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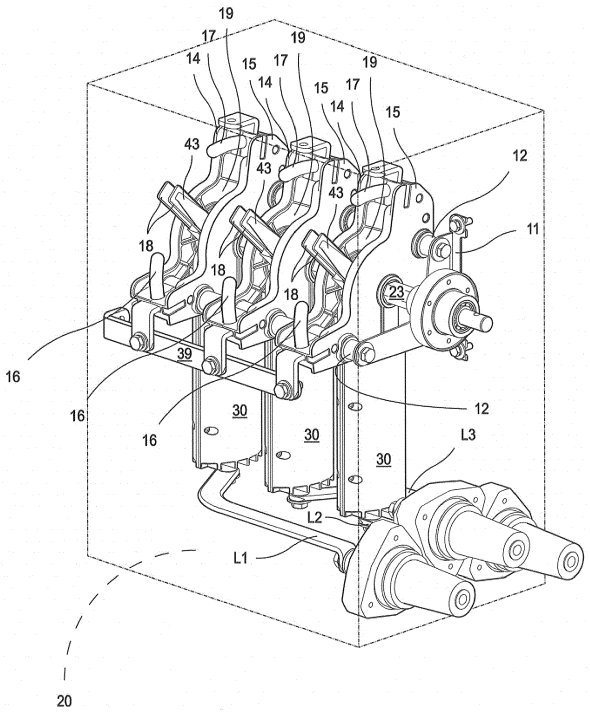
(54) VACUUM SWITCH ASSEMBLY WITH MEDIUM-VOLTAGE DISCONNECTOR

(57) A vacuum switch assembly with a medium-voltage disconnector comprising a cabinet (20) in which supports (11) are positioned for each pole, a casing consisting of two half-shells (14,15) made of an insulating material, each housing pairs of opposing fixed contacts (16,17) that can be individually associated with pairs of blades (18), wherein said blades (18) are alternatingly and selectively rotated to be engaged with one or the other of the two fixed contacts (16,17) connected to at least one user or to the ground, between closed and open positions, wherein the blades (18) are positioned on a plate (21) which is rotated by means of a control shaft (23) and which carries a cam drive (25,26) which, on one side, causes said fixed contacts (16,17) and the blades (18) to acquire the closed and open positions and, on another side, causes movable (29) and fixed (38) contacts of a vacuum switch (30) to be engaged or disengaged.

Fig. 1



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Description

[0001] The present invention relates to a vacuum switch assembly with a medium-voltage disconnector.

[0002] Various solutions of vacuum switch assemblies with medium- and high-voltage disconnectors, are known, in which there are two groups with separate commands. The disconnecting group and the switch assembly are in fact each mounted on a respective shaft and then connected with each other for relative actuation by means of leverages and intermediate joints.

[0003] The provision of individual separate and connected units for both disconnection and interruption creates a certain encumbrance which does not allow them to be installed in limited spaces. Furthermore, the specific provision of two single units for the vacuum switch and disconnector determines actuation in succession in a series of cascade positions which must necessarily be carried out individually to be able to continue the complete actuation operation.

[0004] The operator who operates on this type of known arrangement acts on a drive shaft which first intervenes to open the switch. Only once the switch has been opened is a lever mechanism, arranged in cascade and interconnected between the switch and the actual disconnector, driven to rotate a second shaft through which the disconnector is operated by opening and obtaining the final position.

[0005] It is immediately evident that this type of associated and connected arrangement of a vacuum switch and disconnector comprises numerous components, such as, for example, the above-mentioned connecting lever mechanisms between the vacuum switch assembly and disconnector. These components involve both manufacturing and assembly costs and their presence also determines the above-mentioned encumbrances.

[0006] The assembly of the two groups with relative shafts and connection lever mechanisms also implies that a high assembly precision and correct interaxis arrangement between the two above-mentioned shafts with related difficulties, be respected.

[0007] FR 2744284 discloses a vacuum switch according to the preamble of claim 1.

[0008] The general objective of the present invention is to provide a compact vacuum switch assembly with a medium-voltage disconnector capable of solving the drawbacks of the known art indicated above in an extremely simple, economical and functional way.

[0009] A further objective of the present invention is to provide a compact vacuum switch assembly with a medium-voltage disconnector which is simplified in its parts with as few as possible of the same.

[0010] Another objective of the present invention is to provide a compact vacuum switch assembly with a medium-voltage disconnector which, by providing a minimum number of components, has an assembly and functioning as simplified as possible with respect to what is known.

[0011] The above-mentioned objectives are achieved by a compact switch and medium-voltage disconnector assembly produced according to the independent claim 1 and following sub-claims.

[0012] The structural and functional characteristics of the present invention and its advantages with respect to the known art will appear even more evident from the following description, referring to the attached schematic drawings, which show an embodiment of the invention itself. In the drawings:

- figure 1 is a perspective view of a compact vacuum switch assembly with a medium-voltage disconnector and with centralized actuation according to the present invention;
- figures 2 and 3 are a raised section and a cross-section of a phase of the vacuum switch assembly with disconnector as shown in figure 1, open;
- figures 4 and 5 are a raised section and a cross-section of a phase of the vacuum switch assembly with disconnector of figure 1, in a position with the switch closed;
- figures 6 and 7 are a raised section and a cross-section of a phase of the vacuum switch assembly with disconnector of figure 1, in a grounded position;
- figures 8 and 9 are a raised section and a cross-section of a phase of the vacuum switch assembly with disconnector with disconnection closed and with the switch open;
- figures 10 and 11 are a raised section and a cross-section of a phase of the vacuum switch assembly with disconnector with ground disconnection and with the switch open;
- figures 12, 13 and 14 are perspective views, partially sectioned and split, of the positions shown in figures 4, 2 and 6; and
- figures 15, 16 and 17 show schemes of the various positions of a vacuum switch assembly with a medium-voltage disconnector according to the present invention.

[0013] With reference first of all to figure 1, this shows a cabinet 20 in which a compact vacuum switch assembly with a medium-voltage disconnector and centralized actuation according to the invention, is assembled. The sealed cabinet 20 can alternatively provide in its interior an environment in dry air, such as to satisfy gas-pollution prevention requirements, or protected in an environment in SF6.

[0014] In the example shown, three poles are provided, which are connected on the one hand to phases of a power supply and on the other to respective bars (not shown) of any user.

[0015] Again in the non-limiting example, end supports 11, inside the cabinet 20 (of which only one is shown), support insulated cross-beams 12 inserted in holes 13 of a casing composed of two half-shells 14, 15 made of an insulating material.

[0016] The two half-shells 14, 15 of the casing each house pairs of opposing fixed contacts 16, 17 that can be individually associated with pairs of blades 18 alternatingly and selectively rotatable to be engaged with one or the other of the two fixed contacts 16, 17.

[0017] A leaf spring 43 is positioned on opposite external parts of each blade 18, which presses a blade 18 on the single contact 16, 17, ensuring correct electrical contact.

[0018] The pairs of blades 18 can be moved inside slots 19 defined between the two half-shells 14, 15 when coupled with and connected to each other.

[0019] The pairs of blades 18 are made integral, for example, by riveting to an extension 24 of a plate 21, said plate 21 being provided with a pass-through hole 22, for example hexagonal. A control shaft 23 is housed in the pass-through hole 22, which also has a hexagonal section and is made of an insulting material, supported at its ends and rotatable by means of a normal lever control (not shown), either manual or motorized.

