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

(11) EP 0 542 696 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
03.07.1996 Bulletin 1996/27

(51) Int Cl.[6]: **H01H 35/34**

(21) Application number: **92830550.7**

(22) Date of filing: **01.10.1992**

(54) **Pressure switch having a manually operated safety microswitch**

Druckschalter mit einem handbetätigten Sicherheitsmikroschalter

Interrupteur à pression ayant un microrupteur de sécurité actionné manuellement

(84) Designated Contracting States:
AT CH DE ES FR GB LI NL SE

(30) Priority: **15.11.1991 IT MI913050**

(43) Date of publication of application:
19.05.1993 Bulletin 1993/20

(73) Proprietor: **MA-TER S.r.l.**
I-20060 Pessano con Bornago, (Milano) (IT)

(72) Inventors:
- **Omati, Ennio, c/o MA-TER S.r.l.**
I-22060 Pessano Con Bornago (MI) (IT)
- **Omati, Marco, c/o MA-TER S.r.l.**
I-22060 Pessano Con Bornago (MI) (IT)

(74) Representative: **Cicogna, Franco**
Ufficio Internazionale Brevetti
Dott.Prof. Franco Cicogna
Via Visconti di Modrone, 14/A
20122 Milano (IT)

(56) References cited:
EP-A- 0 058 409
FR-A- 1 543 230
FR-A- 2 121 794
GB-A- 1 217 480
GB-A- 2 058 456
US-A- 3 898 405

EP 0 542 696 B1

Description

BACKGROUND OF THE INVENTION

The present invention relates to a pressure switch having a manually operated safety microswitch.

As is known, for measuring the pressure of fluidsin general, there are conventionally used pressure switches, which include a metal membrane associated or circumferentially sealed to an annular edge of a base cap.

Such a construction, however, in addition to requiring very complex machining steps,also includes several zones in which there is at least partially modified the resiliency of the membrane with a consequent random variation of the trip operation characteristics of the assembly.

A further drawback is that the tappet assembly included in these prior pressure switches is usually welded at the central region of the membrane, which contributes to a further changing of the mechanic and resiliency properties of the membrane.

Yet another drawback of the above mentioned prior pressure switches is that, as an overpressure occurs, the pressure switch components can be damaged which requires that recovering operations be performed.

From EP-A-0 058 409 there is known a pressure switch, comprising a bottom body defining in its inside a chamber communicating with a fluid to be controlled, and being associated with a top cap, supporting an operating switching contacts, said chamber being closed by a membrane, and including a sealing O-ring and being coupled to a steel membrane, with a related driving tappet assembly, said assembly being directly formed on the latter membrane and driving a washer counterbiassed by a first counterbiassing spring, and affecting said switching contacts.

SUMMARY OF THE INVENTION

Accordingly, the aim of the present invention is to overcome the above mentioned drawbacks, by providing a pressure switch, including a manually operated safety microswitch, which provides a perfect tightness with respect to the fluid to be controlled, without requiring any welding operations, so as to greatly improve the resilient responsivity of the membrane.

Within the scope of the above mentioned aim, a main object of the present invention is to provide such a pressure switch, the tapped assembly whereof is made as an integrating portion of the membrane, so as not to modify the physical and operation properties of said membrane.

Yet another object of the present invention is to provide such a pressure switch in which the operation threshold of the membrane can be easily modified in order to quickly and easily fit it to the specific use requirements.

Yet another object of the present invention is to provide such a pressure switch which is very reliable and safe in operation and can be easily made from easily commercially available elements and materials and which, moreover, is very competitive from a mere economic standpoint.

According to one aspect of the present invention, the above mentioned aim and objects, as well as yet other objects, which will become more apparent hereinafter, are achieved by a pressure switch, including a manually operated safety microswitch, characterized in that said pressure switch comprises a bottom body defining in its inside a chamber communicating with a fluid to be controlled, and being associated with a top cap, supporting an operating microswitch, said chamber being closed by a membrane, preferably made of a silicone material, and including a sealing O-ring and being coupled to a steel membrane, with a related driving tappet assembly, said assembly being directly formed on the latter membrane and driving a washer counterbiassed by a first counterbiassing spring, and affecting a pushbutton of the operating microswitch, a safety manually operated microswitch being moreover provided cooperating with a pin element extending from said washer.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the invention will become more apparent hereinafter from the following detailed disclosure of a preferred embodiment of a pressure switch including a manually operated safety microswitch according to the invention, which is illustrated, by way of an indicative, but not limitative, example, in the figures of the accompanying drawings where:

