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(71) Applicant: **ABB AG**
68309 Mannheim (DE)

(72) Inventors:
- **Breder, Henrik**
  723 47 Västerås (SE)
- **Johansson, Claes-Göran**
  72242 Västerås (SE)

(54) **Actuator for an installation switching device**

(57) Actuator for an installation switching device comprising a main current path, further comprising a point of contact in the main current path, which is formed by at least two contact members, whereby at least one of the contact members is movable and whereby the contact members are configured to be separated in a tripping condition under the influence of a tripping device, **characterized in that** the actuator comprises a bistable buckling membrane carrying the at least one movable contact piece and being configured to snap back from a first into a second stable position under the influence of the tripping device in a tripping condition, so that the point of contact can thus be opened and permanently kept open in the tripping condition.

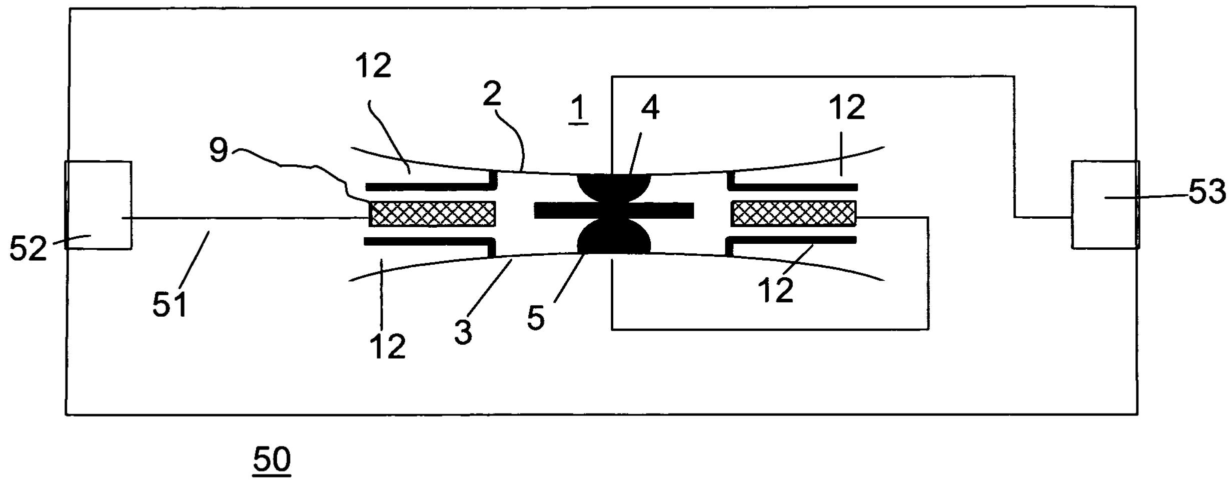

Fig. 4

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Description

[0001] The invention relates to an actuator for an installation switching device comprising a main current path, further comprising a point of contact in the main current path, which is formed by at least two contact members, whereby at least one of the contact members is movable and whereby the contact members are configured to be separated in a tripping condition affected by a tripping device, according to the preamble of claim 1.

[0002] The invention further relates to an installation switching device comprising a main current path, further comprising a point of contact in the main current path, which is formed by at least two contact members, whereby at least one of the contact members is movable and whereby the contact members are configured to be separated in a tripping condition under the influence of a tripping device, according to the preamble of claim 9. Actuators and installation switching devices of the kind mentioned in the preambles of claims 1 and 9 have since long been known in the art. They appear as circuit breakers, residual current circuit breakers, motor protection devices and so on.

[0003] Actuators and installation switching of the kind mentioned usually are electro- mechanical devices. The point of contact comprises a fixed contact member and a movable contact member which is held by a movable contact arm or contact bridge. In the closed position the movable contact member is pressed against the fixed contact member influenced by the force of a contact spring.

[0004] Actuators and installation switching devices of the kind mentioned usually also comprise a mechanical gear mechanism with a latch and a spring force based energy storage assembly.

[0005] Further on, actuators and installation switching devices of the kind mentioned comprise a tripping device which in case of a tripping condition acts on the latch, which then releases the energy from the energy storage so that the gear mechanism can act upon the contact lever or contact bridge in order to open the point of contact. Known tripping devices are for example thermal tripping devices based on bimetal or thermal shape memory alloys, short circuit tripping devices based on a fast moving electromagnetic armature or residual current tripping devices based on an integrating current transformer coupled to an electromagnetic armature.

[0006] The known mechanical setup of actuators of the kind mentioned leads to limitations when it comes to tripping and switching speed, due to the inertia of the masses of the levers and other gear components involved.

[0007] In a range of low voltage applications electromechanical actuators known in the art are too slow. For example, breakers in low voltage systems, e.g. power supply for telecom, need to be fast operating in order to provide selectivity and protection, faster than is today possible with the known electro-mechanical devices. So today the only alternative is an electronic switch. This however has the disadvantage of missing galvanic separation, which can only be achieved in mechanically operating circuit breakers.

[0008] So there is a need today for electromechanical circuit breakers operating much faster than those known in the art.

[0009] The object of the present invention is to suggest ways and means for designing an actuator and an installation switching device in such away that its tripping and switching speed is much faster than with prior-art devices, and which still provides galvanic separation of the contacts in the open contact position.

[0010] According to the invention the above object is achieved by an actuator according to independent claim 1, and by an installation switching device according to claim 9. Advantageous embodiments are described in the characteristic features of the dependent claims.

[0011] According to a first aspect of the invention the actuator comprises a bistable buckling membrane carrying the at least one movable contact piece and being configured to snap back from a first into a second stable position under the influence of the tripping device in a tripping condition, so that the point of contact can thus be opened and permanently kept open in the tripping condition.

