(12) STANDARD PATENT (11) Application No. **AU 2011298854 B2**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
Door closer, particularly for glass doors

(51) International Patent Classification(s)
E05F 3/10 (2006.01)

(21) Application No: **2011298854** (22) Date of Filing: **2011.09.06**

(87) WIPO No: **WO12/032039**

(30) Priority Data

(31) Number	(32) Date	(33) Country
10175479.4	**2010.09.06**	**EP**
10187458.4	**2010.10.13**	**EP**

(43) Publication Date: **2012.03.15**
(44) Accepted Journal Date: **2017.02.23**

(71) Applicant(s)
IN & TEC S.r.l.

(72) Inventor(s)
Bacchetti, Luciano

(74) Agent / Attorney
Cotters Patent & Trade Mark Attorneys, GPO Box 469, Sydney, NSW, 2001, AU

(56) Related Art
GB 1168983 A
WO 2007/125524 A1
GB 2008184 A

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 March 2012 (15.03.2012)

PCT

(10) International Publication Number
WO 2012/032039 A1

(51) International Patent Classification:
E05F 3/10 (2006.01)

(21) International Application Number:
PCT/EP2011/065380

(22) International Filing Date:
6 September 2011 (06.09.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10175479.4 6 September 2010 (06.09.2010) EP
10187458.4 13 October 2010 (13.10.2010) EP

(71) Applicant *(for all designated States except US)*: **DIANORA GOSIO** [IT/IT]; Via della Fonte, 9/C, I-25075 Nave (BS) (IT).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **BACCHETTI, Luciano** [IT/IT]; Via della fonte, 9/C, I-25075 Nave (BS) (IT).

(74) Agents: **AUTUORI, Angelo** et al.; c/o Eureka IP Consulting, Borgo Santa Lucia 31, I-36100 Vicenza (IT).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

(54) **Title**: DOOR CLOSER, PARTICULARLY FOR GLASS DOORS

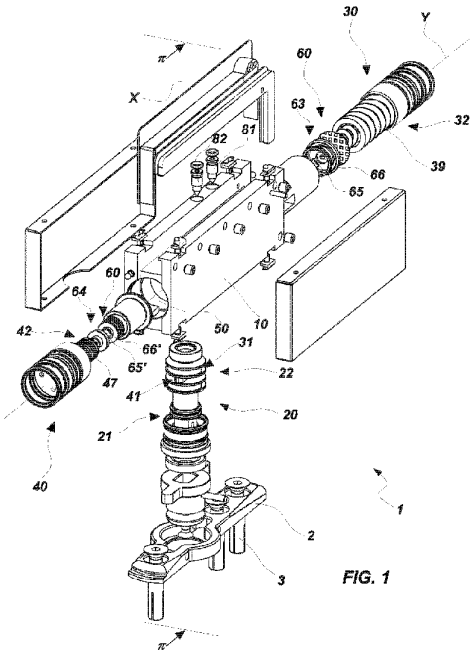

FIG. 1

(57) **Abstract**: A door closer for doors, particularly glass doors, which are supported by a stationary support structure (S) and are movable between an open door position and a closed door position. The door closer comprises a box-like body (10) and a pin (20) reciprocally rotatably coupled to rotate around a first axis (x) between the open door position and the closed door position. Closing means are provided (30) to automatically return the door, as well as a braking means (40) acting thereon to counteract their action. First and second cam elements (31, 41) unitary with the pin (20) and interposed between a first and second plunger elements (32, 42) are provided.

WO 2012/032039 A1

2011298854 27 Jan 2017

DOOR CLOSER, PARTICULARLY FOR GLASS DOORS

Field of the invention

The present invention is generally applicable in the technical field of the closing hinges, and particularly relates to a door closer, in particular for glass doors.

Background of the invention

Existing door closers are generally used to close a door which is supported by a stationary structure, e.g. a door frame.

Door closers usually comprise a movable element, fixed to one of a door and a stationary structure, pivoted on a fix element, usually fixed to the other of the door and the stationary structure.

Moreover, closing means acting on the movable element to automatically return the door or the like to the closed position are provided.

From the document E P04071 50 a door closer is known, which includes a box-like body and an external arm connectable to the door for the automatic returning thereof to the closed position. Such known devices are bulky, since the box-like body has an extremely large size. Therefore, the installation of such a device requires expensive and difficult construction work to the floor, which have to be made by qualified operators.

Further, due to the presence of the external arm, the aesthetic appeal of this known door closer is dramatically reduced.

Moreover, this known device offers a high resistance to closing if pulled. As a consequence, it can be very unsafe for a user, in particular in case of glass doors.

Object of the invention

It is an object of the present invention to overcome or at least ameliorate one or more of the above disadvantages, or at least to provide a useful alternative.

2011298854 27 Jan 2017

Summary of the invention

The present invention provides a system for closing a glass door which is supported by a floor, the door being movable between an open position and a closed position, the system comprising:

- a hydraulic door closing hinge;
- a mounting plate configured to be anchored on the floor;

wherein the hydraulic door closing hinge comprises:

- a box-like body anchorable to the glass door;
- a pin defining a first longitudinal axis anchorable to the mounting plate, said pin and said box-like body being rotatably coupled, such that said box-like body is rotatable around said first axis between the open position and the closed position;
- closing means for automatic return of the door from the open position to the closed position, said closing means comprising a first cam element interacting with a first plunger element, the first plunger element being movable within said box-like body between a first compressed position corresponding to the open position and a first extended position corresponding to the closed position;
- braking means adapted to counteract the closing means, said braking means comprising a second cam element interacting with a second plunger element, the second plunger element being movable within said box-like body between a second compressed position, corresponding to the closed position and a second extended position, corresponding to the open position;

wherein said first plunger element comprises at least one first pushing head interacting with said first cam element, said second plunger element including at least one second pushing head interacting with said second cam element, said closing means including a first spring biasing said first pushing head toward said first cam element, said braking means including a second spring biasing said second pushing head toward said second cam element;

wherein said box-like body includes a chamber containing a working fluid,

2011298854 27 Jan 2017

said chamber extending along a second axis substantially perpendicular to said first axis, said first and second plunger elements being both slidably movable within said chamber, both the first and second cam elements being unitary with the pin, the pin being located between said first and second plunger elements;

further wherein said first plunger element comprises a substantially cylindrical first trailing portion and a first leading portion including said at least one first pushing head, said second plunger element comprising a substantially cylindrical second trailing portion and a second leading portion which includes said at least one second pushing head, said first and second trailing portions separating said chamber into first, second and third adjacent variable volume compartments in reciprocal fluid communication.

There is disclosed herein a door closer for a door which is supportable by a stationary support structure, the door being movable between an open position and a closed position, the door closer comprising:

- a box-like body anchorable to one of the stationary support structure and the door;
- a pin defining a first longitudinal axis anchorable to the other of the stationary support structure and the door, said pin and said box-like body being rotatably coupled to rotate around said first axis between the open position and the closed position;
- closing means for the automatic return of the door from the open position to the closed position;
- braking means acting on said closing means for counteracting the action of the closing means;
- said closing means comprising a first cam element interacting with a first plunger element movable within said box-like body between a first

- compressed position corresponding to the open position and a first extended position corresponding to the closed position;
- said braking means comprising a second cam element interacting with a second plunger element movable within said box-like body between a second compressed position, corresponding to the closed position and a second extended position, corresponding to the open position;

wherein both said first and second cam elements are unitary with said pin and rotate with the pin, wherein said first plunger element comprises at least one first pushing head interacting with a first seat of said first cam element, said second plunger element including at least one second pushing head interacting with a second seat of said second cam element,
wherein said at least one first and second pushing heads comprise respective first and second flat front faces being substantially parallel each other and to said first longitudinal axis, said at least one first and second seats comprising respective first and second substantially flat contact surfaces extending perpendicular to each other and parallel to said first longitudinal axis, said first and second front faces being in engagement with said at least one first and second contact surfaces,
wherein said pin is located between said first and second plunger elements, and further wherein said first and second plunger elements are both slidably movable in a single operating chamber within the box-like body along a second axis substantially perpendicular to said first axis, each said first and second pushing heads having a generally plate-like shape to define respective first and second planes extending substantially perpendicular to said first axis.

The first and second plunger elements are preferably located on opposing sides with respect to said pin.

The at least one first and second planes are preferably generally parallel.

Preferably the at least one first front face and said first contact surface are substantially parallel to each other in said closed position and substantially perpendicular to each other in said open position, said at least one second front face

2011298854 27 Jan 2017

and said second contact surface being substantially perpendicular to each other in said closed position and substantially parallel to each other in said open position.

The closing means preferably comprises first counteracting elastic means acting on said first plunger element to promote the reciprocal interaction of said at least one first pushing head and said first seat, said braking means comprising second counteracting elastic means acting on said second plunger element to promote the reciprocal interaction of said at least one second pushing head and said second seat.

The operating chamber preferably comprises a working fluid, said first plunger element comprising a substantially cylindrical first back portion and a first front portion including said at least one first pushing head, said second plunger element comprising a substantially cylindrical second back portion and a second front portion which include said at least one second pushing head, said first and second back portions separating said operating chamber into first, second and third adjacent variable volume compartments in reciprocal fluidic communication.

Preferably the first and third variable volume compartments have in correspondence of said closed position respectively the maximum and minimum volume and in correspondence of said open position respectively the minimum and maximum volume, said first counteracting elastic means being located in said first compartment, said second counteracting elastic means being located in said third compartment and both said first and second cam elements being located in said second compartment.

The operating chamber preferably comprises control means for controlling the flow of the working fluid designed to allow fluid flow from said first compartment to said third compartment through said second compartment upon the opening of the door and to allow the backflow thereof from said third compartment to said first compartment through said second compartment upon the closing of the door.

