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(71) Applicant: **Berker GmbH & Co. KG**
58579 Schalksmühle (DE)

(72) Inventor: **GUIDETTI, Fabrizio**
25077 Roe'Volciano, Brescia (IT)

(74) Representative: **Nuss, Laurent et al**
Cabinet Nuss
10, rue Jacques Kablé
67080 Strasbourg Cedex (FR)

(54) ELECTRICAL SWITCH DEVICE

(57) This invention has its object in an electrical switch device (20) comprising an electrical contact assembly (30) and operating means (50). The electrical contact assembly (30) comprises a movable contact element (32) configured to pivot between a first position (PI) and a second position (P2) and at least a fixed contact element (34). The movable contact element (32) comprises a contact arm (36). In a middle position (PM) of the movable contact element (32) arranged in between the first position (PI) and the second position (P2), a center line (M1) of an actuating means (54) of the operating means (50) is essentially collinear with a center line (M2) of the contact arm (36).

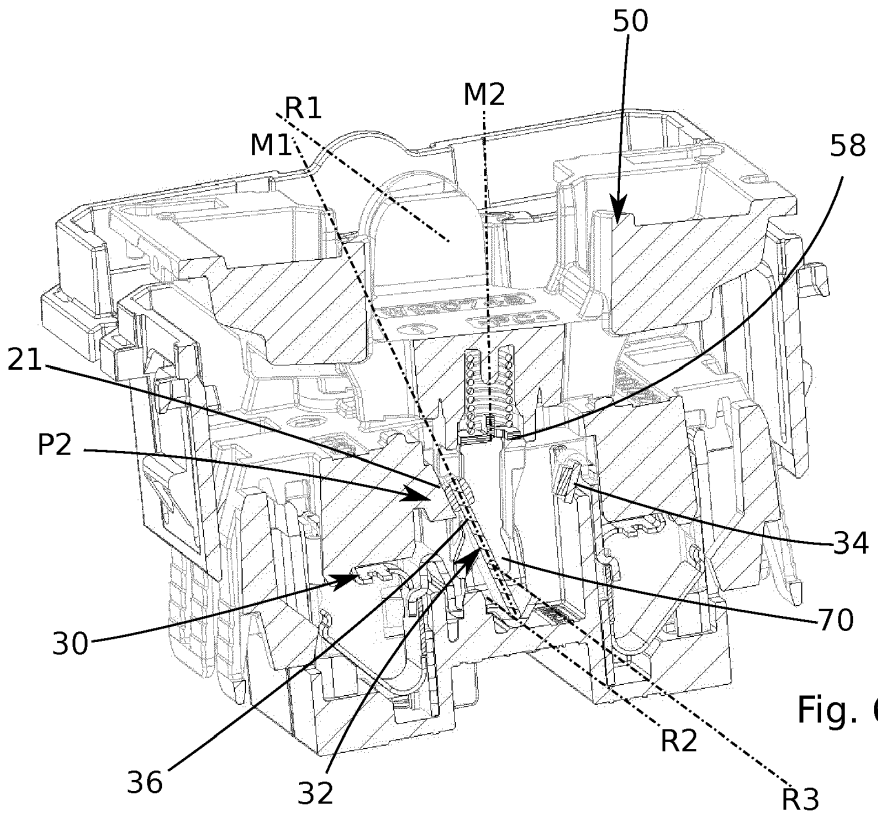

Fig. 6

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Description

[0001] The invention relates to the field of electrical switches or electrical switch devices commonly used in domestic, commercial and industrial wiring installations.

[0002] Switches comprising a so-called "see-saw" mechanism are known from prior art. An example of such a mechanism is depicted in figures 10 and 11. These mechanisms allow for the possibility to realize one-way, two-way, double pole and intermediate switch schemes. These mechanisms have the width of one module. The width of a module corresponds approximately to 22.5 mm. Two modules side-by-side can be mounted into a standard frame of a standard electrical appliance. The drawback of such a "see-saw" mechanism is that it occupies relatively much space and in particular the volume above the terminals of the switch, which limits the space in particular for other features like lamps, et cetera. Another drawback of such a mechanism is that the distance between the terminals (i.e. the length of the switch) increases when shifted down, that is when the switch mechanism is positioned closer to the operating means (i.e. the height of the switch is reduced).

[0003] Switches comprising a so-called "L" mechanism are also known from prior art. An example of such a mechanism is depicted in figure 9. This mechanism can be shifted down without needing to separate the terminals furthermore. That is the height of the switch can be reduced without further increasing its length. However, with those mechanisms, only one-way and two-way schemes can fit into the width of one module, while the double pole and intermediate switches require the width of two modules.

[0004] This invention has as its object to remedy to these drawbacks by proposing an electrical switch device having reduced dimensions and offering high functionality. It is a further object of the invention to propose an electrical switch device occupying the width of only one module, allowing for the possibility for realizing one-way, two-way, double pole and intermediate switch schemes and allowing for the switch mechanism to be shifted down without further increasing the length of the switch.

[0005] For this purpose, the electrical switch device according to the present invention comprises an electrical contact assembly and operating means configured to pivot around a first axis of rotation. The operating means further comprise a rocker and actuating means extending radially with respect to the first axis in a first direction of extension.

[0006] The electrical contact assembly comprises a movable contact element configured to pivot around a second axis of rotation between a first position and a second position and at least a fixed contact element. The movable contact element comprises a contact arm extending radially with respect to the second axis in a second direction of extension.

[0007] The contact arm comprises a first contact surface and the fixed contact comprises a second contact surface. The first contact surface and the second contact surface are configured to be in mutual contact when the movable contact element is in the first position.

[0008] The actuating means are configured to act on the movable contact element in order to cause the movement of the movable contact element from the first position to the second position and/or from the second position upon manual action by a user on the rocker.

[0009] In a middle position of the movable contact element lying in between the first position and the second position, a center line of the actuating means extending in the first direction is essentially collinear with a line of the contact arm extending in the second direction and intersecting the first contact surface.

[0010] The electrical switch device according to the invention enables to overcome the drawbacks of the "see-saw" and "L" mechanisms while keeping their advantages. The electrical switch device according to the invention allows for the possibility to make all of the above mentioned schemes, that is a one-way, two-way, double pole and intermediate switch schemes within the space of one module, The electrical switch device according to the invention further allows for an easy way to provide multipole switch combinations and allows to integrate features like switch lamps et cetera.

[0011] In a preferred embodiment of the present invention, the movable contact element comprises a contact edge extending in parallel to the second axis of rotation, the actuating means being configured to be in physical contact with the contact edge throughout a pivoting motion of the movable contact element between the first position and the second position and/or between the second position and the first position.

[0012] According to this embodiment, the contact edge may form a third axis of rotation between the movable contact element and the actuating means. The actuating means may pivot relative to the movable contact element around the third axis of rotation during a switch operation induced by a manual operation of the operating means by a user.