[0020] In particular, it can be seen from the figures according to the invention that said plate 21 controls the vacuum switch assembly with disconnector between closed and open positions by means of a cam drive.

[0021] In particular, according to the invention, said cam drive is positioned in the plate 21. The plate 21, in fact, provides a cam groove 25 which movably houses a pin 26 carried on two opposite ends of a fork 27. Said fork 27 extends from a rod 28 of a movable contact 29 of an underlying vacuum switch.

[0022] The plate 21, in its cam groove 25, provides two dead points of opposite ends 31, 32 for the pin 26. The forced shifting of the pin 26 in the cam groove 25 commands the movement of the rod 28 of the movable contact 29 and therefore the same movable contact 29 with respect to a fixed contact 38.

[0023] A spring 33 positioned outside a spacer 34 is positioned beneath said fork 27 coaxial with the rod 28. The spacer 34 is also housed inside a hole 35 formed in the flat transverse part of the fork 27. At one of its ends, the spring 33 is abutted beneath the fork 27 and, at the other end, rests on a washer 36 held above the rod 28 of the movable contact 29 by a screw 37 which is screwed into the same rod. With this arrangement, said at least one elastic element consisting of the spring 33 is interposed between the movable contact 29 and the pin 26.

[0024] At the same time, the spacer 34 can slide with respect to the fork 27 inside said hole 35 when the spring 33 is subjected to stress by the fork 27 itself when crushing above the washer 36. This occurs specifically as a result of the rotation of the cam shaft 23 which involves the rotation of the plate 21 with the action of the cam groove 25 on the pin 26 without any movement of the rod 28 of the movable contact 29.

[0025] The movable contact 29 had in fact been abutted against said fixed contact 38 provided in the underlying vacuum switch 30.

[0026] A gripper 40 is arranged fixed between the screw 37 and the spacer 34 and, with its upper ends folded up 41, creates a sliding contact with respect to opposite side walls of the plate 21.

[0027] It should be noted that the fixed contacts 16, 17 in the figures have been shown as the upper one 17 being a contact connectable to bars of a user (not shown). The three fixed lower contacts 16 in the example, are grounded by means of a ground bar 39. The three switches 30 are connected to three phases L1, L2 and L3 of a power supply. Alternatively, a further series of bars (not shown) can be provided on the side of the grounding bar, arranged in correspondence with the lower contacts 16, which allows a further closure for a different user line.

[0028] The various positions illustrated in the sequence of the figures show how a vacuum switch with a medium-voltage disconnector according to the invention, functions.

[0029] In particular, it is possible to pass from a position such as that shown in figures 1, 2 and 3 with the vacuum switch assembly with a medium-voltage disconnector in an open position, to a closed position.

[0030] To do this, the shaft 23 is rotated to achieve a closed position such as that shown in figures 4 and 5 such as to supply a consumer.

[0031] The rotation of the shaft 23 causes a rotation of the plate 21 with a consequent variation in the position of the cam groove 25.

[0032] The rotation of the plate 21 forces the pin 26 to slide in the cam groove 25 until it reaches the dead point 32.

[0033] It should be noted that in the final part of this run of the pin 26 in the cam groove 25, the plate itself 21 forces the pin 26 to move downwards. This movement is allowed by the fact that the fork 27, in the flat transverse part, has the hole 35 which enables the sliding of the spacer 34 in its interior. This shifting causes the crushing of the spring 33, through the fork 27, above the washer 36 until it reaches the position shown in figures 4 and 5.

[0034] The movable contacts 29 and fixed contact 38 of the switch are thus brought stably and firmly against each other.

[0035] As already mentioned, in this position, the contacts 29 and 38 of the switch 30 are brought into contact with each other forced by both the dead-point position 32 of the pin 26 in the cam groove 25 and also by the compression of the spring 33.

[0036] Before reaching this position, it was necessary to pass from the closed disconnection position shown in figures 8 and 9 which is provided only for greater understanding but which in fact is not one of the three possible positions of the vacuum switch assembly with disconnector of the invention.

[0037] The closing of the disconnector was effected in this virtual intermediate position before the switch 30 was caused to close.

[0038] When, on the other hand, a grounded arrangement of the vacuum switch assembly with disconnector is to be provided, it is necessary to intervene starting, for

example, from the open intermediate position (figures 1, 2 and 3) to rotate the shaft 23 in an opposite direction to the previous one to reach the final grounded position shown in figures 6 and 7 with the switch 30 closed.

[0039] Before reaching this position, it was necessary to pass from the closed disconnection grounded position with the switch 30 still open, shown in figures 10 and 11, which is provided only for greater understanding but which in fact, as already previously indicated, is not one of the three possible positions of the vacuum switch assembly with disconnector of the invention.

[0040] Figures 12, 13 and 14 show a perspective view of the effective three closed, open and ground positions already illustrated in figures 4, 2 and 6.

[0041] Figures 15, 16 and 17 show electrical diagrams of the group of the present invention in closed, open and ground positions.

[0042] What has been said and illustrated above shows how a vacuum switch with disconnector according to the invention is particularly compact, eliminating all the connecting lever mechanisms between the switch and disconnector. This is possible thanks to the fact that a single shaft is provided, which controls both the disconnector and the switch.

[0043] The single shaft allows there to be a central control which makes the whole assembly particularly simple.

[0044] It should also be pointed out that the presence of a single control shaft gives great security to the assembly. It is in fact the single shaft itself that does not allow incorrect manoeuvres to be effected even if the various phases of use are guided and also allowing the blocks present in assemblies hitherto known and used to be eliminated.

[0045] It should also be noted that a cabinet 20 is indicated in figure 1 in dots and dashes, to specifically highlight the fact that the same can have any size and form. In this way, the assembly is not subjective, i.e. its correct functioning does not depend on the type and quality of the carpentry in which it is installed.

[0046] As already specified, it is also possible to have not only one user but two users by providing that the second contact 16 is also connected to bars (not shown) thus replacing the ground position.

[0047] The schematic figures do not show the springs positioned integrally with the movable contacts which also collaborate in the usual way for the correct functioning of the assembly.

[0048] The forms of the structure for producing a compact vacuum switch assembly with a medium-voltage disconnector and with centralized actuation of the invention, as also the materials and assembly modes, can obviously differ from those shown for illustrative and non-limiting purposes in the drawings.

[0049] The objective mentioned in the preamble of the description has therefore been achieved.

[0050] The protection scope of the present invention is defined by the enclosed claims.

Claims

1. A vacuum switch assembly with a medium-voltage disconnector comprising a cabinet (20) in which supports (11) are positioned for each pole, pairs of opposing fixed contacts (16,17) that can be individually associated with blades (18), wherein said blades (18) are alternatingly and selectively rotated to be engaged with one or the other of the two fixed contacts (16,17) connected to at least one user or to the ground, between closed and open positions, said blades (18) being rotated by means of a cam drive (25,26) which, on one side, causes said fixed contacts (16,17) and said blades (18) to acquire said closed and open positions and, on another side, movable (29) and fixed (38) contacts of a vacuum switch (30) to be engaged or disengaged, **characterized in that** said blades (18) are arranged on a plate (21) which is positioned directly on a control shaft (23) through which it is rotated, said plate (21) also carrying said cam drive (25,26) wherein each pole provides a casing consisting of two half-shells (14,15) made of insulating material each housing said pairs of fixed contacts (16,17) and wherein said blades (18) are pairs of blades.

