

(19)



(11)

EP 4 550 377 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.05.2025 Bulletin 2025/19

(51) International Patent Classification (IPC):
H01H 1/20 (2006.01) H01H 19/64 (2006.01)

(21) Application number: **23206766.0**

(52) Cooperative Patent Classification (CPC):
H01H 1/2041; H01H 19/64

(22) Date of filing: **30.10.2023**

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

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(54) **ROTARY SWITCH**

(57) Rotary switch comprising:
- an electroconductive rotary contact bridge;
- a rotary member with a circumferential wall.
The rotary member encases the rotary contact bridge
and comprises terminal contact ends with contact faces

on an outer surface of its circumferential wall. The rotary
member is preferably made of a flame retardant material
with a UL94 flammability rating of at least V2, e.g., at least
V0.

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Description

[0001] The invention relates to a rotary switch comprising a rotary contact bridge. Such a rotary contact bridge is typically supported by a spindle rotatably accommodated in an electrically insulative housing between a position where the rotary contact bridge connects two stationary contacts within the housing, and a position disconnecting these stationary contacts. Some switches comprise a plurality of rotary contact bridges at different positions on the spindle, for connecting stationary contacts at different levels of the switch. Some switches may have more than one pair of stationary contacts that can be connected by a contact bridge at a given level of the switch. An example of such a rotary switch is disclosed in EP 2 107 581 A1.

[0002] Disconnection of the stationary and rotary contacts of such a rotary switch can generate an arc, which is an electrical breakdown of surrounding air that produces a prolonged electrical discharge. Such arcs can cause damage to the rotary switch.

[0003] Some rotary switches comprise magnets placed in the housing of the switch, e.g., in a separate arc extinguishing chamber. An example of such a rotary switch is disclosed in CN 217086445 U.

[0004] EP 2 107 581 A1 teaches to reduce arc formation by fast switching using a locking spring member imparting its relatively sudden and rapid rotation to the spindle moving the rotary contacts. Although this helps to reduce arc formation, there is still a need to reduce further the risk of switch-off arc discharges.

[0005] The present invention fulfils this need with a rotary switch comprising an electroconductive rotary contact bridge and a rotary member or drum with a circumferential wall, the rotary member encasing the rotary contact bridge. The rotary contact bridge comprises terminal contact ends with contact faces on the outer surface of the circumferential wall of the rotary member. When the switch is turned to disconnect the contacts, the stationary contact passes the circumferential wall surface and at least partially quenches any arc occurring. In this respect, the circumferential wall is a wall that circles around the rotational axis of the rotary member and can for example be substantially cylindrical.

[0006] Upon rotation of the switch, the stationary contact can slide across the circumferential surface or it can pass the circumferential surface at a short distance within the scope of the arc quenching effect of the circumferential wall, e.g., with a gap width of 0.5 mm or lower, e.g., 0.3 mm or lower.

[0007] Quenching is substantially improved, if at least the circumferential wall of the rotary member is made of a flame retardant material, e.g., a polymeric material with a UL94 flammability rating of at least V2, e.g., at least V0 according to industrial standard UL94, harmonized with IEC 60695-11-10 and 60695-11-20. UL94 flammability ratings are testing standards developed by Underwriters Laboratories to measure the flammability characteristics

of plastic. Commercially available examples of such plastics include RTP 203 FR (a polyamid with 20% glass fibers) available from RTP or Polydac® PA-765 (an ABS available from Chi Mei Corporation). It has been found that these materials also show substantial arc quenching properties.

[0008] More specifically, the contact faces of the terminal contact ends of the rotary contact bridge can be parallel to a rotational axis of the rotary member.

[0009] The contact faces of the rotary contact bridge can be made flush with the circumferential surface of the rotary member, or can protrude from the circumferential surface, e.g., over a distance of 0.5 mm or less, or 0.3 mm or less.

[0010] In a specific embodiment, the circumferential surface of the rotary member is substantially coaxial with the axis of rotation of the rotary contact bridge. This can be combined, for example, with flat stationary contacts, tangentially contacting the contact faces of the rotary contact bridge.

[0011] In a particular embodiment, the rotary member has two C-shaped parts with open sides adjacent the rotary contact bridge. The rotary contact bridge can for example be a strip, bent to follow an inner wall of the rotary member. In that case, the terminal contact ends of the rotary contact bridge can be U-shaped bent ends of the strip. The rotary member can comprise an inwardly directed lower flange connecting the C-shaped parts. In that case, the opposite side of the rotary member can be open, allowing easy assembling of the rotary member and the rotary contact bridge.

[0012] In a specific embodiment, the switch can have an electrically insulating housing, and stationary contacts encased within the housing, wherein the rotary contact bridge is rotatable about its rotational axis between a closed position and an open position. The terminal contact ends of the rotary contact bridge have contact faces parallel to the axis of rotation of the rotary contact bridge, i.e. vertical when the switch is in the upright position. The contact faces contact the stationary contacts, when the rotary contact bridge is in the closed position. In the open position the contact faces are disconnected from the stationary contacts.

[0013] The rotary member with the rotary contact bridge can for example be accommodated in a space in the housing with an inner wall, in particular a cylindrical inner wall, spaced from the rotary member by an air gap.

[0014] Optionally, the rotary switch further may comprise one or more blocks, which are slidable between an arc splitting position closing the air gap, and a retracted position, e.g., in the inner wall of the space accommodating the rotary member and/or in the rotary member itself. Preferably, these blocks are of a flame retardant material, e.g., a polymeric material with a UL94 flammability rating of at least V2, e.g., at least V0 according to industrial standard UL94, harmonized with IEC 60695-11-10 and 60695-11-20.

[0015] In a specific embodiment, the blocks comprise a

magnetic or magnetizable core, such as an iron or steel core, and the inner wall of the space accommodating the rotary member embeds one or more magnets, e.g., two pairs of magnets, e.g., of opposite polarity, moving the blocks into the arc splitting position after passing one of the stationary contacts. Optionally, the magnets push the block back before passing one of the stationary contacts. Such magnets do not only activate the blocks for arc quenching and arc splitting, but also cause a magnetic blowout effect, disrupting and separating electric arcs.