[0013] Preferably, the actuating means comprise guiding means and an actuator arranged within the guiding means, the actuator being movable relative to the guiding means in a direction extending radially from the first axis of rotation, in order to stay in physical contact with the contact edge throughout the pivoting motion of the movable contact element between the first position and the second position and/or between the second position and the first position.

[0014] This embodiment allows for a smooth and continuous motion of the movable contact element and the operating means during the switch operation, that is when a pivoting motion of the movable contact element between the first position and the second position and/or between the second position and the first position is induced by the actuator of the operating means.

[0015] In a preferred embodiment of the present invention, the guiding means comprise two abutment surfaces,

the guiding means further being configured to let the actuator swivel freely between the abutment surfaces around the first axis of rotation.

[0016] This embodiment allows for a smooth and continuous motion of the movable contact element and the operating means during the switch operation.

[0017] Preferably, the actuating means further comprise a spring element physically connected to the guiding means on the one hand and to the actuator on the other hand, the spring element continuously applying a spring force on the actuator throughout the pivoting motion of the movable contact element between the first position and the second position and/or between the second position and the first position.

[0018] This embodiment enables the actuator to remain in contact with the movable contact element throughout the pivoting motion of the movable contact element and therefore allows for a smooth and continuous motion of the movable contact element and the operating means during the switch operation.

[0019] In a preferred embodiment of the present invention, the actuator comprises two actuating arms and an aperture arranged there between, the aperture being configured to receive the contact arm in the middle position of the movable contact element.

[0020] This embodiment allows for the width of the operating means, and in particular the width of the actuator of the operating means, and the width of the contact arm to be reduced.

[0021] Preferably, the actuator has the general shape of a tuning fork, the actuating arms each essentially extending in a plane perpendicular to the first axis of rotation.

[0022] In a preferred embodiment of the present invention, the guiding means further comprise two gliding surfaces each extending in a plane perpendicular to the first axis of rotation an each being in contact with one of the actuating arms.

[0023] This embodiment allows for a smooth and continuous motion of the movable contact element and the operating means during the switch operation.

[0024] Preferably, each of the actuating arms comprises a v-shaped actuating portion configured to stay in physical contact with the contact edge throughout the pivoting motion of the movable contact element between the first position and the second position and/or between the second position and the first position.

[0025] This embodiment allows for a smooth and continuous motion of the movable contact element and the operating means during the switch operation.

[0026] In a preferred embodiment of the present invention, the contact arm comprises two embossments on each side of the contact arm, each configured to be in contact with one of the actuating arms in order to center the contact arm between the actuating arms.

[0027] This embodiment allows the contact arm of the movable contact element to be guided during the continuous motion of the movable contact element during the switch operation.

[0028] Preferably, actuator is made of metal.

[0029] The invention will be better understood using the description below, which relates to one preferred embodiment, given by way of nonlimiting example and explained with reference to the accompanying drawings, in which

- figure 1 shows a sectional view of the electrical switch device according to the preferred embodiment, wherein a movable contact element of the electrical switch device takes a second position,
- figure 2 shows a detailed sectional view of actuating means of the electrical switch device according to the preferred embodiment,
- figure 3 shows a sectional view of the electrical switch device according to the preferred embodiment, wherein the movable contact element of the electrical switch device takes a middle position,
- figure 4 shows a sectional view of the electrical switch device according to the preferred embodiment,
- figure 5 shows a sectional view of the electrical switch device according to the preferred embodiment, wherein the movable contact element of the electrical switch device takes a first position.
- figure 6 shows a perspective sectional view of the electrical switch device according to the preferred embodiment, wherein the movable contact element of the electrical switch device takes the second position,
- figure 7 shows a detailed view of the actuating means of the electrical switch device according to the preferred embodiment,
- figure 8 shows a detailed view of the movable contact element and the actuating means of the electrical switch device according to the preferred embodiment,
- figure 9 shows a movable contact element and actuating means of an electrical switch device known from prior art,
- figures 10 and 11 show another electrical switch device known from prior art.

[0030] The application relates to an electrical switch device 20. A preferred embodiment of the electrical switch device 20 is shown in figures 1 to 8.

[0031] A switch 20" known from prior art and comprising a so-called "see-saw" mechanism 30" is depicted in figures 10 and 11. The switch 20" further comprises operating means 50" for manual operation by a user. These mechanisms 30" have a movable contact element 32" and allow for the possibility to realize one-way, two-way, double pole and intermediate switch schemes. These mechanisms 30" have the width of one module. The width of a module corresponds approximately to 22.5 mm. Two modules side-by-side can be mounted into of standard frame of a standard electrical appliance. The

drawback of such a "see-saw" mechanism 30" is that it occupies relatively much space and in particular the volume above the terminals 31" of the switch 20", which limits the space in particular for other features like lamps, et cetera. Another drawback of such a mechanism 30" is that the distance between the terminals 31" (i.e. the length L of the switch) increases when shifted down, that is when the switch mechanism 30" is positioned closer to the operating means 50" (i.e. the height H of the switch is reduced).

[0032] Another switch 20' known from prior art and comprising a so-called "L" mechanism 30' is depicted in figure 9. The mechanism comprises a movable contact element 32' and the switch 20' further comprises operating means 50'. The movable contact element 32' comprises a contact arm 36' bearing a contact surface 38'. The contact arm 36' extends along a primary direction D1'. Actuating means 54' of operating means 50' extend along a secondary direction D2'. In a middle position of the movable contact element 32' a center line M1' of the actuating means 54' extends parallel to the primary direction D1' and in a plane, which is parallel and distant to a plane in which a line M2' extending parallel to the secondary direction D2' and intersecting the contact surface 38' lies.

[0033] This so-called "L" mechanism 30' can be shifted down without needing to separate the terminals furthermore. That is the height H of the switch 20' can be reduced without further increasing its length L. However, with those mechanisms 30', only one-way and two-way schemes can fit into the width of one module, while the double pole and intermediate switches require the width of two modules.

[0034] The electrical switch device 20 according to the preferred embodiment comprises an electrical contact assembly 30 and an operating means 50. The operating means 50 is configured to pivot around a first axis of rotation R1 and comprises a rocker 52 and actuating means 54 extending radially from the first axis of rotation R1 in a first direction of extension D1.

[0035] The electrical contact assembly 30 comprises a movable contact element 32 configured to pivot around a second axis of rotation R2 between a first position P1 and a second position P2 and at least a fixed contact element 34. The movable contact element 32 comprises a contact arm 36 extending radially from the second axis of rotation R2 in a second direction of extension D2.

[0036] The contact arm 36 comprises a first contact surface 38 and the fixed contact 34 comprises a second contact surface 40. The first contact surface 38 and the second contact surface 40 are configured to be in mutual contact when the movable contact element 32 is in the first position P1. The movable contact element 32 taking the first position PI is shown in figure 5.