2. The vacuum switch assembly with a disconnector according to claim 1, **characterized in that** said cam drive of said plate (21) comprises a cam groove (25) formed in said plate (21) and a sliding pin (26) in said cam groove (25) and positioned integrally with an end of said movable contact (29) of said vacuum switch (30) .

3. The vacuum switch assembly with a disconnector according to claim 2, **characterized in that** at least one elastic element (33) is interposed between said movable contact (29) and said pin (26).

4. The vacuum switch assembly with a disconnector according to claim 3, **characterized in that** said elastic element consists of a spring (33) positioned between a fork carrying said pin (26) and a washer (36) held above a rod (28) of the movable contact (29) by means of a screw (37).

5. The vacuum switch assembly with a disconnector according to claim 4, **characterized in that** said fork (27) provides, in a central flat portion, a hole (35) in which a spacer (34) is housed, positioned coaxially inside said spring (33).

6. The vacuum switch assembly with a disconnector according to claim 2, **characterized in that** said cam groove (25) has two opposite dead end-points (31,32) for said pin (26).

7. The vacuum switch assembly with a disconnector

according to claim 1, **characterized in that** said control shaft (23) has a hexagonal section and is inserted in a hexagonal pass-through hole (22) formed in said plate (21), said control shaft (23) being rotated by a manual or motorized lever control.

8. The vacuum switch assembly with a disconnector according to one or more of the previous claims, **characterized in that** a leaf spring (43) is positioned at external opposite parts of each blade (18), which presses said blade (18) on the single contact (16,17), guaranteeing a correct electrical contact.

9. The vacuum switch assembly with a disconnector according to one or more of the previous claims, **characterized in that** said pairs of blades (18) are movable inside slots (19) defined between the two half-shells (14,15) when coupled and connected with each other.

Fig. 1

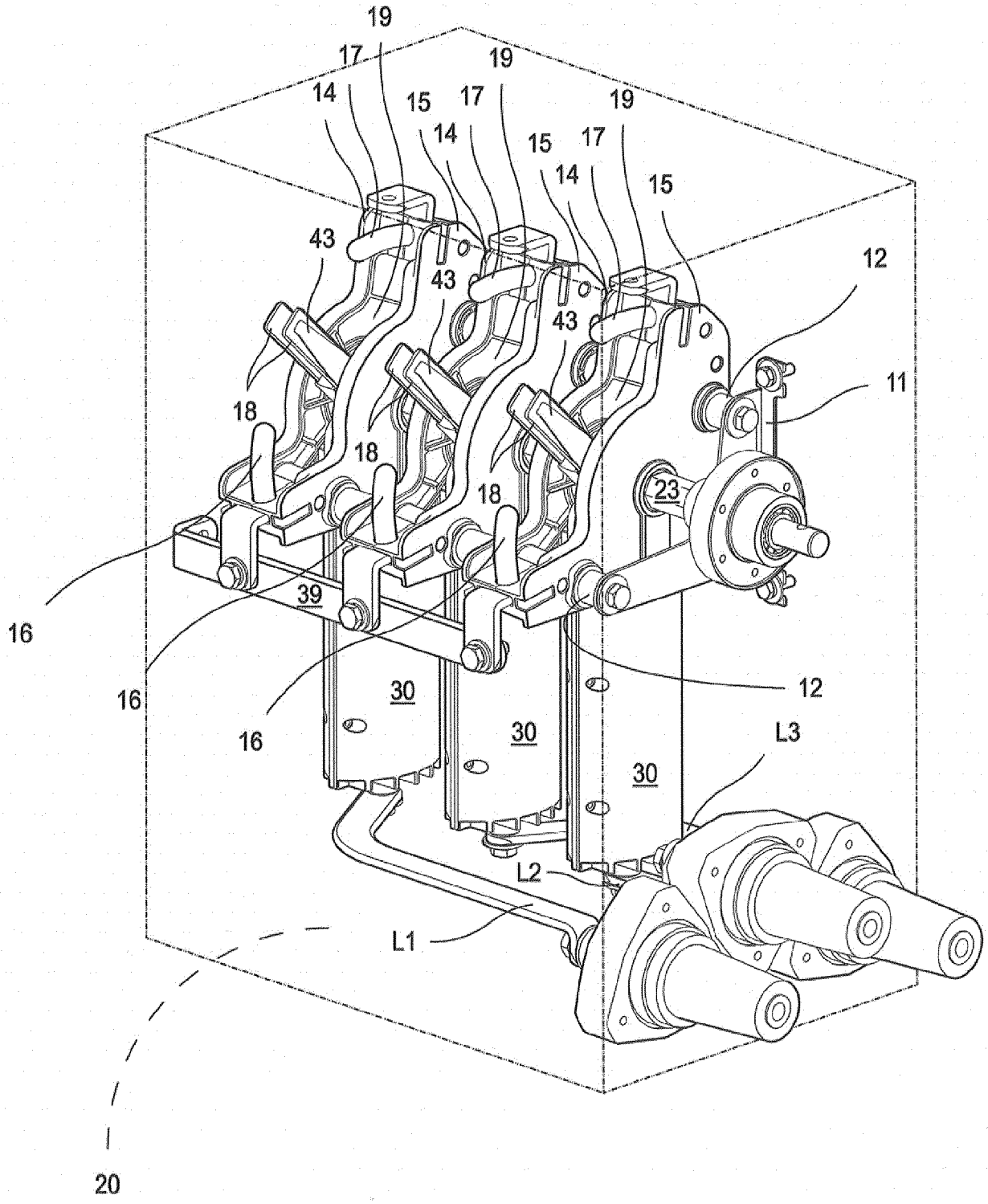
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Fig. 2