[0016] The present invention also relates to a rotary switch, optionally according to the disclosure above, comprising:

- a housing;
- a rotary contact bridge;
- a rotary member supporting the rotary contact bridge;
- a space in the housing, the space accommodating the rotary member with the rotary contact bridge, the space having an inner wall spaced from the rotary member by an air gap, the inner wall of the space a plurality of magnets, e.g., two diametrically opposite arranged pairs of magnets of opposite polarity.

[0017] The magnets can for example be flat platelets in tangential orientation relative to the axis of rotation of the rotary contact bridge.

[0018] Optionally, the inner wall of the space can comprise a groove at either side of at least one of the embedded magnets, the grooves running parallel to the rotational axis. Plasma of a generated arc can be blown and discharged through such grooves.

[0019] Additionally, or alternatively, a mechanical guiding can be used to move the blocks between the arc splitting position and the retracted position. For example, the blocks may contact a guiding contour of the rotary member moving the blocks into the arc splitting position after passing one of the stationary contacts, and pushing the block back before passing one of the stationary contacts. The guiding contour can for example comprise a flange of the rotary member, while the blocks comprise a feeler engaging said flange, and a biasing element, such as a spring, to bias the block into the arc splitting position.

[0020] The rotary switch can for example be a multi-deck switch, e.g., with a plurality of decks providing a space accommodating a rotary contact bridge as disclosed above.

[0021] Optionally, the rotary switch can have connecting ends projecting from an outer surface of the housing, e.g., for connection to a printed circuit board.

[0022] The switch is particularly suitable as a rotary switch for switching high power DC or AC currents, e.g., for use in the field of solar energy.

[0023] The invention is further explained with reference to the accompanying drawings showing exemplary embodiments.

Figure 1: shows an exemplary embodiment of a rotary switch in perspective view;

Figure 2: shows the internals of the switch of Figure 1;

Figure 3: shows in exploded view the rotary member and stationary contacts of the switch of Figures 1 and 2 in a closed position;

Figure 4: shows in exploded view the rotary member and stationary contacts of the switch of Figures 1 and 2 in an open position;

Figure 5: shows a second exemplary embodiment of a rotary switch in exploded view;

Figure 6A: shows a deck of the switch of Figure 5 in top view in open position;

Figure 6B: shows the deck of Figure 6A in cross section;

Figure 7A: shows a deck of Figure 6A in top view in closed position;

Figure 7B: shows the deck of Figure 7A in cross section;

Figure 8: shows a third embodiment of a rotary switch in exploded view;

Figure 9: shows a deck of the rotary switch of Figure 8 in top view;

Figure 10: shows the rotary member of the rotary switch of Figure 8.

[0024] Figure 1 shows a rotary multideck switch 1 with a housing 2 of an electrically insulating material, typically a plastic material. From bottom to top, the housing 2 comprises a stack of a base 3, four decks 4, a top deck 5 and a cover deck 6. A spindle 7 with an axis of rotation R extends along a central longitudinal axis of the rotary switch 1. The spindle 7 has a top end with a mount 8 for a knob (not shown).

[0025] The switch 1 is also shown in Figure 2 with the top deck 5 and cover deck 6 broken away to show the internals of one of the decks 4. The other decks 4 have similar internal components. These include stationary contacts 9 and a rotary member 10 shown in exploded view in Figures 3 and 4.

[0026] The stationary contacts 9 are flat metal strips with a terminal end 11 having a contact face 12 contacting a circumferential wall 13 of the rotary member 10, or at least being close enough to the circumferential wall 13 to have an arc quenching effect. In the shown embodiment, the circumferential wall 13 is substantially cylindrical. The opposite end of the stationary contact is a connection end 14 with a screw 15 for connecting the stationary contact 9 to an electroconductive cable (not shown). The stationary contacts 9 are accommodated in slits 16 in the housing 2. The slits 16 are parallel to the outer surface 17 of the housing 2 and extend between an opening 18 in the outer surface 17 of the housing 2 providing direct access to the screw 15 of the connection end 14 of the stationary contact 9, and a central cylindrical cavity 19 in the housing 2 accommodating the rotary member 10.

[0027] The rotary member 10 holds a rotary contact

bridge 20, formed as a metal strip symmetrically bent with a V-shaped bend 21 in the middle and terminal contact ends 22, which are bent in a U-shape with one leg 23 connected to the V-shape bend 21 and the other leg 24 pointing towards the opposite U-shaped terminal contact end 22. The U-shaped terminal contact ends 22 have outer surfaces 25 with rounded edges 26 forming contact faces for contacting the contact face 12 of the respective stationary contact 9 when the rotary contact bridge 20 is in the closed position.

[0028] The rotary contact bridge 20 is accommodated in an inner space 27 of the rotary member 10. The cylindrical wall 13 of the rotary member is made of a flame retardant material and has a diameter corresponding to, or slightly smaller than the distance between the two contact faces 12 of the two stationary contacts 9. The cylindrical wall 13 is interrupted at two diametrically opposite sides to form two symmetrically arranged C-shaped parts 28, both having an upper flange 29. The two C-shaped parts 28 are held together by an inwardly extending common lower flange 30. The two opposite interruptions 31 in the cylindrical wall 13 receive the U-shaped terminal contact ends 22 of the rotary contact bridge 20 such that only the contact faces 25 and the rounded edges 26 protrude from the cylindrical wall 13. The rest of the rotary contact bridge 20 is fully encased within the rotary member 10. At the position of the two interruptions 31, the lower flange 30 has a ridge 32 fitting within the lower part of the inside of the U-shaped terminal contact ends 22 of the rotary contact bridge 20. The lower flange 30 has an inner diameter sufficiently small to make the flange 30 fully shield the V-shaped bend 21 of the rotary contact bridge 20. The ridges 32 fit within the U-shape of the terminal contact ends 22. The rotary contact bridge 20 is easily inserted and fixated within the rotary member 10.

