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(54) OPERATOR FOR MOTORIZED SWING DOORS

(57) An operator (1) for motorizing the opening and closing of a door panel (2) of a swing door by rotation about a door rotation axis, Zd, is disclosed. An operator hinge (1 h) defines an operator rotation axis, Zo, and allows rotation about the operator rotation axis, Zo, of an elongated component with respect to a post fixing bracket (121). The post fixing bracket comprises a fixing end for fixing to a static post (3) and a hinge end coupled to the operator hinge. The elongated component comprises a motor (1m); a geared transmission comprising gears (1g) and being coupled to the motor; a worm screw (1w) coupled to the motor via the geared transmission for driving a rotation of the worm screw. A housing (1c) covers at least the geared transmission and motor. A panel fixing bracket (131) has a fixing end for fixing the panel fixing bracket to the door panel and a nut end engaged in the worm screw, such that the rotation of the worm screw with respect to the nut end about the longitudinal axis, Xs, drives the translation of the nut end along the longitudinal axis, Xs. The housing has a one-way valve (Iv) which is naturally closed and can be opened by coupling a dispensing tube (50d) to the one-way valve, bringing the dispensing tube in fluid communication with the gears of the geared transmission. A motorized swing door, a kit of parts and use of a one way valve (1v) for lubricating the gear (1g) of the operator are also disclosed.

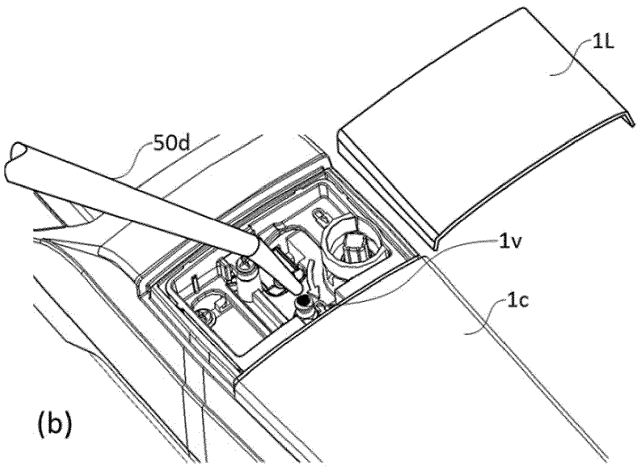

FIG.4

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Description

TECHNICAL FIELD

[0001] The present invention concerns operators for motorizing the opening and closing of a panel of a swing door or gate by swinging the panel about a door rotation axis, Zd. The present invention proposes an enhanced operator requiring less to no periodic services by a specialized technician. In particular, the operators of the present invention substantially simplify the periodic lubrication of the operator's geared transmission to a point that the end-user can do it itself.

BACKGROUND OF THE INVENTION

[0002] Motorized swing doors or gates (both terms being used herein as equivalents) comprising a shutter swinging open and closed about a door rotation axis, Zd, are commonly used to shut off openings, both industrial such as in warehouses, supermarkets, or in industrial halls, and private, such as the entrance gates to a garage or garden, and the like. These shutters must be at least partially rigid and generally comprise a solid panel or a gate with a relatively rigid frame, enclosing a less rigid structure such as a mesh, bars, fabric, and the like. The term "panel" is used herein to encompass any kind of shutter suitable for use in a swing door.

[0003] One type of motorized swing doors uses an operator as illustrated in Figures 1 and 2, comprising a motor (1m) and a geared transmission suitable for rotating a worm screw (1ws) about a longitudinal axis, Xs. One end of the operator comprises a post fixing bracket (121) fixed to a static post (3) defining one edge of the opening to be closed, such as to be able to rotate about an operator rotation axis, Zo, parallel to and offset from the door rotation axis, Zd, by means of an operator hinge (1h). An opposite end of the operator comprises a translating fixing bracket (131) comprising a fixing end fixed to the panel (2), and a nut end comprising a thread engaged in the worm screw, such that the rotation of the worm screw with respect to the nut end about the longitudinal axis, Xs, drives the translation of the nut end along said longitudinal axis, Xs. As illustrated in Figure 1(a), the translation of the nut end along the worm screw drives the swinging of the panel about the door rotation axis, Zd, often defined by panel hinges (2h), thus controlling the opening and closing of the swing door.

[0004] The driving rotation of the motor (1m) is transmitted to the worm screw (1 ws) by means of a geared transmission including gears (1g) meshed together to form a gears train, as illustrated in Figures 2(b) and 3(a) (cf. dashed circle). As any geared transmission, the gears need be lubricated periodically for a good functioning of the operator. For aesthetic reasons and, in particular, for protecting the gears from dust, particles, and dampness, geared transmissions are generally sealed from ambient in a housing (1c). Lubrication of the gears therefore requires the removal of the housing for getting access to the gears. This operation is not straightforward and for this reason a specialized technician is often required to visit periodically installed operators for swing doors. This is quite expensive and availabilities of specialized technicians are not always guaranteed.

[0005] There is a need in the art for an operator requiring less or no periodic visits by a specialized technician for periodic services of the operator. The present invention provides a solution for fulfilling this requirement. These and other advantages of the present invention are presented in continuation.