[0037] The actuating means 54 are configured to act on the movable contact element 32 in order to cause the movement of the movable contact element 32 from the first position P1 to the second position P2 and/or from the second position P2 to the first position P1 upon manual action by a user on the rocker 52. The movable contact element 32 taking the second position P2 is shown in figure 1.

[0038] In a middle position PM of the movable contact element 32 arranged in between the first position P1 and the second position P2, as shown in figure 3, a center line M1 of the actuating means 54 extending in the first direction D1 is essentially collinear with a line M2 of the contact arm 36 extending in the second direction D2 and intersecting the first contact surface 38. The line M2 can also be a center line of the contact arm 36.

[0039] Furthermore, the movable contact element 32, in particular the contact arm 34 of the movable contact element 32, and the actuating means 54 can be configured to pivot in the same plane, that is, that throughout the entire pivoting motion of the movable contact element 32 and the actuating means 54, the center line M1 of the actuating means 54 and the line M2 lie in a sane plane.

[0040] The movable contact element 32 of the electrical switch device 20 according to the preferred embodiment may comprise a contact edge 42 extending in parallel to the second axis of rotation R2, the actuating means 54 being configured to be in physical contact with the contact edge 42 throughout the pivoting motion of the movable contact element 32 between the first position P1 and the second position P2 and/or between the second position P2 and the first position P1.

[0041] According to this embodiment, the contact edge 42 may form a third axis of rotation R3 between the movable contact element 32 and the actuating means 54. The actuating means 54 may pivot relative to the movable contact element 32 around the third axis of rotation R3 during a switch operation induced by a manual operation of the operating means 50 by a user. The first axis of rotation R1 and/or the second axis of rotation R2 and/or the third axis of rotation R3 may be parallel to each other. In the middle position PM, the first axis of rotation R1 and/or the second axis of rotation R2 and/or the third axis of rotation R3 may all lie in the same plane. The contact edge 42 may form a physical fulcrum for the pivoting motion around the third axis of rotation R3 to avoid an unpredictable movement, in particular in the middle position PM, of the actuating means 54 relative to the movable contact 32.

[0042] The actuating means 54 may comprise a guiding means 56 and an actuator 58 arranged within the guiding means 56, the actuator 58 being movable relative to the guiding means 56 in a direction extending radially from the first axis of rotation R1, in order to stay in physical contact with the contact edge 42 throughout the pivoting motion of the movable contact element 32 between the first position P1 and the second position P2 and/or between the second position P2 and the first position PI. The guiding means 56 are configured to guide the actuator 58.

[0043] The guiding means 56 may comprise two abutment surfaces 60, the guiding means 56 further being

configured to let the actuator 58 swivel freely between the abutment surfaces 60 around the first axis of rotation R1. The two abutment surfaces 60 may further be configured to be in physical contact with the actuator 58 in either the first position P1 or the second position P2. The actuator 58 may comprise one or several cams being in physical contact with one of the abutment surfaces 60 in either the first position P1 or the second position P2. The two abutment surfaces 60 may, in vicinity of the contact edge 42, be spaced further apart than in the vicinity of the rocker 52. The fact that the actuator 58 may swivel freely between the abutment surfaces 60 around the first axis of rotation R1 allows for a smooth operation of the operating means 50 throughout the movement of the movable contact 32 from the first position P1 to the second position P2 and/or from the second position P2 to the first position P1.

[0044] The actuating means 54 may further comprise a spring element 62 physically connected to the guiding means 56 on the one hand and to the actuator 58 on the other hand, the spring element 62 continuously applying a spring force on the actuator 58 throughout the pivoting motion of the movable contact element 32 between the first position P1 and the second position P2 and/or between the second position P2 and the first position P1. The guiding means 56 may comprise a retention peg 57 connected to the spring element 62.

[0045] The actuator 58 may comprise spring clips 59 for connecting the actuator 58 to the spring element 62. The spring clips 59 and/or the retention peg 57 may be so designed to act only on the extremity of the spring element 62, in order not to impair to the spring force of the spring element 62. The retention peg 57 and the spring clips 59 safely hold the spring element 62 and the actuator 58 in place in a single subassembly with the operating means 50. The single subassembly can be safely manipulated during the assembly of the electrical switch device 20, limiting the loss of internal parts.

[0046] The actuator 58 may comprises two actuating arms 64 and an aperture 66 arranged there between, the aperture 66 being configured to receive the contact arm 36 in the middle position PM of the movable contact element 32. The contact arm 36 may rotate through the aperture 66 when moving from the first position P1 to the second position P2 and/or from the second position P2 to the first position P1. The first contact surface 38 may be arranged between the two actuating arms 64 within the aperture 66 in the middle position PM. The actuator 58 may have the general shape of a tuning fork, the actuating arms 64 each essentially extending in a plane perpendicular to the first axis of rotation R1.

[0047] The guiding means 56 may further comprise two gliding surfaces 68 each extending in a plane perpendicular to the first axis of rotation R1 and each being in contact with one of the actuating arms 64.

[0048] Each of the actuating arms 64 may comprise a v-shaped actuating portion 70 configured to stay in physical contact with the contact edge 42 throughout the pivoting motion of the movable contact element 32 between the first position P1 and the second position P2 and/or between the second position P2 and the first position P1. The physical fulcrum may be formed between the actuating portion 70 and the contact edge 42. The v-shaped actuating portion 70 also facilitates catching of the contact edge 42 of the movable contact 32 during the assembling operation of the electrical switch device 20.

[0049] The contact arm 36 may comprise two embossments 44 on each side of the contact arm 36, each configured to be in contact with one of the actuating arms 64 in order to center the contact arm 36 between the actuating arms 64. This embodiment facilitates the rotational movement of the contact arm 34 through the aperture 66. The two embossments 44 can ensure that a space of at least 0.5 mm is kept between the actuating arms 64 and the end of the contact arm 36. Preferably, the two embossments 44 are positioned close to the contact edge 42. This preferred embodiment allows to limit the friction between the embossments 44 and actuating arm 64 during the rotational movement of the movable contact element 32.

[0050] The actuator 58 and/or the spring element 62 and/or the electrical contact assembly 30 may be made of metal. An actuator 58 made of metal can reduce the undesirable consumption and deformation of the actuator 58 due to the applied force, friction and eating effect under load conditions.

[0051] Figures 1 and 3 to 5 illustrate the movement of the movable contact element 32 from the second position P2 to the first position P1. In the second position P2, the end of the contact arm 36 rests against an inner wall 21 of the electrical switch device 20. The inner wall 21 may extend parallel to the first direction of extension D1 when the movable contact element 32 takes the second position P2. The actuating means 54, in particular the actuator 58 and/or the actuating portion 70, act(s) upon the movable contact 32 and in particular on the contact edge 42 of the movable contact 32 by means of a spring force induced by the spring element 62, in order to maintain the end of the contact arm 36 to rest against the inner wall 21.

