chamber;
- at least one fixed disrupting grid 20 housed inside such internal chamber to define at least one loading chamber of biologic substances to be disrupted and at least one collecting chamber of disrupted biologic substances;
- at least one rotor 30 rotating inside the internal chamber and adapted to take the biologic substances in contact with the fixed disrupting grid 20 and to cooperate with the fixed disrupting grid 20 to allow the disruption and the passage from the loading chamber to the collecting chamber of the disrupted biologic substances through such fixed disrupting grid 20.

**[0015]** As it is possible to note in the Figures, in a preferred embodiment of the disrupting device 1 according to the present invention, the loading chamber and the collecting chamber are coaxial with respect to the rotation axis of the rotor 30 and, in particular, the collecting chamber is defined by the volume of the cylindrical crown interposed between the fixed disrupting grid 20 with a substantially cylindrical shape placed inside the internal chamber and the internal wall of the external hollow body 10, while the loading chamber is defined by the internal volume of the fixed disrupting grid 20 itself.

**[0016]** In particular, the fixed disrupting grid 20 is composed of a case with passages, of a substantially axial-symmetrical shape with respect to the rotor 30, to delimit the loading chamber of biologic substances to be disrupted around the rotation axis of the rotor 30 and the collecting chamber of disrupted biologic substances between the fixed disrupting grid 20 and the external hollow body 10.

**[0017]** With reference to Figures 5, 11, 12 and 13, it is possible to note that the rotor 30 comprises at least one blade 31, substantially radially projecting with respect to the rotation axis of the rotor 30, and which extends substantially for the whole height of the fixed disrupting grid 20 to be able to take the biologic substances in contact with the fixed disrupting grid 20.

**[0018]** The blade 31 comprises at least one convex surface 2 with tapered end 3, in contact with the biologic substances to be taken in contact with the fixed disrupting grid 20.

**[0019]** With reference to Figures 4 to 10, it is possible to note that the fixed disrupting grid 20 comprises a distribution of holed micro-cells 21 equipped with cutting edges 4 around the rotation axis of the rotor 30.

**[0020]** With reference to Figures 1 to 4 and 15, it is possible to note that the disrupting device 1 according to the present invention comprises at least one removable closing cover 40 of the external hollow body 10 withdrawable from a projecting shaft of the rotor 30 through at least one hole 41.

**[0021]** With reference to Figures 6 to 10, it is possible to note that the fixed disrupting grid 20 is delimited respectively by at least one base ring 22 and by at least one head ring 23.

**[0022]** With reference to Figure 4, it is possible to note that the fixed disrupting grid 20 is supported by the external hollow body 10 through the base ring 22 in at least one grooved seat 11 of a bottom 12 and through the head ring 23 joined to at least one annular flange 50 in a seat 13 next to the removable cover 40.

**[0023]** With reference to Figure 14, it is possible to note that the annular flange 50 is shaped to allow accessing only to the loading chamber of biologic substances to be disrupted through at least one central opening 5 and emptying the collecting chamber of disrupted biologic substances through at least one connecting sleeve 6.

**[0024]** Preferably, the fixed disrupting grid 20 is composed of a cylindrical case with base/height ratio equal to about ⅓.

**[0025]** Moreover, the rotor 30 is preferably of the two-blade type with arrangement of the blades at 180°, with an axial extension approximately equal to the axial extension of the disrupting grid 20, while the external hollow body 10 is axial-symmetrical shaped as a frustum of cone.

**[0026]** Finally, the disrupting device 1 of biologic substances is preferably of the type with vertical axis.

**[0027]** The disrupting device of biologic substances of the present invention allows obtaining the above preset objects.

**[0028]** In fact, through the disrupting device according to the present invention, the disruption of the biologic substances efficiently occurs, through a radial flow of the biologic substances, from the central loading chamber

for biologic substances to be disrupted, to the collecting chamber of disrupted biologic substances.

**[0029]** In particular, through the disrupting device according to the present invention, the axial load of the rotor is removed, with the advantage that it is not necessary to provide for an axial bearing, since the only operative axial load is a balanced radial one, due to an axial-symmetrical shape of the components of the device.

**[0030]** Preferably, the disrupting device of biologic substances is of the type with vertical axis, composed of components which can be easily replaced.

