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(54) **Proximity switch**

(57) A position switch for a movement or transport plant comprises a box-like case (2) anchorable to a fixed part (F) of the plant at the end position of a movable part of the plant and intended to house therein at least one pair of reciprocally movable electric contacts connectable to an electric circuit of the plant, actuator means (3) mounted in the case (2) and operatively associable with the electric contacts in order to interact with the movable part of the plant when the latter reaches the end position and to cause the opening and/or closing the circuit, and adjustment means (9) for adjusting the position of the actuator means (3) integrated in the case (2) in order to cause the translation thereof integrally with the actuator means (3).

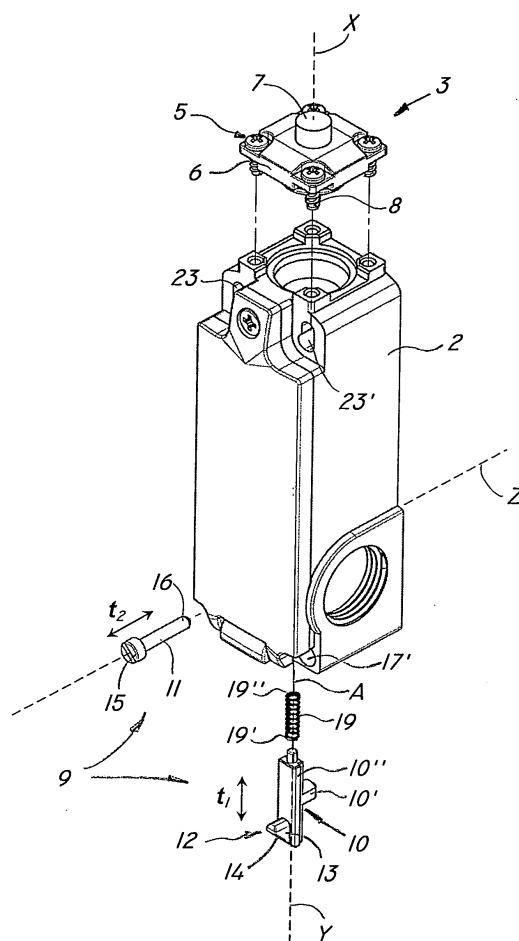


FIG. 4

Description

Field of application

[0001] The present invention is generally applicable to the technical field of electrical devices for controlling a movement and/or transport plant, and specifically has as object a position or safety switch for opening and closing an electric circuit of the plant once a predetermined final position has been reached.

State of the Art

[0002] As is known, position switches are electric devices intended to be installed in a plant, e.g. a movement and/or transport plant, such as elevators, hoists or the like, in order to stop a movable part after such part has attained a final or stop position.

[0003] In particular, position switches, also defined limit or proximity switches, have a box-like cover or frame inside of which at least one pair of electric contacts is arranged, such contacts connected to the power supply circuit of the movable part to be controlled.

[0004] These switches can also have additional functions, e.g. they can be used as safety switches for activating a signal or emergency circuit, or for activating or closing any other electric circuit connected to the plant.

[0005] The switch also comprises actuator means of the electric contacts with an actuation head connected to the electric contacts via mechanical, electric, magnetic or similar means.

[0006] The switch is generally fixed by means of its box-like cover to a fixed part of the plant, at the predetermined stop position.

[0007] In this manner, the actuation head can interact with the movable part of the plant when the latter reaches the stop position, in order to be activated and consequently be able to operate on the electric contacts in a manner so as to open or close the circuit.

[0008] In the case of a position switch, the switch causes the opening of the power supply circuit of the movable part of the plant, in order to stop it in a predetermined position.

[0009] One of the main problems which occur at the time of installation of these position switches is represented by the difficulty of correctly positioning the actuation head, in order to allow the latter to opportunely intervene when the movable part reaches the stop position.

[0010] For such purpose, millimetric precision is necessary in the positioning of the actuation head, and consequently of the entire switch.

[0011] One of the most widespread solutions provides for anchoring the box-like cover to the fixed part of the plant by means of an external bracket provided with slots, which allow a fairly limited adjustment via sliding along a longitudinal direction.

[0012] The cover is in turn provided with one or more through holes in order to allow the passage of screws

suitable for anchoring it to the bracket. A similar solution is known from US4916265 and from DE3140459, for example.

[0013] It is clear that such solutions are hard to implement and require that the operator have expert skill in order to realize the correct positioning of the switch.

[0014] In addition, there is a high risk that the switch loses its adjustment position after a high number of activation/deactivation cycles. Therefore, continuous maintenance of the switch is necessary, with clear increases of the overall cost.