The control means preferably comprises a first hole passing through said first plunger element so as to put into fluidic communication said first compartment and said second compartment and a second hole passing through said second plunger

2011298854 27 Jan 2017

element so as to put into fluidic communication said third compartment and said second compartment, said control means further comprising a first check valve interacting with said first hole and a second check valve interacting with said second hole, said first and second check valves reciprocally cooperating to selectively open upon the opening of the door, thus allowing the flow of the working fluid from said first compartment to said second compartment through said first hole and from said second compartment to said third compartment through said second hole, and to selectively close upon the closing of the door, thus preventing the backflow of the working fluid therethrough.

The control means preferably further comprise a hydraulic circuit internal to said box-like body to put into fluidic communication said third compartment and said first compartment through said second compartment upon the closing of said first and second check valves, thus allowing the backflow of the working fluid upon the closing of the door.

The hydraulic circuit preferably comprises an interspace between said second plunger element and said operating chamber to put into fluidic communication said third variable volume compartment and said second variable volume compartment, said hydraulic circuit further including a channel passing through said box-like body having at least one inlet port in fluidic communication with said second variable volume compartment and at least one outlet port in fluidic communication with said first variable volume compartment.

The channel preferably comprises a second outlet port, said first back portion of said first plunger element comprising a third hole slidable unitary therewith along said second longitudinal axis, said second outlet port and said third passing through hole being susceptible to be reciprocally uncoupled when said first plunger element is in proximity of the compressed end position and reciprocally coupled when said first plunger element is in proximity of the extended end position to selectively put into fluidic communication said channel with said first variable volume compartment, so as to impart a latch action to the door towards the closed position.

An objective is to provide a door closer of moderate size.

2011298854 27 Jan 2017

Another objective is to provide a door closer which is easy to install.

Another objective is to provide a door closer which ensures the automatic closing of the door from the open position.

Another objective is to provide a door closer which ensures the controlled movement of the door on which it is mounted, upon the opening as well as upon closing of the door.

Another objective is to provide a door closer which is capable to control the movement of very heavy doors and windows, without changing its behaviour and without need of any adjustment.

Another objective is to provide a door closer which has a minimum number of constituent parts.

Another objective is to provide a door closer capable to maintain with time the exact closing position.

Another objective is to provide a safe door closer, which does not offer any resistance to closing if pulled.

A preferred embodiment provides a door closer comprising a fix element, suitable to be anchored to one between a door and the stationary structure which support the door, and a movable element, suitable to be anchored to the other between the door and the stationary structure.

The movable element is rotatably coupled to the fix one to rotate about a first longitudinal axis, which may be substantially vertical, between an open door position and a closed door position.

The movable element, respectively the fix element, may comprise a box-like body, which may in turn internally include at least one operating chamber. On the other hand the fix element, respectively the movable element, may comprise a pin which defines the above first longitudinal axis.

Suitably, the door closer comprises closing means acting on the

2011298854 27 Jan 2017

movable element to automatically return the door to the closed position upon the opening thereof.

Furthermore, the door closer may comprise braking means acting on the closing means for counteracting the action thereof.

In this manner, it will be possible to control the rotation of the door from the open position to the closed position.

Advantageously, the closing means may comprise a first cam element interacting with a first plunger element movable within the box-like body between a first compressed end position, corresponding to the open door position and a first extended end position, corresponding to the closed door position.

The first plunger element may move within the box-like body along a first direction, which preferably may be longitudinal and more preferably substantially perpendicular to the first longitudinal axis.

Appropriately, the braking means may comprise a second cam element interacting with a second plunger element movable within the box-like body between a second compressed end position, corresponding to the closed door position and a second extended end position, corresponding to the open door position.

The second plunger element may move within the box-like body along a second direction, which preferably may be longitudinal and more preferably substantially perpendicular to the first longitudinal axis.

In a preferred but non-exclusive embodiment, the two moving directions of the first and the second plunger elements may be parallel each other.

Suitably, the first and second cam elements may be unitary with the pin.

In this manner, they may unitary rotate about the first longitudinal axis.

Advantageously, the pin, that is the first and second cam elements, may be interposed between the first and second plunger elements.

Thanks to such features, the door closer will be very compact and effective, and will have a strong aesthetic impact.

Moreover, thanks to such features, the door closer will have a minimum number of constituent parts, with great advantage of the bulkiness of the door closer.

In a preferred but non-exclusive embodiment, the first and second plunger elements may be reciprocally opposite with respect to the pin, or equivalently with respect to the first longitudinal axis.

More precisely, the first and second plunger elements may be reciprocally opposite with respect to a plane passing through the first longitudinal axis and perpendicular to the above first and/or second moving directions of the first and second plunger elements.

Preferably, the closing means and the braking means may be entirely housed in one single operating chamber, internal to the box-like body.

Advantageously, both the first and second plunger elements may be slidably movable along a single second longitudinal axis substantially perpendicular to the first axis. In other words, the first and second moving directions of the first and second plunger elements may lay on a single longitudinal axis, i.e. said second axis.

Preferably, the first and second plunger elements may be slidably movable in a single operating chamber which defines the second axis. In this embodiment, the first and second plunger elements may be reciprocally faced.

Due to bulkiness reasons, the working chamber defined by the box-like body may include both the first and second cam elements and the first and second plunger elements.

Suitably, the first plunger element may comprise at least one first pushing head interacting with at least one substantially first countershaped seat of the first cam element, whereas the second plunger element may include at least one second pushing head interacting with at least one second substantially countershaped seat of the second cam element.

Thanks to this embodiment, the door closer will maintain the exact closing position with time, by being also greatly safe.

In order to minimize the vertical bulkiness, both the at least one first

and second pushing heads may have a generally plate-like shape to define respective first and second planes substantially perpendicular to the first axis. Preferably, these first and second planes may be reciprocally parallel.

Advantageously, and independently from the shape of the pushing heads of the plunger elements, the said operating chamber may comprise a working fluid, usually a oil.

Independently from the shape of the pushing heads of the plunger elements, the first plunger element may comprise a substantially cylindrical first back portion and a first front portion defining the first pushing head, whereas the second plunger element may comprise a substantially cylindrical second back portion and a second front portion defining the second pushing head.

The first and second back portions may be designed to separate the operating chamber into a first, a second and a third adjacent variable volume compartments in reciprocal fluidic communication.

Suitably, and independently from the shape of the pushing heads of the plunger elements, the operating chamber may comprise control means for controlling the flow of the working fluid so as to allow the flow thereof from the first compartment to the third compartment through the second compartment upon the opening of the door and to allow the backflow thereof from the third compartment to the first compartment through the second compartment upon the closing of the door.

Such embodiment will allow to obtain a door closer which ensures the controlled movement of the door upon the opening, thus being greatly safe and practical.

Moreover, thanks to such features, the door closer according to the invention will allow to hydraulically control the rotation upon the closing of very heavy doors, by also minimizing the bulking.

In fact, the door closer according to the invention will be extremely safe, because the reciprocal rotating movement of the fix and of the movable element is free upon closing. During the closing phase the control means will adjust the backflow of the working fluid from the third to the first variable

volume compartment independently from the reciprocal rotation of the fix and of the movable element, so that an user will be free to close the door with any speed without any danger of breaking the door closer and/or the door.

Advantageous embodiments of the invention are defined according to the dependent claims.

Brief description of the drawings

Further features and advantages of the invention will appear more evident upon reading the detailed description of a few preferred, non-exclusive embodiments of a door closer according to the invention, which is described as non–limiting examples with the help of the annexed drawings, in which:

FIG. 1 is an exploded view of a the door closer **1**;

FiG. 2 is a schematic perspective view of the first and second cam elements **31** and **41**, unitary with the pin **20**, which are interposed between the first and second plunger elements **32**, **42**;

FIG.s 3a and **3b** are respectively perspective and partly sectional views of the box-like body **10**;

FIG.s 4a and **4b** are respectively perspective and sectional views of the first plunger element **32**;

FIG.s 5a, **5b** and **5c** are respectively perspective, sectional and front views of the second plunger element **42**;

FIG.s 6a, **6b** and **6c** are respectively perspectives and side views of the first and second cam element **31**, **41**, which are unitary with the pin **20**;

FIG.s 7a and **7b** are respectively sectional perspective and side views of the door closer **1** in the open door position, wherein the discharging port **72** and the third passing through hole **32'''** are reciprocally uncoupled (the first and second springs **39**, **47** have not been shown for sake of better intelligibility);

FIG.s 8a and **8b** are respectively sectional perspective and side views of the door closer **1** in a position proximate to the closed door position,

wherein the discharging port **72** and the third passing through hole **32'''** are reciprocally coupled to selectively put into fluidic communication the channel **71** with the first variable volume compartment **51**, so as to impart a latch action to the door towards the closed position (the first and second springs **39**, **47** have not been shown for sake of better intelligibility);

FIG.s 9a and **9b** are respectively sectional perspective and side views of the door closer **1** in the closed door position (the first and second springs **39**, **47** have not been shown for sake of better intelligibility).

Detailed description of a preferred embodiment

Referring to the above mentioned figures, the door closer **1** is advantageously applicable to doors, in particular glass doors, which may be supported by a stationary support structure, for example the floor.

In the figures both the door and the stationary support structure, which are not part of the present invention, have not shown because they are known *per se*.

Preferably, as particularly visible in FIG. 1, the door closer **1** may include a plate **2**, which may be anchored to the stationary support structure, e.g. the floor, by suitable fastener **3**.

In this manner, it will be possible to install the door closer **1** easily and smoothly, avoiding for instance the expensive and difficult break-in works which are necessary with the known solutions.

Apparently, the door closer **1** may be equivalently anchored to the support frame of the door.

The door closer **1** may be used individually, with a simple hinge on the other end of the door, or in a combination of two or more of door closers **1**.