[0012] Bistable buckling membranes are known to snap on a short exitation pulse with a high speed from a first to a second stable position and vice versa, as the membrane as such is thin and has a low mass and inertia. Bistable buckling membranes as such are known e.g from the document WO 2004/057911, the disclosure of which shall be regarded as part of the present specification. Applications of buckling membranes in actuators for installation switching devices are known in the art only in relation to tripping devices. Document DE 10 2004 056 283 A1 shows an installation switching device with a tripping member comprising a buckling membrane made of a shape memory alloy. The switching member in DE 10 2004 056 283 however is a conventional one, having a conventional gear mechanism with latching lever.

[0013] When designing a buckling membrane, a pre-stress can be generated and adjusted back to the edge of reverse buckling. This means that a small impulse from the tripping device is sufficient to excite the buckling effect and open the point of contact. Advantageously this avoids a couple of problems inherent in known mechanical setups involving gear mechanism and latching lever, such as tripping force and changing latching force at the latching point of gear mechanisms. The switching behaviour of a bistable buckling membrane shows nearly no aging effects, and the switching speed is determined by mechanical properties of the membrane alone, without influence from the tripping force or tripping speed. Particularly, no levers like latch levers or the such which mechanically interact involving friction effects that result in loss of force, speed and deterioration of repeatability are involved. This makes actuators according to the invention faster and more reliable. The fast operation of the buckling membrane is independent of the kind of tripping device used. Any kind of electromagnetic or thermal or piezoelectric or magnetostrictive tripping device may be used with a buckling membrane based switching member according to the present invention. The tripping device shall have the property of showing a dilatation effect in response to a change of another physical property. The dilatation is coupled to the buckling membrane and moves it across the dead center so that it can snap to its second stable position.

[0014] An advantageous effect of the application of a bistable buckling membrane as switching member in an actuator and an installation switching device is that fast operating circuit breakers can be realised. Such fast operating circuit breakers can also provide current limiting performance in very low voltage systems applications, below 60 V. The fast operation capability as well as current limiting performance can provide prevention against dips in the power supply networks of low voltage systems.

[0015] In a preferred embodiment of the invention the tripping device comprises a Thomson coil which is configured for a tripping current to pass through it, and further comprises a trip member lying in its home position close to the Thomson coil, whereby in a tripping condition the trip member is being pushed off the Thomson coil and whereby the trip member is coupled to the bistable buckling membrane in a way that it causes the buckling membrane to snap from a first into a second stable position when being pushed off the coil. The interaction of the Thomson coil with the trip member follows the physical law of Lenz's rule. The trip member can be for example a closed ring made of an electrically conducting, non-magnetic material, which is positioned in front of a coil. When a current with a sufficiently high pulse rate of rise flows through the coil, a quickly rising-magnetic field will permeate the ring, resulting in an eddy current in the ring. The magnetic field correlated to the eddy current counteracts its origin, which is the rising magnetic field of the coil. As a consequence the ring will be repelled very fast from the coil.

[0016] Applying such a Thomson coil as magnetic actuator further increases the speed and repeatability of the actuator. No mechanical interacting parts like latching levers which inherently show friction effects resulting in varying mechanical forces and a loss of speed are required.

[0017] In a preferred embodiment of the invention the tripping device comprises a bimetal member or a member made of a thermal shape memory alloy, which is coupled to the bistable buckling membrane in a way that it causes the buckling membrane to snap from a first into a second stable position when being thermally deformed. The bimetal member could be used either as sole tripping device, resulting in a thermally tripped ultrafast circuit breaker. It could also be applied in addition to an electromagnetic tripping device like the Thomson coil arrangement, resulting in a thermally as well as electromagnetically tripped high-speed circuit breaker.

[0018] In a preferred embodiment of the invention a bistable buckling membrane is carrying several movable contact pieces. The advantage of such an embodiment is that the current can flow in parallel across several contact pieces reducing the load that each contact piece has to deal with.

[0019] In a preferred embodiment of the invention there is comprised a buckling membrane assembly with a first and a second buckling membrane, each of which is carrying at least one movable contact piece, and the buckling membranes are located in such a manner that in their first stable position the at least one movable contact piece of the first membrane makes electrical contact to the at least one movable contact piece of the second membrane and in their second stable position the movable contact pieces of the first and second membrane are separated from each other. Such an assembly provides a simple mechanical setup and a large opening distance between the at least two contact pieces.

[0020] In a preferred embodiment of the invention there are comprised several buckling membranes, each of which is carrying at least one movable contact piece, whereby the main current path is led through all the movable contact pieces in a serial manner, and the trip member is coupled to a coupling member which is acting upon all buckling membranes simultaneously. This is also an advantageous way of reducing the load each single contact piece has to carry.

[0021] In a preferred embodiment of the invention the point of contact is shunted out by a resistor which is configured in such a way that when the point of contact is in open position the main current path is led via the resistor. Such a damping resistor supports an arc-free interruption of a DC current.

[0022] In a preferred embodiment of the invention there is comprised a reset assembly which is coupled to the buckling membrane and which is configured in such a way that influenced by the reset assembly the buckling membrane can snap back from its second into its first stable position. The reset assembly can be any of the above mentioned tripping devices. In case for example that a thermally driven bimetal piece is used, this would revert to its original shape after interruption of the main current path and the resulting decline of temperature. When reverting to its original shape the bimetal piece would exert a force on to the buckling membrane to let it snap back to its first stable position. Thus an automatic tripping and resetting device could be realized.