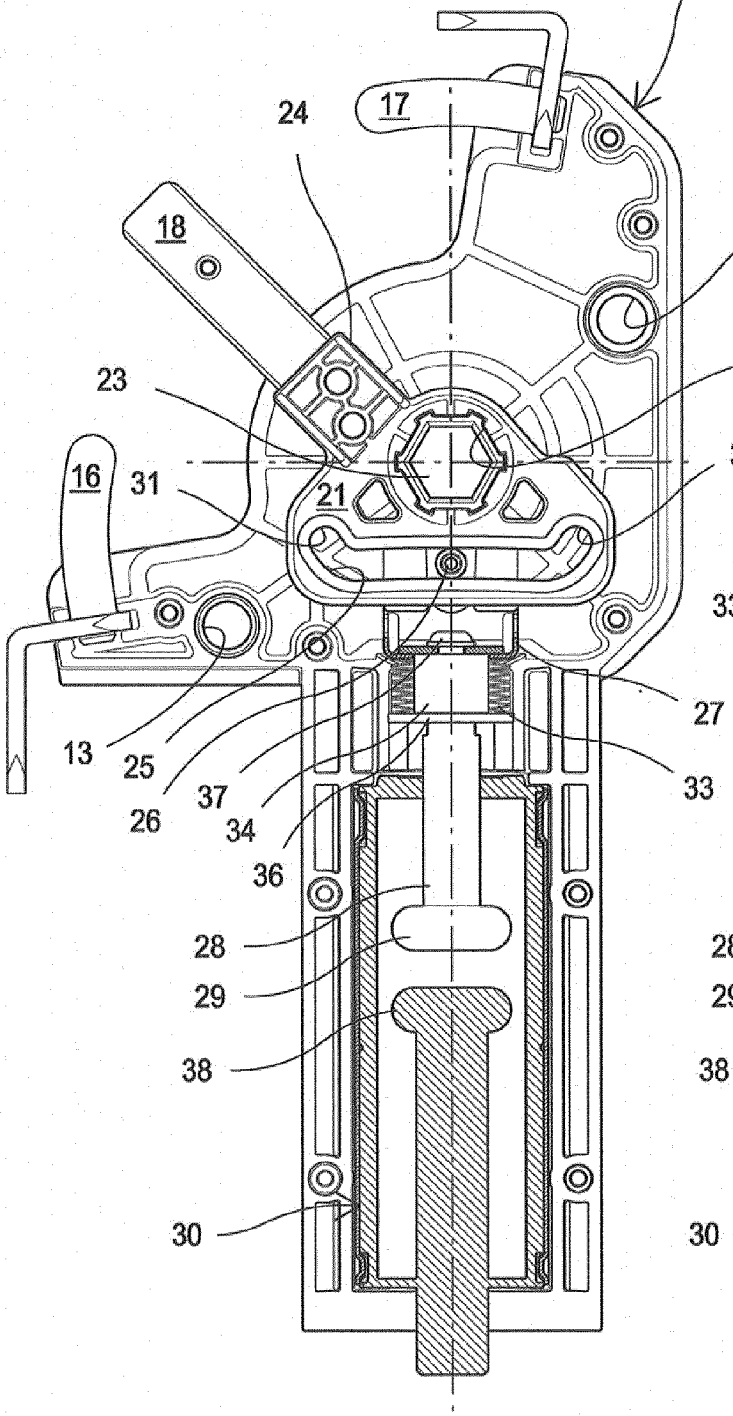
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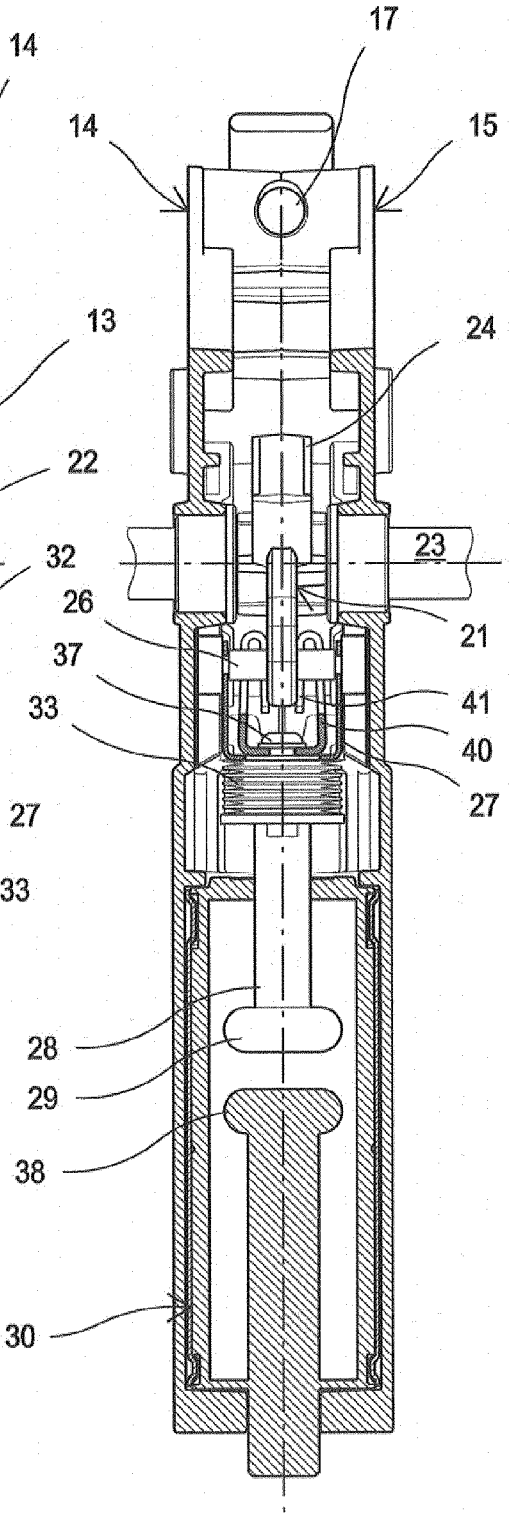
Fig. 3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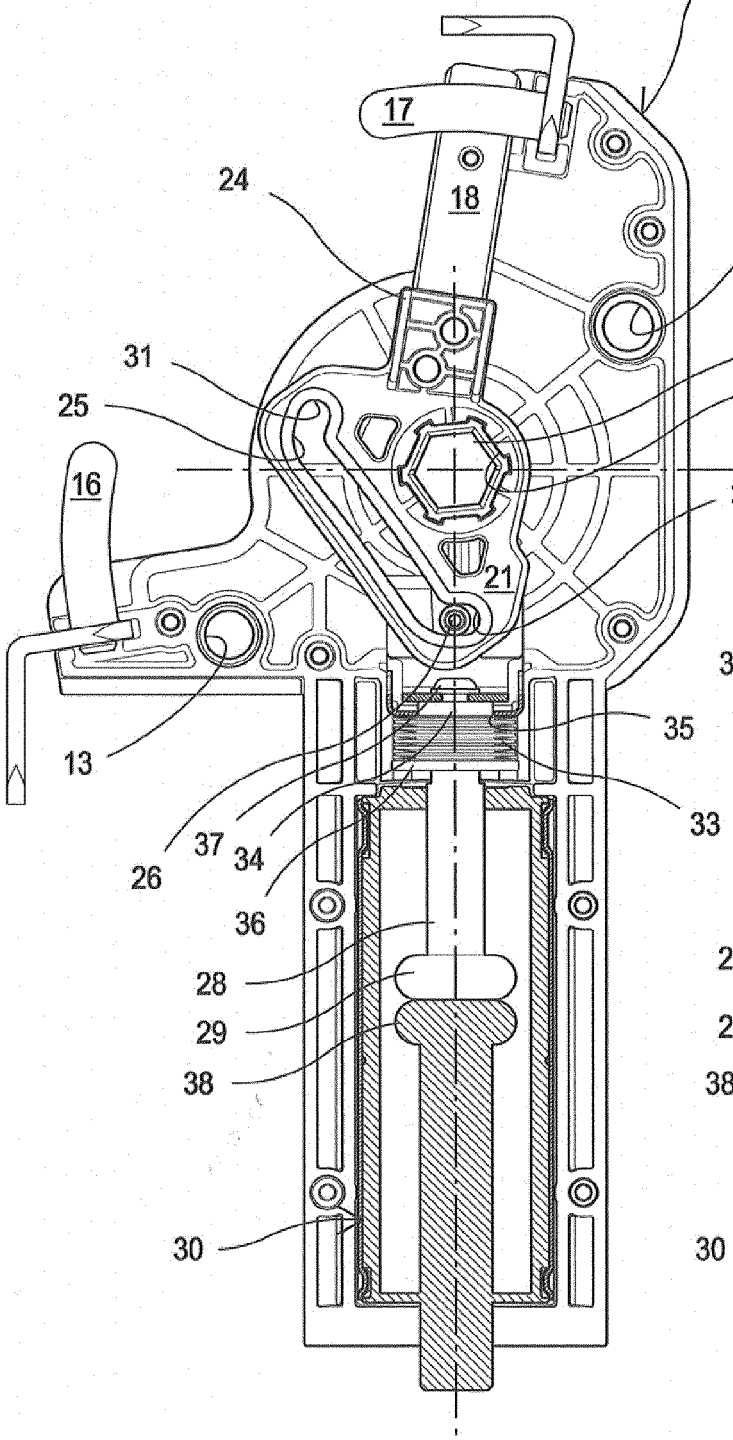
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Fig. 5