SUMMARY OF THE INVENTION

[0006] The present invention is defined in the appended independent claims. Preferred embodiments are defined in the dependent claims. In particular, the present invention concerns an operator for motorizing the opening and closing of a door panel of a swing door by rotation about a door rotation axis, Zd. The operator comprises:

(a) an operator hinge defining an operator rotation axis, Zo, said operator hinge being configured for allowing the rotation about the operator rotation axis, Zo, of an elongated component with respect to a post fixing bracket, wherein
(b) said post fixing bracket comprises a fixing end for fixing said post fixing bracket to a static post flanking one side of the door panel, and comprising a hinge end coupled to the operator hinge, and wherein
(c) said elongated component comprises:

- a motor;
- a geared transmission comprising gears and being coupled to the motor;
- a worm screw extending along a longitudinal axis, Xs, between a proximal end and a distal end, the proximal end being coupled to the motor via the geared transmission, such that the motor can drive the rotation of the worm screw about the longitudinal axis, Xs; and

(d) a housing covering at least the geared transmission and motor;

(e) a panel fixing bracket comprising a fixing end for fixing the panel fixing bracket to the door panel and a nut end engaged in the worm screw, such that the rotation of the worm screw with respect to the nut end about the longitudinal axis, Xs, drives the translation of the nut end along said longitudinal axis, Xs.

[0007] The operator of the present invention is characterized in that the housing is provided with a one-way valve which is naturally closed and can be opened by coupling a dispensing tube to the one-way valve, bringing the dispensing tube in fluid communication with the gears of the geared transmission. The one-way valve is preferably selected from a grease nipple and a duck bill valve.

[0008] The present invention also concerns a motorized swing door for closing a space flanked at least at one side by a static post. The motorized swing door comprises:

(a) a door panel comprising a frame and hinges mounted on said frame and defining a door rotation axis, Zd,
(b) an operator for driving a swinging of the panel about the door rotation axis, Zd, between a closed position wherein at least a portion of said space is closed by the door panel, and an open position wherein said at least portion of said space is open, said operator comprising:

- a motor;
- a geared transmission comprising gears, and being coupled to the motor;
- a worm screw extending along a longitudinal axis, Xs, between a proximal end and a distal end, the proximal end being coupled to the motor via the geared transmission, such that the motor can drive the rotation of the worm screw about the longitudinal axis, Xs; and
- a housing covering at least the geared transmission and motor.

[0009] The swing door of the present invention is characterized in that the housing of the operator is provided with a one-way valve which is naturally closed and can be opened by coupling a dispensing tube to the one-way valve, bringing the dispensing tube in fluid communication with the gears of the geared transmission.

[0010] The operator is preferably as defined above and may comprise:

(a) an operator hinge defining an operator rotation axis, Zo, distinct from and parallel to the door rotation axis, Zd, (Zo $\neq$ Zd and Zo || Zd), said hinge being configured for allowing the rotation about the operator rotation axis, Zo, of an elongated component with respect to a post fixing bracket, wherein
(b) said post fixing bracket comprises a fixing end fixed to the first static post, and comprising a hinge end coupled to the operator hinge, and wherein
(c) said elongated component comprises

- the motor,
- the geared transmission,
- the worm screw, which extends along a longitudinal axis, Xs, between a proximal end and a distal end, the proximal end being coupled to the motor via the geared transmission, such that the motor can drive the rotation of the worm screw about the longitudinal axis, Xs, and

(d) a panel fixing bracket (1 31) comprising a fixing end fixed to the door panel and a nut end engaged in the worm screw, such that the rotation of the worm screw about the longitudinal axis, Xs, drives the translation of the nut end along said longitudinal axis, Xs, such that said translation drives the rotation of the elongated component about the operator rotation axis, Zo, and the rotation of the door panel about the door rotation axis, Zd.

[0011] The present invention also concerns a kit of parts comprising:

(a) an operator as defined above,
(b) a source of lubricant containing a lubricant and comprising a dispensing tube having an outlet end fitting and suitable for opening the one way valve, and preferably
(c) a swing door.

[0012] The kit of parts may further comprise a device for pressurizing the source of lubricant for dispensing the lubricant through the dispensing tube.

[0013] The present invention also concerns the use of a one-way valve ads defined above for lubricating the geared transmission of an operator for motorizing the opening and closing of a swing door as defined supra.

BRIEF DESCRIPTION OF THE FIGURES

[0014] For a fuller understanding of the nature of the present invention, reference is made to the following detailed description taken in conjunction with the accompanying drawings in which:

Figure 1: shows (a) a top view and (b) a front view of a motorized swing door comprising an operator, illustrating the principle of such operator.

Figure 2: shows (a) a top view of an operator with housing, (b) a top view of an operator without housing and (c) a front view of an operator without housing; (b)&(c) show gears of the geared transmission.

Figure 3: shows a magnified view of the geared transmission with and without lubrication of the gears through a nipple.

Figure 4: shows a perspective view of an operator (a) with a lid in place and (b) with the lid removed revealing a nipple at the top of the operator.

Figure 5: Shows various views of a nipple suitable for the present invention.

Figure 6: Shows various views of a duck bill valve suitable for the present invention.

Figure 7: Shows operators mounted on a swing door (a) top view of an operator with lid off and access to a one way valve and (b) top cut view of the operator showing the location of the geared transmission.

DETAILED DESCRIPTION OF THE INVENTION

[0015] The present invention concerns an operator (1) for motorizing the opening and closing of a door panel (2) of a swing door by rotation about a door rotation axis, Zd, said operator being of the type comprising

(a) an operator hinge (1h) defining an operator rotation axis, Zo, said operator hinge being configured for allowing the rotation about the operator rotation axis, Zo, of an elongated component with respect to a post fixing bracket (121); wherein

(b) said post fixing bracket comprises a fixing end for fixing said post fixing bracket to a static post (3) flanking one side of the door panel, and comprising a hinge end coupled to the operator hinge, and wherein

(c) said elongated component comprises:

- a motor (1m);
- a geared transmission comprising gears (1g), and being coupled to the motor;
- a worm screw (1ws) extending along a longitudinal axis, Xs, between a proximal end and a distal end, the proximal end being coupled to the motor via the geared transmission, such that the motor can drive the rotation of the worm screw about the longitudinal axis, Xs; and

(d) a housing (1c) covering at least the geared transmission and motor;

(e) a panel fixing bracket (131) comprising a fixing end for fixing the panel fixing bracket to the door panel and a nut end engaged in the worm screw, such that the rotation of the worm screw with respect to the nut end about the longitudinal axis, Xs, drives the translation of the nut end along said longitudinal axis, Xs.