[0023] The reset assembly can also be a rather straightforward mechanical assembly, for example operated by a manually driven handle. In the latter case the actuator according to the present invention will automatically snap to its second stable position upon automatic tripping, but will need to be manually resetted.

[0024] According to another aspect of the present invention an installation switching device comprises an actuator as described above.

[0025] In a preferred embodiment of the invention the electromagnetic tripping device, e.g. a Thomson coil, forms part of the main current path. Such an arrangement is suitable for a circuit breaker application. If a Thomson coil is used it is configured such that the trip member is repelled from the coil when the electrical current through the coil shows a high pulse rate of rise.

[0026] In a preferred embodiment of the invention the electromagnetic tripping device, e.g. a Thomson coil, forms part of a fault current path. Such an arrangement is suitable for example for a residual current circuit breaker. If a Thomson coil is used it is configured such that the trip member is repelled from the coil when the electrical fault current current through the coil shows a high pulse rate of rise.

[0027] The invention will be described in greater detail by description of four embodiments with reference to the accompanying drawings, wherein

Fig. 1a-c	shows a buckling membrane assembly with two conversely oriented buckling membranes snapping in opposite directions, each membrane carrying 4 contact pieces and a bimetallic member,
Fig. 2	shows a buckling membrane assembly with 3 buckling membranes each of which is carrying multiple contact pieces and a trip member coupled to a coupling member which is acting upon all buckling membranes simultaneously;
Fig. 3a,b	shows a buckling membrane flip-flop arrangement;
Fig. 4	shows a schematic view of an installation switching device with a buckling membrane arrangement as of fig. 1 where the Thomson coil forms part of the main current path, and
Fig. 5	shows a schematic view of an installation switching device with a buckling membrane arrangement as of fig. 1 where the Thomson coil forms part of a fault current path.

[0028] Figure 1b shows a first buckling membrane assembly 1 comprising a first buckling membrane 2 and a second buckling membrane 3 in the closed position. Each buckling membrane 2, 3 is made of a thin metal sheet and is prestressed in a way that there are two stable positions regarding the buckling contour.

[0029] In the first stable position the buckling contour of the first (second) membrane 2 (3) is facing to the left (right) hand side, and in the second stable position the buckling contour tof the first (second) membrane 2 (3) is facing to the right (left) hand side. In other words, the convex bows of the membranes 2, 3 are facing each other. Transition between the first and second stable position goes through a dead center in between.

[0030] Once the membrane is brought near the dead center, a slight additional impulse is sufficient to push it slightly across the dead center, from where it will then very fast and with a pre-defined force snap into the other stable position. The snapping force is determined by various material factors such as thickness, surface area, pre-stress etc. of the membranes.

[0031] About in the middle of each of the membranes 2, 3 there is a metal bump 4, 5 serving as contact members. The two metal bumps 4, 5 are facing each other.

[0032] In the distance between the two membranes 2, 3 there is further arranged a metal plate 6, which is taking part in closing the electrical contact. When the two metal bumps 4, 5 are pressed against the metal plate 6, there is electrical connection from the first metal bump 4 to the second metal bump 5.

[0033] Conductor pieces 7, 8 are connected with each of the metal bumps 4, 5, forming part of a main current path. So the buckling membrane assembly 1 is functioning as point of contact in the main current path.

[0034] The two buckling membranes 2 and 3 in figure 1b are each in their first stable position, and there is a slight bulge in each of them, whereby the bulges are facing each other. Due to the bulge each of the metal bumps 4, 5 is pressed against the metal plate 6, one from either side, achieving an electric contact between the two contact members and closing the current path.

[0035] In the middle between the two buckling membranes 2, 3, there is in addition a flat circular coil 9, a so called Thomson coil. It is concentrically covering the metal plate 6. Coil conductor pieces 10, 11 are connecting the coil 9 to a tripping current path.

[0036] Beside the metal bump 5, 6 there is attached to the surface of each buckling membrane 2, 3 a metallic elbow piece 12, comprising a first, short arm 13, projecting about perpendicularly from the membrane surface, and a second, disk-shaped long arm 14, forming about a rectangular angle with the first arm 13. The long arm 14 has the shape of a disk or a plate and is oriented in parallel to the flat surface of the coil 9 and lying very close to it. This is the so called home position of the long arm 14. The elbow piece 12 with its long arm 14 is acting as a trip member in the electromagnetic tripping device made up by the Thomson coil arrangement.

[0037] In a tripping condition a tripping current will flow through the coil 9. In case that the tripping current has a sufficiently high pulse rate of rise, which will happen for example in a short circuit case, it will cause a fast change of the magnetic field of the coil. The coil field will generate an eddy current in the long arm 14, which in turn generates its own magnetic field counteracting the magnetic coil field. The result will be a fast repelling force acting on the elbow pieces 12 and through them on the membranes 2, 3 away from the coil 9 and the metal plate 6. This repelling force is driving the membranes 2, 3 very fast across their dead center, from where they will continue snapping into their second stable position, as shown in fig. 1 a.

[0038] In the second stable position as shown in fig. 1a, the concave bows of each membrane 2, 3 are facing each other. The metal bumps 4, 5 are torn away from the metal plate 6, thus opening the point of contact and the main current path. As the membranes are in their stable positions, no further meachanical gear arrangement is necessary to keep them open.

[0039] As an alternative to the Thomson coil shown here certainly all other known kinds of electromagnetic tripping devices can be used to interact with the buckling membranes 2, 3 in the way described.

[0040] If the point of contact shall be closed again, starting from the open position in fig. 1a, a closing force needs to act upon the convex bows of the membranes 2, 3. Such a closing force can be applied for example via a simple actuating lever or a push button that can be manually operated, but which are not shown in the drawings here.

