(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 459 650 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
06.11.2024 Bulletin 2024/45

(21) Application number: **24000040.6**

(22) Date of filing: **28.03.2024**

(51) International Patent Classification (IPC):
H01H 13/06 *(2006.01)* ***H01H 1/26*** *(2006.01)*
H01H 13/18 *(2006.01)* ***H01H 13/36*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H01H 13/06; H01H 1/26; H01H 11/00; H01H 13/18; H01H 13/36; H01H 2229/036

(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:
GE KH MA MD TN

(30) Priority: **05.05.2023 IT 202300008955**

(71) Applicant: **Pizzato Elettrica S.r.l.**
36063 Marostica (Vicenza) (IT)

(72) Inventor: **Pizzato, Marco**
36063 Marostica (VI) (IT)

(74) Representative: **Dalla Rosa, Silvia**
C/o Ing. Ranieri Marino
Strada del Pasubio 146
36100 Vicenza (IT)

(54) MICROSWITCH AND RELATED PRODUCTION PROCESS

(57) A microswitch comprises a case (**11**) formed by at least two half-shells (**35, 36**) mutually joined at respective mutually facing and overlapping perimeter edges to define a compartment (**12**) which houses a first electrical contact (**15**), a second electrical contact (**16**) and a contact element (**19**) movable with respect to the first electrical contact (**15**) and to the second electrical contact (**16**) and wherein the two half-shells (**35, 36**) are stably joined together by at least partial mutual welding of the respective perimeter edges.

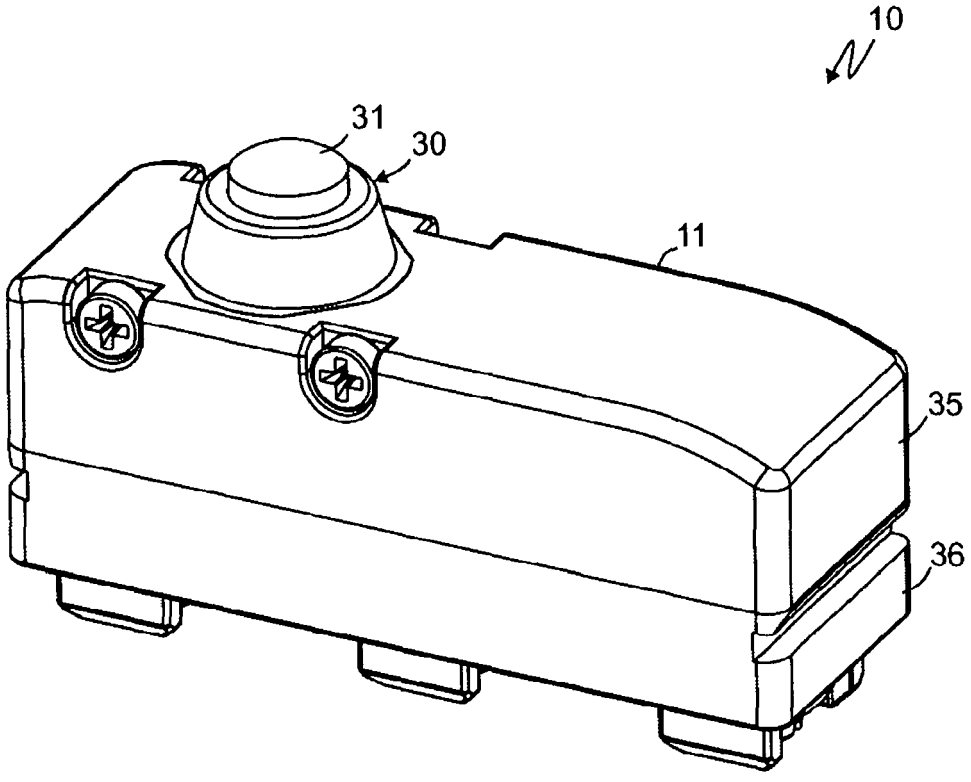

fig. 1

EP 4 459 650 A1

Description

Technical Field

[0001] The present invention refers to a microswitch and to the related manufacturing process, which can find application for the opening and closing of an electrical circuit of an industrial plant, or of any machine or device, in response to a pressure applied by the outside on the microswitch.

State of the art

[0002] Microswitches are known which normally comprise a case defining an inner compartment wherein a movable electrical contact and two fixed electrical contacts connected to respective outer electrical circuits are arranged.

[0003] Furthermore, the known microswitches also comprise a driving head, arranged outside the case, and suitable for receiving a mechanical pressure to be transmitted to the movable electrical contact and make it move between the fixed electrical contacts, opening or closing the electrical circuits to which the latter are connected. Generally, the case of known microswitches comprises two shells fixed to each other by means of screws, rivets, bolts, or other similar fastening elements, or by means of a joint obtained with a shape coupling.

[0004] In addition, in some cases it is required that the compartment inside the case is hermetically sealed to prevent water, dust or similar elements from reaching the electrical contacts located inside and causing their malfunction.

[0005] To this purpose, known microswitches usually comprise a gasket arranged between the two shells of the case to prevent water, dust or anything else from leaking into the inner compartment of the case, passing through the contact area between the two shells.