**[0031]** The particular configuration of the microcells composing the fixed disrupting grid allows operating without the help of chemical reagents, to obtain cellular suspensions and micro-grafts of tissues, keeping the characteristics and the functions of the original, non-disrupted biologic material intact and unaltered, allowing the use of the disruptor of the invention in several medical, veterinary and cosmetic applications.

**[0032]** Moreover, the connecting sleeve fastened to the annular flange to allow emptying the collecting chamber of disrupted biologic substances can comprise a connection of the LEUR type.

## Claims

**1.** Disrupting device (1) of biologic substances comprising:

- at least one external hollow body (10) defining at least one internal chamber;
- at least one fixed disrupting grid (20) housed inside said internal chamber to define at least one loading chamber of biologic substances to be disrupted and at least one collecting chamber of disrupted biologic substances, said fixed disrupting grid (20) being composed of a case with passages, of a substantially axial-symmetrical shape with respect to said rotor (30), to delimit said loading chamber of biologic substances to be disrupted around a rotation axis of said rotor (30) and said collecting chamber of disrupted biologic substances between said fixed disrupting grid (20) and said external hollow body (10); and
- at least one rotor (30) rotating inside said internal chamber to take said biologic substances in contact with said fixed disrupting grid (20) and to cooperate with said fixed disrupting grid (20) to allow a disruption and a passage from said loading chamber to said collecting chamber of said disrupted biologic substances through said fixed disrupting grid (20);

**characterized in that** said rotor (30) comprises at least one blade (31), radially projecting with respect to said rotation axis of said rotor (30), said blade (31) extending substantially for the whole height of said fixed disrupting grid (20) to take said biologic substances in contact with said fixed disrupting grid (20), said blade (31) comprising at least one convex surface (2) with tapered end (3), in contact with said biologic substances to be taken in contact with said fixed disrupting grid (20).

**2.** Disrupting device (1) of biologic substances according to claim 1, **characterized in that** said fixed disrupting grid (20) comprises a distribution of holed micro-cells (21), said holed micro-cells (21) being equipped with cutting edges (4) around said rotation axis of said rotor (30).

**3.** Disrupting device (1) of biologic substances according to claim 1 or 2, **characterized in that** it comprises at least one removable cover (40) to be able to close the opening of the external hollow body (10), said removable cover (40) being withdrawable from a projecting shaft of said rotor (30) through at least one hole (41).

**4.** Disrupting device (1) of biologic substances according to the previous claim, **characterized in that** said fixed disrupting grid (20) is delimited respectively by at least one base ring (22) and by at least one head ring (23), said fixed disrupting grid (20) being supported by said external hollow body (10) through said base ring (22) in at least one grooved seat (11) of a bottom (12) and through said head ring (23) joined to at least one annular flange (50) in a seat (13) next to said removable cover (40).

**5.** Disrupting device (1) of biologic substances according to the previous claim, **characterized in that** said annular flange (50) is shaped to allow accessing only to said loading chamber of biologic substances to be disrupted through at least one central opening (5) and emptying the collecting chamber of disrupted biologic substances through at least one connecting sleeve (6).

**6.** Disrupting device (1) of biologic substances according to any one of the previous claims, **characterized in that** said fixed disrupting grid (20) is composed of at least one cylindrical case with base/height ratio equal to about ⅓, said rotor (30) being of the two-blade type with arrangement of the blades at 180°, with an axial extension approximately equal to the axial extension of said disrupting grid (20).

**7.** Disrupting device (1) of biologic substances according to the previous claim, **characterized in that** said external hollow body (10) is axial-symmetrical shaped as a frustum of cone.

**8.** Disrupting device (1) of biologic substances accord-

ing to any one of the previous claims, **characterized in that** it is of the type with vertical axis.