Figure 1 is an elevation view of the pressure switch according to the present invention;
Figure 2 is an exploded perspective view illustrating the pressure switch according to the invention;
Figure 3 is a vertical cross-sectional view of the subject pressure switch;
and
Figure 4 is a detail view illustrating the safety microswitch included in the pressure switch according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the number references of the figures of the accompanying drawings, the pressure switch, including a manually operated safety microswitch, according to the present invention, which has been generally indicated at the reference number 1, comprises a bottom body, or base cap 2 which, in its inside, defines a chamber 3 which, through a duct 4, is communicated with a fluid the pressure of which must be detected or sensed.

To the bottom body 2 there is connected a top cap 5, associated with said bottom body by means of a metal

circumferential edging 6.

As shown, the chamber 3 is closed by a membrane 10 which is formed as a single body with a sealing peripheral inner O-ring, adapted to provide a perfect tightness, said membrane being preferably made of a silicone or other suitable material.

Said silicone material membrane 10 is connected to a stainless steel membrane 12 which is super-imposed on said membrane 10 and is provided, at the central region thereof, with an integral tappet assembly 13.

As shown, said membranes 10 and 12 are held in a set position by means of a safety ring element 11 which is circumferentially engaged with the membrane 12 and holds in its preset position the sealing O-ring 11 so as to provide both the metallic clamping effect and an accurate tightness provided by said O-ring.

That same safety ring element 15, moreover, prevents the membrane 12 from being deformed as the pressure switch must be adjusted through the dowel element 32.

The tappet assembly 13 affects the central portion of a washer element 20, which is slidably guided on the top cap 5 and supports an aluminium disc 21, having a variable thickness, so as to adjust the operating threshold on the push-button 22 of an operating microswitch 23 which is connected to said cap 5 by means of screws 24.

On the washer 20 and, more precisely, on said aluminium disc 21, abuts a first biassing spring 30, which is coaxially arranged with respect to the washer and houses a top sliding bush 31 which contacts an adjusting screw 32 in turn rotatably supported by the cap 5.

A guide pin 33 is moreover provided, for guiding the washer, which can slide in a hollow 34 formed inside the adjusting screw 32.

From the washer 20 axially projects a pin element 40, which cooperates with a manually operated safety microswitch, generally indicated at the reference number 45, which is supported by the cap 5 by means of a ryton small plate 46, restrained by screws 47.

As shown, the microswitch 45 is provided with an operating lever 48, thereon the pin 40 can operate at different points, which can be set by means of a plurality of engaging slots 50 provided through the cap, in order to allow the lever arm to be easily changed.

If desired, a further thrust spring can moreover be provided.

The lever 48 operates the push-button 52 of the safety microswitch 45 and, at one end portion thereof, interacts with a resilient locking tongue 60, having a lug 61, and which is so arranged as to easily change its latching conditions (see figure 4).

Advantageously, it is furthermore possible to provide a latching spring 62, operating between the locking tongue 60 and the wall of the small plate 46, in order to prevent the resiliency characteristics of the tongue from varying in the time.

Moreover, it is also possible to use a manually resettable microswitch, which does not comprise any small plate, and it is also possible to provide a second biassing spring 70, operating in the chamber 3 on the membrane, so as to allow the possibility of presetting a plurality of operating threshold values, with a very small working pressure.

In operation, if inside the chamber 3 a pressure value greater than the rated value is generated, then the membrane is upwardly displaced, so as to cause the washer 20 to be also displaced, and energizing the operating microswitch 23.

A possible failure of the microswitch 23 is compensated for by the operation of the safety microswitch, which will be brought to its locking position, with a consequent need of performing a manual resetting operation, by operating the locking lever 60.

The calibrating or rated values can be easily modified by operating, for example, the adjusting screw 32, by introducing several aluminium discs of different thicknesses, in order to reduce the operating travel or by introducing a further biassing spring, operating on the underside of the membrane 10.