[0029] The rotary member 10 also accommodates a spindle segment 33 of a modular spindle 7. Every deck 4 in the multideck rotary switch 1 has essentially the same internals and accommodates a similar spindle segment 33. Upon assembly, all spindle segments 33 are aligned and connected to form a central spindle 7 for jointly rotating the rotary contact bridges 20 in all decks 4 of the rotary switch 1. The spindle segment 33 has a cylindrical body 34 with a diameter corresponding to the inner diameter of the lower flange 30 of the rotary member 10, so as to further fixate the rotary contact bridge 20 within the rotary member 10. One side of the cylindrical body 34 engages the rotary contact bridge 20. The opposite side of the cylindrical body 34 comprises a semi-cylindrical protrusion 35 with a recessed lower side 36 matching with a spindle ridge 37 on the lower flange 30 of the rotary member 10. When the spindle segment 33 is inserted into the inner space 27 of the rotary member 10, the spindle ridge 37 fits within the recessed lower side 36 of the semi-cylindrical protrusion 35 and the spindle segment 33 is clamped between the rotary contact bridge 20 and the opposite part of the cylindrical wall 13 of the rotary

member 10, such that the spindle segment 33 is coaxial with the cylindrical wall 13 of the rotary member 10.

[0030] The spindle segment 33 has two oppositely arranged protrusions 38 fitting within the upper part of the U-shaped terminal contact ends 22 of the rotary contact bridge 20 and has an upper flange 39 with a diameter corresponding to the inner diameter of the upper flange 29 of the rotary member 10. The upper flange 29 of the spindle segment 33 has two diametrically opposite extensions 40 fitting within the interruptions 31 of the upper flange 29 of the rotary member 10, so as to fully shield the top side of the rotary contact bridge 20 and fully lock the rotary contact bridge 20 within the rotary member 10.

[0031] The spindle segment 33 has a non-circular extension 41 on its top side, tightly fitting with a matching opening in the lower side of a similar spindle segment 33 in the next higher deck 4 of the rotary switch 1 via an opening in the bottom of the respective deck 4.

[0032] By rotating the spindle 7, the rotary member 10 with the rotary contact bridge 20 can be rotated between a closed position, as shown in Figure 3, and an open position, as shown in Figure 4. In the closed position, the electroconductive rotary contact bridge 20 bridges the two opposite stationary contacts 9 allowing an electrical current between the two stationary contacts 9 to further connected circuitry (not shown).

[0033] When the spindle 7 is rotated with the rotary member 10, the terminal contact ends 25 of the rotary contact bridge 20 are disconnected from the stationary contacts 9. The contact faces 12 of stationary contacts 9 slide along or close to the outer surface of the cylindrical wall 13 of the rotary member 10. The flame retardant material of the cylindrical wall 13 quenches any arc discharge coming from the disconnected stationary contacts 9.

[0034] Figures 5 - 7B show an alternative embodiment of a switch 1' with the same build-up and components as the switch 1 of Figure 1 except in that it has two additional movable blocks 50. In the drawings, the same reference number are used for parts which are the same in the switch of Figures 1 - 4.

[0035] The two slider blocks 50 are made of a flame retardant material and are accommodated in two diametrically opposite recesses 51 in the housing 2'. The slider blocks 50 have a base 52 and a slider end 53. The base 52 is broader than the slider end 53 and is locked within the respective recess 51 by stops 54 within the recess 51, allowing reciprocating movement of the slider block 50 only in a longitudinal direction of the block 50 between a retracted position (Figures 7A and 7B), and an arc splitting position with the slider end 53 engaging the outer surface of the cylindrical wall 13 of the rotary member 10 when the rotary contact bridge 20 is in the open position (Figure 6A and 6B).

[0036] The slider blocks 50 are biased into the arc splitting position by a biasing element, in this embodiment a compression spring 55.

[0037] The slider blocks 50 further comprise a feeler 56 (see in particular Figure 6A) engaging the edge of the upper flange 29 of the rotary member 10. In top view, the upper flange 29 is flattened in the middle between the two interruptions 31, i.e. the diameter of the upper flange gradually increases where it comes closer to one of the interruptions 31. When the rotary contact bridge 20 is in the closed position (Figures 7A and 7B), the feeler 56 contacts the part of the upper flange 29 with the larger diameter, so the sliding block 50 is forced into the retracted position against the action of the compression spring 55. When the rotary contact bridge 20 is rotated in clockwise direction into the open position, the feeler 56 of the sliding block 50 engages the flatter middle part of the upper flange 29, allowing the compression spring 55 to force the slider block 50 into the arc splitting position. In this position, the slider block 50 directly engages the cylindrical outer wall 13 of the rotary member 10. Any arc discharge will be split by the slider blocks 50 into smaller segments.

[0038] Figure 8 shows in exploded view a further alternative embodiment of a rotary switch 100. The shown embodiment is particularly designed for connection to a printed circuit board. To this end the two stationary contacts 109 of each deck 104 have flat and coplanar connecting ends 114 extending from the housing 102 of the rotary switch 100. However, a similar more regular switch with the same arc quenching and splitting features, but with the configuration of stationary contacts as in the switch of Figure 1, can also be made.

[0039] In the rotary switch 100 of Figures 8 - 10, the rotary member is an integral part of spindle segment, forming a rotary drum 110 with a closed top side carrying the upward extending non-circular extension 141 to be fit into a matching recess 142 in the bottom side of a next higher spindle module 104 (see Figure 10).

[0040] The rotary drum 110 comprises a cylindrical outer wall 111 extending downward from the top side 112 and having the same diameter as the top side 112. The outer wall 111 encircles an inner cylinder 113 (see Figure 10) of substantially the same length comprising the recess 142 for receiving the non-circular extension 141 of a next lower spindle module. Between the inner cylinder 113 and the outer cylindrical wall 111, is a gap 115 for receiving the rotary contact bridge 120 which is similar to the rotary contact bridge 20 of the rotary switch 1 of Figures 1 - 4. To this end, the outer cylindrical wall 111 has two diametrically opposite interruptions 131 for receiving the U-shaped terminal contact ends 125 of the rotary contact bridge 120, such that the contact faces 125 with the respective rounded edges 126 protrude from the cylindrical outer wall 111.

[0041] At the inner side, the cylindrical outer wall 111 has two diametrically opposite thickened sections 149, but thickened sections 149 being adjacent to a respective interruption 131. The outer surface of the cylindrical outer wall 111 has a recess 150 in the respective thickened section 149 receiving a slider block 152 which is movable

in the recess 150 in a radial direction relative to the axis of rotation of the rotary drum 110. The two slider blocks 152 are of a flame retardant material with material properties favourable to arc quenching but have a magnetic or magnetizable core, e.g., a steel or iron core, embedded in the flame retardant material.