[0006] A drawback of known microswitches is represented by the fact that, although they include a gasket, perfect hermetic closure of the inner compartment of the case is not always guaranteed. As matter of fact, during the assembly operations of the microswitch, it is typical for the gasket not to be positioned perfectly in its seat, preventing the two shells of the case from being correctly fixed together.

[0007] Another drawback consists in the fact that the screws, rivets, bolts, or other fastening elements of the two shells, or even the shape coupling itself between the two shells, occupy a high volume and consequently limit the available volume of the compartment inside the case.

[0008] This drawback limits the dimensions of the electrical contacts housed in the inner compartment of the case and, therefore, also the electric currents to which they can be subjected, effectively limiting the applications of use of the microswitch.

[0009] This problem is aggravated in cases where the gasket is also provided between the two shells of the case. In fact, the housing for the gasket, and the gasket itself, occupy a portion of the volume of the inner compartment of the case, still limiting the available volume for housing the electrical contacts.

Scope of the invention

[0010] The object of the present invention is to realize a microswitch, and a related manufacturing process, which can overcome the above-mentioned drawbacks of the microswitches of the prior art.

[0011] A particular object of the present invention is to realize a microswitch having a ratio as close to unity between the volume of the inner compartment of the case and the overall volume of the microswitch.

[0012] Another object of the present invention is to realize a microswitch to be used for applications wherein very high electric currents are expected.

[0013] Another object of the present invention is to realize a microswitch simple to be manufactured, with compact dimensions and a high degree of sealing of the inner compartment of the case.

[0014] A further object of the present invention is to develop a process for manufacturing a microswitch which allows the reduction of fixing errors between the shells of the case. These objects, as well as others which become more apparent hereinafter, are obtained by a microswitch which, in accordance with claim 1, comprises a case formed by at least two half-shells mutually joined with each other at respective peripheral edges facing each other and overlapping for define a compartment which houses thereinside a first electrical contact, a second electrical contact and a contact element movable with respect to said first electrical contact and said second electrical contact and wherein said at least two half-shells are stably joined together by at least partial mutual welding of the respective perimeter edges.

[0015] In this way, as there are no external fastening elements or shape couplings, there will also be no elements that will occupy the inner space of the compartment, allowing for more space available for the contacts.

[0016] As a consequence, the contacts may have sections of increased width compared to known solutions but without it being necessary to increase the overall dimensions of the microswitch.

[0017] Therefore, the microswitch, while maintaining relatively small dimensions and high construction simplicity, may also be used in applications involving electrical currents of relatively high amperage.

[0018] Advantageous embodiments of the microswitch are obtained in accordance with the dependent claims.

Brief disclosure of the drawings

[0019] Further features and advantages of the invention will become more apparent in light of the detailed description of a preferred but not exclusive embodiment of a microswitch, shown by way of non-limiting example

with the aid of the attached drawing tables in which:

Fig. 1 is an axonometric view of a microswitch according to an embodiment of the present invention;
Fig. 2 is a view of a portion of the microswitch of Fig. 1;
Figs. 3, 4 and **5** are sectional views of the microswitch of Fig. 1 according to section planes III, IV and V, respectively;
Fig. 6 is a sectional view of a detail of the microswitch of Fig. 1;
Fig. 7 is an axonometric view of a microswitch in accordance with an embodiment of the present invention;
Fig. 8 is a view of a portion of the microswitch of fig. 7.

Best mode of carrying pout the invention

[0020] A microswitch according to the present invention, generally referred as **10,** is designed to be connected to one or more outer electric circuits and to open or close the latter in response to a pressure received from an external member.

[0021] In particular, with reference to **Fig. 1,** the microswitch **10** comprises a case **11** defining inside a compartment **12** wherein two or more electrical contacts **15, 16,** adapted to be connected to the above one or more electrical circuits, are arranged.

[0022] In the present example, the microswitch **10** comprises a first electrical contact **15** and a second electrical contact **16,** which in the illustrated configuration are fixed inside the compartment **12.**

[0023] Each electrical contact **15, 16** is associated with a respective connection terminal **15', 16'** to allow the connection thereof to respective outer electrical circuits.

[0024] By way of example, the connection terminals **15', 16'** may be of the faston type, screw type, cable lug type, or other similar types.

[0025] Inside the compartment **12** there is also a contact element **19,** movable with respect to the electrical contacts **15,16** between a first position and a second position and adapted to operate on the electrical contacts **15, 16** to open or close the electrical circuits connected thereto.

[0026] The movable contact element **19** is also associated with a connection terminal **19'** to electrically connect it to outer electrical circuits.

[0027] In the example of **Fig. 3** the movable contact element **19** comprises a lamella **20** having a first end **21** fixed to the connection terminal **19'** and a second cantilevered end **22** arranged between the first electrical contact **15** and the second electrical contact **16.** In this case, in the first position the second end **22** is in contact with the first electrical contact **15** and in the second position the second end **22** is in contact with the second electrical contact **16.**

[0028] The lamella **20** comprises two lateral portions **25** which connect the first end **21** to the second end **22** and a central portion **26** which extends from the second end **22** and is blocked against an abutment element **23** integral with the case **11.** The central portion **26** is deformed elastically with respect to the lateral portions **25** to promote a snap movement of the second end **22** between the first electrical contact **15** and the second electrical contact **16** when pressure is exerted on the lamella **20.**

[0029] Furthermore, in this configuration, it is possible to hold the second end **22** of the lamella **20** stably against one of the two electrical contacts **15, 16** when no pressure is exerted on the lamella **20.** In the present example, when no pressure is exerted on the lamella **20** its second end **22** is held against the first electrical contact **15.**

[0030] The microswitch **10** also comprises driving means **30** adapted to receive pressure from a member external to the microswitch **10** and operate on the movable contact element **19** to make it move from the first to the second position, or vice versa.