[0041] Fig. 1c shows a top view onto one of the buckling membranes from fig. a1 and 1b, disclosing a second embodiment. The difference to the embodiment shown in fig. 1a and 1b is that there are four metal bumps 41, 42, 43, 44 arranged symmetrically on the membrane 2. The main current path is flowing through all of them in parallel, reducing the contact resistance.

[0042] Another additional feature the embodiment of fig. 1c shows is a bi-metal member 15 which is attached to the membrane surface. The bi-metal member 15 is acting like a thermal tripping device. In case of a temperature change, for example heating up, the bi-metal member 15 will deflect out of its home position. Due to the attachment of the bi-metal member 15 on the membrane 2, the deflection of the member 15 will translate into the membrane 2 and cause a deflection of the membrane 2 towards and across its dead center, from where it will snap over into its second stable position.

[0043] When the temperature falls again, the bi-metallic member 15 will flex back into its home position again. Due to the attachment of the bi-metal member 15 to the membrane 2, the backward flexing movement of the member 15 will translate into the membrane 2 and cause a flection of the membrane 2 backwards and across its dead center, from where it will snap over into its first stable position again.

[0044] The bi-metallic member 15 thus acts both as a thermal tripping member and as a reset member. Instead of a bi-metallic member of course other materials can be used also, such as thermal shape memory alloys. Also, the principle of tripping the buckling membrane by means of a deflecting member attached to the membrane can also make use of other types of materials showing dilatation effects, such as piezo-electric members or magnetostrictive members.

[0045] Fig. 2 shows another embodiment of an actuator according to the invention. In fig. 2 there are 3 buckling membrane type assemblies 1001, 1002, 1003, which are mechanically connected by a coupling member 121. The current enters at an inlet conductor piece 101, is flowing across the metal bumps or contact pieces in all three buckling membrane assemblies 1001, 1002, 1003 in a series connection, and leaves the assembly at an outlet conductor piece 111. The coupling member 121 is actuated by one common Thomson coil arrangement 91, comprising a Thomson coil 911, a trip member in form of a tripping plate 912 and an intermediate member 913 coupling the coupling member 121 to the tripping plate 912. The right hand side of fig. 2 shows a top view onto a multi-segmented membrane 23 which can be used in the buckling membrane assemblies 1001, 1002, 1003. Each of the segments 231 is made for carrying a metal bump contact piece as described above.

[0046] Fig. 4 shows an in a schematic way an installation switching device 50 with a buckling membrane arrangement as shown in fig. 1. Equal parts or parts with an equivalent function compared to those described in the previous figures are carrying the same reference numbers. The main current path 51 is flowing inside the device 50 from an input clamp 52 to an output clamp 53. The current flows across the Thomson coil 9 and the contact points made up by metal bumps 4, 5. When a short circuit occurs, the Thomson coil will stimulate the buckling membranes 2, 3 as described above and interrupt the current path 51. Also and in addition an arrangement with a bi-metallic member as described in fig. 1c may be applied.

[0047] Fig. 5 shows in a schematic way an installation switching device 60 with yet another embodiment of a buckling membrane arrangement. Equal parts or parts with an equivalent function compared to those described in the previous figures are carrying the same reference numbers. The device 60 is working like a fault current interruptor or residual current circuit breaker, RCCB. There is a main current path 51 between a first input clamp 52 and a first output clamp 53. In addition there is a neutral path 511 between a second input clamp 521 and a second output clamp 531. Both the main and neutral current are flowing through a current transformer 61 in different directions, thus resulting in a zero output from the current transformer 61. In case of a fault current the sum of the main and neutral currents are different from zero, and the current transformer 61 will generate an output signal which is driving the Thomson coil 9. Upon the stimulation of the Thomson coil 9 both buckling membranes 2 and 3 will be driven and snapping apart, in a manner similar to the one described above, and both the main and the neutral current path 51, 511 will be separated.

[0048] In this embodiment, the point of contact 510, 5110 for each current path 51, 511 is made up of two contact members 512, 513; 5111, 5112 that are supported on the free end of a contact arm 205, 206, 207, 208 being part of an elbow piece 201, 202, 203, 204 comprising the said contact arm 205, 206, 207, 208 and adjacent to this a supporting arm 209, 210, 211, 212. The elbow piece 201, 202, 203, 204 is connected to the buckling membrane 2, 3 in a way that the supporting arm 209, 210, 211, 212 of the elbow piece 201, 202, 203, 204 is projecting about perpendicularly from the membrane surface. The angle of the contact arms 206, 205; 208, 207 of two adjacent elbow pieces 201, 202; 203, 204 is configured such that the two contact members 5111, 5110; 512, 513 are having contact when the buckling membrane 2, 3 is in its home position, the convex bow of the buckling membrane 2, 3 facing towards the Thomson coil. This is the situation shown in fig. 5. When in the second stable position of the buckling membrane 2, 3 the convex bow of the buckling membrane 2, 3 is facing outward, the angle of the two supporting arms 212, 209; 210, 211 is such that the point of contact 5110, 510 is opened.

[0049] Fig. 3a and 3b show a buckling membrane assembly which is configured to function as a type of open/close switch. It is made up similiarly to the one described in fig. 5. Equal parts or parts with an equivalent function compared to those described in the previous figures are carrying the same reference numbers. The difference to the buckling membrane assembly according to fig. 5 is that in fig. 3 there are two Thomson coils 9, 901 which are acting on the first and second membrane 2, 3 respectively. The convex shapes of the membranes 2 and 3 are showing in the same direction. In the first stable position, see fig. 3a, membrane 2 is bent down and membrane 3 is approximately flat. Thus the point of contact 510 associated with membrane 2 is open, and contact point 5110 associated with membrane 3 is closed. In fig 3b the second stable position is shown, and contact point 510 is closed and contact point 5110 is open.