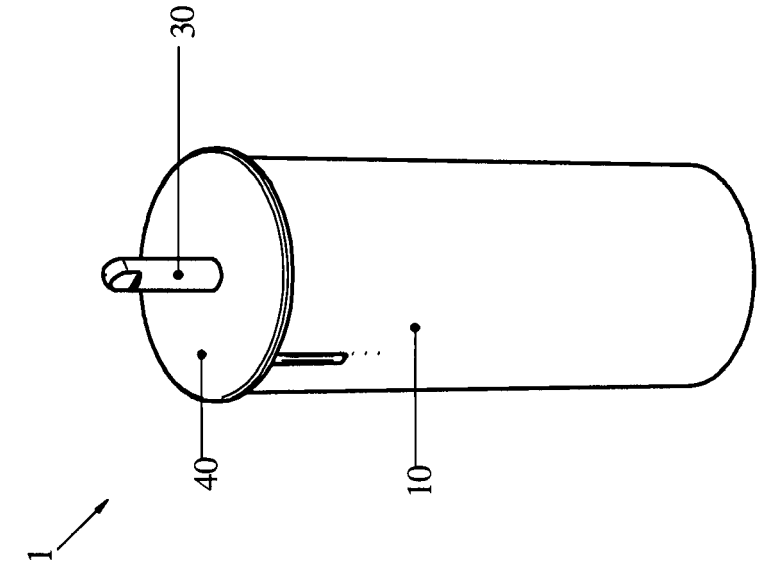



FIG. 2

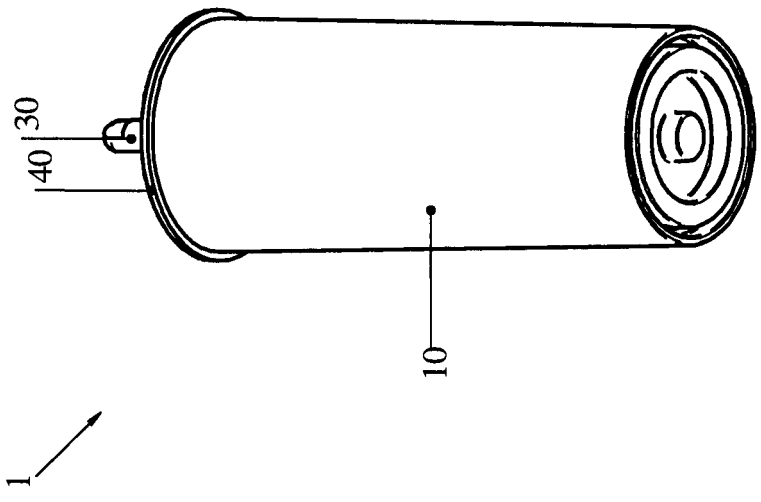



FIG. 1

FIG. 5