[0031] In this case, the driving means **30** comprise an operating head **31** external to the case **11** and an actuator pin **32,** associated with the driving head **31,** and adapted to exert pressure on the lamella **20** so as to move its second end **22** from the first position to the second position.

[0032] In this case, the elastic energy stored in the deformed central portion **26** of the lamella **20** allows a rapid snap movement of the second end **22** when the lamella **20** is pressed by the actuator pin **32.**

[0033] The driving head **31** is slidably fixed to the case **11** and, preferably, between the driving head **31** and the case **11** there are first sealing means adapted to prevent the infiltration of water or dirt, or in general of liquids or external bodies, inside the case **11** and in particular inside the compartment **12.** Preferably, the driving means are movable along an operating direction **X.** Even more preferably, the driving head **31** slides along the operating direction **X.**

[0034] By way of example, the first sealing means may comprise a collar **33** fixed to the case **11** by means of screws, joints or the like and which surrounds the driving head **31,** also acting as a guide therefor.

[0035] Similarly, second sealing means are preferably also present between the actuator pin **32** and the case **11.** By way of example, the second sealing means may comprise a flexible bellows **34** fixed to the case **11** and to the actuator pin **32.**

[0036] The case **11** comprises at least two half-shells **35, 36** each provided with respective perimeter edges **37** and designed to be arranged in a mutually facing and overlapping position to delimit the compartment **12.**

[0037] Preferably, the two half-shells **35, 36** are arranged in a mutually facing and overlapping position with respect to a joining plane **P** perpendicular to the operating direction **X.** Even more preferably, the peripheral edges **37** of the two half-shells **35, 36** lie substantially on the joining plane **P** or in a plane parallel to the joining plane **P.**

[0038] In this way the ultrasonic welding is more effec-

tive for joining the two half-shells **35, 36** as the energy of the ultrasonic vibrations transmitted to the two half-shells **35, 36** during the welding operation is constant throughout the development of the perimeter edges **27** of the two half-shells **35, 36.**

[0039] Furthermore, even more preferably, each half-shell **35, 36** comprises an outer surface **53, 54** (**Figs. 7** and **8**) substantially parallel to the joining plane **P.** In this way, the distance between each point of this outer surface **53, 54** and the joining plane **P** is substantially constant for every point of the outer surfaces **53, 54.** This feature also facilitates the ultrasonic welding operation of the two half-shells **35, 36** as it allows an arrangement of the welding member at ultrasound (sonotrode) parallel to the joining plane **P** and therefore to the perimeter edges **27.**

[0040] In accordance with a peculiar aspect of the present invention, the two half-shells **35, 36** will be stably joined together by welding, which will preferably be ultrasonic welding.

[0041] In a particularly preferable manner, the welding of the perimeter edges **37** will be carried out throughout their entire development.

[0042] Advantageously, this allows for a hermetic coupling between the two half-shells **35, 36** even without the presence of a gasket or other additional sealing means.

[0043] In addition, this conformation allows the two half-shells **35, 36** to be joined without using fixing elements such as screws, rivets or others, and without providing for a specific shape or interlocking coupling therebetween.

[0044] In the preferred embodiments, each of the first and second electrical contacts **15, 16** comprises at least two contact areas independent of each other. In particular, said contact areas are distinct and physically separated from each other.

[0045] This conformation is possible thanks to the fact that the two half-shells **35, 36** are joined by ultrasonic welding.

[0046] In fact, the absence of fastening elements between the two half-shells **35, 36** and of gaskets allows for a compartment **12** inside the case **11** having a very large volume, suitable for containing large electrical contacts **15, 16.**

[0047] Furthermore, thanks to this conformation the reliability of the contact between the lamellae **20** and the electrical contacts **15, 16** is also improved.

[0048] In particular, the presence of two distinct and separate contact areas for each electrical contact **15, 16** reduces the risk of an unstable, or not perfectly aligned, contact with the contact element **19.**

[0049] Advantageously, in this way the microswitch **10** of the present invention may have compact dimensions and, at the same time, transmit currents of high values even higher than 5 A, either DC and AC.

[0050] In the current example, each electrical contact **15, 16** comprise a respective plate **40, 41** on which at least one conductive pad is fixed.

[0051] Preferably, two or more independent conductive pads **42, 43** are fixed to each plate **40, 41.** In this way each electrical contact **15, 16** comprises at least two independent contact areas, defined by the conductive pads **42, 43.**

[0052] Furthermore, the contact end **22** of the lamella **20** also comprises at least two contact areas independent of each other.

[0053] This feature also contributes to transmitting high value currents, even exceeding 5 A, either DC and AC.

[0054] As matter of fact, the two contact areas independent of each other reduce the risk of unstable contact or sticking between the lamellae **20** and the electrical contacts **15, 16.** In this case, the contact end **22** of the lamellae **20** comprises at least two pairs of conductive pads **44, 45.** In particular, two upper conductive pads **44** are designed to contact the pair of conductive pads **42** of the first electrical contact **15** and two lower conductive pads **45** are designed to contact the pair of conductive pads **43** of the second electrical contact **16.**

[0055] Preferably, but not necessarily, the surface of the cross section S **(Fig. 6)** of each conductive pad **42, 43, 44, 45** is greater than 3.5 mm2.