[0042] The rotary member 110 is accommodated in a circular cavity 160 in a top side of the deck 104. The circular cavity 160 has an inner wall 153 spaced from the rotary member 110 by an air gap 161.

[0043] Figure 9 shows the switch 100 is the closed position with the contact faces 125 of the rotary contact bridge contacting the stationary contacts 109. In this position, the slider blocks 152 are retracted and close to an exhaust channel 162. By turning the switch 100 in the rotational direction R the rotary contact bridge 120 is moved into the open position. In the shown exemplary embodiment, the rotational direction is counterclockwise. In other embodiments, the rotational direction can be clockwise.

[0044] The slider blocks 152 are slidable between an arc splitting position closing the air gap 161, and a retracted position. To move the slider blocks 152, two pairs of magnetic platelets 154A, 154B are embedded in the inner wall 153 at diametrically opposite sides of the cavity 160, such that both stationary contacts 109 pass at least one of the pair of magnetic platelets 154A, 154B, when the switch is turned from a closed position into an open position in the direction R.

[0045] The two magnetic platelets 154A, 154B of each pair have opposite polarizations, e.g., N-S, followed by S-N, or the other way around. The first magnetic platelet 154A to be passed by the slider block 152 has a polarization which is opposite to the polarization of the magnetic core of the slider block 152, so it attracts the slider block 152 and pulls the slider block 152 out of the recess 150 into the arc splitting position. In this position, the slider block 152 slides over the inner wall of the cavity 160 to quench arc discharge.

[0046] The second magnetic platelet 154B has the same magnetic polarization as the magnetic core of the slider block 152.

[0047] The magnetic platelets also cause a magnetic blowout effect disrupting and separating an electric arc discharge. The magnetic platelets 154A, 154B are flanked by grooves 156. Disrupted plasma is blown away via these grooves 156.

[0048] Before, after or during passing the magnetic platelets 154A, 154B, the contact faces 125 of the rotary contact bridge can pass the exhaust channel 162.

[0049] The shown drawings are schematic, not necessarily to scale. Details that are not required for understanding the present invention may have been omitted. The terms "upward", "downward", "below", "above", and the like relate to the embodiments as oriented in the drawings, unless otherwise specified.

[0050] Elements and aspects discussed for or in relation with a particular embodiment may be suitably com-

combined with elements and aspects of other embodiments, unless explicitly stated otherwise.

[0051] The disclosure is not restricted to the above described embodiments which can be varied in a number of ways within the scope of the claims. For instance, the spindle does not need to be a modular spindle but can be an unsegmented spindle. Similarly, the housing does not need to be a multideck housing.

Claims

1. Rotary switch comprising:

- an electroconductive rotary contact bridge;
 - a rotary member with a circumferential wall, the rotary member encasing the rotary contact bridge;
- wherein the rotary contact bridge comprises terminal contact ends with contact faces on an outer surface of the circumferential wall of the rotary member.

2. Rotary switch according to claim 1, wherein the rotary member is made of a flame retardant material with a UL94 flammability rating of at least V2, e.g., at least V0.

3. Rotary switch according to claim 1 or 2, wherein the circumferential wall of the rotary member is a cylindrical wall.

4. Rotary switch according to any one of the preceding claims, wherein the contact faces are parallel to the rotational axis of the rotary member.

5. Rotary switch according to any one of the preceding claims, the contact faces of the rotary contact bridge being flush with the outer surface of the circumferential wall of the rotary member or protrude from the outer surface, e.g., over a distance of 0.5 mm or less, or 0.3 mm or less.

6. Rotary switch according to any one of the preceding claims, wherein the rotary member has two C-shaped parts with open sides adjacent the rotary contact bridge.

7. Rotary switch according to any one of the preceding claims, wherein the rotary contact bridge is a strip, bent to follow an inner wall of the annular member.

8. Rotary switch according to claim 7, wherein the terminal ends of the rotary contact bridge are U-shaped bent ends of the strip.

9. Rotary switch according to claim 6, 7, or 8, wherein the annular member comprises an inwardly directed

lower flange connecting the C-shaped parts.

10. Rotary switch according to any one of the preceding claims, further comprising an electrically insulating housing, and stationary contacts encased within the housing, wherein the rotary contact bridge is rotatable about a rotational axis between a closed position where the contact faces of the terminal contact ends contact the stationary contacts, and an open position where the contact faces are disconnected from the stationary contacts.

11. Rotary switch according to claim 10, wherein the rotary member with the rotary contact bridge is accommodated in a space in the housing with an inner wall spaced from the rotary member by an air gap, the rotary switch further comprising one or more blocks of a non-conductive material, which are slidable between an arc splitting position closing the air gap, and a retracted position.

12. Rotary switch according to claim 11, wherein the non-conductive blocks are of a flame retardant material, e.g., a material with a UL94 flammability rating of at least V2, e.g., at least V0.

13. Rotary contact switch according to claim 11 or 12, wherein the blocks comprise a magnetic or magnetizable core, e.g., of steel or iron, and the inner wall of the space accommodating the rotary member embeds two pairs of magnets of opposite polarity; and optionally further comprising a groove at either side of at least one of the embedded magnets, the grooves running parallel to the rotational axis.

14. Rotary contact switch according to any one of claims 10 to 13, wherein the blocks contact a guiding contour of the rotary member moving the blocks into the arc splitting position after passing one of the stationary contacts, and pushing the block back before passing one of the stationary contacts.

15. Rotary switch according to claim 14, wherein the guiding contour is a flange of the rotary member and the blocks comprise a feeler engaging said flange and a biasing element, such as a spring, to bias the block into the arc splitting position.