[0015] From US4342885, a position switch is known in which the adjustment of the position of the actuation head is realized by acting directly on the head itself.

[0016] The head comprises a portion for anchoring to the cover and a push button having a fixed part associated with the anchorage portion and a movable part slidable on the fixed part. The correct positioning of the actuator is realized by adjusting the position of the slidable part on the fixed part.

[0017] In addition to being rather complex, this solution also has not proven to be particularly effective and above all is not suitable for the various types of position switches currently available on the market.

Presentation of the invention

[0018] The object of the present invention is to overcome the abovementioned drawbacks by realizing a position switch for movement or transport plants, in particular elevators, hoists or the like, which has high efficiency and is relatively inexpensive.

[0019] A particular object is to realize a position switch which is easily adjustable and which ensures an extremely fine adjustment precision,

[0020] A particular object is to realize a position switch which maintains a precise adjustment even after a relatively high number of use cycles.

[0021] Still another object is to realize a position switch which has a relatively simplified configuration.

[0022] Still another object is to realize a position switch which can be adjusted in a simple manner, regardless of the type of actuator means installed.

[0023] These objects, as well as others which will be clearer below, are achieved by a position switch in accordance with claim 1, comprising a box-like case or cover anchorable to the fixed part of a plant at the end position of the movable part and housing therein at least one pair of reciprocally movable electric contacts connectable to a circuit of the plant, actuator means mounted into said case and operatively associated with said electric contacts, said actuator means being designed for interacting with the movable part of the plant as this latter reaches the end position and to cause in turn the reciprocal movement of said contacts for opening/closing the electric circuit, means for adjusting the position of said actuator means with respect to said fixed part of the plant.

[0024] The switch is characterized in that the adjust-

ment means are integrated into said box-like case in order to cause the translation thereof integrally with said actuator means and to allow the precise adjustment of the position of said actuator means with respect to the fixed part of the plant.

[0025] Due to this arrangement, the adjustment of the position of the actuator means, and in particular of the actuation head, can be carried out by moving the case with the latter already anchored to the fixed part of the plant, being therefore extremely simplified.

[0026] Advantageously, the adjustment means comprise a first adjustment member having a first portion anchorable to the fixed part of the plant and a second portion inside said case and slidable along a predetermined first adjustment direction.

[0027] In addition, the adjustment means can comprise a second adjustment member, movable in said case along a second adjustment direction, said second member being designed for being driven from the outside along said second direction and interacting with said first member in order to cause the sliding thereof along said first direction.

[0028] Due to these further features, the adjustment of the position can be realized by acting only on the second adjustment member, thus resulting even more precise and simple.

[0029] Indeed, unlike the known solutions which provide for the fixing of the case by means of the alignment of two holes in two slots provided on the fixed part of the plant, with consequent possible alignment problems with respect to a direction orthogonal to the adjustment direction, the switch according to the invention will only have to be adjusted along the adjustment direction.

[0030] Advantageous embodiments of the position switch are obtained in accordance with the dependent claims.

Brief description of the drawings

[0031] Further characteristics and advantages of the invention will be clearer in light of the detailed description of a preferred but not exclusive embodiment of a position switch according to the invention and of several variants thereof, illustrated as a non-limiting example with the aid of the drawing set, in which:

FIG. 1 is a front view of a position switch according to the invention in a first preferred configuration;

FIG. 2 is a view of the switch of Fig. 1 sectioned along the plane 2-2;

FIG. 3 is a perspective view of a case belonging to a switch according to the invention and several examples of actuator means associable with the case;

FIG. 4 is a front, exploded perspective view of a switch in accordance with the invention in a second preferred configuration;

FIG. 5 is a rear, exploded perspective view of the switch of Fig. 1;

FIG. 6 is a perspective view of the switch of Fig. 1 anchored to the fixed part of a plant and with part of the case partially removed in order to allow the view of its interior,

Detailed description of a preferred embodiment

[0032] A position switch according to the invention can be used in movement or transport plants, e.g. elevators, hoists and the like.

[0033] Nevertheless, a switch according to the invention can also be used in all machines and plants, of civilian and industrial type, in which it is necessary to control the movement of one or more movable parts of the same, in order to stop the travel thereof once a predetermined end position has been reached.

[0034] A switch according to the invention can also be used as a safety switch in order to activate or close a signal and/or emergency circuit when the movable part reaches a pre-established position.

[0035] It is understood, however, that the switch according to the invention can be applied in all those cases where it is necessary to open or close any one electric circuit connected to the plant to be served.