[0016] As illustrated in Figure 1(a), the translation of the nut end along the rotating worm screw varies the distance from the nut end and the operator hinge (1h). Because the distance between the panel fixing bracket (131) and the door rotation axis, Zd, remains constant, the only way to vary the distance from the nut end and the operator hinge (1h) is to rotate the panel about the door rotating axis, Zd, which is offset from the operator rotating axis, Zo.

[0017] As shown in Figures 2 and 3, the geared transmission coupling the motor (1m) to the worm screw (1ws) comprises a train of gears (1g) meshed together. The geared transmission may comprise any type of gears or cogwheels usually used in such gear trains, including spur gears, helical or double helical gears, bevel gears, spiral bevel gears,

hypoid gears, crown gears, worm gears, epicyclic gears, and the like. For a smooth running of the gears train, the gears and cogwheels must be lubricated periodically. In prior art operators, part of or the whole housing (1c) must be removed from the operator to access the geared transmission for lubricating the gears. The housing (1c) is used for aesthetic reasons but also, and principally, for protecting the worm screw, gears, and motor from ambient aggressions, such as dust, particles, humidity, and the like. The housing is therefore essential and cannot be made without. Removal of the housing for periodically lubricating the geared transmission must be carried out by a trained technician, and most end-users lack such training and must call an external technician for servicing their operators.

[0018] The present invention substantially simplifies the lubrication operation by providing a one-way valve (1v) which is naturally closed and can be opened by coupling to the one-way valve a lubricating tube (50d) thus bringing the dispensing tube in fluid communication with the gears of the geared transmission. The gear is still enclosed within the housing, but accessible through the one-way valve. For aesthetic reasons, but also for protecting the one-way valve from ambient aggressions, a lid (1L) can be provided, which can easily be removed. For example, in Figure 3(b) the lid (1L) can be opened by swinging it about hinges. In Figures 4(b) and 7(a), the lid can simply be removed from the housing.

[0019] Flow of a lubricant dispensed from a lubricant dispenser (50) through a dispensing tube (50d) coupled to the one-way valve, can be driven by pressure from the dispenser or gravity. Even if the lubricant is injected into the geared transmission under pressure, it is preferred to also profit of the gravity for the lubricant to reach at least one gear of the gear of the geared transmission, so that the lubricant can be transferred to the other elements of the train of gears by rotation-contacts between the different meshed elements. Consequently, depending on the orientation of the longitudinal axis, Xs, when the operator is mounted on a swing door, the one-way valve is preferably located vertically above the gears of the geared transmission when the operator is mounted. The longitudinal axis, Xs, of the worm screw is preferably substantially normal to the door rotation axis, Zd. For example, in case of a swing door swinging about a door rotation axis, Zd, which is vertical as depicted in Figures 1 and 7, the longitudinal axis, Xs, of the worm screw is substantially horizontal. The one-way valve can then be positioned at a portion of the housing located vertically above the gears, between the worm screw and the motor..

[0020] The one-way valve (1v) can preferably be selected from a grease nipple as illustrated in Figure 4, and a duck bill valve as illustrated in Figure 5. Other types of one-way valves known in the art can be used instead.

[0021] Grease nipples (1v) are preferred because of their reliability and stability over long periods of time. A grease nipple is a metal fitting used in the operator to feed lubricants, such as a lubricating grease, into the gear under moderate to high pressure using a grease gun (50). As can be seen in Figure 5, a grease nipple comprises coupling means, such as a threaded connection (1vt) for permanently coupling it to the housing (1c). As shown in Figure 5(c), the grease nipple may comprise a nipple connection for coupling the dispensing tube (50d) of a grease gun (50). The pressure supplied by the grease gun forces a small captive bearing ball (1vb) in the fitting to move back against the force of its retaining spring (1vs). The one-way valve opens under pressure to allow lubricant to pass through a channel (1vc) and flows into the gears (1g) of the geared transmission. When the lubricant pressure drops, the ball (1vb) is driven back to its closed position by the bias of the retaining spring (1vs). The ball excludes dirt and functions as a check valve to prevent grease escaping back out of the fitting.

[0022] In an alternative embodiment, the one way-valve can be a duck bill valve. As illustrated in Figure 6, a duckbill valve is a valve, manufactured from rubber or synthetic elastomer, and shaped like the beak of a duck. It is commonly used in applications where backflow must be prevented. A funnel shaped channel (1vc) extends from an inlet at an upstream end of the duck bill valve to an outlet at a downstream end of the valve. The inlet is open to accommodate a tip of a dispensing tube (50d) of a lubricant dispenser (50); the inlet is usually round shaped. The downstream end, referred to as the duckbill, has natural flattened shape, naturally biased so as to close the channel. When a lubricant is pumped through the dispensing tube (50d) and the duckbill, the flattened end opens to permit the pressurized lubricant to pass. When pressure is removed, however, the duckbill end returns to its flattened and closed shape, preventing backflow. A higher closing pressure of the duckbill can be reached by providing external resilient means applying a pressure against two opposite faces of the duckbill.

[0023] The operator of the present invention, described above, can be mounted on a swing door to motorize the opening and closing by the swinging of a panel of a space flanked at least at one side by a static post. The swing door comprises the following elements.

(a) A door panel (2) comprising a frame and hinges (2h) mounted on said frame and defining a door rotation axis, Zd,
(b) An operator (1) as described above for driving a swinging of the panel about the door rotation axis, Zd, between a closed position wherein at least a portion of said space is closed by the door panel, and an open position wherein said at least portion of said space is open.