[0050] Additional aspects of the invention and the embodiments, although not shown in the figures, are the following. The operating force of the tripping actuator can be enhanced by switching stored electrical charges into the coil.

[0051] There are more than the shown methods of obtaining contact multiplicity, e.g. by combined rotational systems. Contacts in this case can be placed on disks and cylinders.

[0052] Contacts can also be linked by resistors in such a way that they are shorted during normal operation, in contact closed position, and active when the contacts are opened. Means of a "zick-zack type" geometry can be applied in this case. Such resistors will function as damping elements when the contact is opened in order to obtain an arc free interruption of DC.

[0053] Summarising, he features and advantages of the present invention are that electrical contacts driven by bi-stable buckling membranes can be made very fast operating. An electromagnetic actuator may be provided for the release and eventually as additional acceleration force of any electrical contact system attached. The energy for the release or additional actuator acceleration can be provided by commuting /conducting the fault current into the release and/or actuator circuit. The pre-stress can be adjusted back to the edge of reverse buckling. A Thomson drive coil used as an electromagnetic actuator can both release and drive two membranes with contact parts. A thermal release bi-metal or shape memory function can be integrated with the membrane.

[0054] Finally, the invention shall not be limited to the embodiments shown, but each equivalent shall certainly be comprised within the range of protection of this specification.

List of reference signs

		121	Coupling member

(continued)

1	Buckling membrane assembly		201	Elbow piece
2	First buckling membrane		202	Elbow piece
3	Second buckling membrane		203	Elbow piece
4	Metal bump		204	Elbow piece
5	Metal bump		205	Contact arm
6	Metal plate		206	Contact arm
7	Conductor piece		207	Contact arm
8	Conductor piece		208	Contact arm
9	Thomson coil		209	Supporting arm
10	Coil conductor piece		210	Supporting arm
11	Coil conductor piece		211	Supporting arm
12	Elbow piece		212	Supporting arm
13	Short arm		231	Segments
14	Long arm		510	Point of contact
15	Bimetal member		511	Neutral path
23	Multi-segmented membrane		512	Contact member
41	Metal bump		513	Contact member
42	Metal bump		521	Second input clamp
43	Metal bump		531	Second output clamp
44	Metal bump		901	Thomson coil
50	Installation switching device		911	Thomson coil
51	Current path		912	Tripping plate
52	Input clamp		913	Intermediate member
53	Output clamp		1001	Buckling membrane assembly
60	Installation switching device		1002	Buckling membrane assembly
61	Current transformer		1003	Buckling membrane assembly
91	Coil arrangement		5110	Point of contact
101	Inlet conductor piece		5111	Contact member
111	Outlet conductor piece		5112	Contact member

Claims

1. Actuator for an installation switching device comprising a main current path, further comprising a point of contact in the main current path, which is formed by at least two contact members, whereby at least one of the contact members is movable and whereby the contact members are configured to be separated in a tripping condition affected by a tripping device, **characterized in that** the actuator comprises a bistable buckling membrane carrying the at least one movable contact piece and being configured to snap back from a first into a second stable position under the influence of the tripping device in a tripping condition, so that the point of contact can thus be opened and permanently kept open in the tripping condition.

2. Actuator according to claim 1, **characterized in that** the tripping device comprises a Thomson coil which is configured for a tripping current to pass through it, and further comprises a trip member lying in its home position close to the Thomson coil, whereby in a tripping condition the trip member is being pushed off the Thomson coil and whereby

the trip member is coupled to the bistable buckling membrane in a way that it causes the buckling membrane to snap from a first into a second stable position when being pushed off the coil .

3. Actuator according to claim 1, **characterized in that** the tripping device comprises a bimetal member or a member made of a thermal shape memory alloy, which is coupled to the bistable buckling membrane in a way that it causes the buckling membrane to snap from a first into a second stable position when being thermally deformed.

4. Actuator according to claim 1, **characterized in that** a bistable buckling membrane is carrying several movable contact pieces.

5. Actuator according to claim 1, **characterized in that** it comprises a buckling membrane assembly with a first and a second buckling membrane, each of which is carrying at least one movable contact piece, and that the buckling membranes are located in such a manner that in their first stable position the at least one movable contact piece of the first membrane makes electrical contact to the at least one movable contact piece of the second membrane and that in their second stable position the movable contact pieces of the first and second membrane are separated from each other.

6. Actuator according to claim 2, **characterized in that** it comprises several buckling membranes, each of which is carrying at least one movable contact piece, whereby the main current path is led through all then movable contact pieces in a serial manner, and that the trip member is coupled to a coupling member which is acting upon all buckling membranes simultaneously.

7. Actuator according to claim 1, **characterized in that** the point of contact is shunted out by a resistor which is configured in such a way that when the point of contact is in open position the main current path is led via the resistor.

8. Actuator according to claim 1, **characterized in that** it comprises a reset assembly which is coupled to the buckling membrane and which is configured in such a way that influenced by the reset assembly the buckling membrane can snap back from its second into its first stable position.

9. Installation switching device comprising a main current path, further comprising a point of contact in the main current path, which is formed by at least two contact members, whereby at least one of the contact members is movable and whereby the contact members are configured to be separated in a tripping condition under the influence of a tripping device, **characterized in that** the installation switching device comprises an actuator according to one of previous claims 1 to 8.

10. Installation switching device according to claim 9, **characterized in that** it comprises an actuator according to previous claim 2.