[0056] It should be noted that the cross section S is the maximum cross section of a conductive pad **42, 43, 44, 45** with respect to a sectional plane parallel to the surface of the lamella **20** on which the conductive pad **42, 43, 44, 45** lies.

[0057] This configuration is also possible thanks to the fact that the two half-shells **35, 36** are joined by ultrasonic welding.

[0058] As matter of fact, the absence of fastening elements between the two half-shells **35, 36** and of gaskets allows to have a compartment **12** inside the case **11** having a very large volume, suitable for containing a contact end **22** of the lamella **20** of high dimensions. Advantageously, this feature also allows the microswitch **10** of the present invention to have compact dimensions and, at the same time, to transmit currents of high values even greater than 5 A, either DC and AC.

[0059] The person skilled in the art easily understands that the cross section **S** of the conductive pads **42, 43, 44, 45,** which in the current example is circular in shape, may be of a different shape, for example square, polygonal, or defined by any combination of straight or curved sections, without thereby departing from the scope of protection of the present invention.

[0060] Preferably, the microswitch **10** further comprises fixing means **51, 52** adapted to allow the fixing of the microswitch **10** to an industrial machine or plant. In the example of **Figs. 7** and **8** the fixing means are through fixing holes **51, 52.**

[0061] The through fixing holes **51, 52** are advantageously obtained on one of the two half-shells **35, 36.** Preferably, the through fixing holes **51, 52** are advantageously obtained only on one of the two half-shells **35, 36.** In particular, the through fixing holes **51, 52** pass only

through a single half-shell **36** and have a respective central axis parallel to the joining plane **P.** This is advantageous because, in use, a fixing screw inserted into a through fixing hole **51, 52** passes only through a single half-shell **36** and is never in contact with a perimeter edge **27** designed to be welded. This increases the resistance of the microswitch **10** of the present invention since the forces transmitted by the fixing screw to the half-shell **36** are applied in an area of the half-shell **36** having no solution of continuity.

[0062] The present invention also refers to a process for manufacturing the microswitch **10** which comprises a step of stable coupling the half-shells **35, 36** wherein the half-shells **35, 36** are stably joined with each other by at least partial mutual welding of the respective perimeter edges **37.**

Claims

1. A microswitch **(10)** comprising a case **(11)** formed by at least two half-shells **(35, 36)** mutually joined at respective perimeter edges **(37)** mutually facing and overlapping to define a compartment **(12)** which houses thereinside a first electrical contact **(15),** a second electrical contact **(16)** and a contact element **(19)** movable with respect to said first electrical contact **(15)** and to said second electrical contact **(16); characterized in that** said at least two half-shells **(35, 36)** are stably joined together by at least partial mutual welding of said respective perimeter edges **(37).**

2. Microswitch as claimed in claim 1, **characterized in that** said at least two half-shells **(35, 36)** are stably joined together, along the entire development of said perimeter edges **(37)** by said welding and in the absence of further fixing and/or joints and/or shape couplings between said perimeter edges **(37).**

3. Microswitch as claimed in claim 1 or 2, **characterized in that** the perimeter edges **(37)** of said at least two half-shells **(35, 36)** are in direct mutual contact in the absence of gaskets placed therebetween.

4. Microswitch as claimed in any preceding claim, **characterized in that** said welding is ultrasonic welding.

5. Microswitch as claimed in any preceding claim, **characterized in that** said contact element **(19)** is movable in said compartment **(12),** and wherein said microswitch comprises driving means **(30)** adapted to move said contact element **(19)** between at least one first position wherein it is in electrical continuity with said first electrical contact **(15)** and a second position wherein it is in electrical continuity with said second electrical contact **(16),** and vice versa.

6. Microswitch as claimed in claim 5 and wherein said driving means **(30)** are movable along an operating direction **(X) characterized in that** said half-shells **(35, 36)** are arranged in a mutually facing and overlapping position with respect to a joining plane **(P)** perpendicular to said operating direction **(X).**

7. Microswitch as claimed in any preceding claim, **characterized in that** at least one of said electrical contacts **(15, 16)** comprises at least two distinct and separate contact areas, adapted to be placed in electrical continuity with each other by means of said contact element **(19).**

8. Microswitch as claimed in claim 7, **characterized in that** each of said electrical contacts **(15, 16)** comprises two contact areas.

9. Microswitch as claimed in claim 8, **characterized in that** each of said electrical contacts **(15,16)** comprises a respective plate (**40**, **41**) on each of which two conductive pads **(42, 43)** are fixed, defining said contact areas.

10. Microswitch as claimed in claims 5 and 9, **characterized in that** said contact element **(19)** comprises a lamella **(20)** having a first end **(21)** fixed to said case **(11)** and a second cantilevered end **(22)** on which two upper conductive pads **(44)** are arranged, positioned to come into contact with the conductive pads **(42)** of said first electrical contact **(15)** when said contact element **(19)** is in said first position and two lower conductive pads **(45)** positioned to contact the conductive pads **(43)** of said second electrical contact **(16)** when said contact element **(19)** is in said second position.