In particular, the door closer **1** will comprise a box-like body **10** rotatably coupled to a pin **20**, in such a manner to rotate about a first longitudinal axis **X**, which may be substantially vertical.

In the embodiment shown in the appended figures, the box-like body **10** is anchored to the door to define the movable element of the door closer **1**, whereas the pin **20** is anchored to the floor **S** through the plate **2** to define the fix element thereof.

It is understood that, equivalently, the pin **20** may be anchored to the

door to define the movable element and the box-like body **10** may be anchored to the stationary support structure **S** to define the fix one without departing from the scope pf protection of the invention defined by the appended claims.

The pin **20**, which may have elongated shape to define the axis **X**, may include a first anchoring portion **21** suitable to the anchoring of the pin **20** to the plate **2** and a second working portion **22**, the function of which will be better explainer hereinafter. The first and the second portion may be monolithic, as they are both part of the same pin **20**.

In this manner an user, upon the opening of the door, will cause the reciprocal rotation of the box-like body **3** and of the pin **5** around the axis **X**.

In order to ensure the automatic closing of the door once opened, closing means may be provided, generally indicated with **30**, acting on the movable element of the door closer **1** to automatically return the doorto the closed position.

Braking means, generally indicated with **40**, acting on the closing means **30** to counteract the action thereof, may be further provided.

As particularly visible in FIG. 2, the closing means **30** may comprise a first cam element **31** interacting with a first plunger element **32**, whereas the braking means **40** may include a second cam element **41** interacting with a second plunger element **42**.

As used herein, the term “cam” means a mechanical part, having any configuration, suitable to change a circular motion into a rectilinear motion.

Both the first and second cam elements **31**, **41** may be unitary with the pin **20**, in such a manner to unitary rotate therewith. In particular, the first and second cam elements **31**, **41** may define the working portion **22** of the pin **20**.

On the other hand, the first and second plunger elements **32**, **42** may be movable within the box-like body **10**.

In a preferred but non-exclusive embodiment, both the plunger elements **32**, **42** may be slidably movable in a single operating chamber **50**, which defines a second longitudinal axis **Y** substantially perpendicular to the first axis **X**.

Suitably, the operating chamber **50** may house also the first and second cam elements **31**, **41**. Appropriately, the operating chamber **50** may be

cylindrical.

In particular, the first plunger element **32** may slidably move along the second axis **Y** between a first compressed end position, corresponding to the open door position, and a first extended end position, corresponding to the closed door position.

On the other hand, the second plunger element **42** may slidably move along the second axis **Y** between a second compressed end position, corresponding to the closed door position, and a second extended end position, corresponding to the open door position.

Advantageously, the pin **20**, or equivalently the longitudinal axis **X**, or equivalently the first and second cam elements **31**, **41**, may be interposed between the first and second plunger elements **32**, **42**.

Suitably, in the preferred, non-exclusive embodiment shown in the appended figures, the first and second plunger elements **32**, **42** may be reciprocally opposite with respect to a plane **π** passing through the first longitudinal axis **X** and perpendicular to the second longitudinal axis **Y**.

Advantageously, the first and second plunger elements **32**, **42** may be reciprocally faced in the operating chamber **50**.

Appropriately, the box-like body **10** may have an elongated shape along the axis **Y**. In other words, the box-like body **10** may develop mainly in length along the axis **Y**, with the length dimension higher than the other two dimensions.

In a preferred but non-exclusive embodiment of the invention, the first plunger element **32** may comprise a couple of first pushing heads **33**, **33'** interacting with a corresponding couple of substantially first countershaped seats **34**, **34'** of the first cam element **31**, whereas the second plunger element **42** may include a second pushing head **43** interacting with a second substantially countershaped seat **44** of the second cam element **41**.

Advantageously, both the first pushing heads **33**, **33'** and the second one **43** may have a generally plate-like shape to define respective first planes **π'**, **π''** and a second plane **π'''**.

Thanks to the above features, the bulk of the body, in particular the vertical one, will be extremely minimized, and the aesthetic appeal greatly increased.

Suitably, the second plane **π'''** defined by the second pushing head **43** may lay between the first planes **π'**, **π''** defined by the first pushing heads **33**, **33'**.

As particularly shown in FIG. 3, the pushing heads **33**, **33'** and **43** may include respective couples of substantially flat upper and lower walls, respectively indicated with **35** and **35'**; **36** and **36'**, **45** and **45'**.

On the other hand, the countershaped seats **34**, **34'** and **44** may comprise respective couples of substantially flat upper and lower walls, respectively indicated with **37** and **37'**; **38** and **38'**, **46** and **46'**.

The upper and lower walls **35** and **35'**; **36** and **36'** of the pushing heads **33**, **33'** may respectively face the corresponding upper and lower walls **37** and **37'**; **38** and **38'** of the countershaped seats **34**, **34'**, whereas the upper and lower walls **45** and **45'** of the pushing head **43** may face the corresponding upper and lower walls **46** and **46'** of the countershaped seat **44**.

In a preferred but-non exclusive embodiment of the invention, all the planes **π'**, **π''** and **π'''** may be substantially perpendicular to the first axis **X** and preferably reciprocally parallel.

Suitably, the upper and lower walls **35** and **35'**; **36** and **36'**, **45** and **45'**, **37** and **37'**; **38** and **38'**, **46** and **46'** may be all substantially parallel to the second axis **Y**.

It is however understood that the pushing heads **33**, **33'** and **43** may have any shape, as long as substantially plate-like, without departing from the scope of protection of the invention defined by the appended claims. For instance, the pushing heads **33**, **33'** and **43** may be substantially wedge-shaped, with converging upper and lower walls.

Appropriately, the first pushing heads **33**, **33'** may comprise respective first flat front faces **35''** and **36''**, whereas the second pushing head **43** may comprise a second flat front face **45''**.

The front faces **35''**, **36''** and **45''** may be all substantially parallel each other and to the first longitudinal axis **X**.

The first countershaped seats **34**, **34'** may include respective first substantially flat contact surfaces **37''**, **38''**, whereas the second countershaped seat **44** may include a second substantially flat contact surface **46''**.

The first contact surfaces **37''**, **38''** may be reciprocally parallel each other, and in particular they may be co-planar, i.e. they may lay on the same plane. On the other hand, the first contact surfaces **37''**, **38''** may be perpendicular to the second countershaped seat **44**.

The front faces **35''**, **36''** and **45''** may respectively be in contact engage with the contact surfaces **37''**, **38''** and **46''**.

As already pointed out above, the cam elements **31**, **41** are unitary with the pin **20**, in such a manner that they can rotate therewith about the vertical axis **X**. Therefore, also the contact surfaces **37''**, **38''** and **46''** of the coutershaped seats **34**, **34'** and **44** will rotate about the axis **X** unitary with the pin **20**.

the first front faces **35''**, **36''** and the first contact surfaces **37''**, **38''** will be substantially parallel to each other in the closed door position and substantially perpendicular to each other in the open door position, whereas the second front face **45''** and the second contact surface **46''** will be substantially perpendicular to each other in the closed door position and substantially parallel to each other in the open door position.

To promote the pushing of the heads **33**, **33'** of the first plunger element **32** against the countershaped seats **34**, **34'** of the first cam element **31**, that is to promote the interaction between the first front faces **35''**, **36''** and the first contact surfaces **37''**, **38''**, first counteracting elastic means may be provided, which may comprise, respectively consist of, a first spring **39**, acting on the first plunger element **32**.

On the other hand, to promote the pushing of the head **43** of the second plunger element **42** against the countershaped seat **44** of the second cam element **41**, that is to promote the interaction between the second front face **45''** and the second contact surfaces **46''**, second counteracting elastic means may be provided, which may comprise, respectively consist of, a second spring **47**, acting on the first second element **42**.

Advantageously, the first contact surfaces **37''**, **38''** of the first cam element **31** may be designed according to the teachings of the International Patent Application n° WO2007125524, in the name of the same Applicant.

In particular, the first contact surfaces **37''**, **38''** of the first cam element **31** may be offset with respect to the axis **X** of a predetermined distance, such

as the first front faces **35''**, **36''** of the first plunger element **32** in its extended end position is positioned beyond said axis **X**.

Suitably, the surfaces **37''**, **38''** may have a distance from the axis **X** which may be comprised between 1 mm and 6 mm, preferably comprised between 1 and 3 mm and even more preferably close to 2 mm.

Thanks to such feature, the closing movement of the door closer will be completely automatic. In other words, the plunger element **32** will start to work after few rotation degrees, starting from the open position.

In a preferred, not-exclusive embodiment of the invention, the operating chamber **50** may be filled with a predetermined quantity of a working fluid, usually oil.

The first plunger element **32** may comprise a substantially cylindrical first back portion **32'** and a first front portion **32''** which include the first pushing heads **33**, **33'**, whereas the second plunger element **42** may comprise a substantially cylindrical second back portion **42'** and a second front portion **42''** including the second pushing head **43**.

Appropriately, the first and second back portions **32'**, **42'** may be designed to separate the operating chamber **50** into a first, a second and a third adjacent variable volume compartments in reciprocal fluidic communication, respectively indicated **51**, **52** and **53**.

The three compartments **51**, **52** and **53** may be designed in such a manner that the second compartment **52** is interposed between the first and third compartments **51**, **53**. In this manner, the fluidic communication between the first and third compartments **51**, **53** will necessarily involves the passage of the working fluid trough the second compartment **52**.

Appropriately, the first variable volume compartment **51** houses the first counteracting elastic means **39**, the third variable volume compartment **53** houses the second counteracting elastic means **47** and the second variable volume compartment **52** houses both the first and second cam elements **31**, **41**.

Suitably, the first and third compartments **51**, **53** may be designed to have in correspondence of the closed door position respectively the maximum and minimum volume, whereas in correspondence of the open door position respectively the minimum and maximum volume.