11. Installation switching device according to claim 10, **characterized in that** the Thomson coil forms part of the main current path and is configured such that the trip member is repelled from the coil when the electrical current through the coil shows a high pulse rate of rise.

12. Installation switching device according to claim 10, **characterized in that** the Thomson coil forms part of a fault current path and is configured such that the trip member is repelled from the coil when the electrical current through the coil shows a high pulse rate of rise.

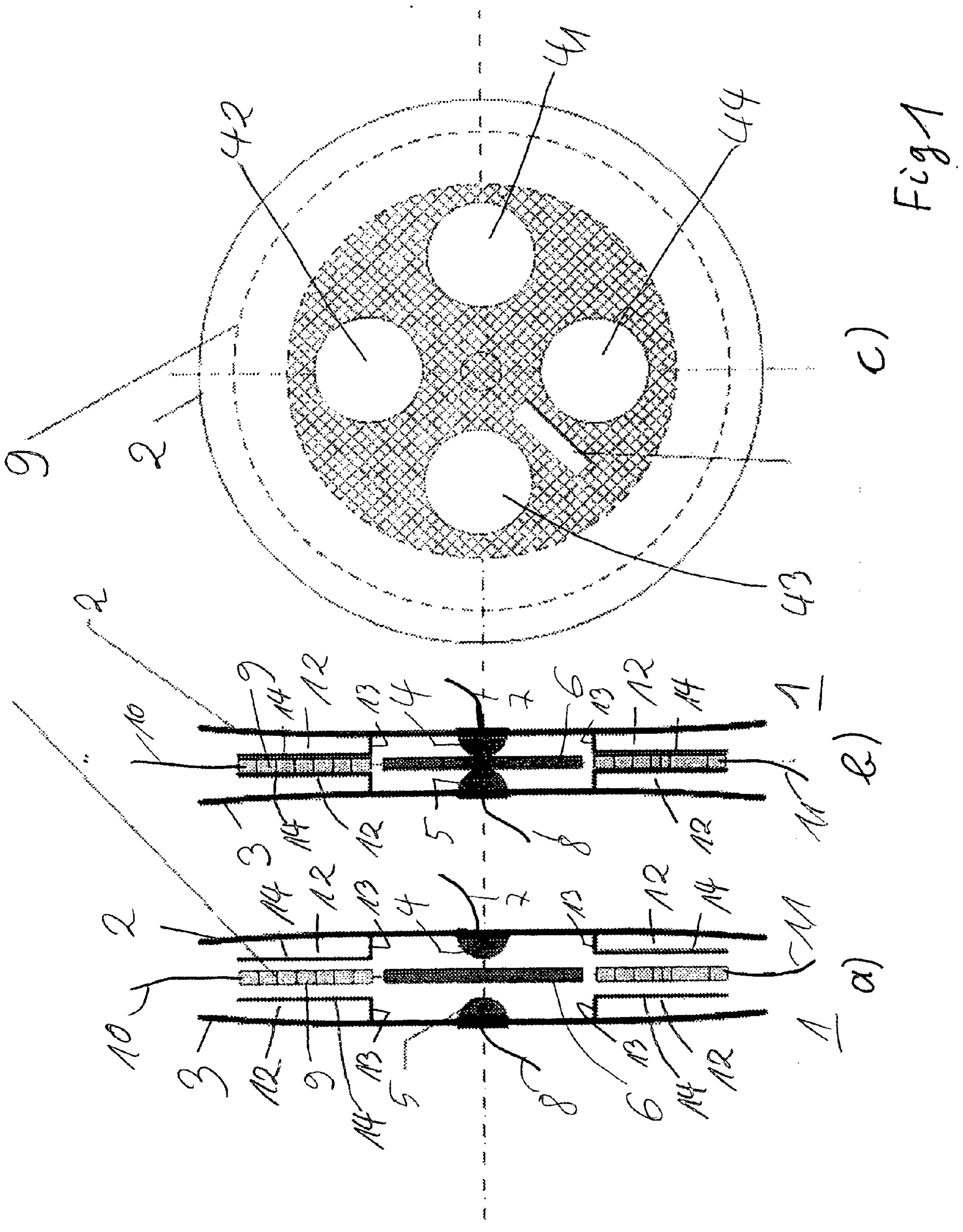

Fig 1
a)
b)
c)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
41
42
43
44

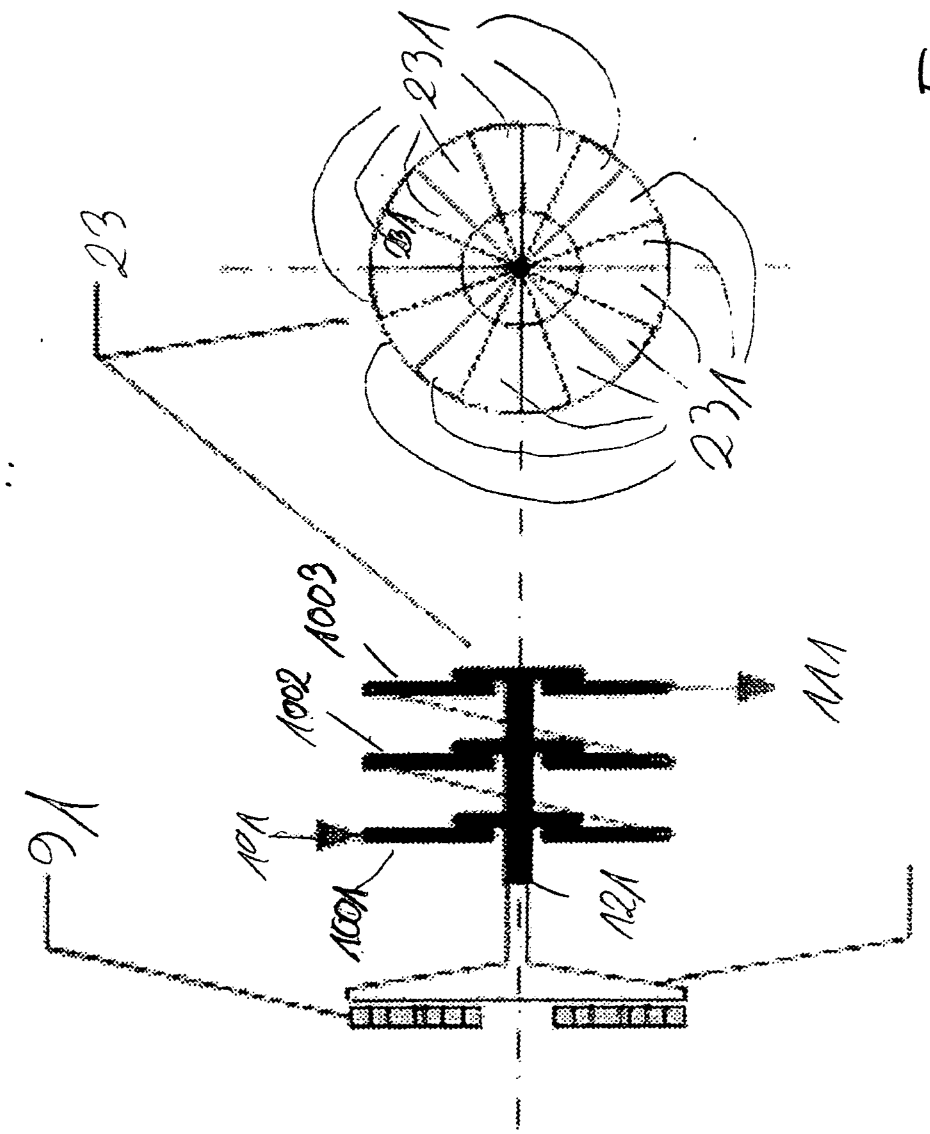

Fig. 2

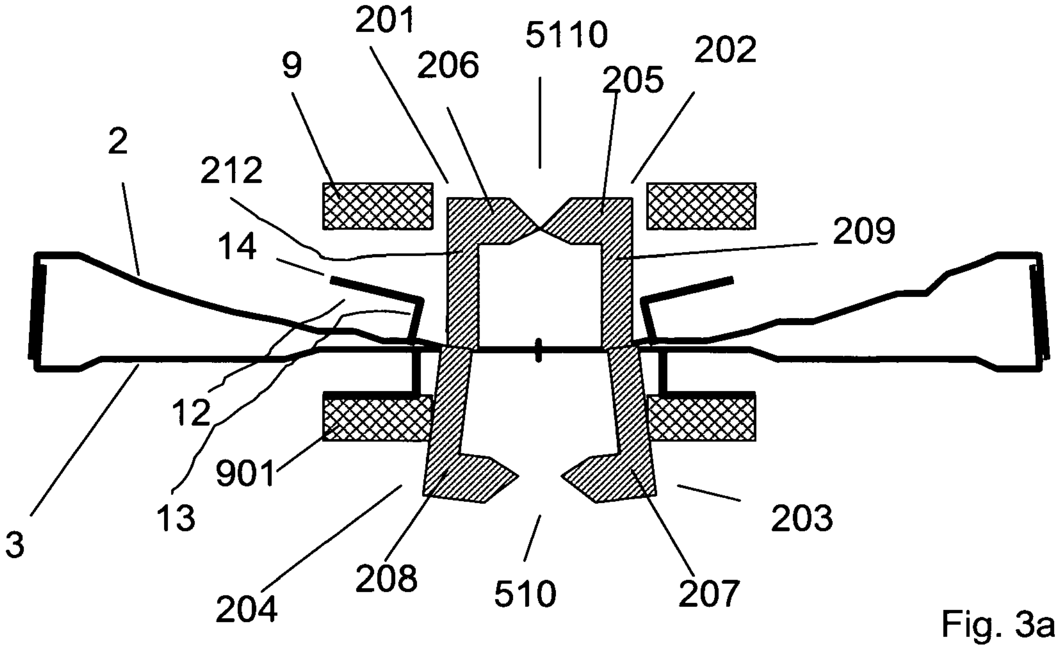
201
5110
202
9
206
205
2
212
209
14
12
901
13
203
3
204
208
510
207