Fig. 1

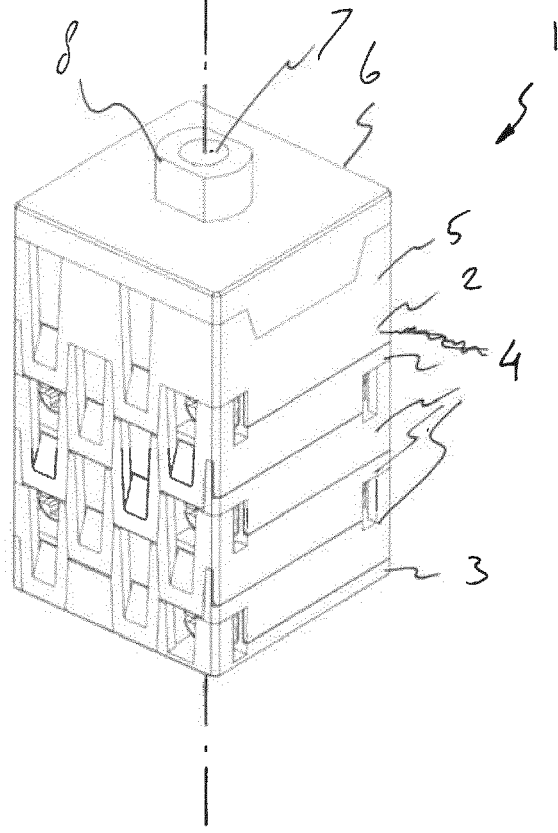


Fig. 2

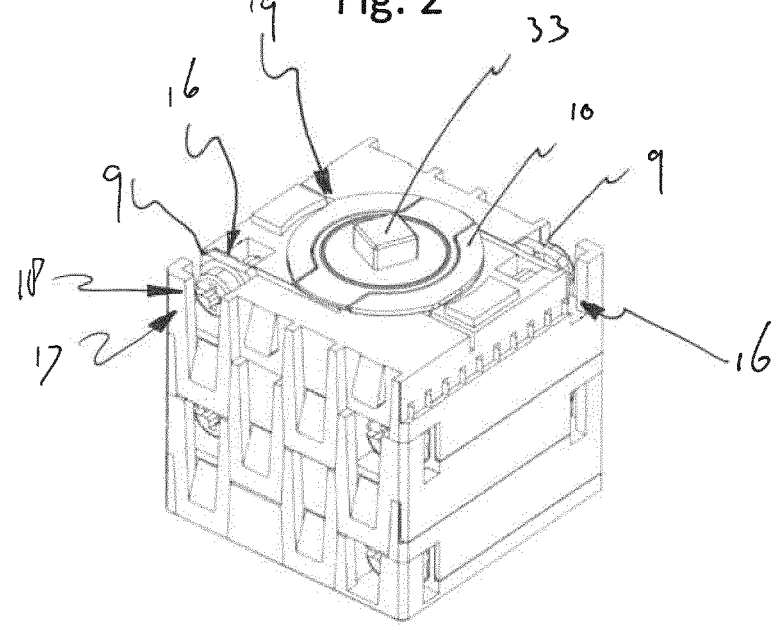


Fig. 3

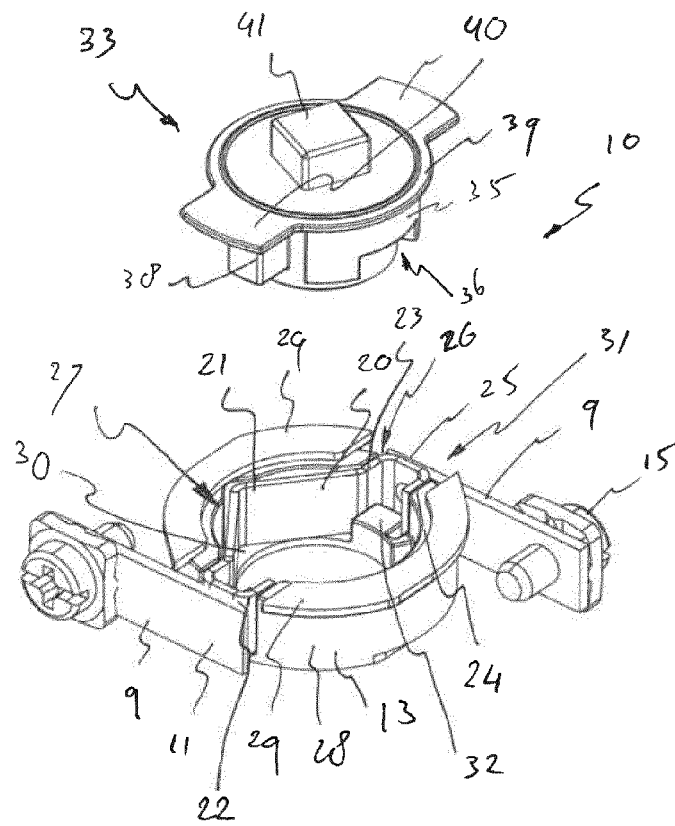


Fig. 4

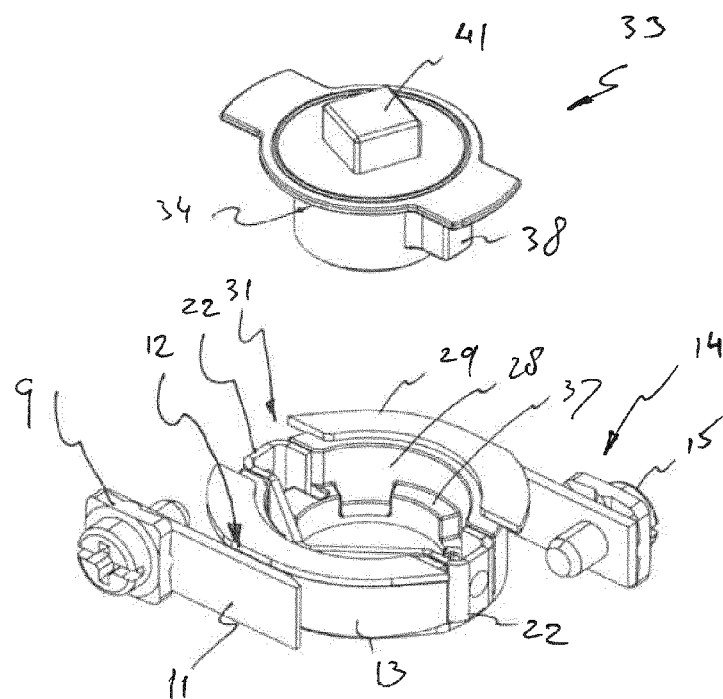


Fig. 5

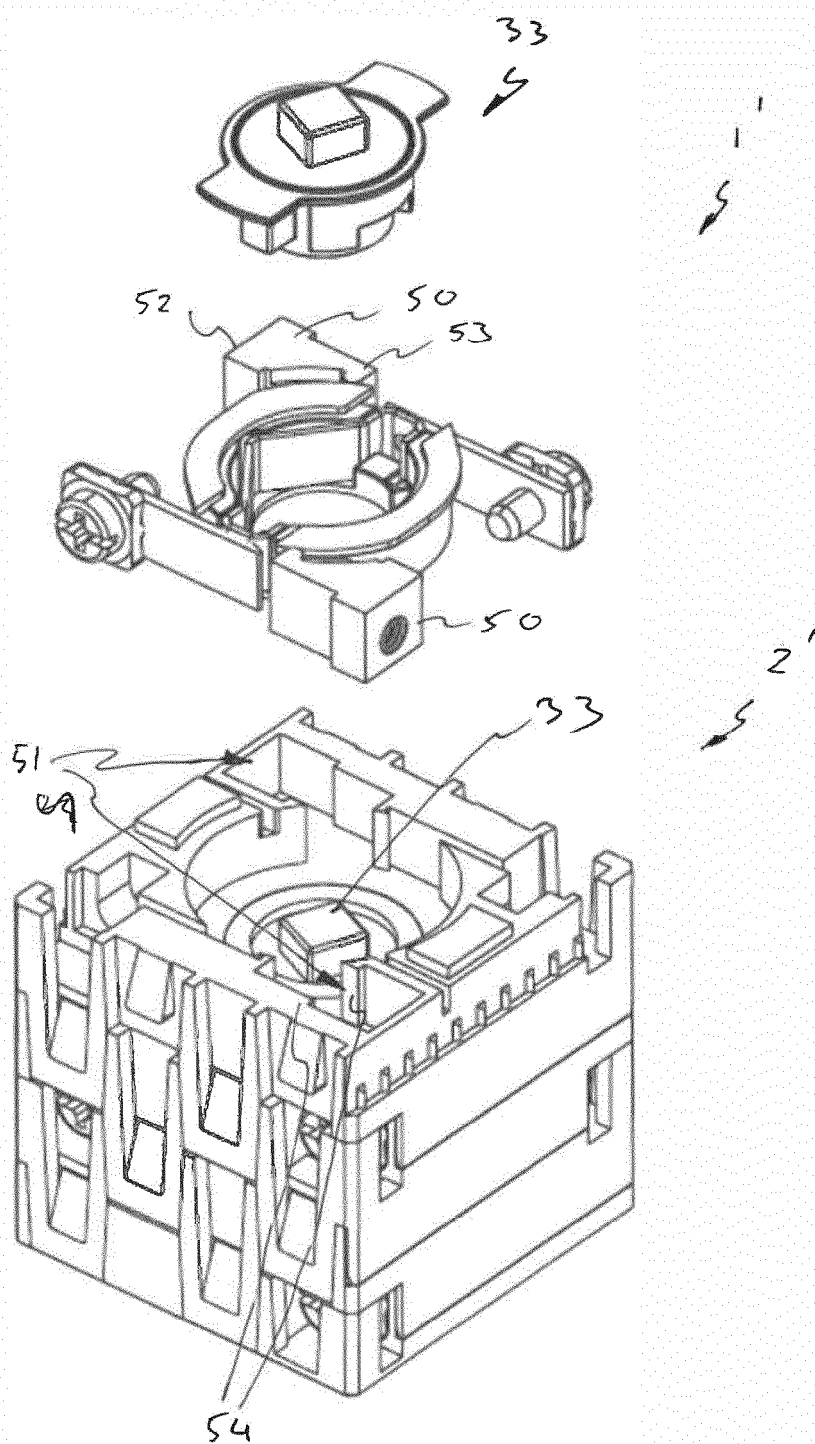


Fig. 6A

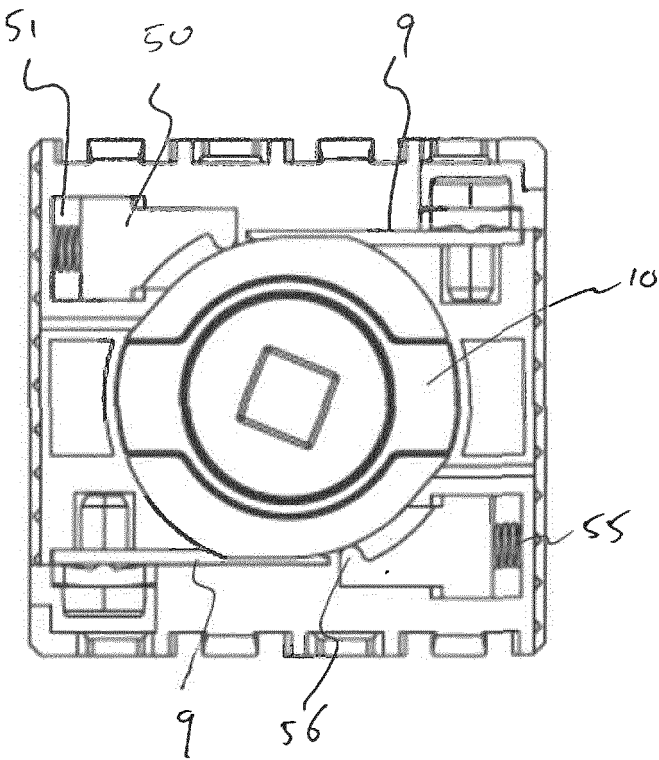