[0036] A further possible use can be, for example, when it is necessary to activate or block a second movable part when the first movable part reaches the predetermined end position.

[0037] In particular, in accordance with the present invention, a plant adapted to be served by a switch will comprise a fixed part F and at least one movable part, not illustrated in the figures, adapted to be moved between at least one start position and at least one end position.

[0038] By fixed part F, it is intended a part that is stationary with respect to the switch, but which can in any case also be movable with respect to a further reference.

[0039] The end position can be a stop position for the movable part or even an intermediate position during the travel thereof.

[0040] As illustrated in the enclosed figures, a switch according to the invention, generally indicated with 1, will comprise a box-like case or cover 2 anchorable to the fixed part F of the plant at the end position of the movable part.

[0041] The case 2, in a known manner, will house therein at least one pair of reciprocally movable electric contacts connectable to an electric circuit of the plant, not illustrated since this is known.

[0042] The electric contacts, not visible in the present figures since they are completely contained in the case 2, can be of any type and will not be further described, since their possible functioning and their possible configurations are well known to those skilled in the art.

[0043] It will also be clear to those skilled in the art that the case 2 can also house more than one pair of electric contacts and that the switch 1 can also be connected to multiple movable parts of a plant in order to stop the mo-

tion thereof, and/or to auxiliary circuits - service, emergency and the like - of the same plant.

[0044] The switch **1** will also comprise actuator means **3** mounted on the case **2** and operatively associated with the electric contacts.

[0045] In another known manner, the actuator means **3** will be configured for interacting with the movable part of the plant when the latter reaches the end or stop position, in order to cause the reciprocal movement of the contacts, which can be a moving-closer or moving-away movement, and the consequent opening/closing of the circuit.

[0046] As is visible in **Fig. 1**, the actuator means **3** generally comprise an actuation head **5** mounted on the case **2**. Also illustrated in **Fig. 3** are several possible embodiments of actuation heads **5** susceptible to being applied to a case **2**.

[0047] The head **5** can have different configurations and will typically comprise a fixed anchorage portion **6**, adapted to be removably but stably anchored to the case **2** or integral with the same, and a movable push button **7**, e.g. movable via translation, rotation or rotation-translation, susceptible to being moved following the interaction with the movable part of the plant according to known modes.

[0048] The movement of the push button **7** will produce the consequent movement of a transmission **8** placed inside the head **5**, which will be susceptible to translate along a predetermined actuation direction **X** in order to interact with the contacts and determine the opening/closing movement of the circuit connected thereto.

[0049] In the present text, by interaction between the transmission **8** and the contacts, it is intended any type of interaction, e.g. mechanical, magnetic or electric.

[0050] The actuation head **5** can be mounted integrally with the case **2**, so as to define a single unit, as in the example of **Fig. 1**, or removably, as in the examples of **Fig. 3** and **Fig. 4**.

[0051] In any case, the head **5** will be rigidly coupled to the case **2**, in the sense that the position of its fixed portion **6** will be univocally determined upon mounting without it could be moved along the actuation direction **X** to adjust its position with respect to the end position of the movable part of the plant.

[0052] For such purpose, the switch **1** will instead comprise adjustment means **9** for adjusting the position of the actuator means **3** that, according to a particular feature of the invention, will be integrated in the box-like case **2**.

[0053] In this manner, the adjustment means **9** will cause the translation of the case **2** integrally with the actuator means **3**.

[0054] Preferably, the adjustment means **9** will comprise a first adjustment member **10** having a first portion **10'** anchorable to the fixed part **F** of the plant and a second portion **10''** inside the case **2**.

[0055] In the preferred embodiment of the figures, exemplifying but not limiting of the invention, the first portion

10' of the first adjustment member **10** can be defined by a male member projecting from the case **2** and designed to be inserted in a corresponding female member **H** suitably provided for on the fixed part **F** of the plant.

[0056] Nevertheless, in a substantially equivalent manner from a functional standpoint, the first adjustment member **10** can be provided with a female member suitable for being engaged by a male member of the fixed part **F**.

[0057] The second portion **10''** of the first adjustment member **10** will be integral with the first anchorage portion **10'** and slidable along a first predetermined adjustment direction **Y**.

[0058] Advantageously, the first adjustment direction **Y** will be substantially parallel to the actuation direction **X** defined by the actuator means **3**, to simplify the entire adjustment operation.

[0059] In addition, the adjustment means **9** will comprise a second adjustment member **11** that is movable in the case **2** along a second adjustment direction **Z**.

[0060] The second adjustment member **11** will be designed to be driven from the outside along the second direction **Z** and to interact with the first member **10** to cause the sliding thereof along the first direction **Y**.