[0024] As discussed supra, the operator comprises a motor (1m), a geared transmission coupled to the motor and comprising a geared transmission between the motor and a worm screw (1s) for driving a rotation of the worm screw, and a housing (1c) covering at least the geared transmission and motor.

[0025] The gist of the present swing door is that the housing of the operator is provided with a one-way valve which is naturally closed and can be opened by coupling a dispensing tube (50d), thus bringing said dispensing tube in fluid communication with the gears of the geared transmission. The one-way valve can be opened because the dispensing tube is inserted into the channel (1vc) of the one-way valve, forcing it open. Alternatively, the dispensing tube is coupled to an inlet of the channel, and the channel is forced open by the injection pressure of the lubricant. The one-way valve is preferably located very close to at least one gear of the geared transmission, preferably vertically above it when the operator is mounted on a swing door in order to profit of gravity for a homogenous distribution of the lubricant in the geared transmission.

[0026] The operator preferably comprises all the components (a) to (d) described above. The operator hinge defines an operator rotation axis, Zo, distinct from and parallel to the door rotation axis, Zd, ($Zo \neq Zd$ and $Zo \parallel Zd$).

[0027] As shown in Figures 1 and 7, an operator is mounted onto a swing door by means of a post fixing bracket (121) and a panel fixing bracket (131) fixed to a post flanking the space to be closed and to the panel, respectively. The operator is most efficiently mounted with the longitudinal axis, Xs, of the worm screw (1ws) substantially normal to the door rotation axis, Zd. In many cases, as illustrated in Figures 1 and 7, the panels of swing doors generally open and close the aperture by swinging about a door rotation axis, Zd, which is vertical. In such configuration, an operator is preferably mounted with the longitudinal axis, Xs, of the worm screw substantially horizontal.

[0028] Although of very simple construction, nobody to our knowledge ever thought of providing an operator with a one-way valve to give easy access to the geared transmission for periodically lubricating the gears (1g). The use of a one-way valve for lubricating the gear of a an operator simplifies so much the periodic lubrication of the geared transmission that any end-user can do it itself, without having to ask a technical specialist to perform this periodic duty.

#		feature
1	c	housing
1	g	gear
1	h	operator hinge
1	L	lid
1	v	One-way valve (e.g., nipple, duck bill valve)
1	ws	wormscrew
1		operator
2	h	panel hinge
2		panel
3		static post
121		post fixing bracket
131		panel fixing bracket

Claims

1. Operator (1) for motorizing the opening and closing of a door panel (2) of a swing door by rotation about a door rotation axis, Zd, said operator comprising:

(a) an operator hinge (1h) defining an operator rotation axis, Zo, said operator hinge being configured for allowing the rotation about the operator rotation axis, Zo, of an elongated component with respect to a post fixing bracket (121), wherein
(b) said post fixing bracket comprises a fixing end for fixing said post fixing bracket to a static post (3) flanking one side of the door panel, and comprising a hinge end coupled to the operator hinge, and wherein
(c) said elongated component comprises:

- a motor (1m);
- a geared transmission comprising gears (1g), and being coupled to the motor;
- a worm screw (1w) extending along a longitudinal axis, Xs, between a proximal end and a distal end, the proximal end being coupled to the motor via the geared transmission, such that the motor can drive the

rotation of the worm screw about the longitudinal axis, Xs; and

(d) a housing (1c) covering at least the geared transmission and motor;
(e) a panel fixing bracket (131) comprising a fixing end for fixing the panel fixing bracket to the door panel and a nut end engaged in the worm screw, such that the rotation of the worm screw with respect to the nut end about the longitudinal axis, Xs, drives the translation of the nut end along said longitudinal axis, Xs;

characterized in that the housing (1 c) is provided with a one-way valve (1v) which is naturally closed and can be opened by coupling a dispensing tube (50d) to the one-way valve, bringing the dispensing tube in fluid communication with the gears (1g) of the geared transmission.

2. Operator according to claim 1, wherein the one-way valve (1v) is selected from a grease nipple and a duck bill valve.

3. Motorized swing door for closing a space flanked at least at one side by a static post (3), said motorized swing door comprising:

(a) a door panel (2) comprising a frame and hinges (2h) mounted on said frame and defining a door rotation axis, Zd,
(b) an operator (1) for driving a swinging of the panel about the door rotation axis, Zd, between a closed position wherein at least a portion of said space is closed by the door panel, and an open position wherein said at least portion of said space is open, said operator comprising:

- a motor (1m);
- a geared transmission comprising gears (1g), and being coupled to the motor;
- a worm screw (1w) extending along a longitudinal axis, Xs, between a proximal end and a distal end, the proximal end being coupled to the motor via the geared transmission, such that the motor can drive the rotation of the worm screw about the longitudinal axis, Xs; and
- a housing (1c) covering at least the geared transmission and motor;

characterized in that the housing is provided with a one-way valve (1v) which is naturally closed and can be opened by coupling a dispensing tube (50d) to the one-way valve, bringing the dispensing tube in fluid communication with the gears (1g) of the geared transmission.

4. Motorized swing door according to claim 3, wherein the operator comprises:

(a) an operator hinge (1h) defining an operator rotation axis, Zo, distinct from and parallel to the door rotation axis, Zd, ($Zo \neq Zd$ and $Zo \parallel Zd$), said hinge (1h) being configured for allowing the rotation about the operator rotation axis, Zo, of an elongated component with respect to a post fixing bracket (121), wherein
(b) said post fixing bracket comprises a fixing end fixed to the first static post (3), and comprising a hinge end coupled to the operator hinge, and wherein
(c) said elongated component comprises

- the motor (1m),
- the geared transmission,
- the worm screw (1w), which extends along a longitudinal axis, Xs, between a proximal end and a distal end, the proximal end being coupled to the motor via the geared transmission, such that the motor can drive the rotation of the worm screw about the longitudinal axis, Xs, and

(d) a panel fixing bracket (131) comprising a fixing end fixed to the door panel (2) and a nut end engaged in the worm screw (1w), such that the rotation of the worm screw about the longitudinal axis, Xs, drives the translation of the nut end along said longitudinal axis, Xs, such that said translation drives the rotation of the elongated component about the operator rotation axis, Zo, and the rotation of the door panel about the door rotation axis, Zd.