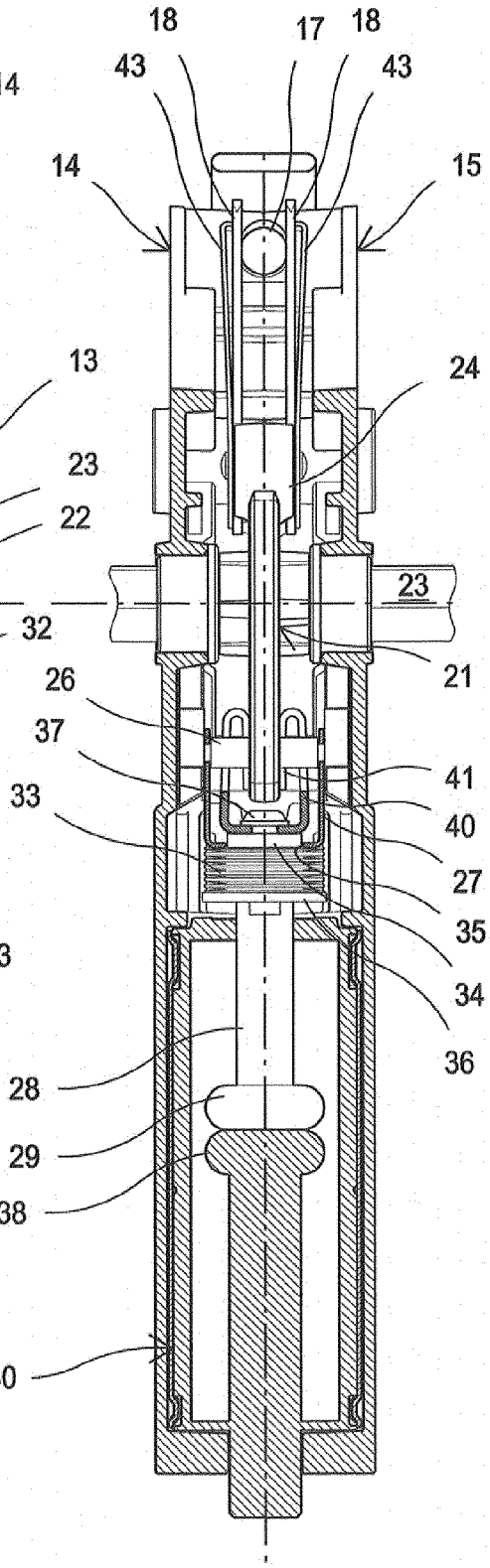
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Fig. 6

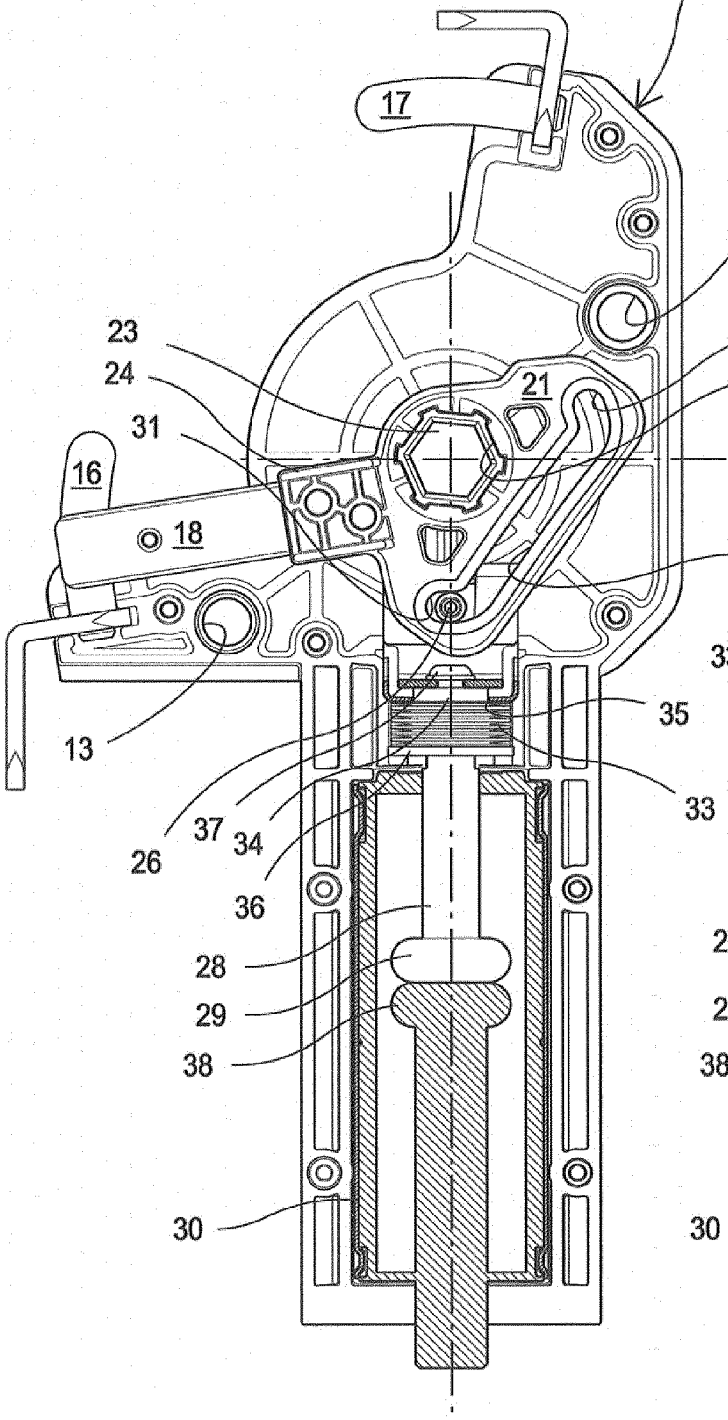
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Fig. 7