In a preferred but non-exclusive embodiment of the invention, the operating chamber **50** comprises control means, generally indicated with **60**, to control the flow of the working fluid, in such a manner to allow the flow thereof from the first compartment **51** to the third compartment **53** through the second compartment **52** upon the opening of the door and to allow the backflow thereof from the third compartment **53** to the first compartment **51** through the second compartment **52** upon the closing of the door **D**.

Advantageously, the control means **60** may comprise a first hole **61** passing through the first plunger element **32**, preferably in correspondence of the first front portion **32''** thereof, so as to put into fluidic communication the first compartment **51** and the second compartment **52**, and a second hole **62** passing through the second plunger element **42**, preferably in correspondence of the first front portion **42''** thereof, so as to put into fluidic communication the third compartment **53** and the second compartment **52**.

Furthermore, the control means **60** may comprise a first check valve **63** interacting with the first passing through hole **61** and a second check valve **64** interacting with the second passing through hole **62**.

The first and second check valves **63**, **64** reciprocally cooperates so as to allow the flow of the working fluid from the first compartment **51** to the second compartment **52** through the first passing through hole **61** and from the second compartment **52** to the third compartment **53** through the second passing through hole **62** upon the opening of the door **D**, and to prevent the backflow thereof upon the closing of the same door **D**.

With this purpose the check valves **63**, **64** interacting with the passing through holes **61**, **62** may be of the butterfly type, with the butterflies **65**, **65'** housed in the compartments **66**, **66'** in correspondence with the inlet of the passing through holes **61**, **62**.

This way, when the door is opened, that is when it passes from the closed door position to the open one, the decreasing of volume of the first compartment **51**, i.e. the pressure of the working fluid in the compartment, will causes the butterfly element **65** axially slide in the compartment **66**, in such a manner that the working fluid is free to flow through the hole **61** towards the second compartment **52**.

At the same time the pressure of the working fluid in the second

compartment **52** will causes the butterfly element **65'** axially slide in the compartment **66'**, in such a manner that the working fluid is free to flow through the hole **62** towards the third compartment **53**.

Vice versa, when the door is closed, that is when it passes from the open position to the closed one, the butterfly elements **65**, **65'** will axially slide in the direction opposite to the opening one and will close, thus preventing the backflow of the working fluid through the holes **61**, **62**.

In order to allow the controlled backflow of the working fluid, the control means **60** may further comprise an hydraulic circuit, generally indicated with **70**, internal to the box-like body **10**.

Advantageously, the hydraulic circuit **70** may comprise a channel **71** in fluidic communication with the operating chamber **50** to allow the controlled backflow of the working fluid from the third compartment **53** to the first compartment **51** through said second compartment **52** upon the closing of the door **D**.

Suitably, the channel **71** may comprise an inlet port **72**, particularly visible in FIG. 3b, and at least one first outlet port **73**. Preferably, the channel **71** may comprise a second outlet port **74**, the function of which is better explained below.

The inlet port **72** may put into fluidic communication the second compartment **52** and the channel **71**, while the first outlet port **73** may put into fluidic communication the channel **71** and the first compartment **51**.

Appropriately, the second plunger element **42** may be inserted into the operating chamber **50** with a predetermined clearance, in such a manner that the cylindrical outer surface of the back portion **42'** thereof will define a interspace **75**, preferably substantially tubular, with the side wall of the operating chamber **50**. The interspace **75** may be suitable to put into a mutual fluidic communication the third and second variable volume compartments **53**, **52**.

In this manner, when the door is closed, that is when it passes from the open door position to the closed one, the decreasing of volume of the third compartment **53**, i.e. the pressure of the working fluid in the compartment, will causes the flowing of the working fluid through the interspace **75**, in such a manner to flow towards the second compartment **52**.

At the same time the pressure of the working fluid in the second compartment **52** will causes the flowing of the working fluid through the inlet port **72**, the channel **71** and the first outlet port **73**, until the first compartment **51**.

Thanks to the above features, it will be possible to control the rotation of the doorfrom the open to the closed position and vice versa. More generally, the door closer according to the invention ensures a controlled movement of the door upon the opening as well as upon the closing thereof.

In fact, upon the opening, the controlled movement will prevent the door from suddenly opening, so as to protect both the door itself and a possible user who is in the corresponding action area. Further, upon the closing, the controlled movement will allow to prevent the said doorfrom strongly impact with the frame.

Thanks to such features, the door closer according to the invention will be extremely safe and practical for a user.

The door closer according to the invention will be greatly safe also because the reciprocal rotating movement of the fix and of the movable element is free upon its closing. In fact, upon the closing phase, the oil will flow from the third compartment **53** to the second one **52** and then to the first one **51** independently from the reciprocal rotation speed of the fix and movable elements.

In this manner, a user will be free to close the door with any speed without any danger to break the door closer or the door.

In order to adjust the rotation speed of the door from the open to the closed position, the channel **71** may include first suitable adjusting means.

Advantageously, the first adjusting means may comprise a first screw **81** passing through the box-like body **10** and interacting with the first outlet port channel **73** to obstruct the passing section of the working fluid therein.

In this manner, it is possible to adjust the passing section of the first outlet port **73**, i.e. adjusting the volume of working fluid which passes through it, thus adjusting the closing speed of the door.

Suitably, the first back portion **32''** of the first plunger element **32** may comprise a third passing through hole **32'''**, slidable unitary therewith along the second longitudinal axis **Y**.

Advantageously, the second outlet port **74** of the channel **71** and the third passing through hole **32'''** are susceptible to be reciprocally uncoupled when the first plunger element **32**, during its sliding along the axis **Y**, is in proximity of the compressed end position and reciprocally coupled when the same first plunger element **32** is in proximity of the extended end position.

In the last position, the coupling between the second outlet port **74** and the third passing through hole **32'''** will selectively put into fluidic communication the channel **71** and the first variable volume compartment **51**, so as to impart a latch action to the door towards the closed position.

Appropriately, in order to adjust the above latch action, i.e. the force by which the door accelerates towards the closed position, the channel **71** may include second suitable adjusting means.

Advantageously, the second adjusting means may comprise a second screw **82** passing through the box-like body **10** and interacting with the second outlet port **74** to obstruct the passing section of the working fluid therein.

In this manner, it is possible to adjust the passing section of the second outlet port **74**, i.e. adjusting the volume of working fluid which passes through it, thus adjusting the latch action of the door towards the closed position.

Suitably, the first outlet port **73** may be located downstream of the second outlet port **74** along the channel **71**.

Advantageously, the first outlet port **73** may be located sufficiently far from the second outlet port **74**, in such a manner that the back portion **32'** of the first plunger element **32** will not obstruct the passage of the working fluid through it during its sliding along the axis **Y**.

From the above description, it is evident that the door closer according to the invention fulfils the intended objects.

The door closer according to the invention is susceptible to many changes and variants, all falling within the inventive concept expressed in the annexed claims. All particulars may be replaced by other technically equivalent elements, and the materials may be different according to the needs, without departing from the scope of of the invention.

Although the door closer has been particularly described referring to the annexed figures, the reference numbers used in the description and claims

are used to improve the intelligence of the invention and do not constitute any limit to the claimed scope.

2011298854 24 Jan 2017

Claims:

1. A system for closing a glass door which is supported by a floor, the door being movable between an open position and a closed position, the system comprising:

- a hydraulic door closing hinge;
- a mounting plate configured to be anchored on the floor;

wherein the hydraulic door closing hinge comprises:

- a box-like body anchorable to the glass door;
- a pin defining a first longitudinal axis anchorable to the mounting plate, said pin and said box-like body being rotatably coupled, such that said box-like body is rotatable around said first axis between the open position and the closed position;
- closing means for automatic return of the door from the open position to the closed position, said closing means comprising a first cam element interacting with a first plunger element, the first plunger element being movable within said box-like body between a first compressed position corresponding to the open position and a first extended position corresponding to the closed position;
- braking means adapted to counteract the closing means, said braking means comprising a second cam element interacting with a second plunger element, the second plunger element being movable within said box-like body between a second compressed position, corresponding to the closed position and a second extended position, corresponding to the open position;

wherein said first plunger element comprises at least one first pushing head interacting with said first cam element, said second plunger element including at least one second pushing head interacting with said second cam element, said closing means including a first spring biasing said first pushing head toward said first cam element, said braking means including a second spring biasing said second pushing head toward said second cam element;

wherein said box-like body includes a chamber containing a working fluid, said

2011298854 24 Jan 2017

chamber extending along a second axis substantially perpendicular to said first axis, said first and second plunger elements being both slidably movable within said chamber, both the first and second cam elements being unitary with the pin, the pin being located between said first and second plunger elements;

further wherein said first plunger element comprises a substantially cylindrical first trailing portion and a first leading portion including said at least one first pushing head, said second plunger element comprising a substantially cylindrical second trailing portion and a second leading portion which includes said at least one second pushing head, said first and second trailing portions separating said chamber into first, second and third adjacent variable volume compartments in reciprocal fluid communication.

2. The system according to claim 1, wherein said first cam element includes at least one first seat, said at least one first pushing head comprising a first pushing head front portion, said at least one first seat comprising a first contact surface, said first pushing head front portion being in engagement with said first contact surface.

3. The system according to claim 2, wherein said first pushing head front portion includes a first substantially flat pushing surface extending substantially parallel to said first axis, said first contact surface being substantially flat and extending parallel to said first longitudinal axis.

4. The system according to claim 3, wherein said first substantially flat pushing surface and said first contact surface are substantially parallel to each other in said closed position and substantially perpendicular to each other in said open position.

5. The system according to any one of claims 1 to 4, wherein said at least one first pushing head has a generally plate-like shape extending substantially perpendicular to said first axis, said first cam element being countershaped with respect to said at least one first pushing head.