5. Motorized swing door according to claim 3 or 4, wherein the operator is according to claim 1 or 2.

6. Kit of parts comprising:

(a) an operator according to claim 1 or 2, and

(b) a source (50) of lubricant containing a lubricant and comprising a dispensing tube (50) having an outlet end fitting and suitable for opening the one way valve (1v).

7. Kit of parts according to claim 6, further comprising a swing door.

8. Kit of parts according to claim 6 or 7, further comprising a device for pressurizing the lubricant for dispensing the lubricant through the dispensing tube.

9. Use of a one-way valve (1v) for lubricating the gear (1g) of an operator according to claim 1 or 2.

10. Use according to claim 9, wherein said one-way valve (1v) is selected from a grease nipple and a duck bill valve.

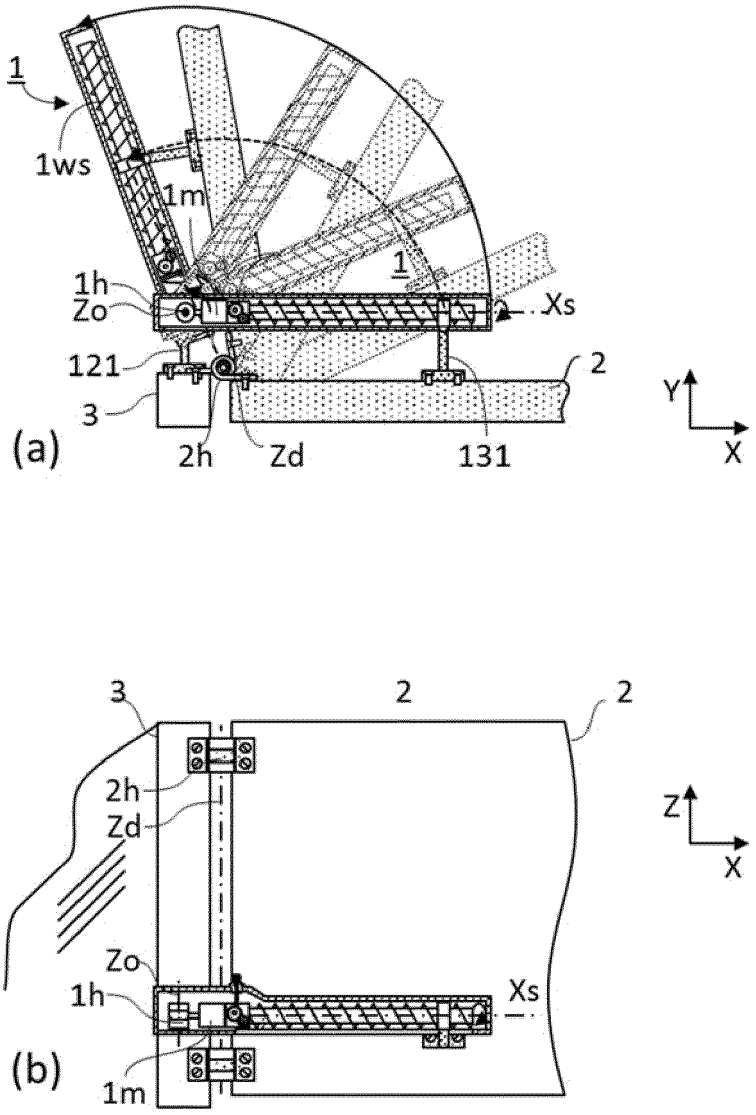


FIG.1

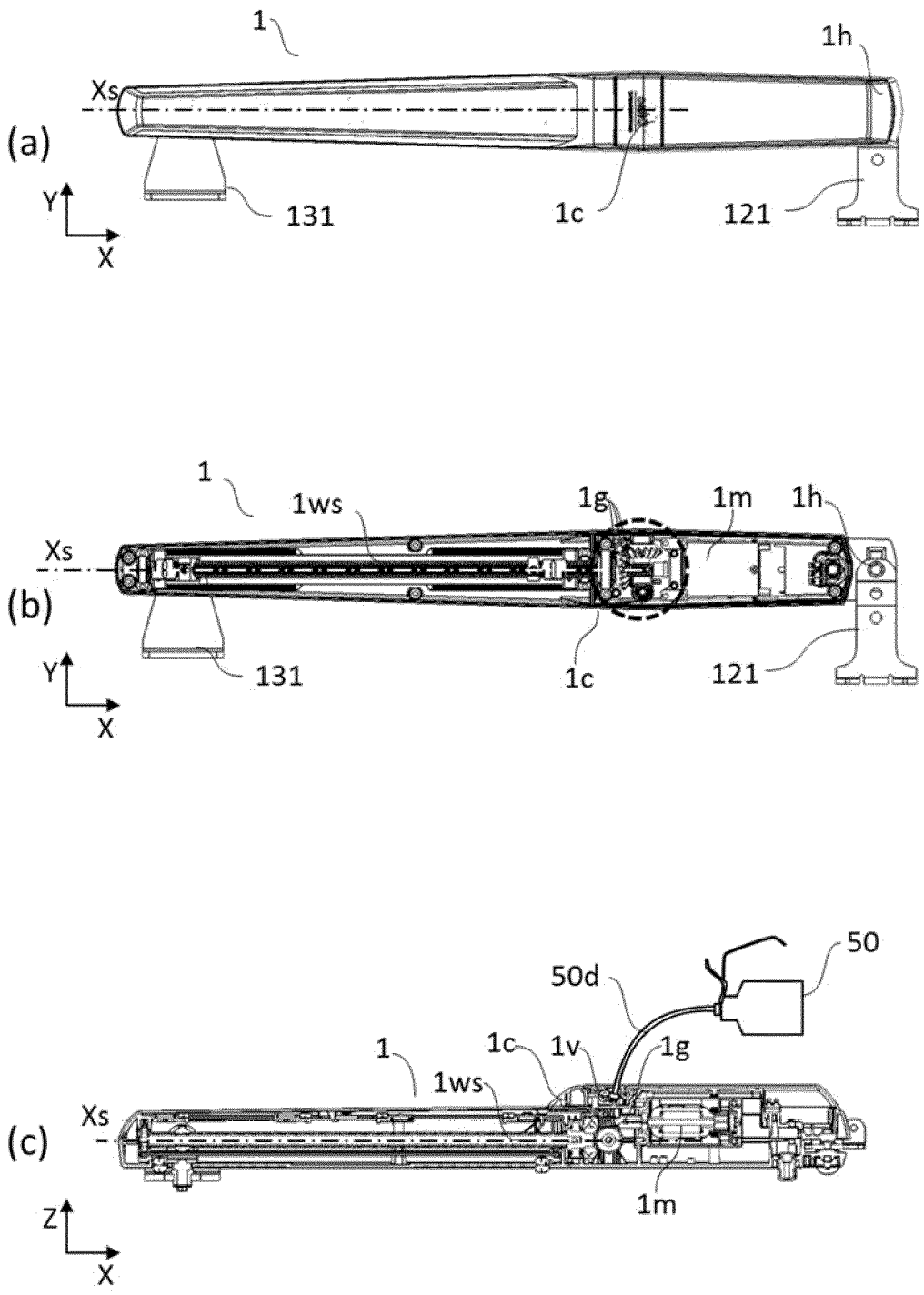

(a)
1
1h
Xs
131
1c
121
Y
X
(b)
1
1ws
1g
1m
1h
Xs
131
1c
121
Y
X
(c)
50
50d
1
1c
1v
1g
1ws
Xs
1m
Z
X