Fig. 6B

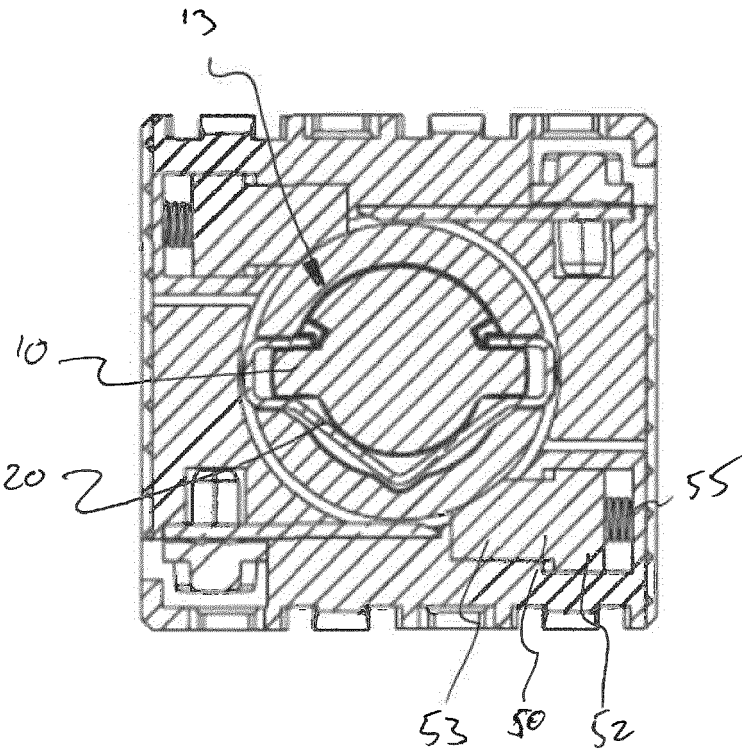


Fig. 7A

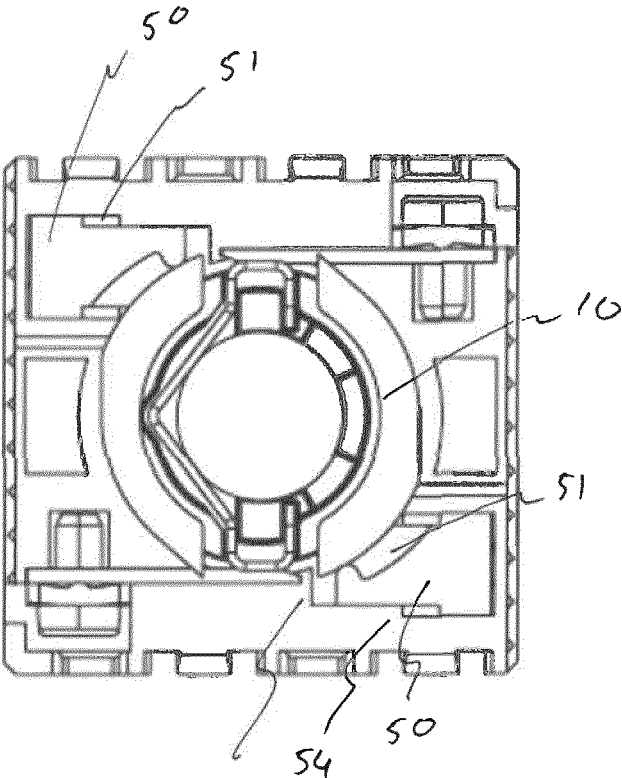


Fig. 7B

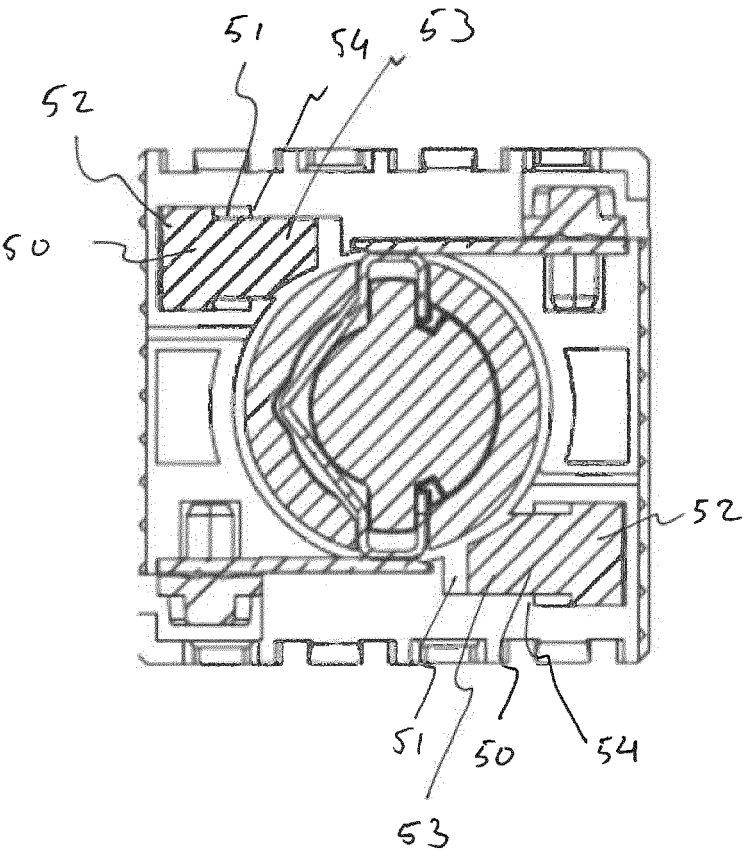


Fig. 8

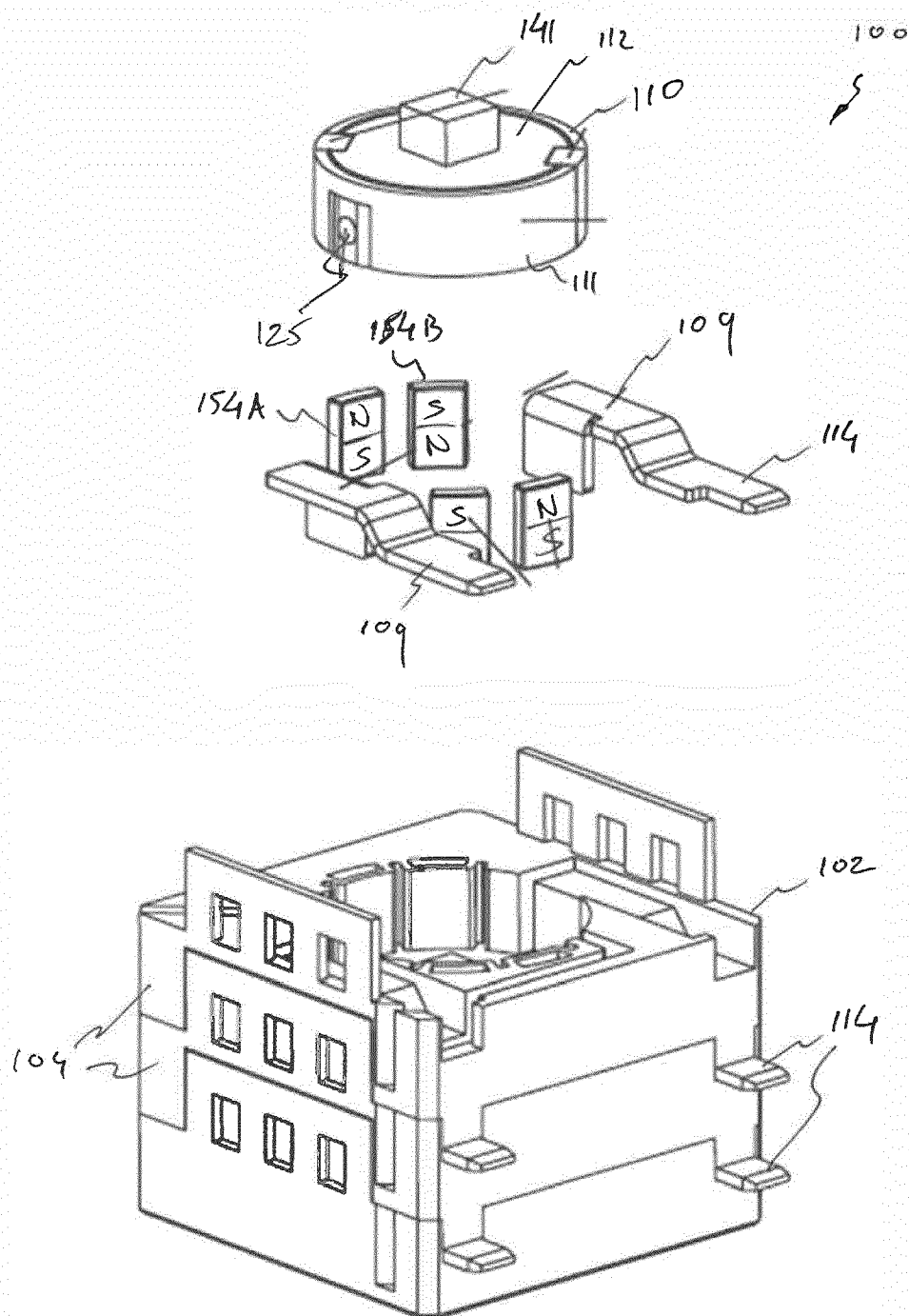


Fig. 9

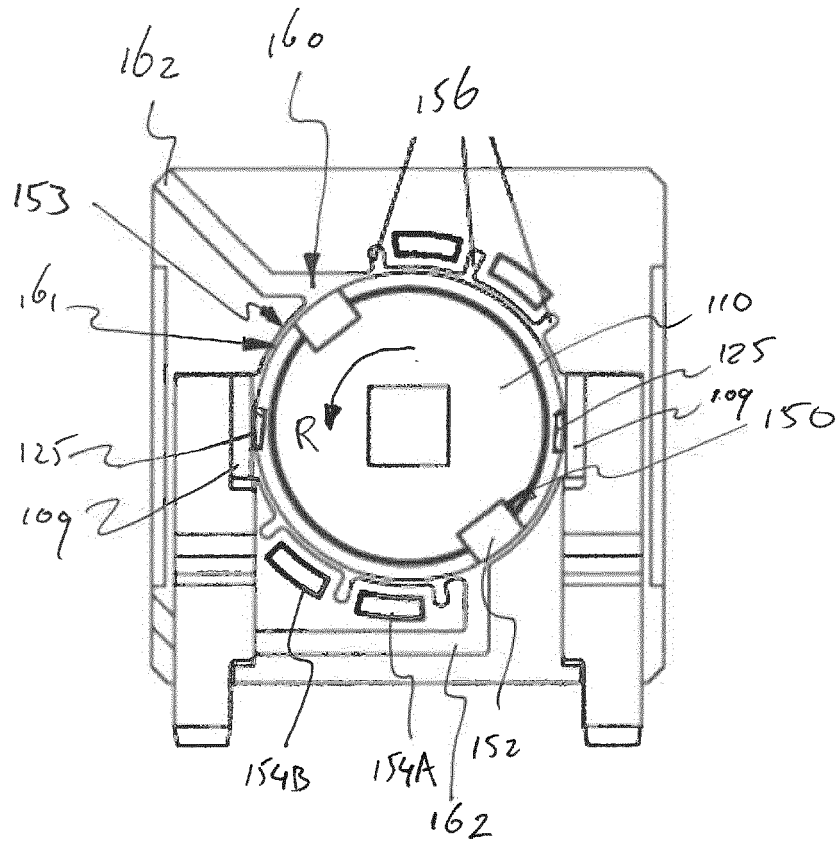
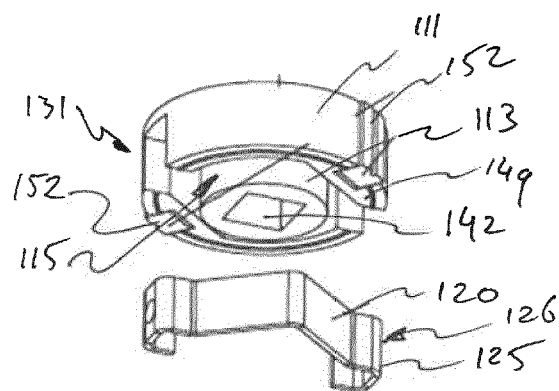


Fig. 10





EUROPEAN SEARCH REPORT

Application Number

EP 23 20 6766

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	CN 2 599 728 Y (QILI PREC INDUSTRY CO LTD [CN]) 14 January 2004 (2004-01-14) * figures 2, 3, 4, 5, 7, 10 - 12 * -----	1-5, 10-15 6-9	INV. H01H1/20 H01H19/64
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 15 April 2024	Examiner Arenz, Rainer
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 23 20 6766

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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