[0052] Upon manual action by a user on the rocker 52, the movable contact element 32 may leave the second position P2, such that the end of the contact arm 36 is removed from the wall 21. Upon further manual action by a user on the rocker 52, the movable contact element 32 may reach the middle position PM. The middle position PM is depicted in figure 3. Due to the spring force induced by the spring element 62 and applied to the movable contact element 32 via the actuating means 54 and in particular the actuator 58 of the actuating means 54, the operating means 50 and the movable contact element 32 are in an unstable equilibrium. The center line M1 and the line M2 are collinear. The first axis of rotation R1, the second axis of rotation R2 and the third axis of rotation R3 extend in the same plane.

[0053] As depicted in figure 4, upon even further man-

ual action by a user on the rocker 52, the operating means 50 and the movable contact element 32 leave the stable equilibrium and the contact arm 36 of the movable contact element 32 and/or the first contact surface 38 move(s) towards the fixed contact element 34 and/or the second contact surface 40. After having left the stable equilibrium, the spring force induced by the spring element 62 urges the movable contact element 32 towards the first position PI without the need of further manual action by the user on the rocker 52. In the first position P1, the first contact surface 38 is in contact with the second contact surface 40. The movable contact element 32 taking the first position PI is shown in figure 5.

[0054] Of course, the invention is not limited to the at least one embodiment described and represented in the accompanying drawings. Modifications remain possible, particularly from the viewpoint of the composition of the various elements or by substitution of technical equivalents without thereby exceeding the field of protection of the invention.

Claims

1. Electrical switch device comprising an electrical contact assembly (30) and operating means (50),
the operating means (50) being configured to pivot around a first axis of rotation (R1) and comprising a rocker (52) and an actuating means (54) extending radially from the first axis of rotation (R1) in a first direction of extension (D1),
the electrical contact assembly (30) comprising a movable contact element (32) configured to pivot around a second axis of rotation (R2) between a first position (P1) and a second position (P2) and at least a fixed contact element (34),
the movable contact element (32) comprising a contact arm (36) extending radially from the second axis of rotation (R2) in a second direction of extension (D2),
the contact arm (36) comprising a first contact surface (38) and the fixed contact (34) comprising a second contact surface (40),
the first contact surface (38) and the second contact surface (40) being configured to be in mutual contact when the movable contact element (32) is in the first position (P1),
the actuating means (54) being configured to act on the movable contact element (32) in order to cause the movement of the movable contact element (32) from the first position (P1) to the second position (P2) and/or from the second position (P2) to the first position (P1) upon manual action by a user on the rocker (52),
characterized in that, in a middle position (PM) of the movable contact element (32) arranged in between the first position (P1) and the second position (P2), a center line (M1) of the actuating means (54) extending in the first direction (D1) is essentially collinear with a line (M2) of the contact arm (36) extending in the second direction (D2) and intersecting the first contact surface (38).

2. Electrical switch device according to claim 1, **characterized in that** the movable contact element (32) comprises a contact edge (42) extending in parallel to the second axis of rotation (R2), the actuating means (54) being configured to be in physical contact with the contact edge (42) throughout a pivoting motion of the movable contact element (32) between the first position (P1) and the second position (P2) and/or between the second position (P2) and the first position (P1).

3. Electrical switch device according to claim 2, **characterized in that** the actuating means (54) comprise guiding means (56) and an actuator (58) arranged within the guiding means (56), the actuator (58) being movable relative to the guiding means (56) in a direction extending radially from the first axis of rotation (R1), in order to stay in physical contact with the contact edge (42) throughout the pivoting motion of the movable contact element (32) between the first position (P1) and the second position (P2) and/or between the second position (P2) and the first position (P1).

4. Electrical switch device according to claim 3, **characterized in that** the guiding means (56) comprise two abutment surfaces (60), the guiding means (56) further being configured to let the actuator (58) swivel freely between the abutment surfaces (60) around the first axis of rotation (R1).

5. Electrical switch device according to any one of the claims 3 or 4, **characterized in that** the actuating means (54) further comprise a spring element (62) physically connected to the guiding means (56) on the one hand and to the actuator (58) on the other hand, the spring element (62) continuously applying a spring force on the actuator (58) throughout the pivoting motion of the movable contact element (32) between the first position (P1) and the second position (P2) and/or between the second position (P2) and the first position (P1).

6. Electrical switch device according to any one of the claims 3 to 5, **characterized in that** the actuator (58) comprises two actuating arms (64) and an aperture (66) arranged there between, the aperture (66) being configured to receive the contact arm (36) in the middle position (PM) of the movable contact element (32).

7. Electrical switch device according to claim 6, **characterized in that** the actuator (58) has the general

shape of a tuning fork, the actuating arms (64) each essentially extending in a plane perpendicular to the first axis of rotation (R1).

8. Electrical switch device according to claim 7, **characterized in that** the guiding means (56) further comprise two gliding surfaces (68) each extending in a plane perpendicular to the first axis of rotation (R1) and each being in contact with one of the actuating arms (64).

9. Electrical switch device according to any one of the claims 6 to 8, **characterized in that** each of the actuating arms (64) comprises a v-shaped actuating portion (70) configured to stay in physical contact with the contact edge (42) throughout the pivoting motion of the movable contact element (32) between the first position (P1) and the second position (P2) and/or between the second position (P2) and the first position (P1).

10. Electrical switch device according to any one of the claims 6 to 9, **characterized in that** the contact arm (36) comprises two embossments (44) on each side of the contact arm (36), each configured to be in contact with one of the actuating arms (64) in order to center the contact arm (36) between the actuating arms (64).

11. Electrical switch device according to any one of the claims 3 to 7, **characterized in that** the actuator (58) is made of metal.