FIG.2

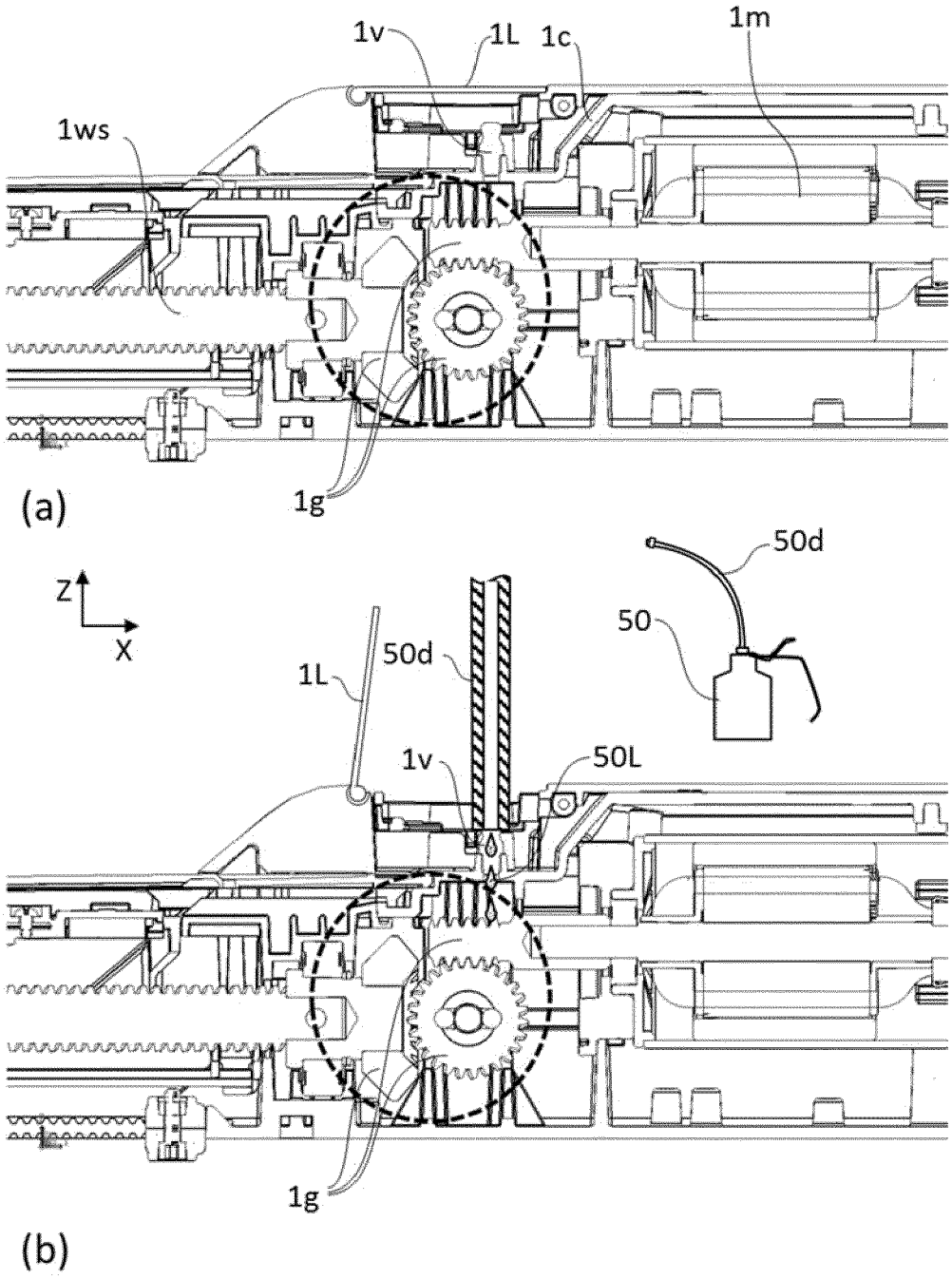


FIG.3

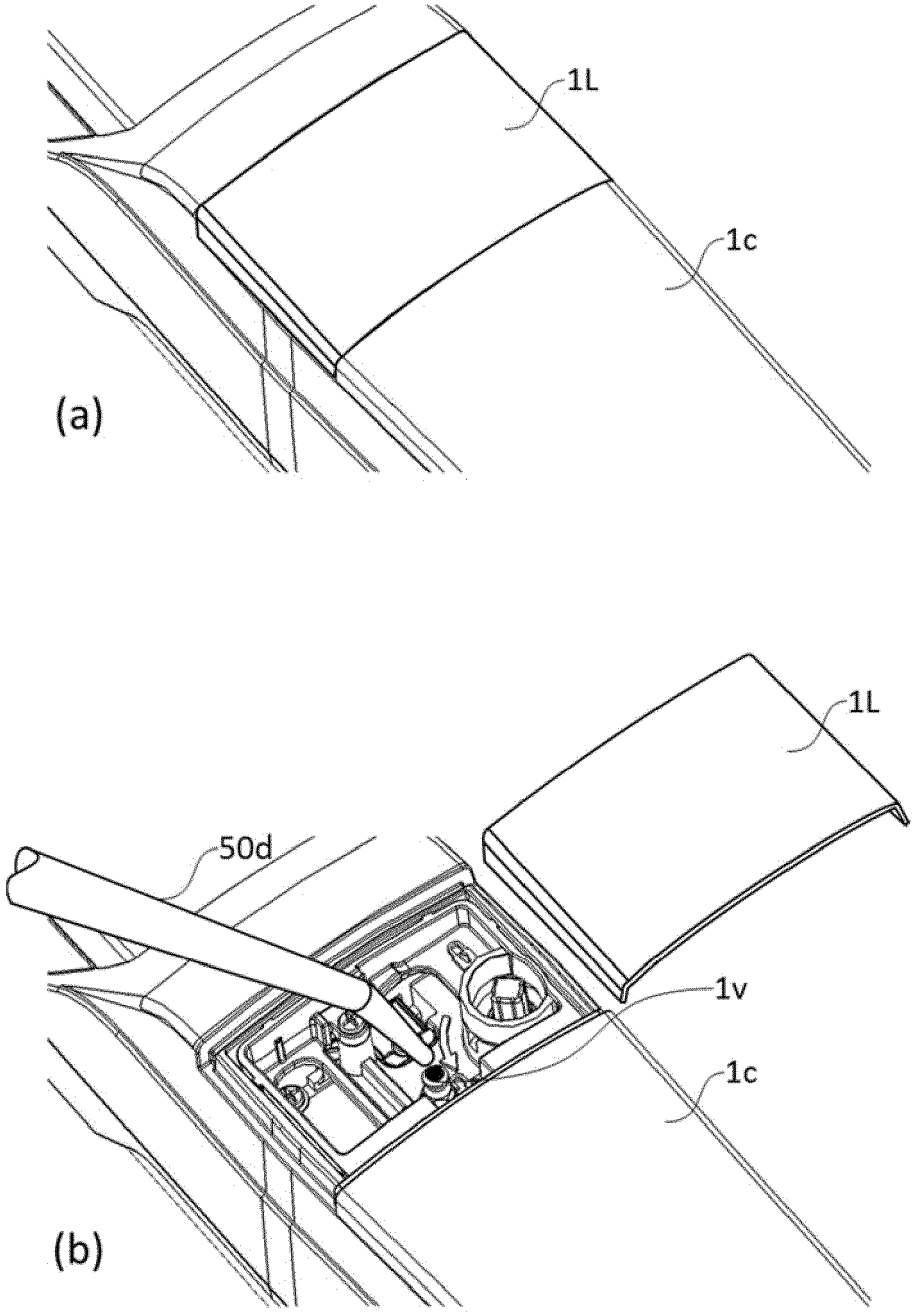


FIG.4

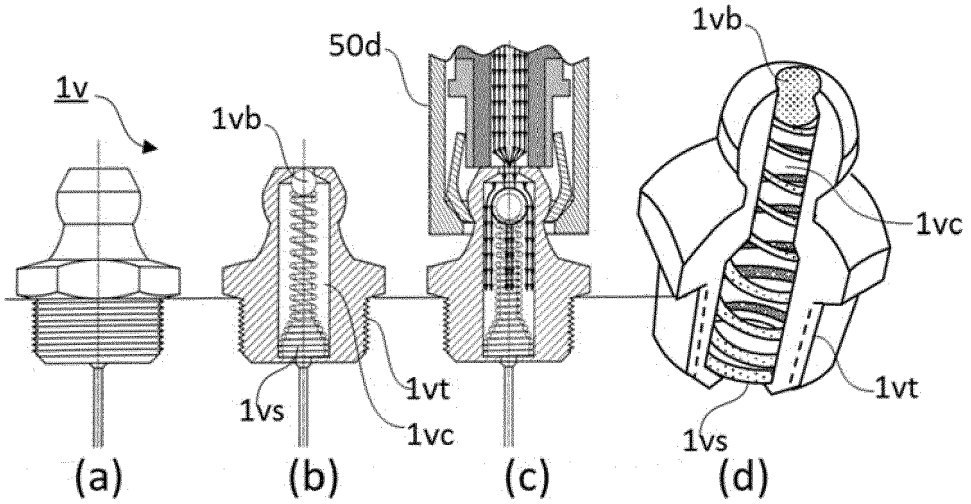


FIG.5

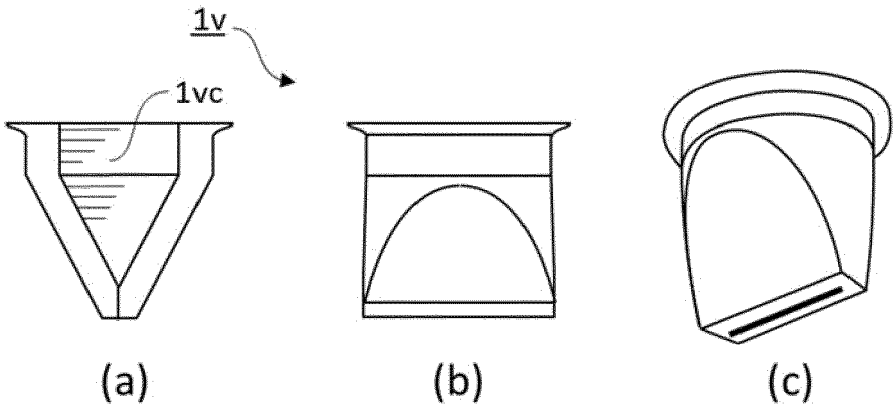
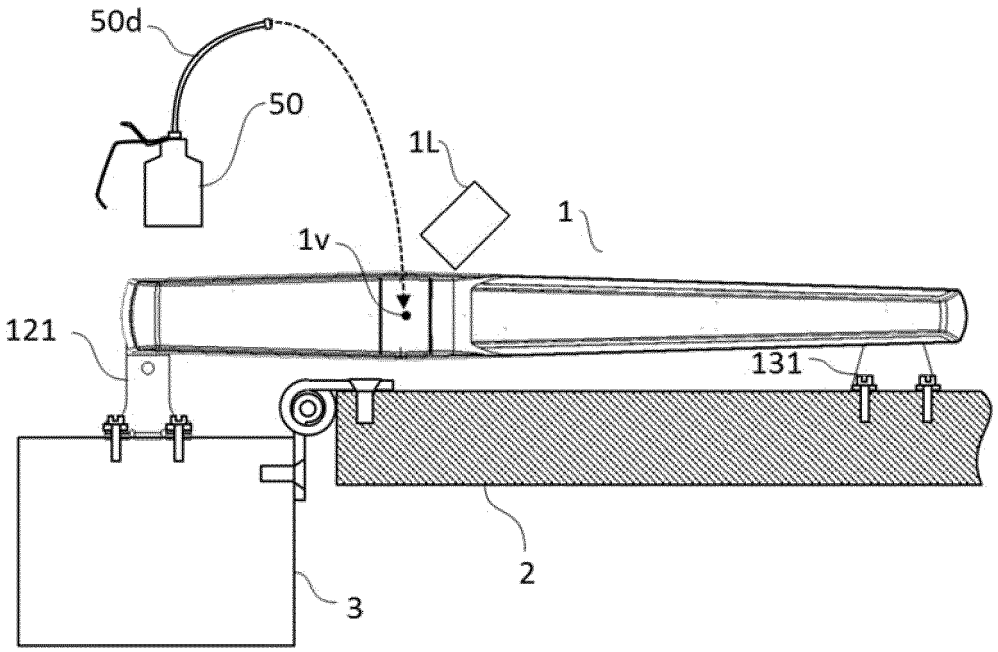
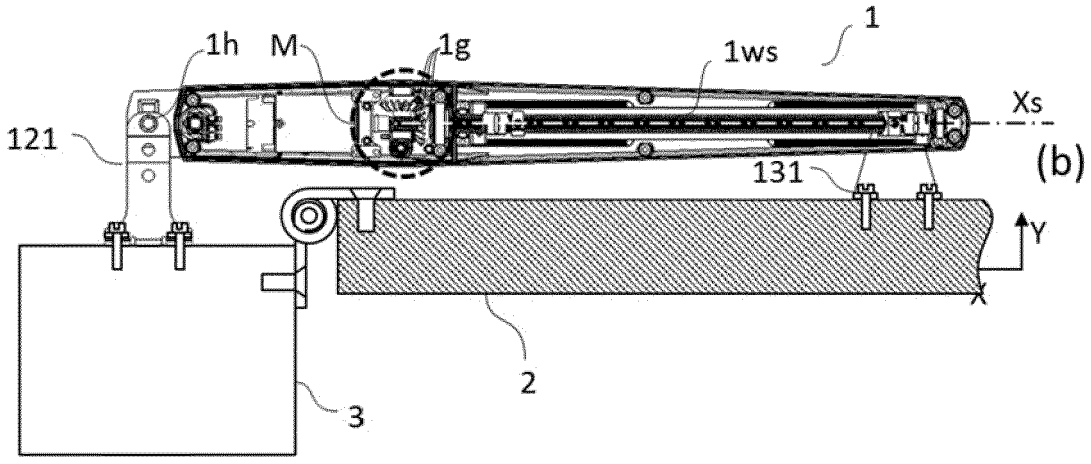


FIG.6



(a)



(b)

FIG.7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 20 5708

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2 486 242 A (ASHTON BENJAMIN N) 25 October 1949 (1949-10-25) * column 1, line 2 * * column 3, line 36 - column 4, line 5 * * column 4, line 51 - line 65; figures 1-3 * -----	1-10	INV. E05F15/622
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TECHNICAL FIELDS SEARCHED (IPC)

E05F
F16H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 March 2018	Guillaume, Geert

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 20 5708

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