Likewise, it is possible to adjust the operation threshold of the safety microswitch by modifying the coupling point between the pin 40, which can also be constituted by a height adjustable screw, and the lever of said safety microswitch.

Even in this case, it is possible to provide a broad adjustement range of the safety microswitch operating threshold, which can be obtained by providing an elongated slot through the mentioned small plate, allowing a clockwise displacement, or, possibly, by using a spring biassed screw.

From the above disclosure it should be apparent that the invention fully achieves the intended aim and objects.

In particular the fact is to be pointed out that a pressure switch has been provided adapted to provide very accurate threshold values, since its membrane is not welded but is peripherally held through the interposition of a resilient material membrane, made of a resilient material such as silicone or the like, which is moreover provided with a tightness or sealing O-ring.

Obviously, the subject pressure switch can also be provided with two operating microswitches.

In practicing the invention, the used materials, provided that they are compatible to the intended use, as well as the contingent size and shapes, can be any, according to requirements.

Claims

1. A pressure switch (1), including a manually operated safety microswitch (45), comprising a bottom body (2) defining in its inside a chamber (3) communicating with a fluid to be controlled, and being associated with a top cap (5), supporting an oper-

ating microswitch (23), said chamber (3) being closed by a membrane (10), preferably made of a silicone material, and including a sealing O-ring (11) and being coupled to a steel membrane (12), with a related driving tappet assembly (13), said assembly (13) being directly formed on the latter membrane (12) and driving a washer (20) counterbiassed by a first counterbiassing spring (30), and affecting a push-button (22) of the operating microswitch (23), a safety manually operated microswitch (45) being moreover provided cooperating with a pin element (40) extending from said washer (20).

2. A pressure switch, according to Claim 1, characterized in that that pressure switch (1) compris-es a safety ring element (15) interposed between the bottom body (2) and the cap (5) and operating peripherally on the latter membrane (12).

3. A pressure switch (1), according to Claims 1 and 2, characterized in that said pressure switch (1) comprises an adjustement screw (32), operating on the first reaction spring (30) and being rotatably supported by said cap (5).

4. A pressure switch, according to one or more of the preceding claims, characterized in that said pressure switch (1) comprises a sliding element (31) interposed between an end portion of the first reaction spring (30) and the adjustment screw (32).

5. A pressure switch, according to one or more of the preceding claims, characterized in that said safety microswitch (45) is of the safety manually re-armed or re-operated type.

6. A pressure switch, according to one or more of the preceding claims, characterized in that it further comprises, on said safety microswitch (45), a lever (48) cooperating with the safety push-button (52) of the safety microswitch (45) and engageable by the pin (40).

7. A pressure switch, according to one or more of the preceding claims, characterized in that on said lever (48) operates a calibrating spring.

8. A pressure switch, according to one or more of the preceding claims, characterized in that said pressure switch (1) further comprises, on said cap (5), a plurality of differently arranged holes (50), for allowing said pin (40) to pass therethrough, adapted to provide a different operating point of said pin (40) on the control lever (48) of the safety microswitch (45).

9. A pressure switch, according to one or more of the preceding claims, characterized in that said pressure switch (1) further comprises, on said washer (20), an adjustment screw cooperating with said operating microswitch (23).

10. A pressure switch, according to one or more of the preceding claims, characterized in that said pressure switch (1) further comprises, on said washer (20), an adjustment and calibrating screw, cooperating with said safety microswitch (45).

11. A pressure switch, according to one or more of the preceding claims, characterized in that said pressure switch (1) further comprises different thickness aluminium disc elements arranged on said washer (20), in order to change the trip values of said operating microswitch (23).

12. A pressure switch, according to one or more of the preceding claims, characterized in that said pressure switch (1) further comprises a second re-action spring (70) arranged under said membrane (10).

13. A pressure switch, according to one or more of the preceding claims, characterized in that it comprises a locking tongue element (60) for manually re-arming said safety microswitch (45).

14. A pressure switch, according to one or more of the preceding claims, characterized in that said pressure switch (1) further comprises a latching spring (62) operating on said locking tongue (60) element of said safety microswitch (45).