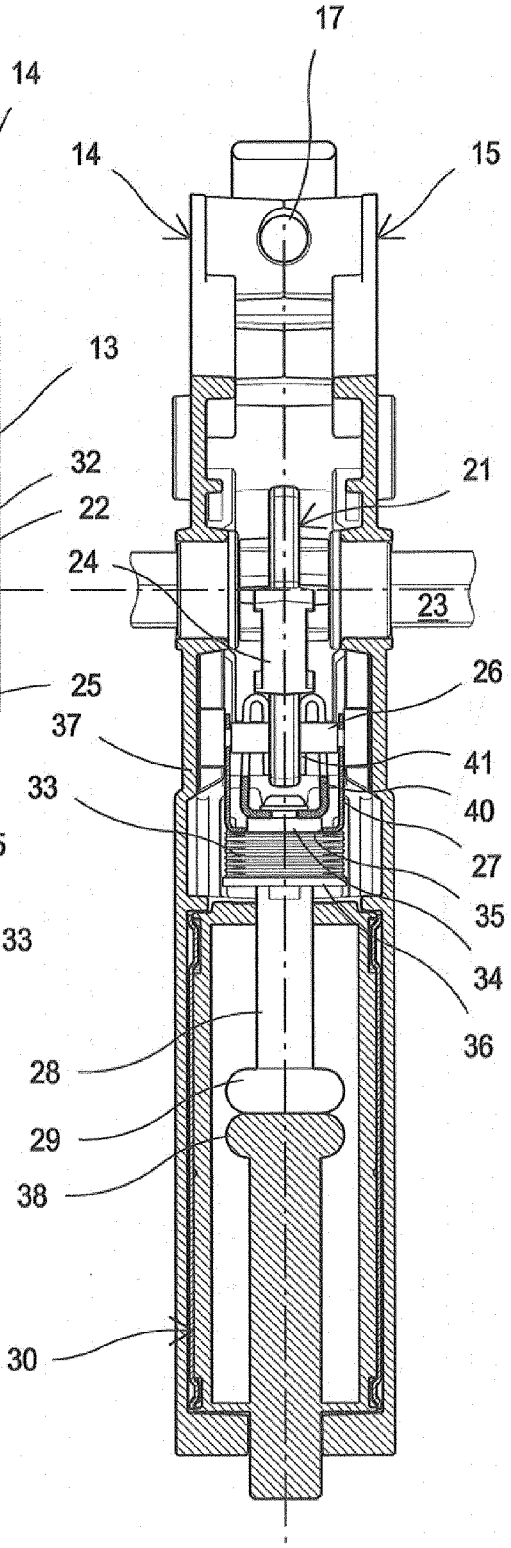
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Fig. 8

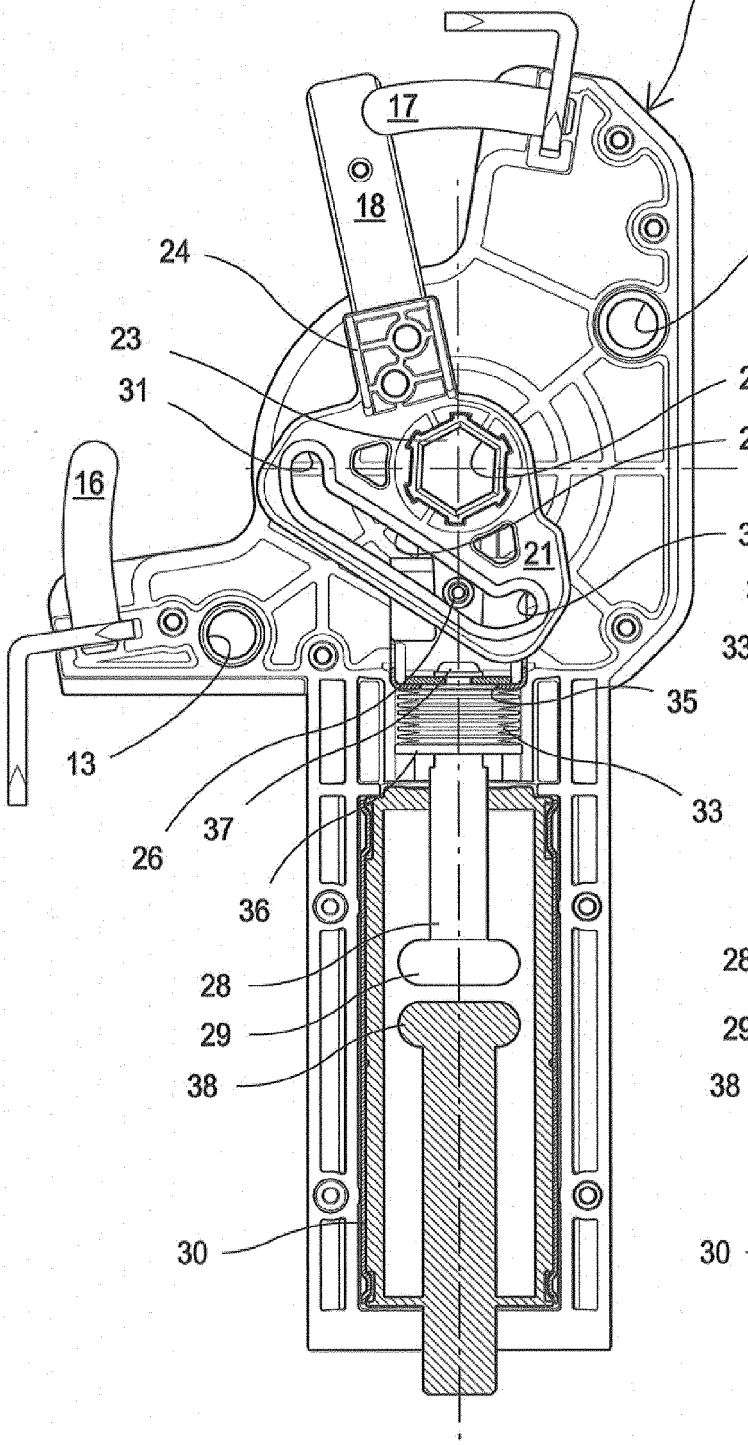
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Fig. 9

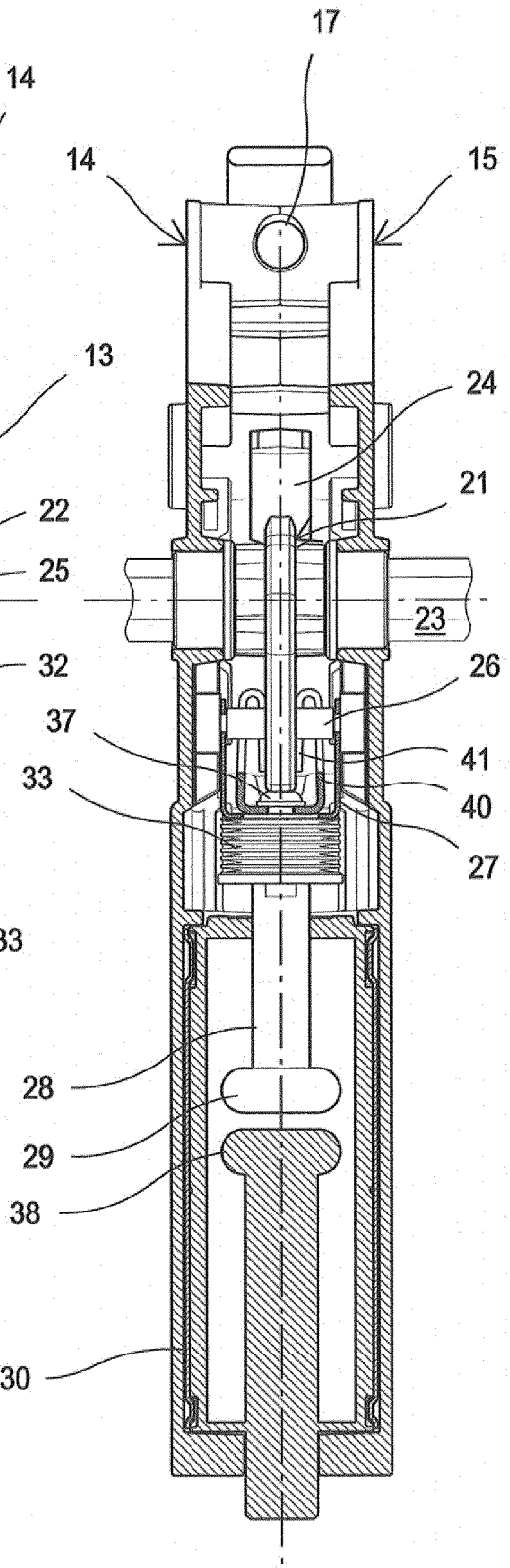
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Fig. 10