11. Microswitch as claimed in claim 10, **characterized in that** said contact element **(19)** also comprises an abutment element **(23)** integral with said case **(11),** said lamella **(20)** comprising two lateral portions **(25)** connected to said first and second ends **(21, 22)** and an inner portion **(26)** which develops from said second end **(22)** and is held in a deformed configuration by said abutment element **(23).**

12. Microswitch as claimed in claim 11, **characterized in that** said driving means **(30)** comprise a driving head **(31)** external to said case **(11)** and an actuator pin **(32)** associated with said operating head **(31)** and adapted to exert a pressure on said lamella (20) suitable to move said second end **(22)** of said lamella **(20)** from said first position to said second position.

13. Microswitch as claimed in claim 12, **characterized by** comprising sealing means **(33, 34)** associated with said driving means **(30)** and with said case **(11)** and adapted to avoid the infiltration of liquids or ex-

ternal bodies inside said compartment **(12).**

14. Microswitch as claimed in any claim 10 to 13, **characterized in that** the surface of the cross section (S) of each of said conductive pads (**42**, **43**, **44**, **45**) is greater than 3.5 mm2.

15. Microswitch as claimed in any claim 6 to 14 **characterized in that** at least one of said two half-shells (**35**, **36**) comprises at least one through fixing hole **(51, 52)** passing through and having a central axis parallel to said joining plane **(P).**

16. Microswitch as claimed in any claim 6 to 15 **characterized in that** at least one of said two half-shells (**35**, **36**) comprises at least one outer surface **(53, 54)** substantially parallel to said joining plane **(P).**

17. Process for manufacturing a microswitch **(10)** comprising a case **(11)** formed by at least two half-shells **(35, 36)** having respective perimeter edges **(37)** and suitable for defining a compartment **(12)** which houses at its inside a first electrical contact **(15),** a second electrical contact **(16)** and a contact element **(19)** movable with respect to said first electrical contact **(15)** and to said second electrical contact **(16);**
characterized by comprising a step of stable coupling of said half-shells **(35, 36)** wherein said half-shells **(35, 36)** are stably joined with each other by at least partial mutual welding of the respective perimeter edges (37).