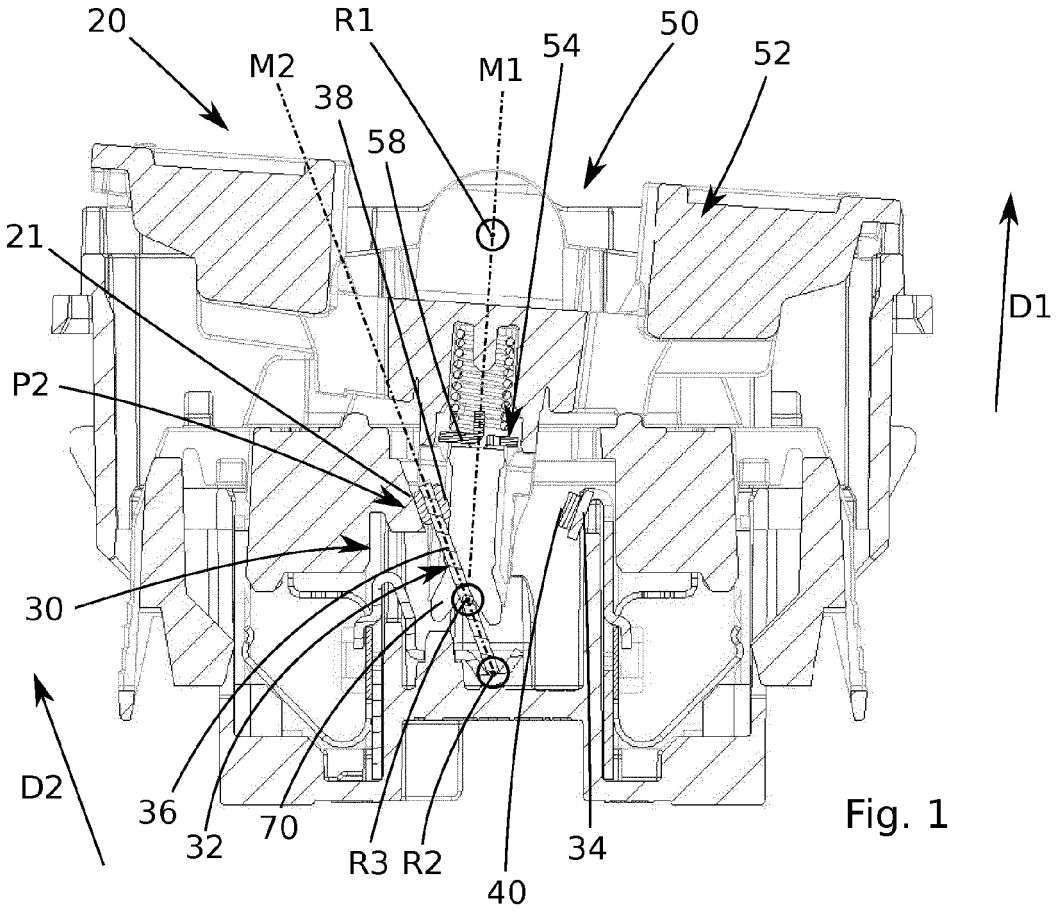
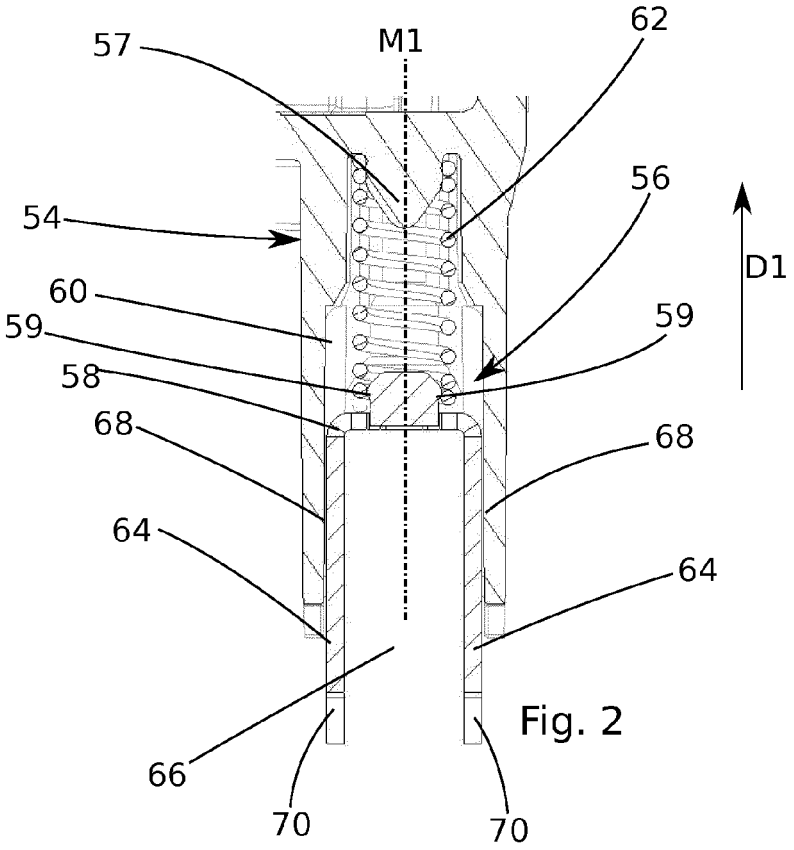

20
R1
M2
M1
54
50
52
38
58
21
D1
P2
30
D2
36
32
70
R3
R2
40
34

Fig. 1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D1
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58
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68
64
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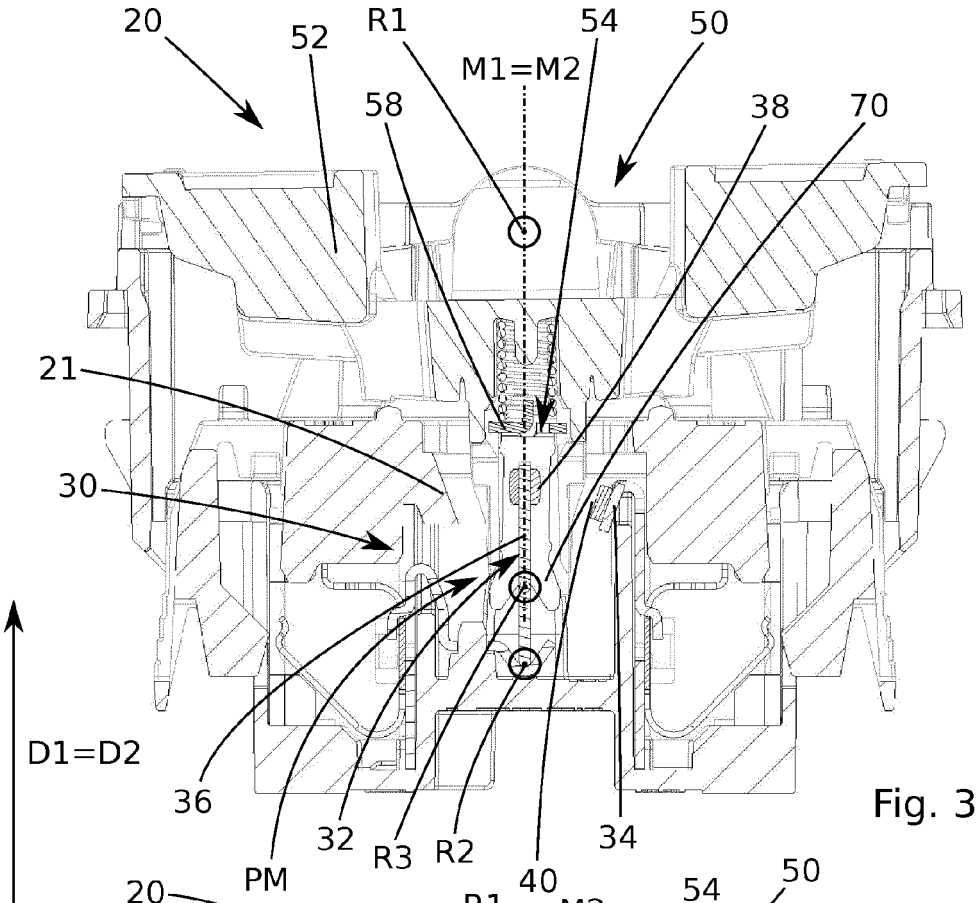
70
70