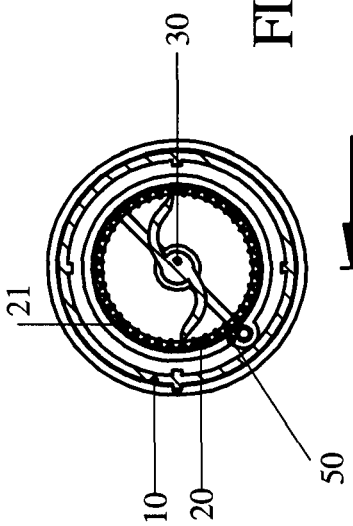



FIG. 3

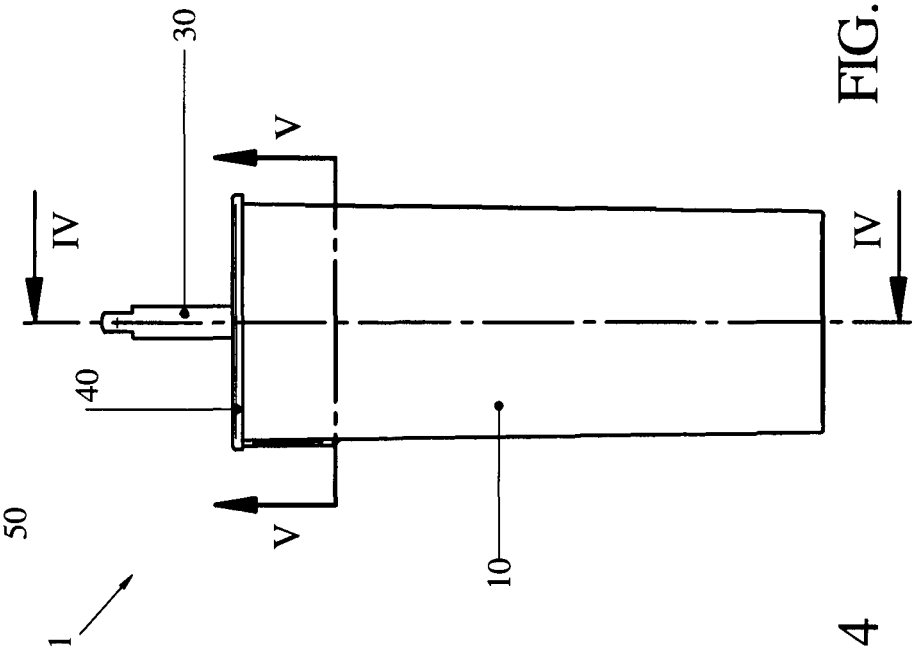
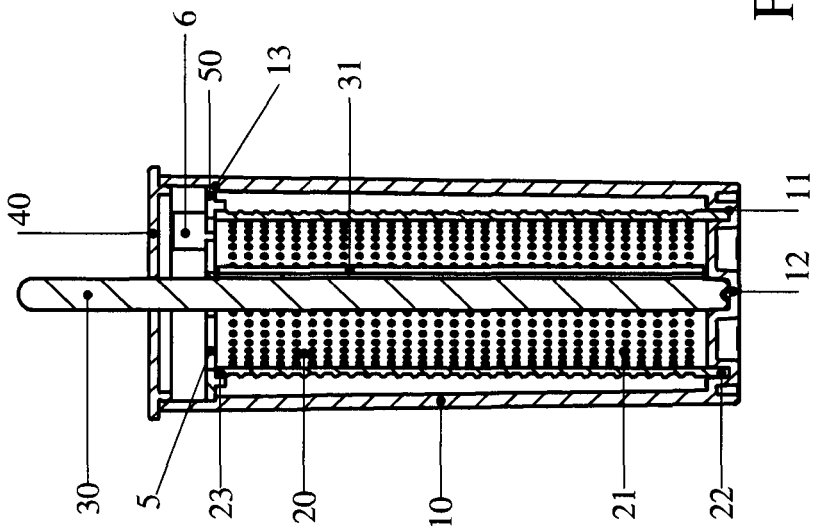