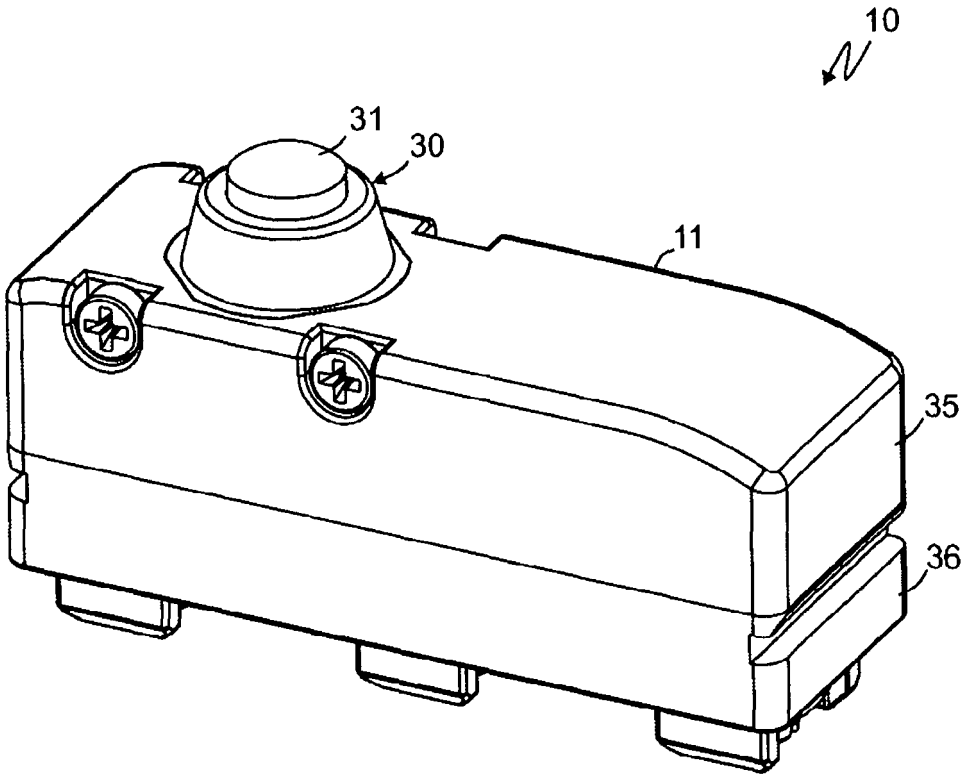
10
31
30
11
35
36

fig. 1

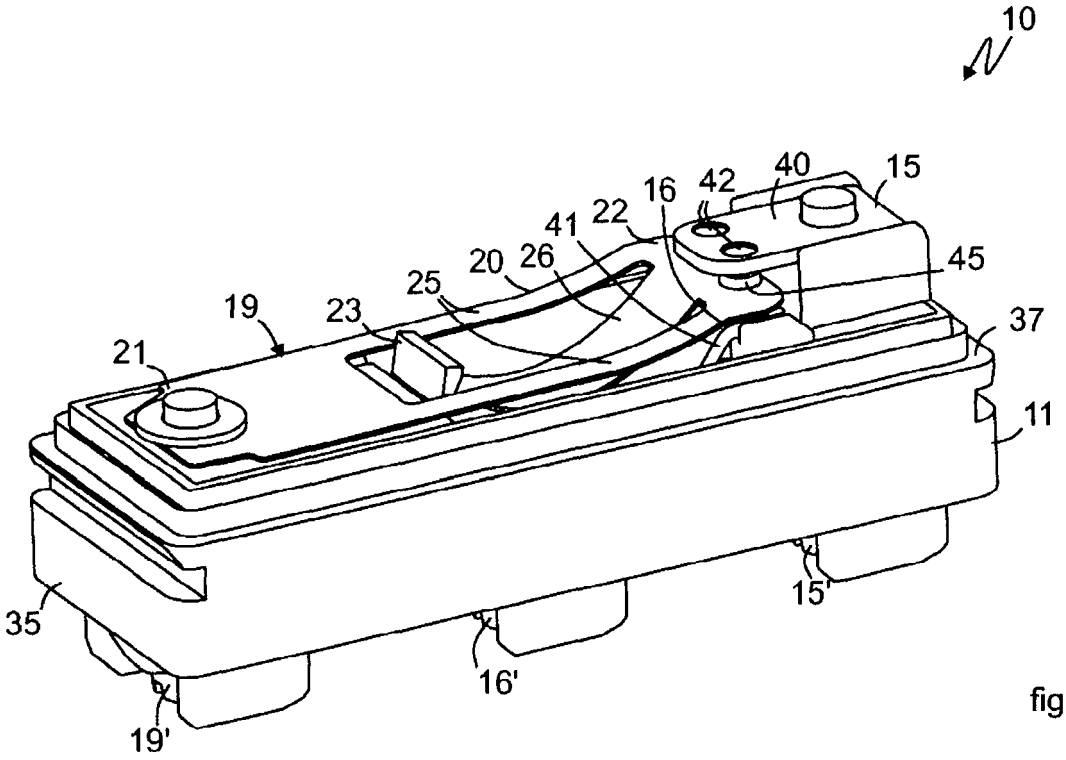
10
40
15
42
16
22
41
20
26
25
23
19
21
45
37
11
35
15'
16'
19'