6. The system according to any one of claims 1 to 5, wherein said first and third variable volume compartments are designed to have in correspondence of said closed door position respectively the maximum and minimum volume and in correspondence

2011298854 24 Jan 2017

of said open door position respectively the minimum and maximum volume, said first spring being located in said first compartment, said second spring being located in said third compartment, both said first and second cam elements being located in said second compartment.

7. The system according to claim 6, wherein said chamber comprises control means for controlling the flow of the working fluid designed to allow the flow thereof from said first compartment to said third compartment through said second compartment upon the opening of the door and to allow the backflow thereof from said third compartment to said first compartment through said second compartment upon the closing of the door.

8. The system according to claim 7, wherein said control means comprise a first hole passing through said first plunger element so as to put into fluid communication said first compartment and said second compartment, said control means further comprising a first check valve interacting with said first passing through hole, said first check valve to selectively opens upon the opening of the door to allow the flow of the working fluid from said first compartment to said second compartment through said first passing through hole and to selectively closes upon the closing of the door to prevent the backflow of the working fluid through said first passing through hole, said control means further comprising an hydraulic circuit within said box-like body to allow the backflow of the working fluid upon the closing of the door.

DIANORA GOSIO

By Patent Attorneys for the Applicant

COTTERS

Patent & Trade Mark Attorneys

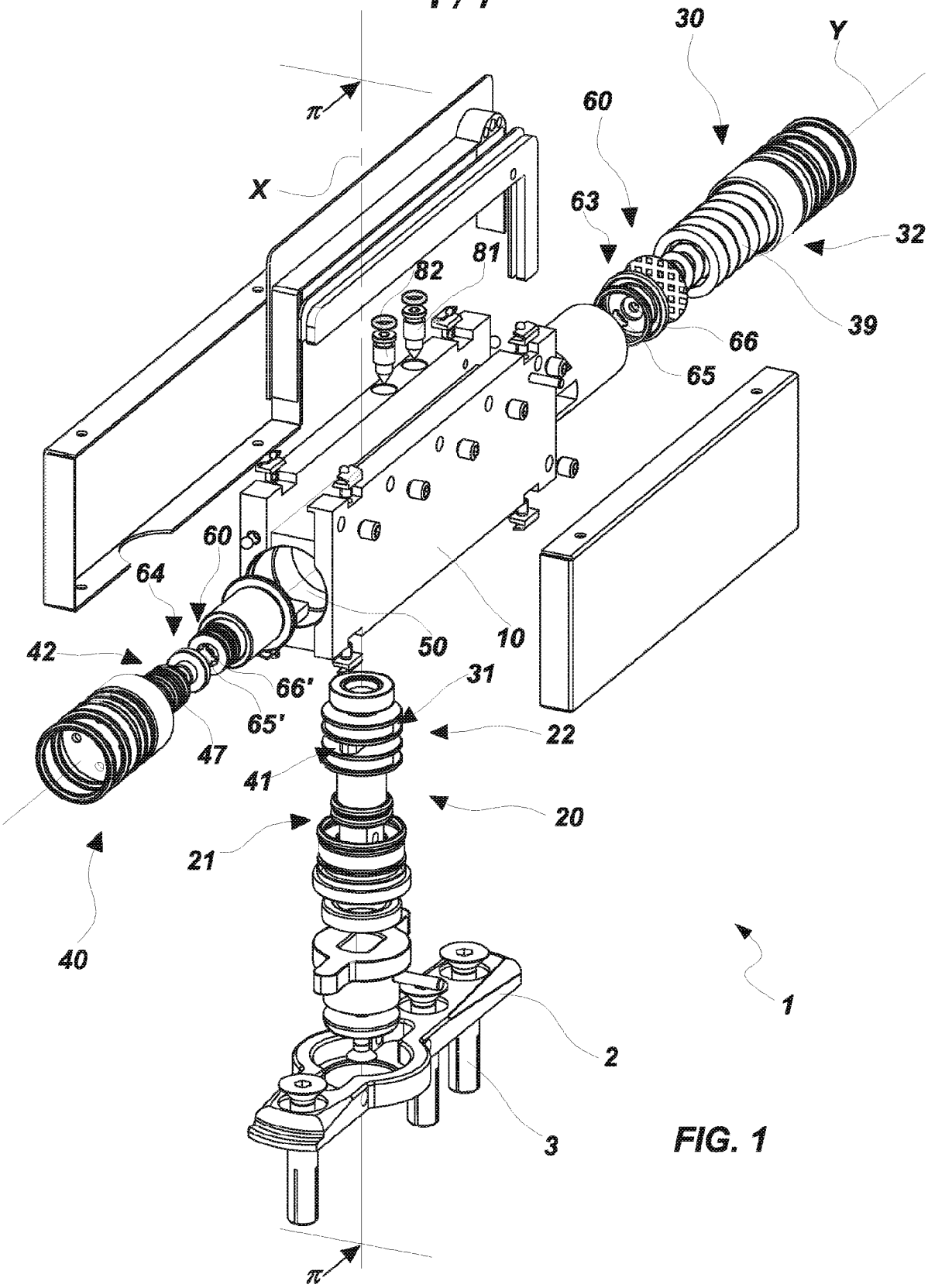
π
X
30
Y
60
63
32
81
82
39
66
65
60
64
42
50
10
66'
31
65'
22
47
41
20
21
40
1
2
3
π