Fig. 2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52
R1
54
50
M1=M2
58
38
70
21
30
D1=D2
36
32
R3
R2
34
PM
40

Fig. 3

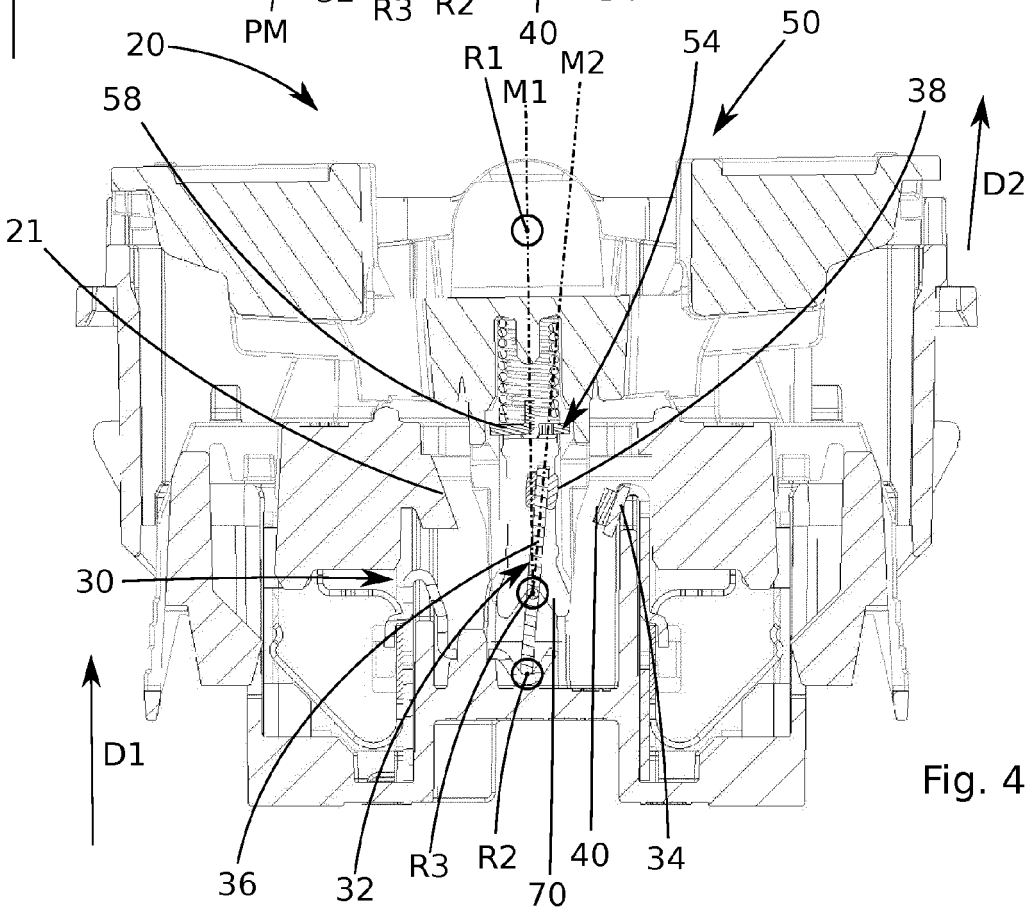
20
R1
M2
M1
54
50
58
38
D2
21
30
D1
36
32
R3
R2
70
40
34

Fig. 4

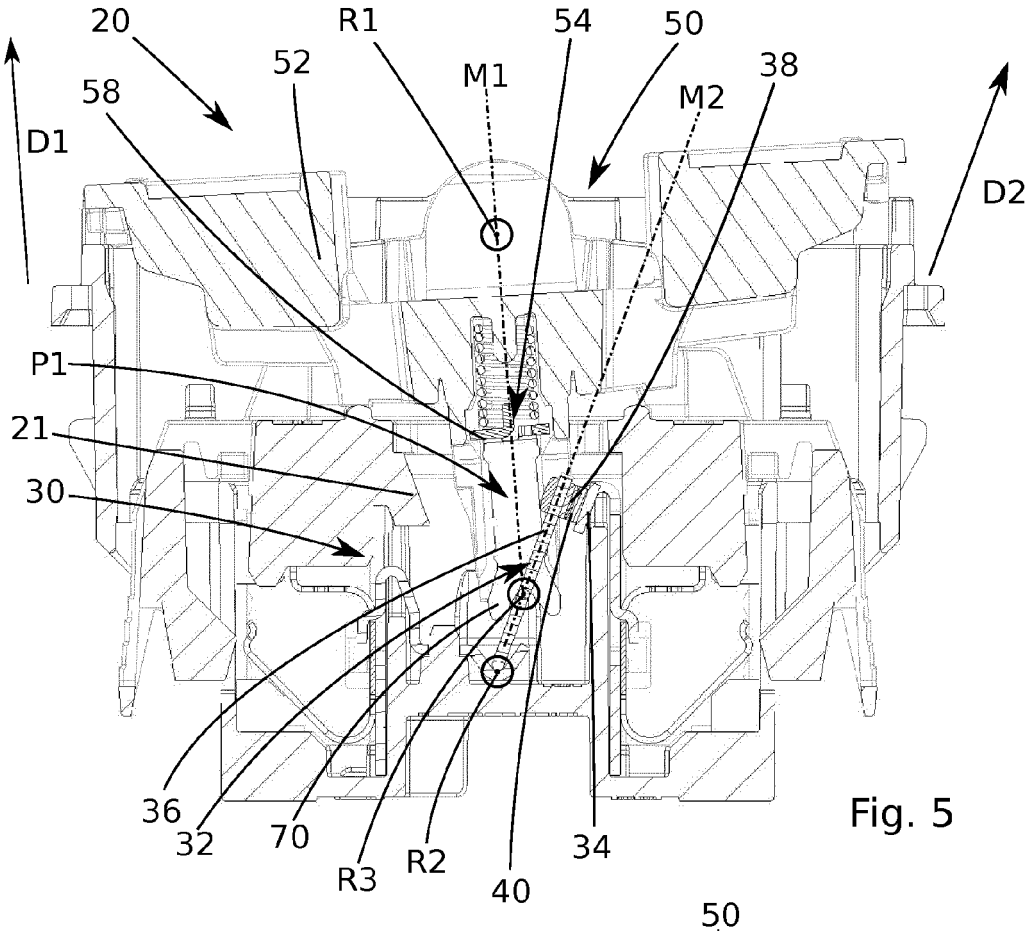
20
R1
54
50
52
M1
38
58
M2
D1
D2
P1
21
30
36
32
70
R3
R2
40
34