fig. 2

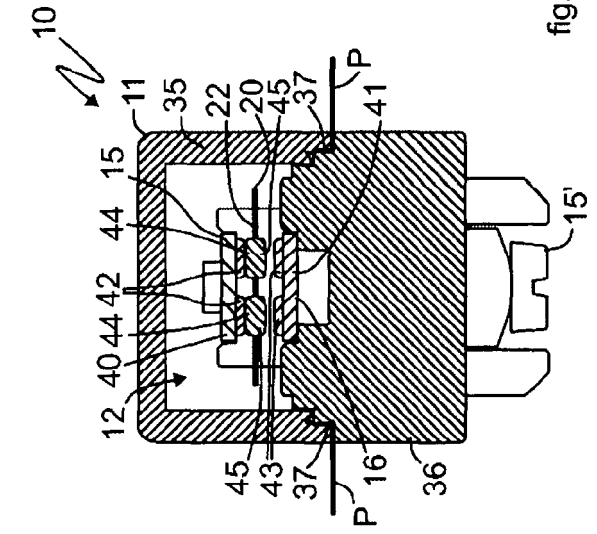

fig. 4

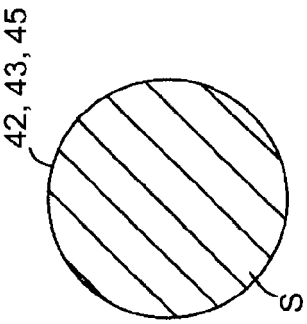

fig. 6

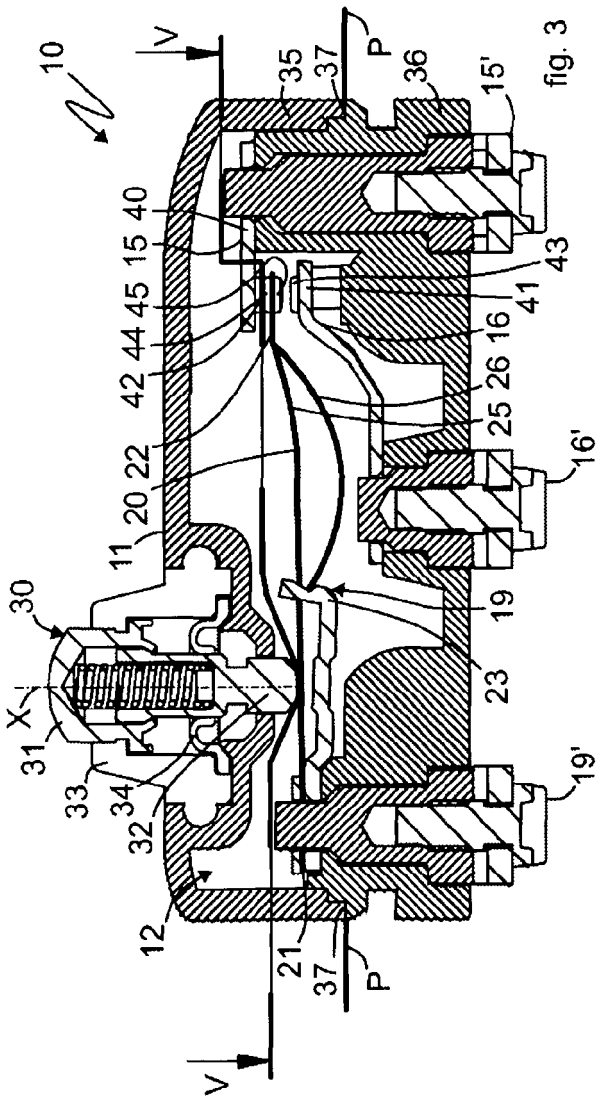

fig. 3

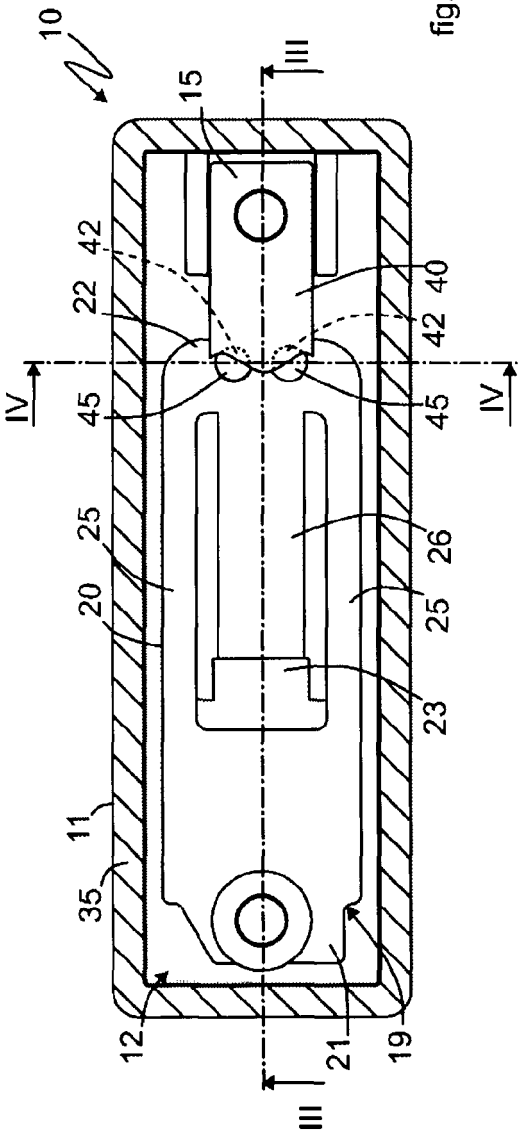

fig. 5

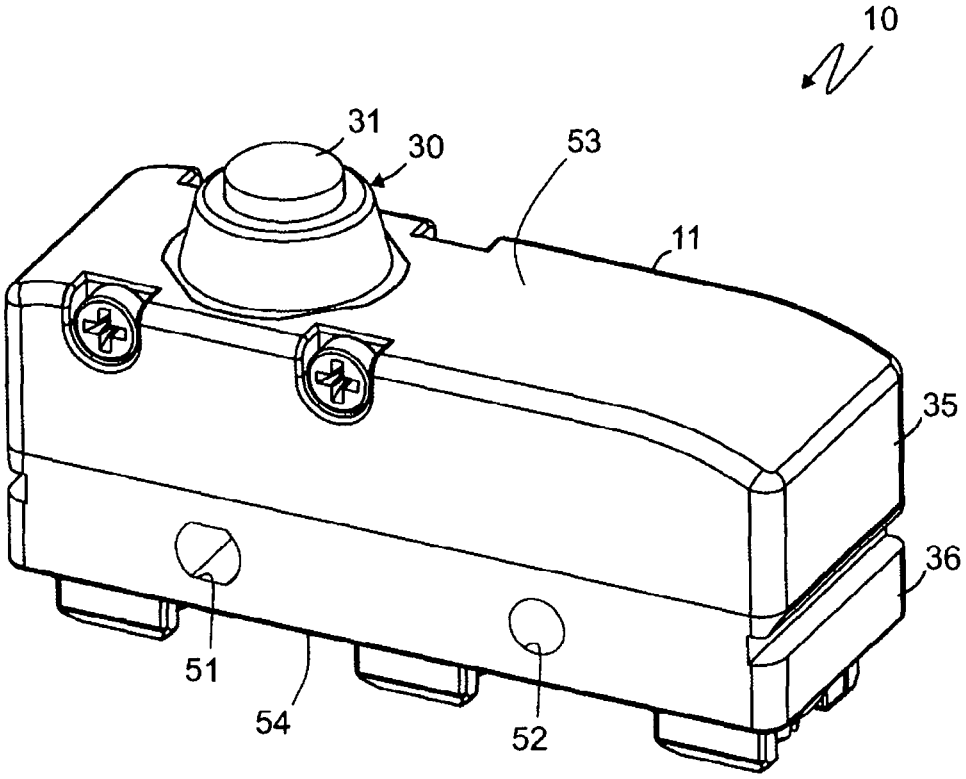
10
31
30
53
11
35
36
51
54
52

fig. 7

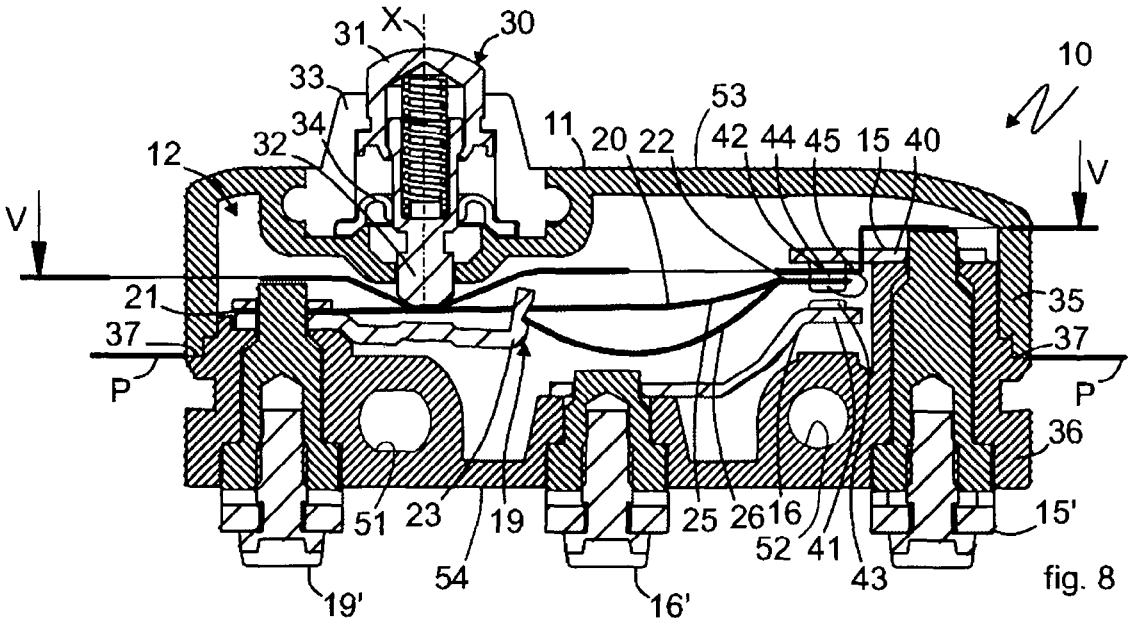
31
X
30
10
33
53
34
11
20
22
42
44
45
15
40
12
32
V
V
21
35
37
37
P
P
36
51
23
19
25
26
16
15'
52
41
43
54
19'
16'

fig. 8

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 24 00 0040

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 Y	US 4 394 553 A (FEIL PAUL G) 19 July 1983 (1983-07-19) * abstract; figures 1A-2B * * column 2, line 42 - column 4, line 12 * * column 1, line 40 - column 2, line 14 * * column 4, lines 36-47 *	1-12, 14-17 13	INV. H01H13/06 H01H1/26 H01H13/18 H01H13/36
X Y	CN 109 509 664 A (SHENZHEN DONGNAN WEIYE ELECTRONICS CO LTD) 22 March 2019 (2019-03-22) * translation relateing to cited figures; figures 2,3,5,10,13,14,17,19 *	1-17 13	
X Y	US 4 835 348 A (POLING RONALD W [US] ET AL) 30 May 1989 (1989-05-30) * figures 2,3 * * column 2, line 57 - column 3, line 56 * * column 4, line 22 - column 5, line 62 *	1-17 13	
Y A	CN 206 379 293 U (HUIZHOU HONGBAO ELECTRONICAL EQUIPMENT CO LTD) 4 August 2017 (2017-08-04) * figures 1-6 *	13 1-11,14	TECHNICAL FIELDS SEARCHED (IPC) H01H
Y A	WO 2020/042572 A1 (TRANTEK ELECTRONICS CO LTD [CN]) 5 March 2020 (2020-03-05) * abstract; figures 1-5,18 *	13 1-12, 14-17	