FIG. 1

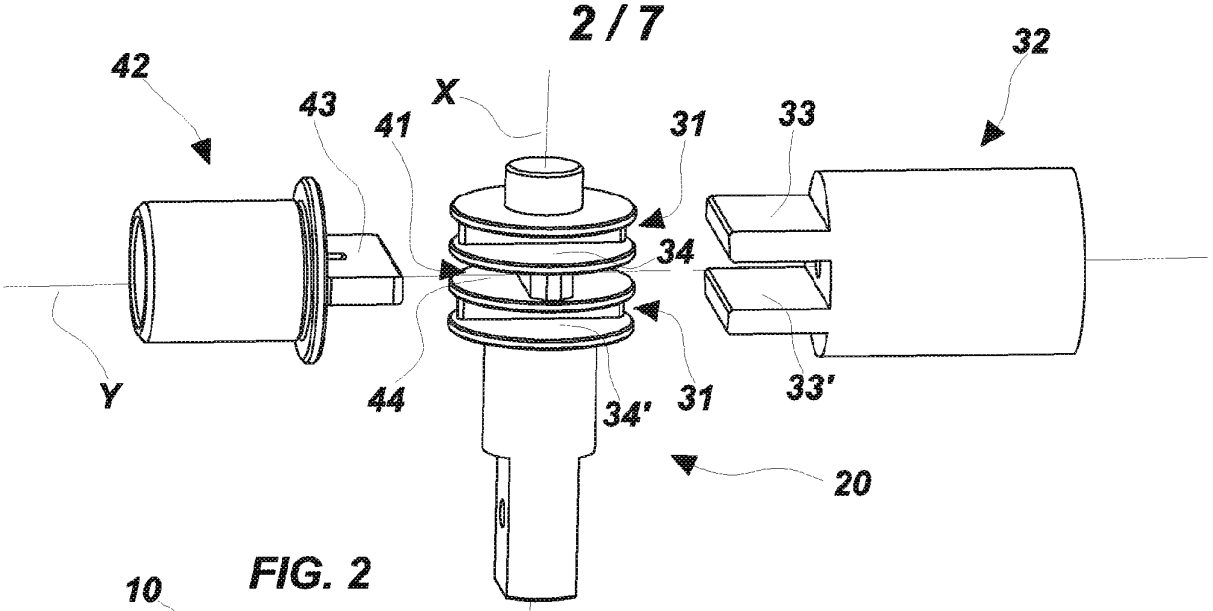

FIG. 2

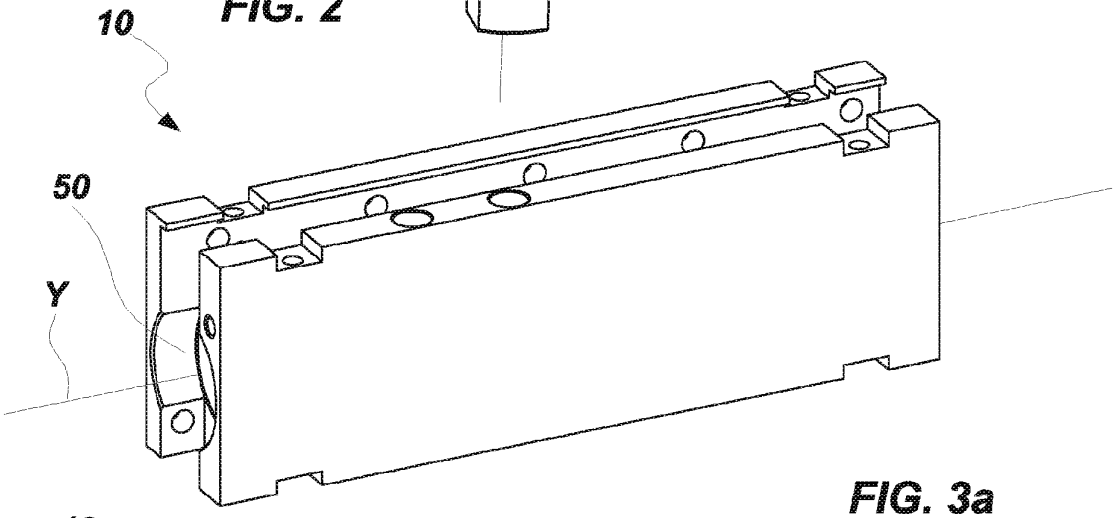

FIG. 3a

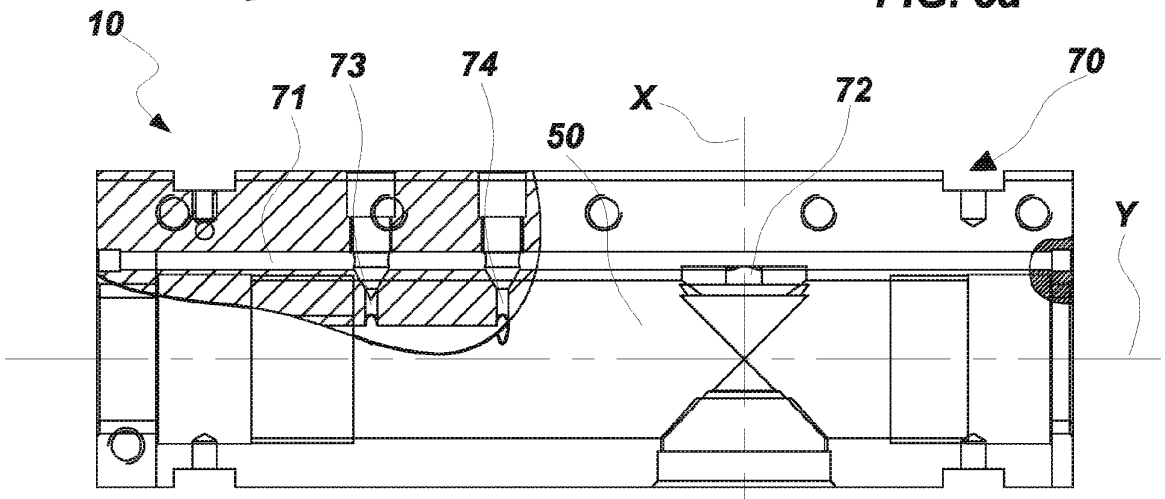

FIG. 3b

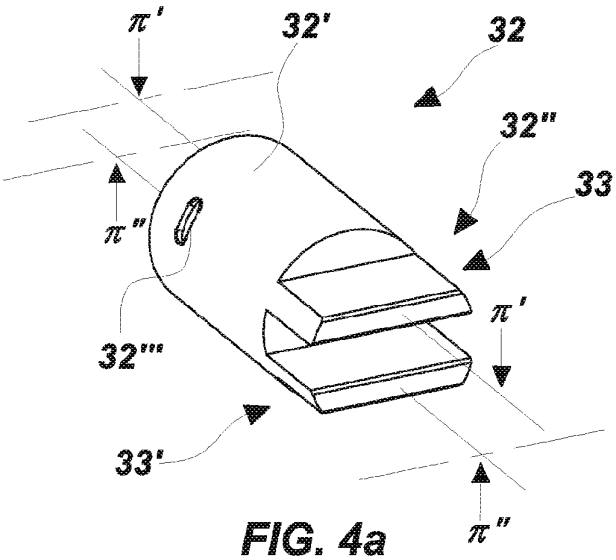

FIG. 4a

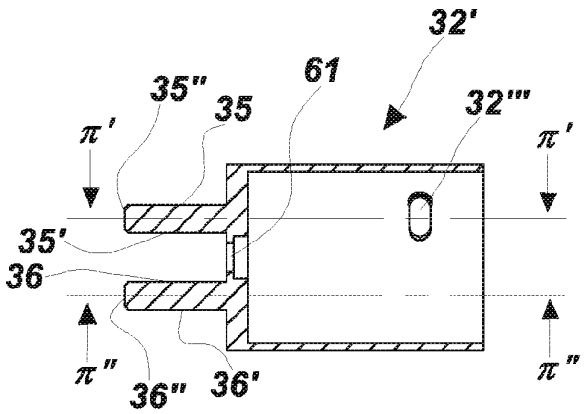

FIG. 4b

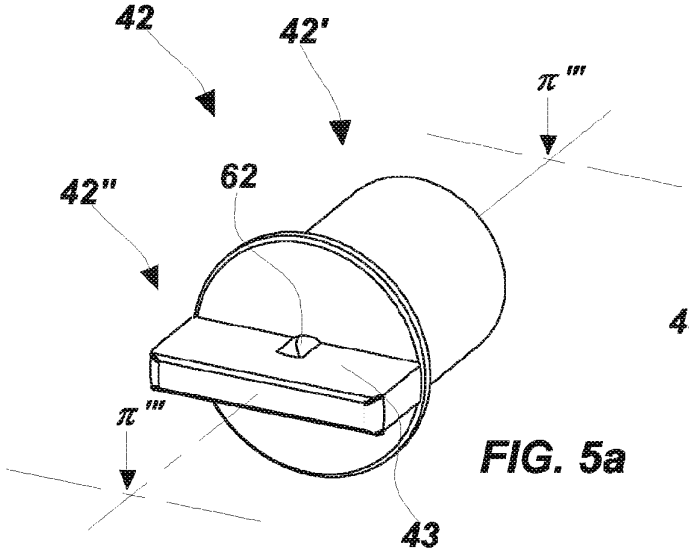

FIG. 5a

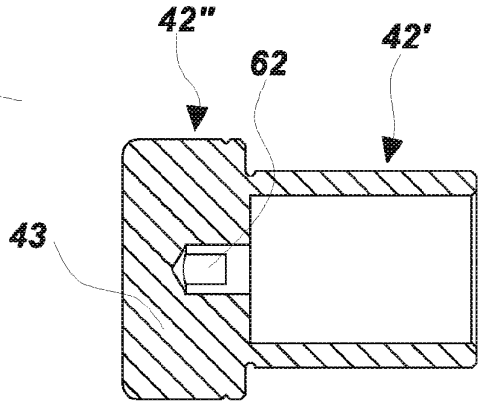

FIG. 5b

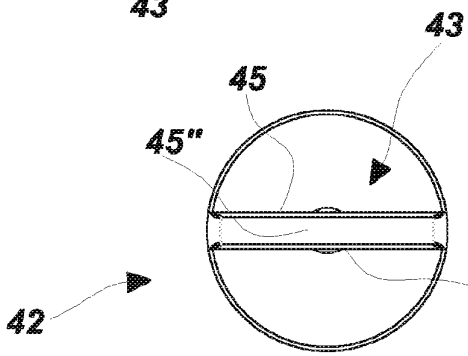

FIG. 5c

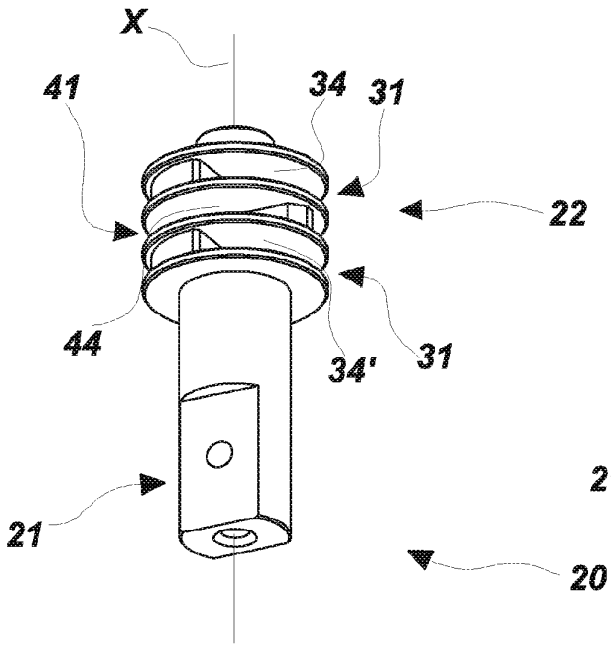