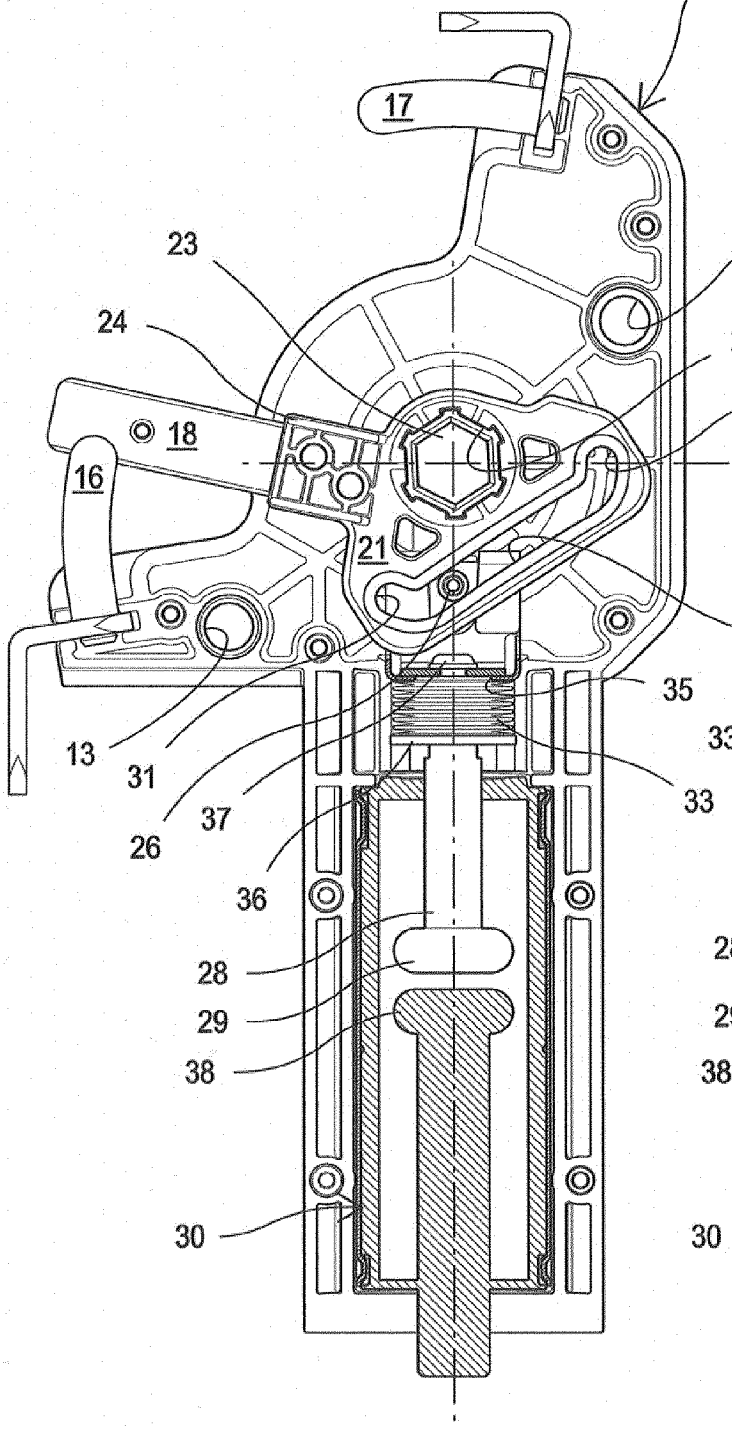
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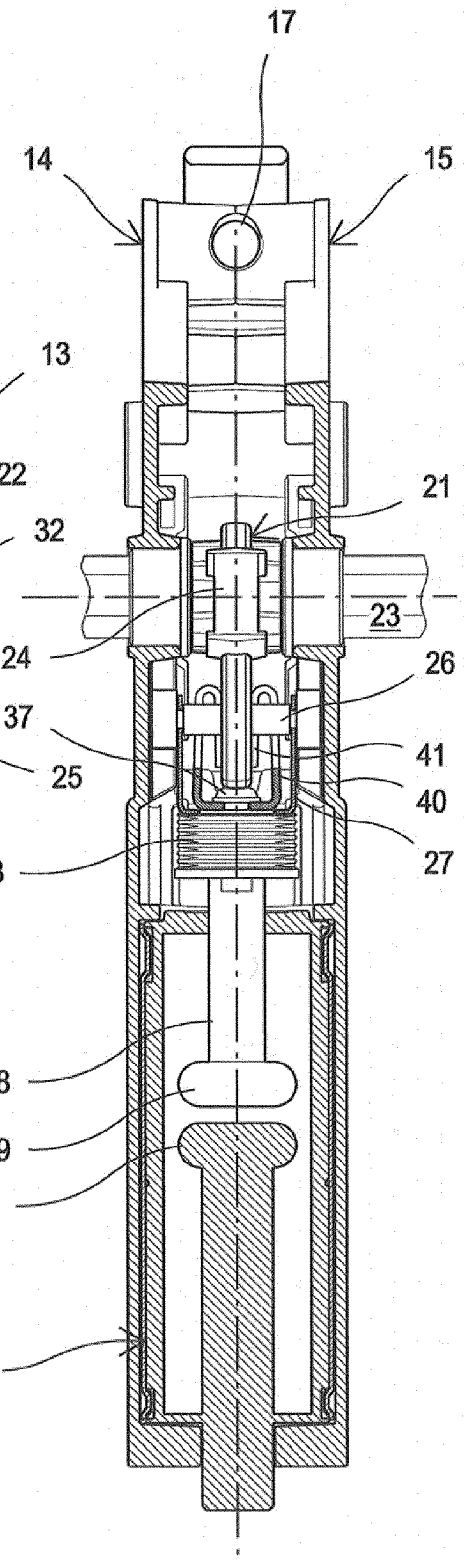
Fig. 11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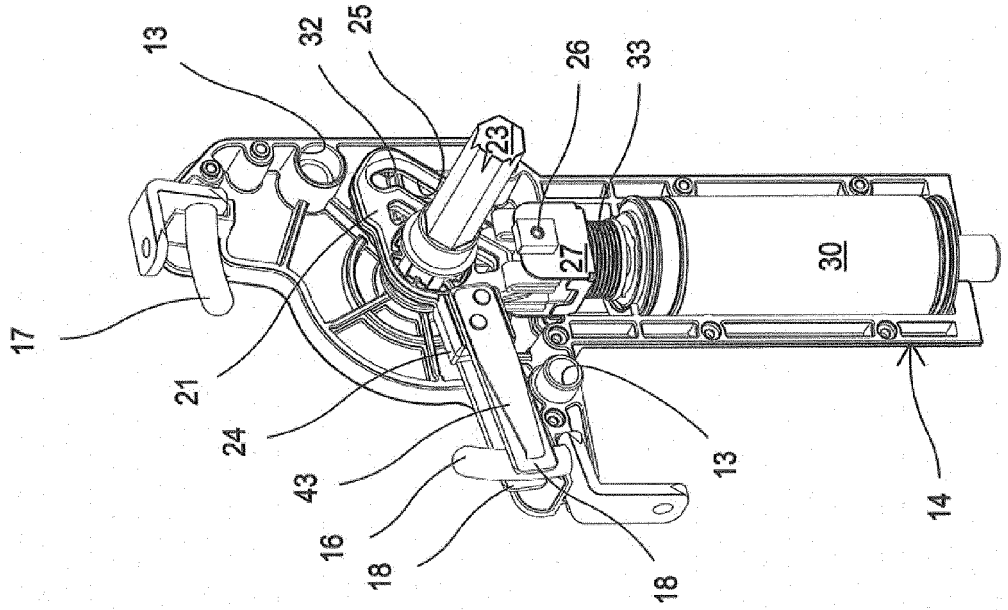