Fig. 3a

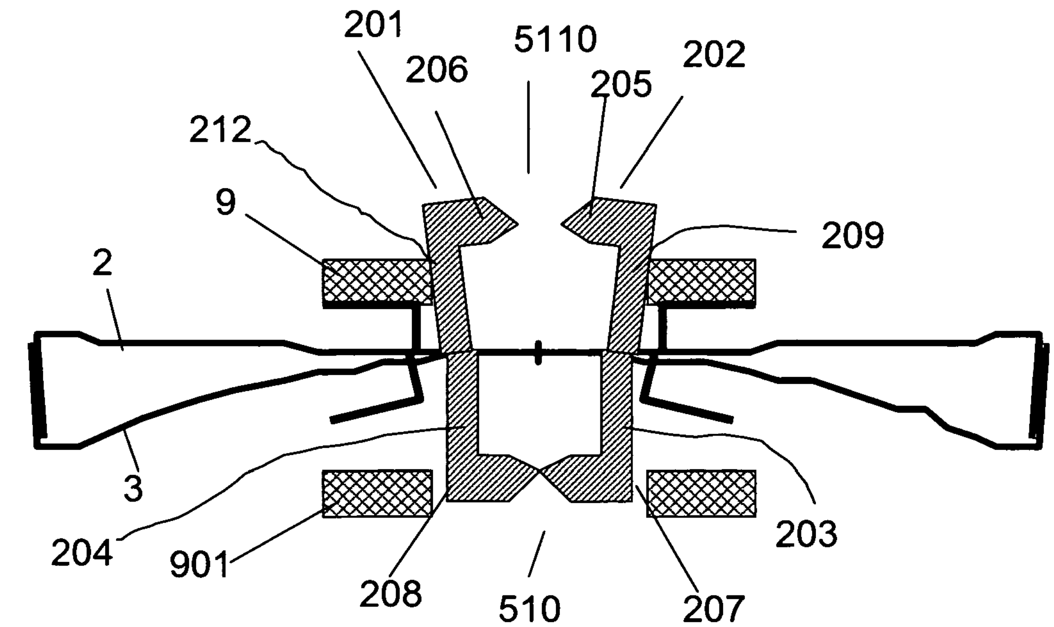
201
5110
206
202
205
212
209
9
2
3
204
901
203
208
510
207

Fig. 3b

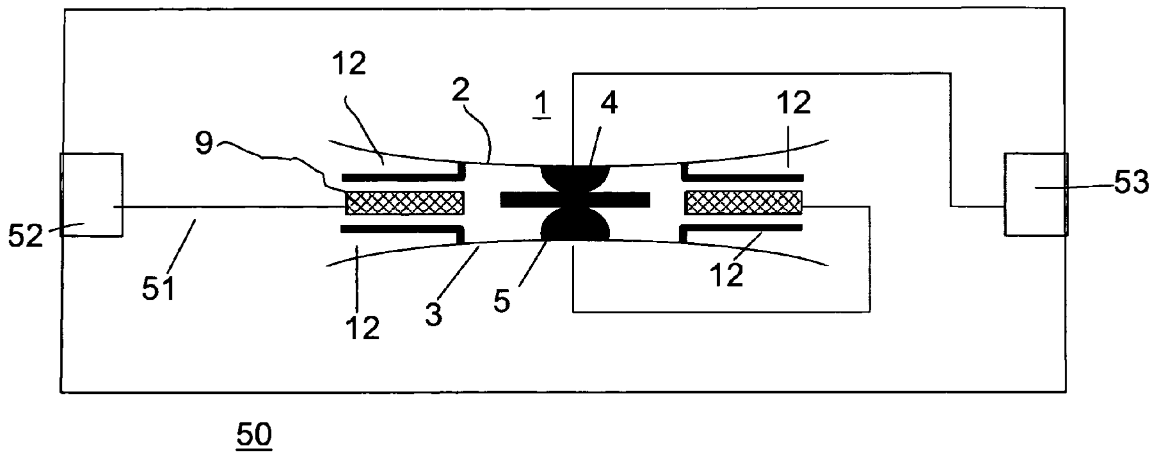
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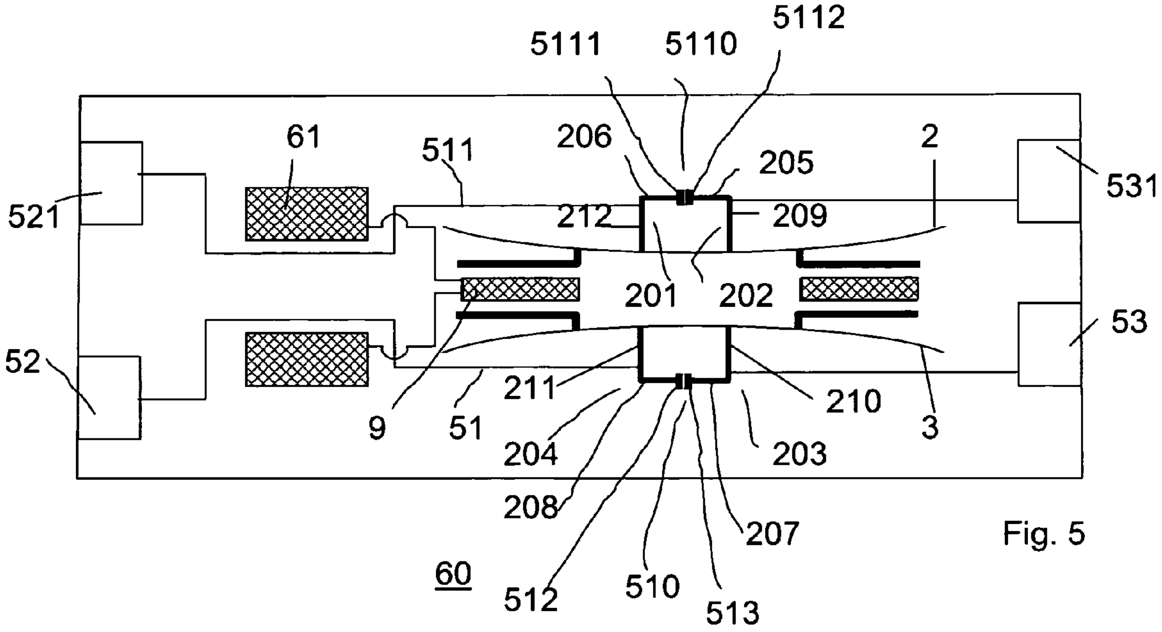
Fig. 4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203
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513
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Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 08 02 1063

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Place of search	Date of completion of the search	Examiner
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