FIG. 6a

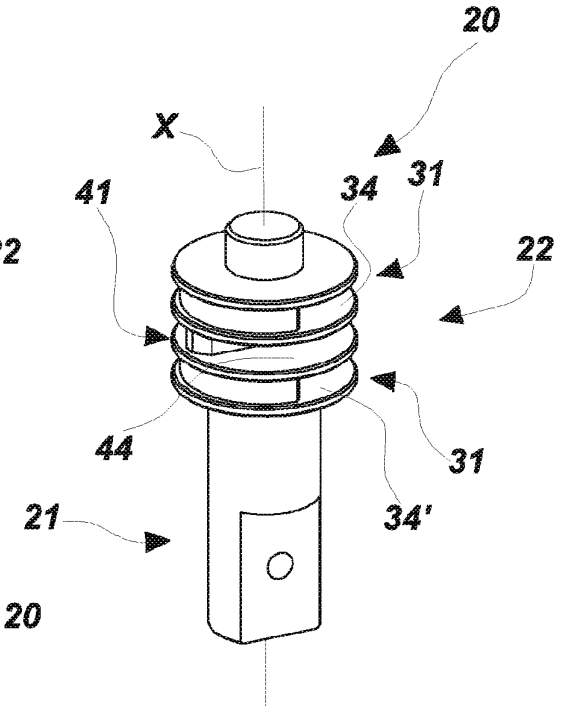

FIG. 6b

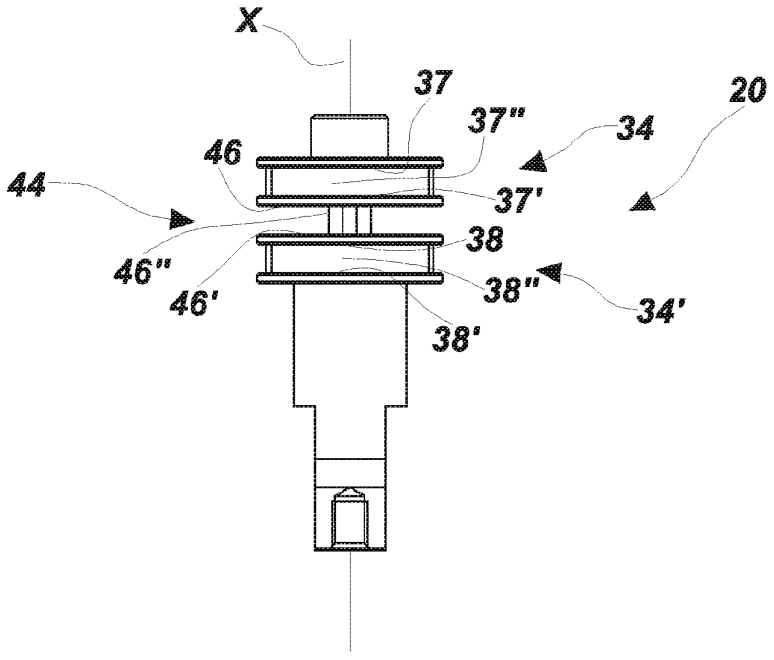

FIG. 6c

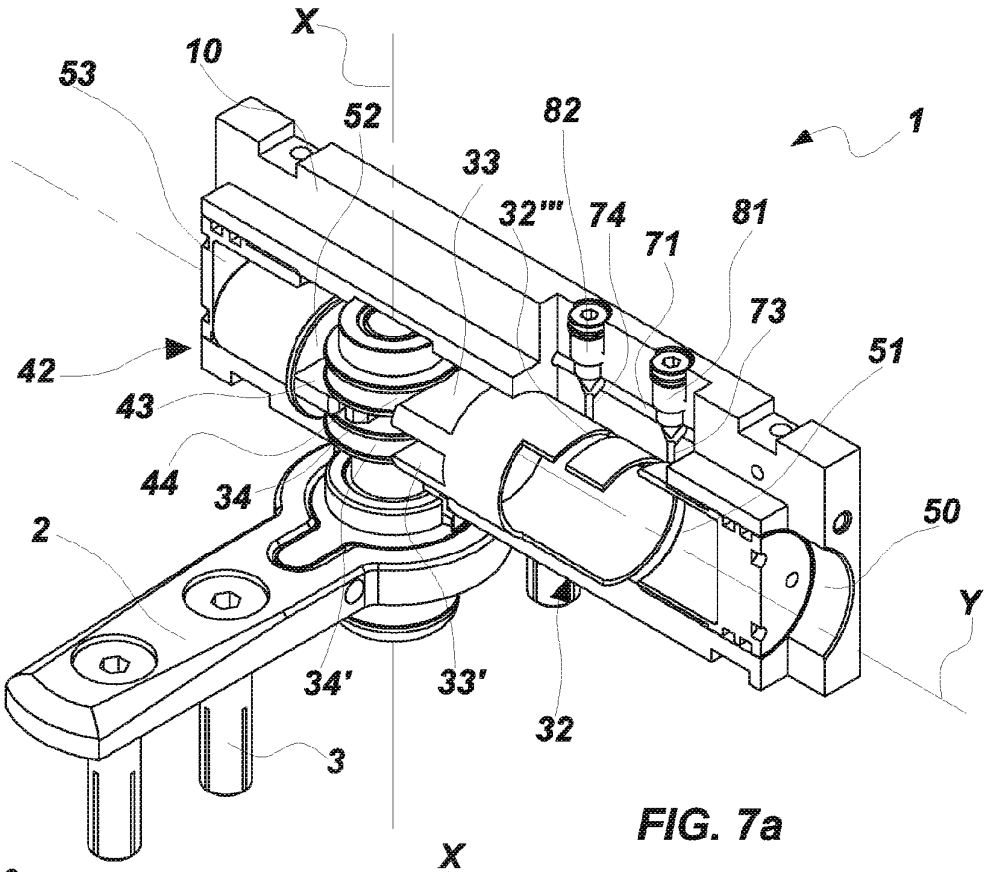
X
10
53
52
82
1
33
32'''
74
71
81
73
51
42
43
44
34
2
50
Y
34'
33'
32
3

FIG. 7a

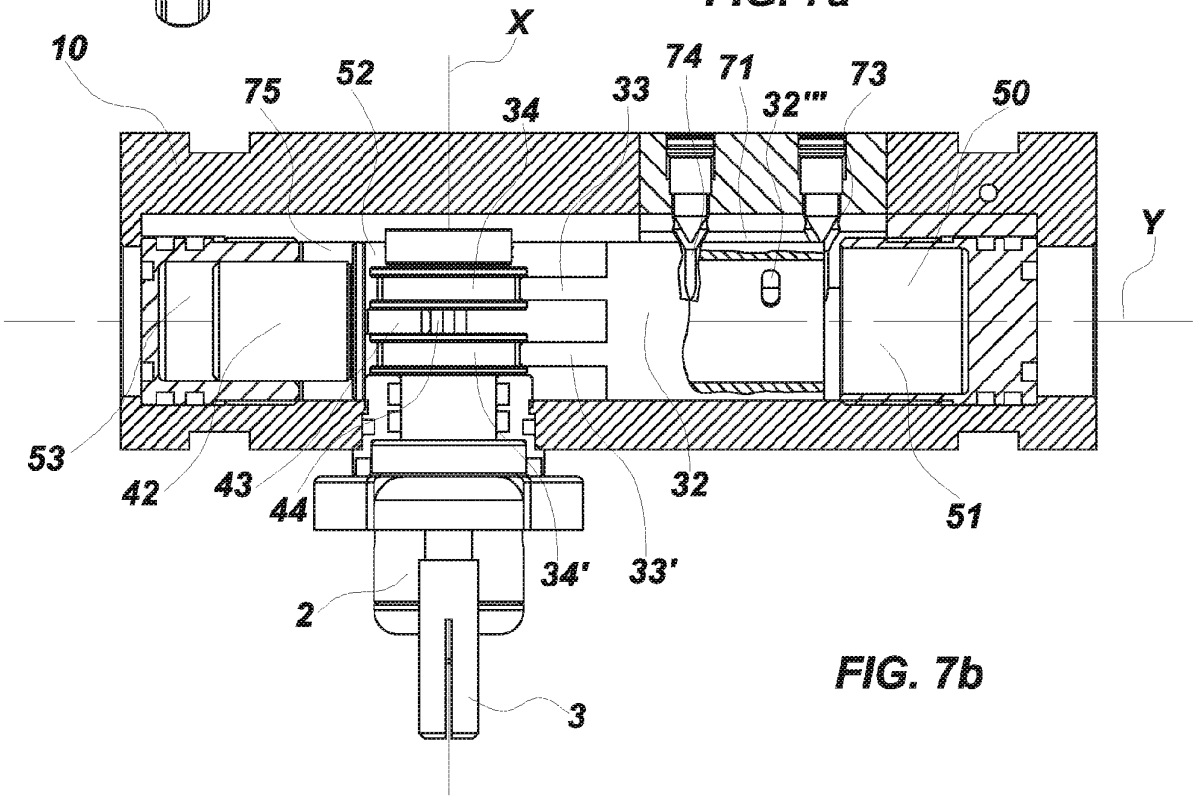
X
10
75
52
34
33
74
71
32'''
73
50
Y
53
42
43
44
32
51
34'
33'
2
3

FIG. 7b

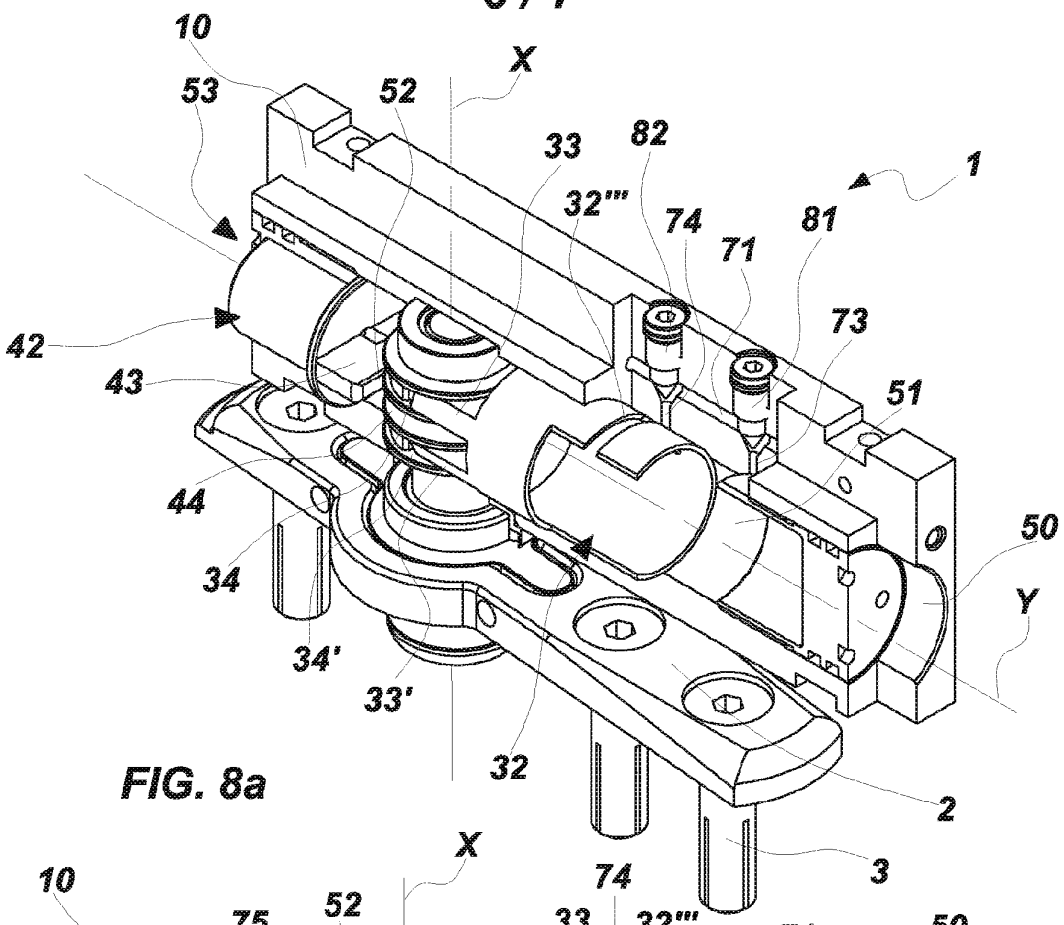
10
X
53
52
33
82
1
32""
74
81
71
42
73
43
51
44
50
34
Y
34'
33'
32
2
3