Fig. 14

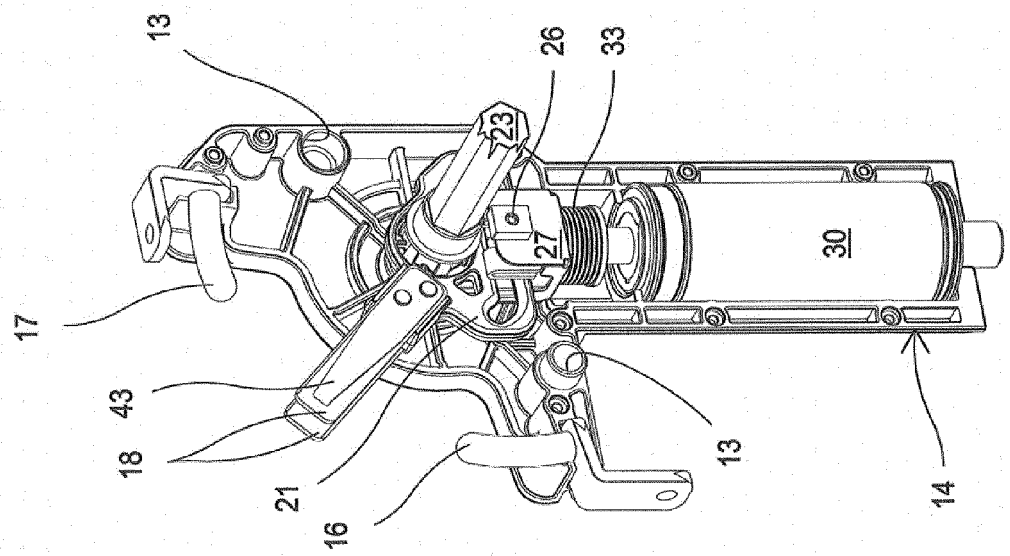

Fig. 13

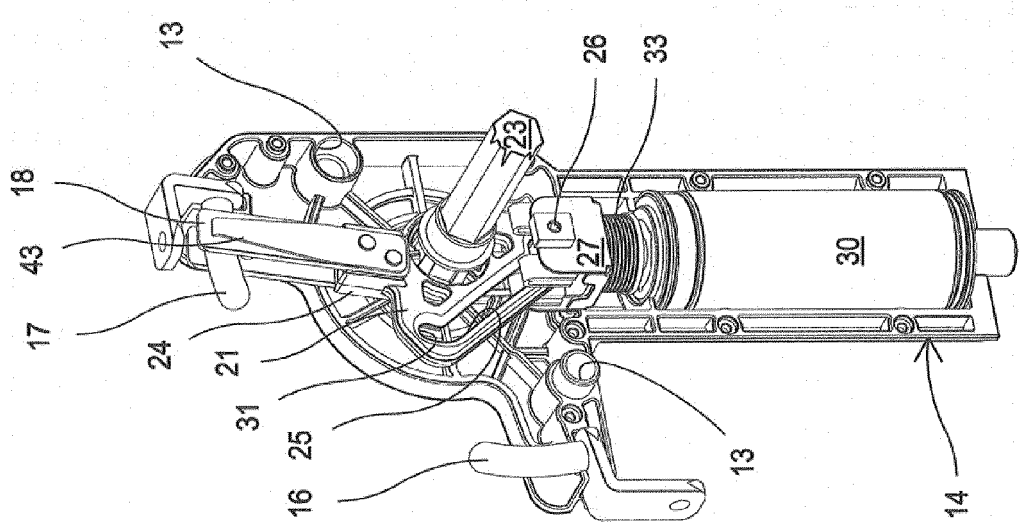

Fig. 12

Fig. 15

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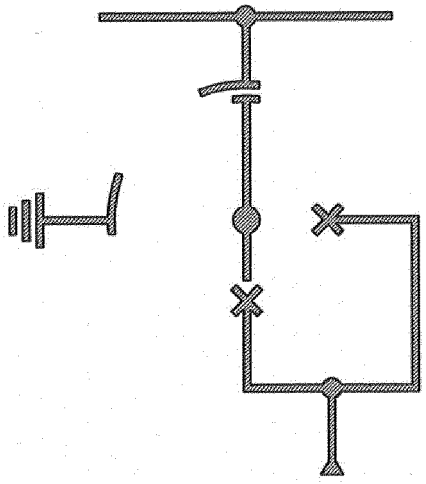

Fig. 16

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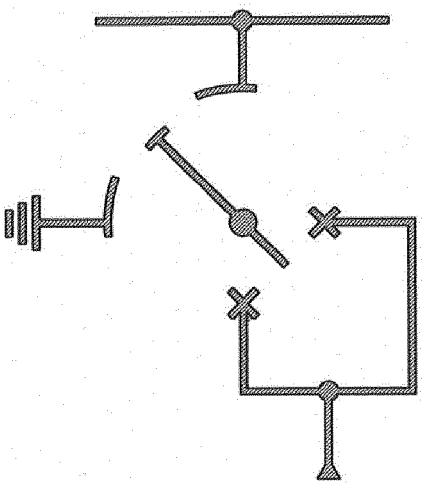
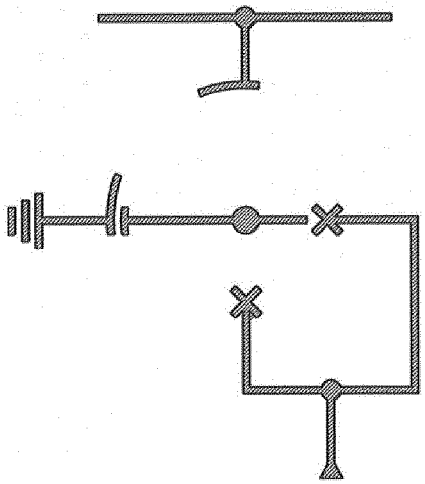


Fig. 17

GROUND



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EUROPEAN SEARCH REPORT

Application Number
EP 18 15 5060

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	FR 2 744 284 A1 (SCHNEIDER ELECTRIC SA [FR]) 1 August 1997 (1997-08-01) * abstract; figures 4,5 *	1-9	INV. H01H31/00
A	US 2004/045937 A1 (HOGLUND JUSTIN R [US] ET AL) 11 March 2004 (2004-03-11) * figure 6 *	1	
A	WO 86/04452 A1 (ASS ELECT IND [GB]) 31 July 1986 (1986-07-31) * abstract; figure 3 *	1	

TECHNICAL FIELDS SEARCHED (IPC)

H01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 June 2018	Simonini, Stefano

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 15 5060

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12-06-2018

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