A	CN 112 786 331 A (HUIZHOU FENGSHI WEIQI ELECTRONIC TECH CO LTD) 11 May 2021 (2021-05-11) * figures 2,8,9 *	15,16	
A	WO 2019/176680 A1 (OMRON TATEISI ELECTRONICS CO [JP]) 19 September 2019 (2019-09-19) * figures 1,3,4,7 *	15,16	

-/--

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	29 August 2024	Bauer, Rodolphe

CATEGORY OF CITED DOCUMENTS

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

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

EPO FORM 1503 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 24 00 0040

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 108 766 803 A (SHANGHAI FEILI XUNCHENG ELECTRIC TECH CO LTD) 6 November 2018 (2018-11-06) * figures 2,4 * -----	15,16	

TECHNICAL FIELDS SEARCHED (IPC)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	29 August 2024	Bauer, Rodolphe

CATEGORY OF CITED DOCUMENTS

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

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 00 0040

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-08-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4394553 A	19-07-1983	NONE	
CN 109509664 A	22-03-2019	NONE	
US 4835348 A	30-05-1989	NONE	
CN 206379293 U	04-08-2017	NONE	
WO 2020042572 A1	05-03-2020	CN 109841438 A	04-06-2019
		CN 209282095 U	20-08-2019
		WO 2020042572 A1	05-03-2020
CN 112786331 A	11-05-2021	NONE	
WO 2019176680 A1	19-09-2019	JP 2019160649 A	19-09-2019
		TW 201939550 A	01-10-2019
		WO 2019176680 A1	19-09-2019
CN 108766803 A	06-11-2018	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82