FIG. 8a

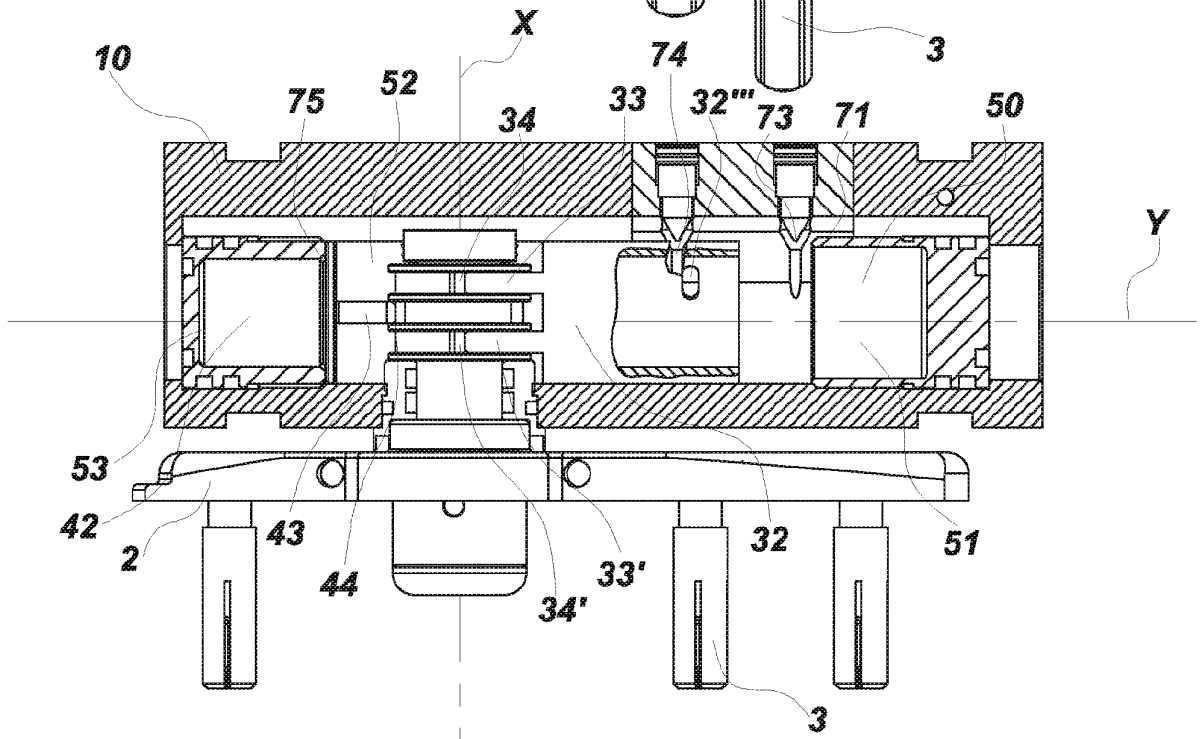
X
10
74
75
52
34
33
32""
73
71
50
Y
53
42
2
43
44
33'
34'
32
51
3

FIG. 8b

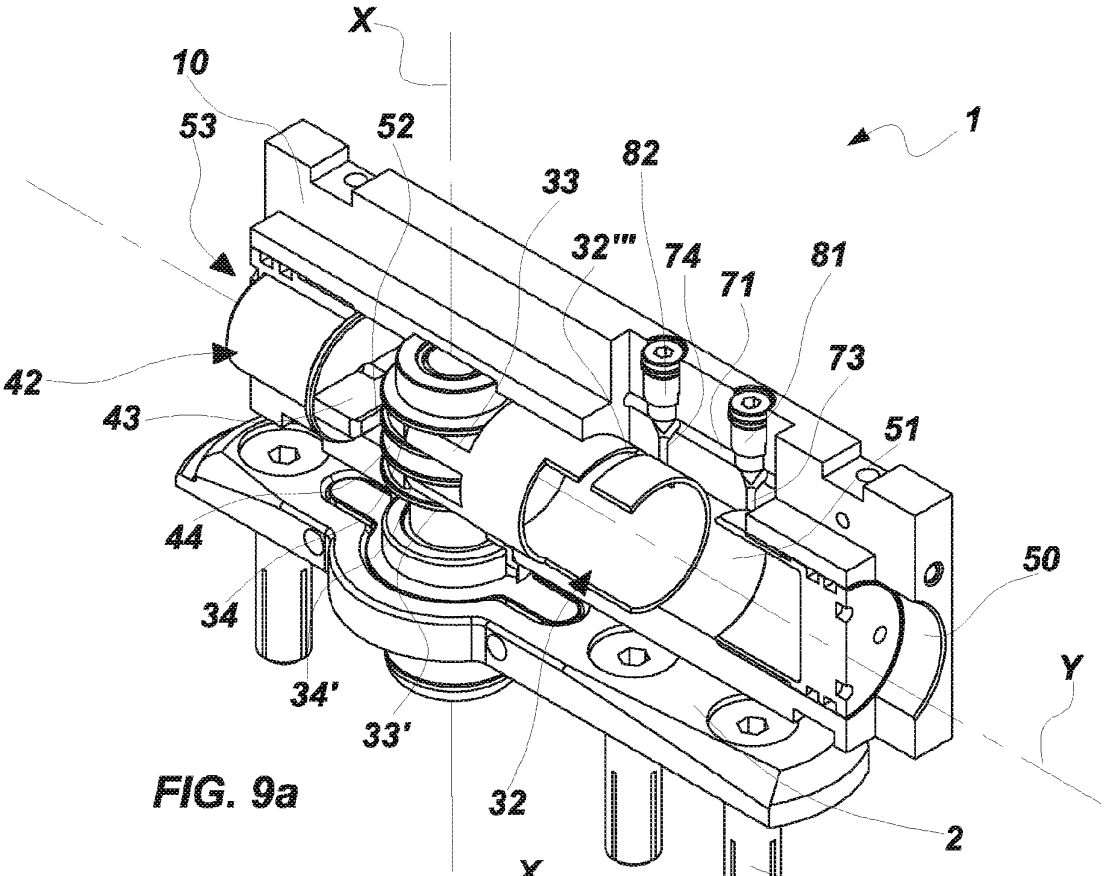
X
10
53
52
82
1
33
32'''
74
71
81
42
73
43
51
44
50
34
Y
34'
33'
32
2
3

FIG. 9a

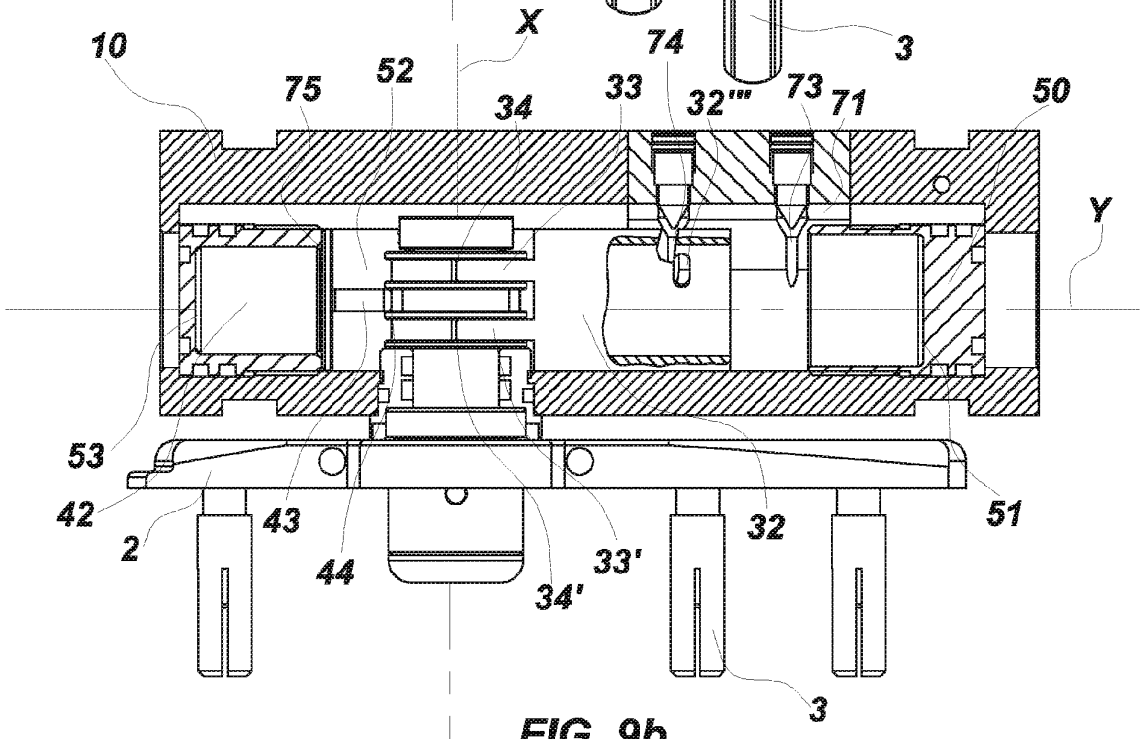
X
10
74
75
52
34
33
32'''
73
71
50
Y
53
42
2
43
44
34'
33'
32
51
3

FIG. 9b