15. A pressure switch, according to one or more of the preceding claims, characterized in that said pressure switch (1) further comprises a lug element (61) the shape of which can be adjusted so as to change the latching conditions between said locking tongue elements (60) and said safety microswitch lever (45).

16. A pressure switch, according to one or more of the preceding claims, characterized in that said safety microswitch (1) is supported by a ryton plate (46), connected by screws to said cap (5).

17. A pressure switch, according to one or more of the preceding claims, characterized in that said pressure switch (1) comprises two operating microswitches (23,45).

Patentansprüche

1. Ein Druckschalter (1) einschließlich eines manuell betriebenen Sicherheitsmikroschalters (45), umfassend einen unteren Körper (2), der in seinem Inneren eine Kammer (3) festlegt, die mit einer zu

steuernden Flüssigkeit verbunden ist, und der mit einer oberen Kappe (5) verbunden ist, die einen Betriebsmikroschalter (23) trägt, wobei diese Kammer (3) von einer Membran (10) abgeschlossen wird, die vorzugsweise aus Silikonmaterial besteht, und einen abdichtenden O-Ring (11) einschließt und mit einer Stahlmembran (12) verbunden ist, mit einer entsprechenden Stößelvorrichtung (13), wobei diese Vorrichtung (13) direkt auf letzterer Membran (12) ausgeführt ist und auf eine Unterlegscheibe (20) wirkt, die durch eine erste Gegenspannungsfeder (30) dagegen gedrückt wird und auf einen Druckknopf (22) des Betriebsmikroschalters (23) wirkt, wobei ferner ein von Hand zu betätigender Mikroschalter (45) bereitgestellt ist, der mit einem Stiftelement (40) zusammenwirkt, das sich von dieser Unterlegscheibe (20) aus erstreckt.

2. Ein Druckschalter nach Anspruch 1, dadurch gekennzeichnet, daß dieser Druckschalter (1) ein Sicherheitsringelement (15) umfaßt, das zwischen den unteren Körper (2) und die Kappe (5) eingeschoben ist und auf den Umfang letzterer Membran (12) wirkt.

3. Ein Druckschalter (1) nach Anspruch 1 und 2, dadurch gekennzeichnet, daß dieser Druckschalter (1) eine Einstellschraube (32) umfaßt, die auf die erste Gegendruckfeder (30) wirkt und durch diese Kappe (5) drehbar gelagert ist.

4. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß dieser Druckschalter (1) ein gleitendes Element (31) umfaßt, das zwischen einem Endbereich der ersten Gegendruckfeder (30) und der Einstellschraube (32) angeordnet ist.

5. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß dieser Sicherheitsmikroschalter (45) vom manuell zu betätigenden oder wieder betriebsbereit zu machenden Typ ist.

6. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß er ferner einen Hebel (48) auf diesem Sicherheitsmikroschalter (45) umfaßt, der mit dem Sicherheitsdruckknopf (52) des Sicherheitsmikroschalters (45) zusammenwirkt, und in den der Stift (40) eingreifen kann.

7. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß auf diesen Hebel (48) eine Kalibrierfeder wirkt.

8. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß dieser Druckschalter (1) ferner auf dieser Kappe (5) eine Vielzahl unterschiedlich angeordneter Löcher (50) umfaßt, durch die der Stift (40) gleiten kann, die angepaßt sind, um diesen Stift (40) mit einem unterschiedlichen Angriffspunkt auf den Steuerhebel (48) des Sicherheitsmikroschalters (45) zu versehen.

9. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß dieser Druckschalter (1) ferner eine Einstellschraube auf dieser Unterlegscheibe (20) umfaßt, die mit diesem Betriebsmikroschalter (23) zusammenwirkt.

10. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß dieser Druckschalter (1) ferner eine Einstell- und Kalibrierschraube auf dieser Unterlegscheibe (20) umfaßt, die mit diesem Sicherheitsmikroschalter (45) zusammenwirkt.

11. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß dieser Druckschalter (1) ferner Aluminiumscheibenelemente unterschiedlicher Stärke umfaßt, die auf dieser Unterlegscheibe (20) angeordnet sind, um die Auslösewerte dieses Betriebsmikroschalters (23) zu verändern.

12. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß dieser Druckschalter (1) ferner eine zweite Gegendruckfeder (70) umfaßt, die unter dieser Membran (10) angeordnet ist.

13. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß er ein einrastendes Zungenelement (60) umfaßt, um diesen Sicherheitsmikroschalter (45) manuell wieder betriebsbereit zu machen.

14. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß dieser Druckschalter (1) ferner eine Schnappfeder (62) umfaßt, die auf dieses Schnappzungenelement (60) dieses Sicherheitsmikroschalters (45) wirkt.

15. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß dieser Druckschalter (1) ferner ein vorspringendes Element (61) umfaßt, dessen Form so angepaßt werden kann, daß sich die Bedingungen für das Einrasten zwischen diesen Schnappzungenelementen (60) und diesem Sicherheitsmikroschalterhebel (45) verändern.

16. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß dieser Sicherheitsmikroschalter (1) auf einer Ryton-Platte (46) gelagert ist, die durch Schrauben mit dieser Kappe (5) verbunden ist.

17. Ein Druckschalter nach einem oder mehreren der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß dieser Druckschalter (1) zwei Betriebsmikroschalter (23, 45) umfaßt.

Revendications

1. Un interrupteur à pression (1) incluant un microrupteur (45) de sûreté actionné à la main, comprenant un corps inférieur (2) définissant dans son intérieur une chambre (3) communiquant avec un fluide qui doit être contrôlé, et associé à un couvercle (5) supérieur supportant un microrupteur de démarrage (23), ladite chambre (3) étant fermée par une membrane (10), faite préférablement d'un matérieau en silicone, et incluant un joint d'étanchéité annulaire (11) et reliée à une membrane en acier (12), avec un dispositif de commande à poussoir (13), ledit dispositif (13) étant directement formé sur cette dernière membrane (12) et agissant sur une rondelle (20), contrechargée par un premier ressort tendeur (30), et influençant un bouton-poussoir (22) du microrupteur de démarrage (23), un microrupteur de sûreté (45) actionné à la main étant de plus mis en oeuvre lequel coopère avec une cheville (40) saillant de ladite rondelle (20).

2. Un interrupteur à pression selon la revendication 1, caractérisé en ce que l'interrupteur à pression (1) comprend un élément annulaire de sûreté (15) intercalé entre le corps inférieur (2) et le couvercle (5) et agissant sur la périphérie de ladite membrane (12).

3. Un interrupteur à pression (1) selon les revendications 1 et 2, caractérisé en ce que ledit interrupteur à pression (1) comprend une vis d'ajustage (32) agissant sur le premier ressort de réaction (30) et supportée par ledit couvercle (5) de sorte à être en état de tourner.

4. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que ledit interrupteur à pression (1) comprend un coulisseau (31) intercalé entre un bout du premier ressort de réaction (30) et la vis d'ajustage (32).

5. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que ledit microrupteur de sûreté (45) est du type réarmé démarré à la main.

6. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce qu'il comprend en outre sur ledit microrupteur de sûreté (45) un levier (48) coopérant avec le bouton-poussoir (52) du microrupteur de sûreté (45) et susceptible d'être actionné par la cheville (40).

7. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que ledit levier (48) agit sur un ressort de calibration.

8. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que ledit interrupteur à pression (1) comprend en outre sur ledit couvercle (5) une multiplicité d'ouvertures (50) de dispositions variées, pour permettre à ladite cheville (40) d'y passer à travers, idoines à mettre en oeuvre un point de fonctionnement variable de ladite cheville (40) sur le levier de commande (48) du microrupteur de sûreté (45).

9. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que ledit interrupteur à pression (1) comprend en outre, sur ladite rondelle (20), une vis d'ajustage coopérant avec ledit microrupteur de démarrage (23).

10. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que ledit interrupteur à pression (1) comprend en outre, sur ladite rondelle (20), une vis d'ajustage et de calibration coopérant avec ledit microrupteur de sûreté (45).

11. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que ledit interrupteur à pression (1) comprend en outre des éléments en disque en aluminium d'épaisseurs variées, situés sur ladite rondelle (20), afin de varier la course dudit microrupteur de démarrage (23).

12. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que ledit interrupteur à pression (1) comprend en outre un second ressort de réaction (70) situé sous ladite membrane (10).

13. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce qu'il comprend une languette de verrouillage (60) pour réarmer à la main ledit microrupteur de sûreté (45).

14. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce

que ledit interrupteur à pression (1) comprend en outre un ressort de verrouillage (62) agissant sur ladite languette de verrouillage (60) dudit microrupteur de sûreté (45).

15. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que ledit interrupteur à pression (1) comprend en outre une partie en saillie (61) dont la forme peut être adaptée de sorte à varier les conditions de verrouillage entre ladite languette de verrouillage (60) et ledit levier dudit microrupteur de sûreté (45).

16. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que ledit interrupteur à pression (1) est supporté par une plaque en ryton (46) reliée audit couvercle (5) moyennant des vis.

17. Un interrupteur à pression selon l'une ou plusieurs des revendications précédentes, caractérisé en ce que ledit interrupteur à pression (1) comprend deux microrupteurs de démarrage (23, 45).

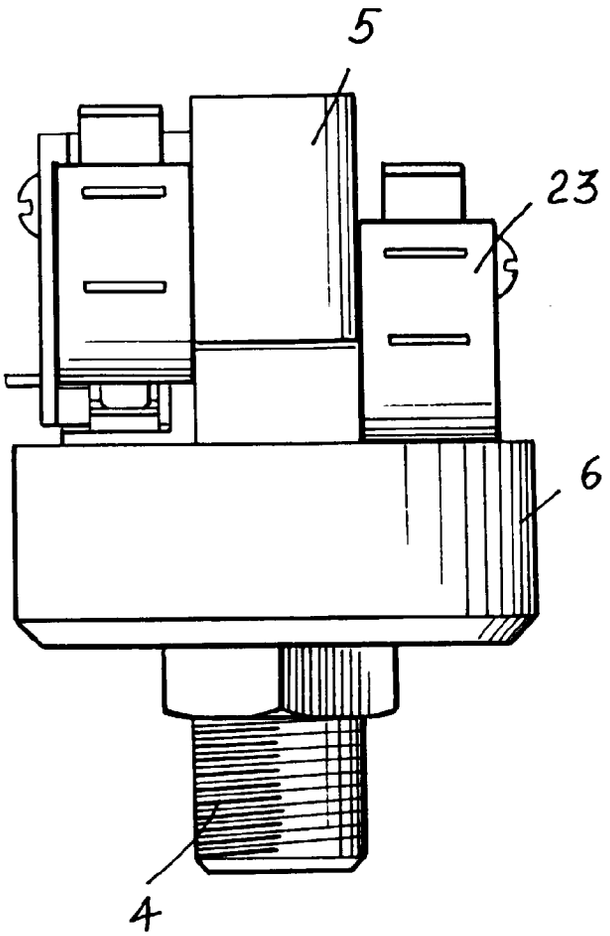

FIG. 1

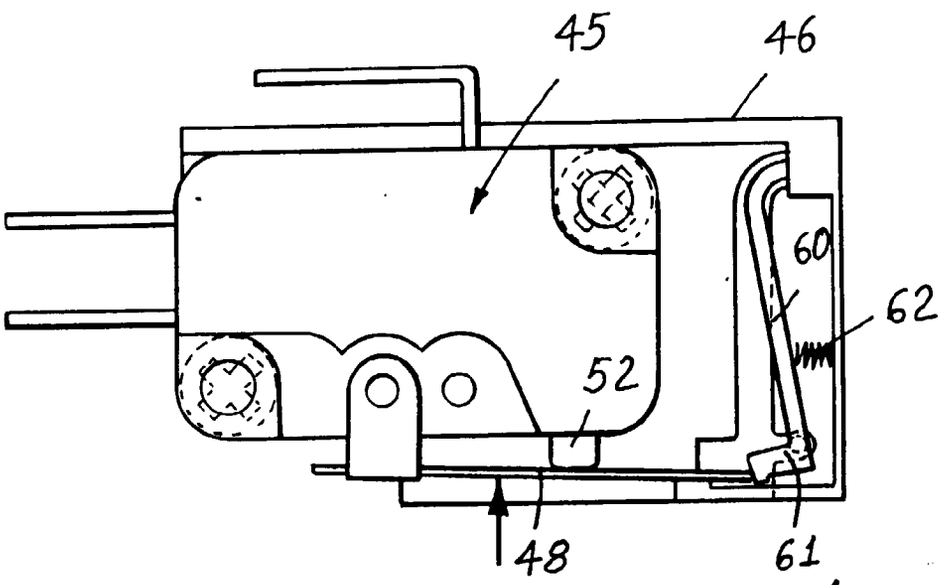

FIG. 4

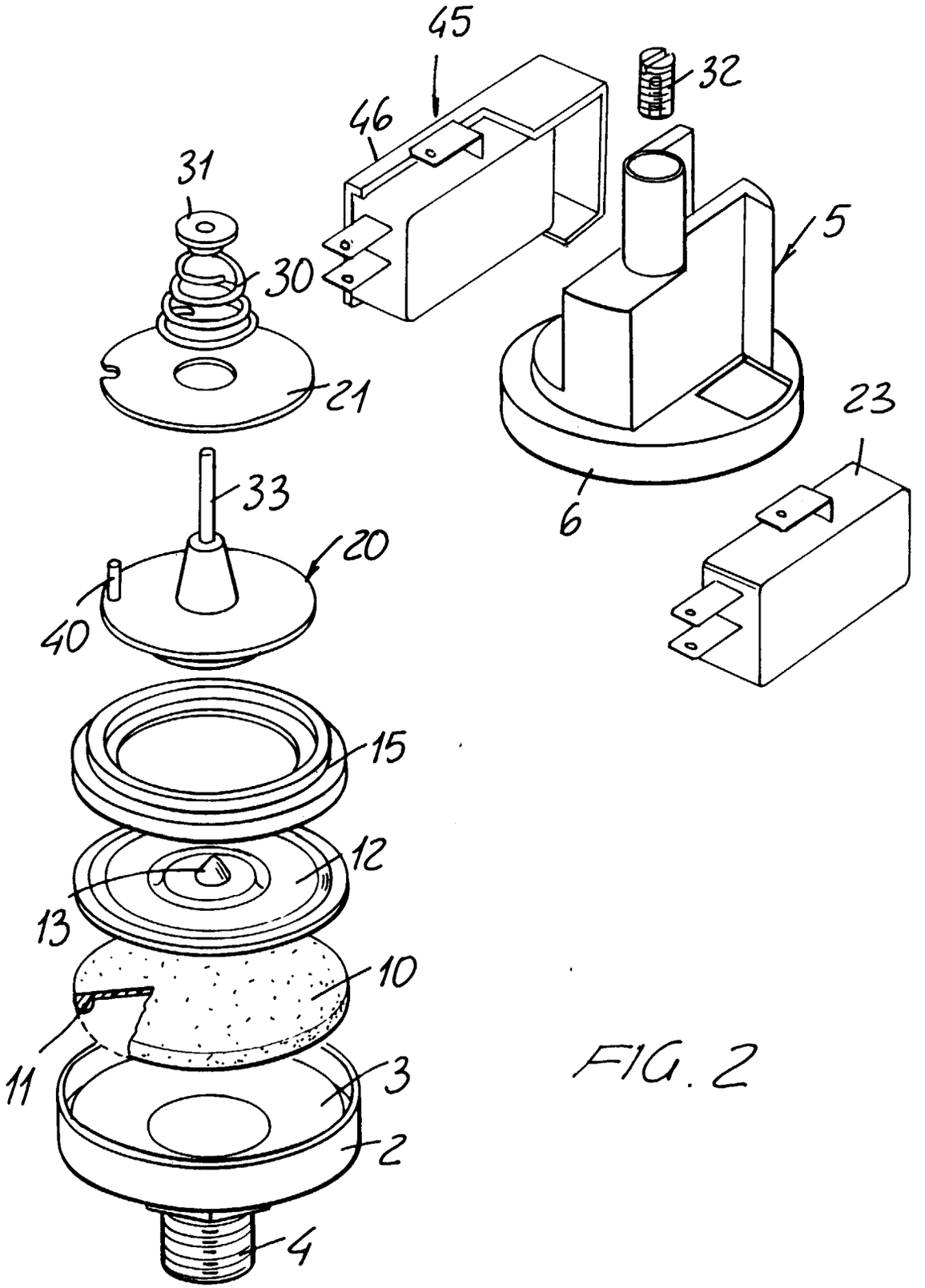

FIG. 2

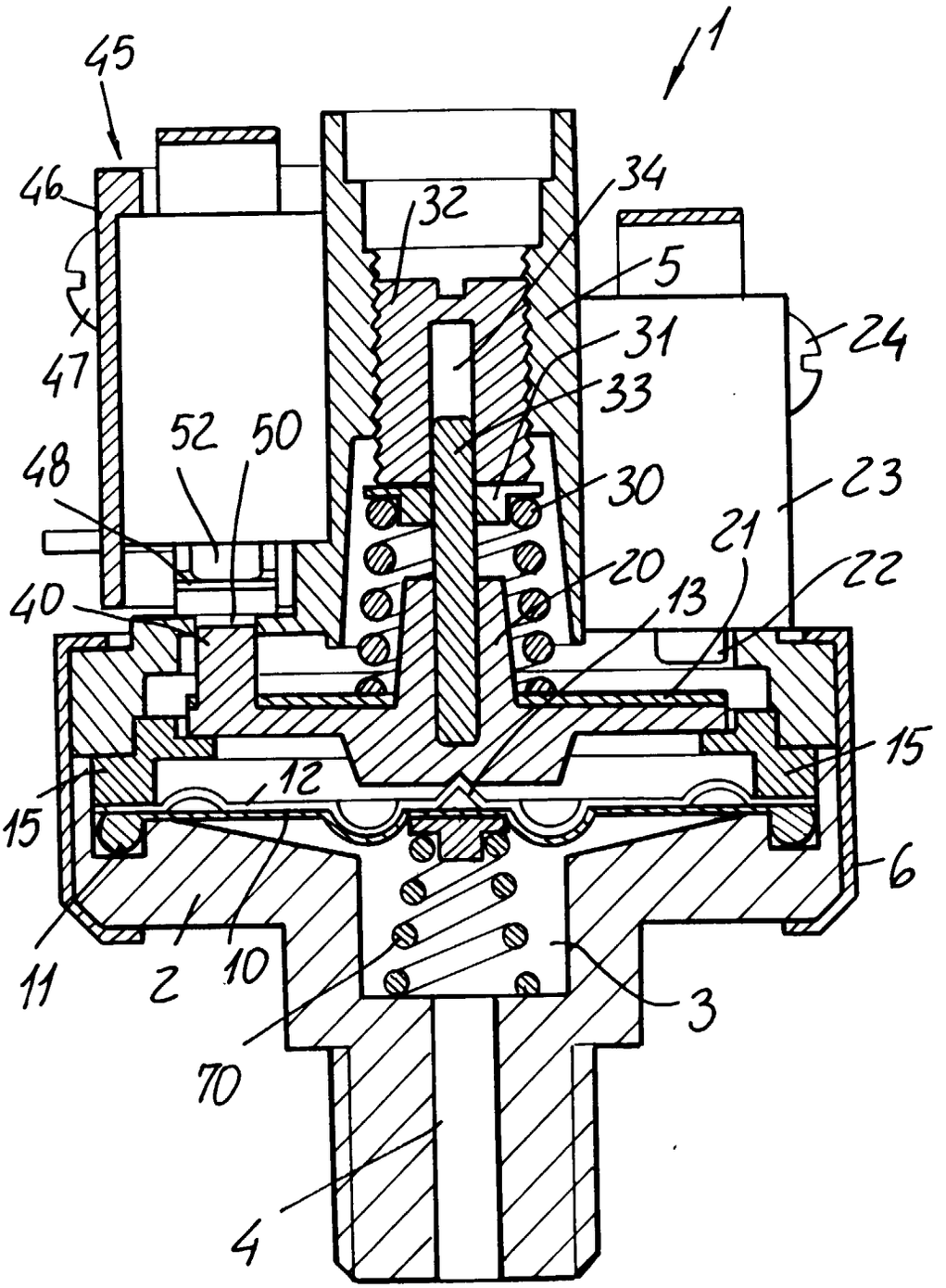
1
45
46
47
48
52
50
40
32
34
5
31
33
30
20
13
21
22
24
23
15
12
15
6
11
2
10
70
3
4

FIG. 3