Fig. 5

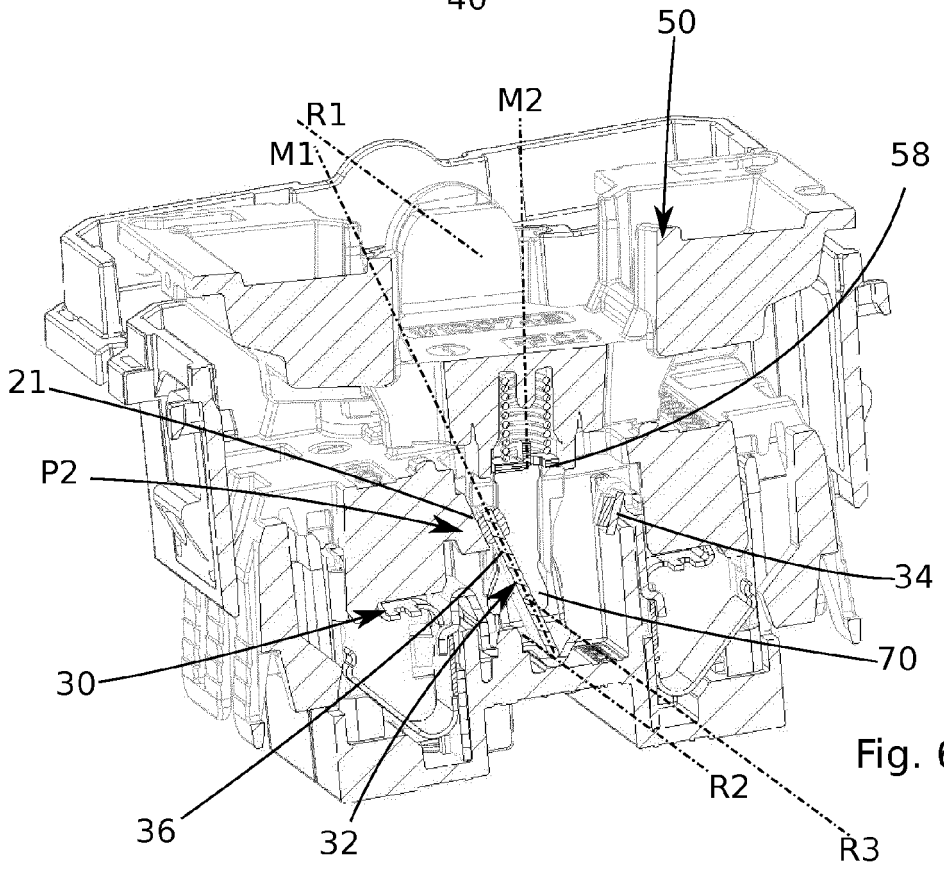
50
R1
M2
M1
58
21
P2
34
70
30
R2
36
32
R3