FIG. 4



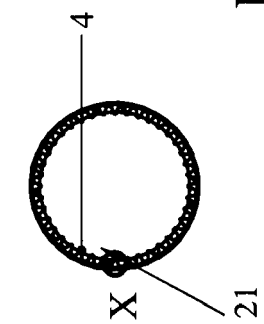



FIG. 9

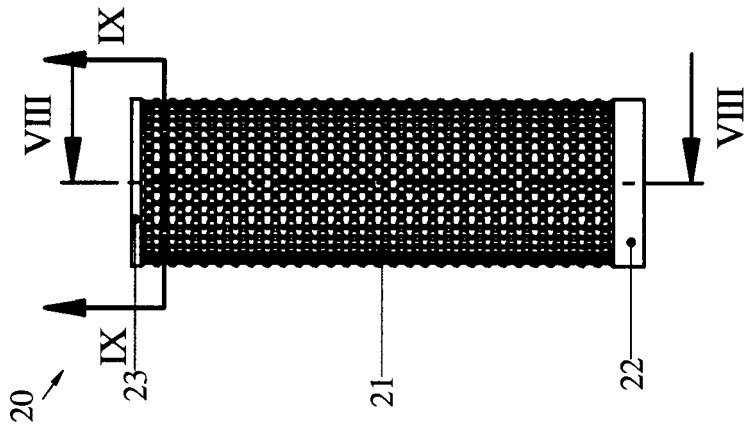



FIG. 7

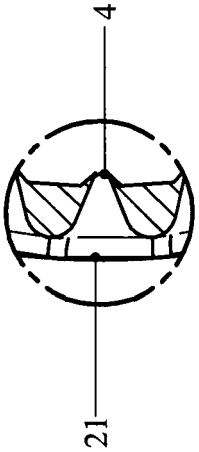



FIG. 10

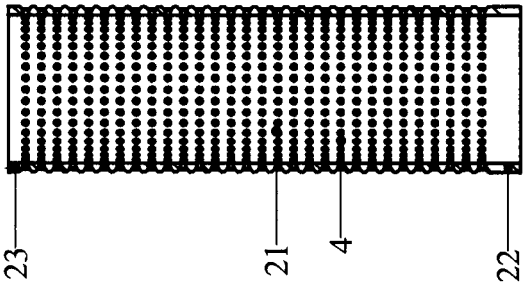



FIG. 8

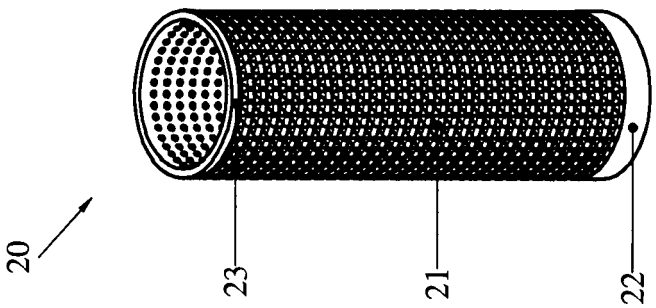



FIG. 6

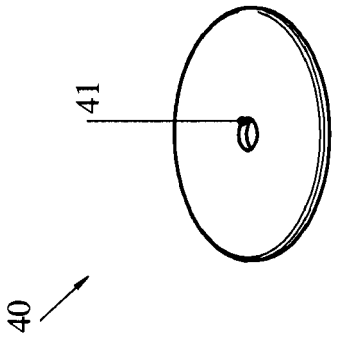



FIG. 15

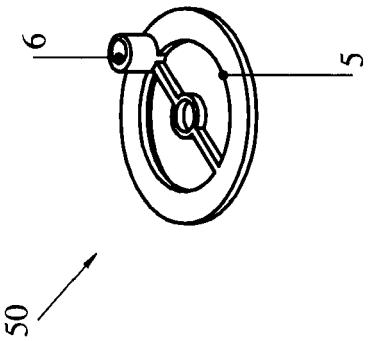



FIG. 14

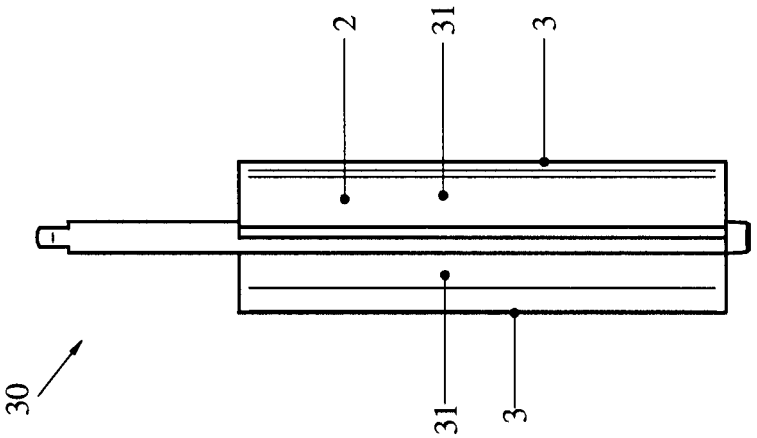



FIG. 12

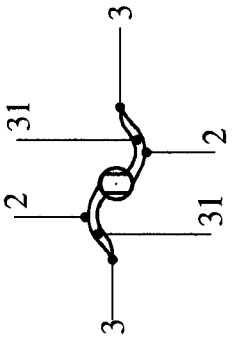



FIG. 13

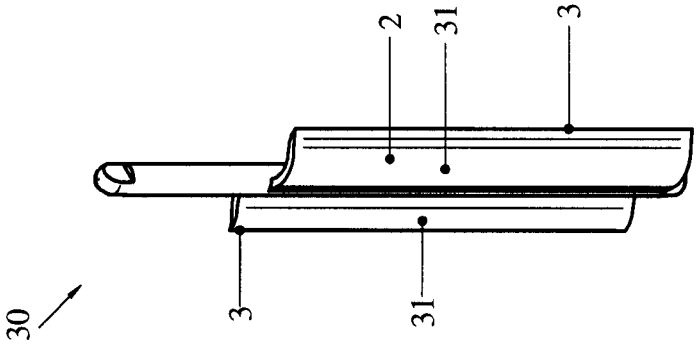



FIG. 11

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# EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 26 September 2018 | Iuliano, Emanuela |

CATEGORY OF CITED DOCUMENTS

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