Fig. 6

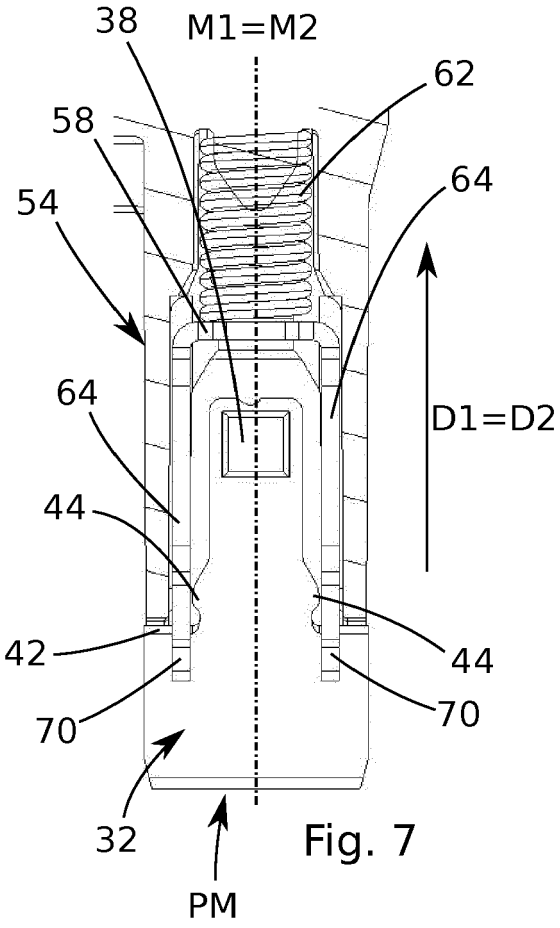

Fig. 7

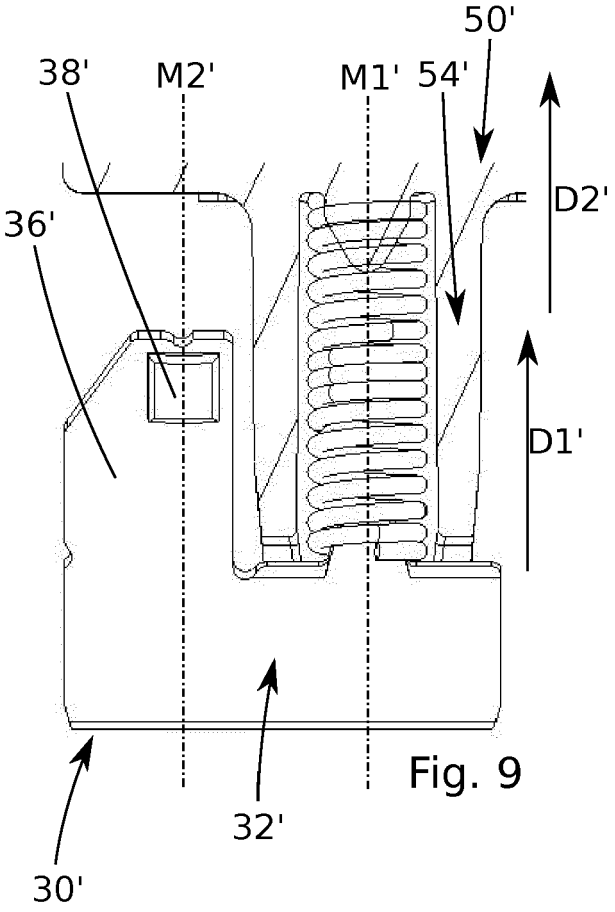

Fig. 9

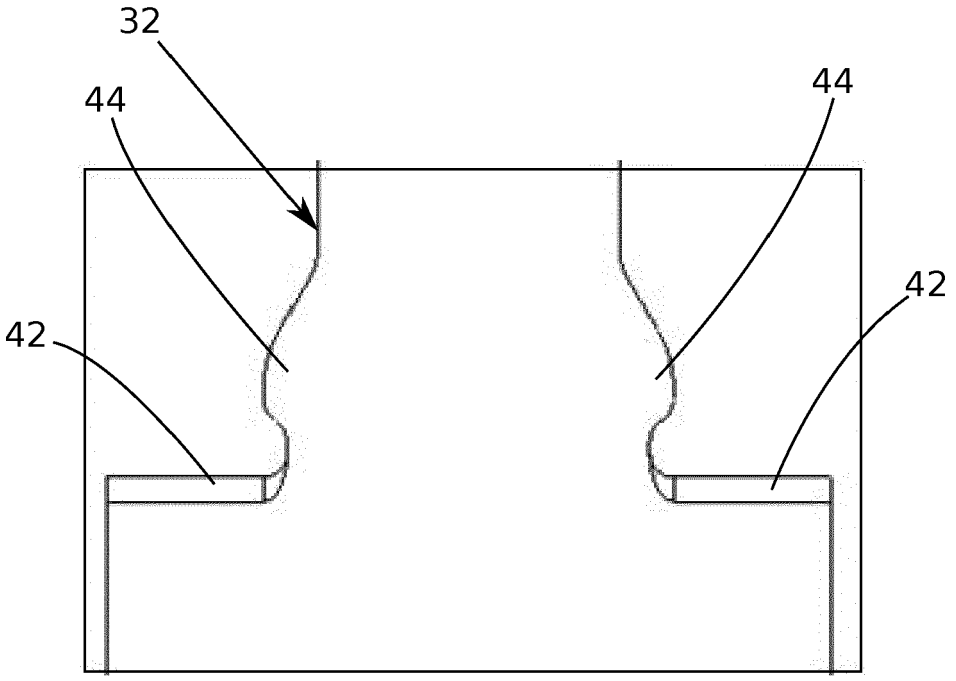

Fig. 8

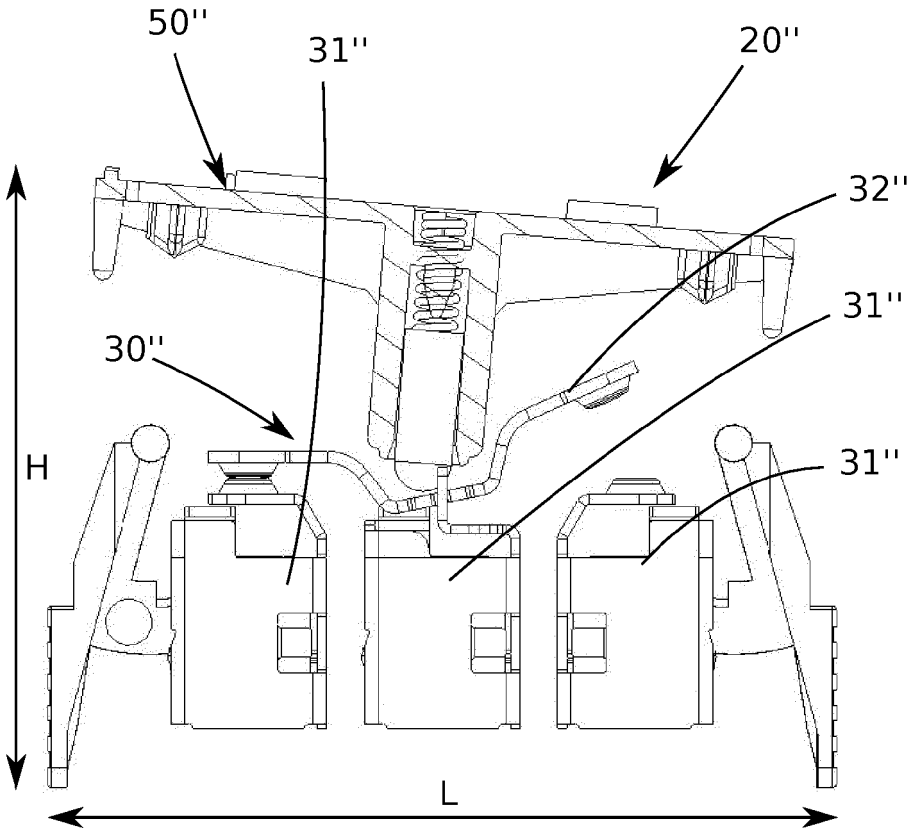

Fig. 10

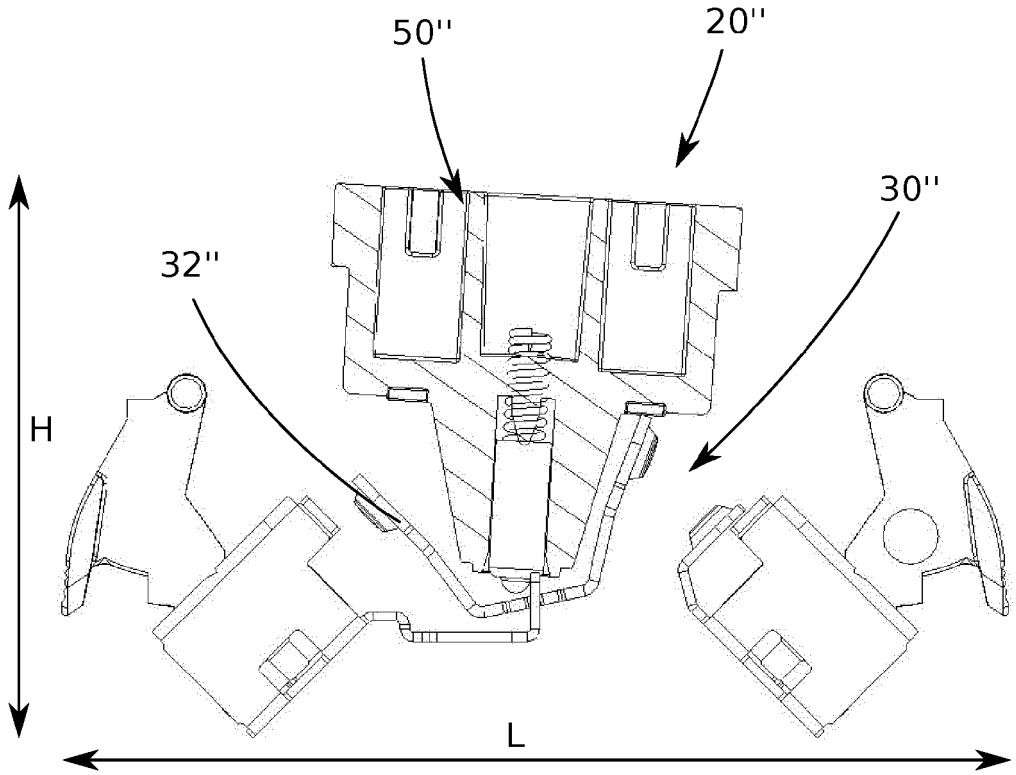

Fig. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 18 30 5740

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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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	23 November 2018	Ledoux, Serge

CATEGORY OF CITED DOCUMENTS

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