[0061] In the illustrated configurations, the first **Y** and the second **Z** adjustment directions are substantially orthogonal to each other. It is understood that they can have any mutual angle. Nevertheless, the orthogonality of the two directions **Y**, **Z** will allow having a direct interaction between the first **10** and the second **11** adjustment members, simplifying the switch **1** structurally.

[0062] The interaction between the two adjustment members **10**, **11** will be realized by suitable interface means **12** interposed between the members and designed for transferring the motion of the second member **11** to the first **10** with a predetermined transmission ratio.

[0063] As is clearly visible in **Fig. 2** and in **Figs. 4 - 6**, the interface means **12** will comprise a shaped member **13** having a first section in contact with the first adjustment member **10** and a second section facing the second member **11**.

[0064] Preferably, the shaped member **13** will be integral with the first adjustment member **10**.

[0065] The second section will have a face **14** arranged at the second adjustment member **11**, such face advantageously configured as an inclined plane,

[0066] The inclination α of the face **14** can have any value, without limitation, and can be selected as a function of the overall size.

[0067] The shaped member **13** with the inclined face **14** can also be substituted by other elements suitable for transforming the movement of the second adjustment member **11** along the second direction **Z** into the movement of the first member **10** along the first direction **Y**. For example, it can be a cam or similar member.

[0068] The movements of the first **10** and second **11** adjustment members can also be complex movements, not mere translation, but they will preferably always have

a component directed along the respective adjustment directions **Y**, **Z**.

[0069] The second adjustment member **11** will be preferably elongated, with main extension axis substantially coinciding with the second adjustment direction **Z**, or in any case parallel thereto.

[0070] In addition, it will have a first axial end **15** engageable by an operator in order to cause the translation of the second member **11** along the second direction **Z**.

[0071] The second axial end **16** of the second member **11** will instead be susceptible to interact with the first adjustment member **10** in order to cause in turn the translation **t₁** thereof along the first direction **Y**.

[0072] In particular, the second end **16** of the second adjustment member **11** can be placed in contact with the inclined face **14** in order to press on the same and exert a force **F₁** directed along the second adjustment direction **Z**.

[0073] In this manner, the translation **t₂** of the second adjustment member **11** will be transformed into the translation **t₁** of the first **10**, with transmission ratio which will depend on the inclination α of the inclined face **14**.

[0074] Advantageously, the second adjustment member **11** can be constituted by a screw having a thread with a predetermined pitch, housed in a cavity **17** realized in the case **2**.

[0075] The cavity **17** will consequently have a counter-threaded inner side surface **18**. The pitch of the thread of the screw **11** and of the counter-threaded wall of the cavity **17** will preferably be considerably reduced in order to allow an extremely precise adjustment.

[0076] The use of a screw or the like as second adjustment member **11** will also allow using a common screwdriver for adjusting the position of the case **2** and hence of the actuation head **5**.

[0077] Suitably, the adjustment means **9** will also comprise a biasing member **19** acting against the first adjustment member **10** along a predetermined axis **A** in order to exert an opposing force **F₂** on such member.

[0078] Such force **F₂** will be substantially parallel to the first direction **Y** and will have opposite sense with respect to the translation **t₁** of the first member **10**.

[0079] Preferably, both the biasing member **19** and the first adjustment member **10** will be housed in a seat **20** realized in the case **2**. The seat **20** will essentially extend along the first adjustment direction **Y**.

[0080] The elastic member **19** will preferably be a spiral spring extended parallel to the first adjustment direction **Y**, with a first axial end coil **19'** acting against the first adjustment member **10** and a second axial end coil **19''** which abuts against the bottom wall **21** of the housing seat **20**.

[0081] Advantageously, the case **2** will have symmetric configuration with respect to a center line plane π substantially parallel to the first adjustment direction **Y**.

[0082] In addition, the case **2** can be provided with two mirroring seats **20**, **20'** arranged for receiving respective first adjustment members **10** and two cavities **17**, **17'**

arranged for receiving respective second adjustment members **11**.

[0083] In this manner, the adjustment means **9** can be arranged on one of the sides of the symmetry plane π , as required, conferring greater flexibility of use to the switch **1**.

[0084] Finally, the case **2** can be provided with anchorage means **22** for stably anchoring to the fixed part **F** of the plant.

[0085] The anchorage means **22** can be defined by one or more passages or slots **23**, **23'** alignable with corresponding holes (not illustrated) provided on the fixed part **F** of the plant.

[0086] Operatively, for the configuration of the figures, the switch **1** will first be positioned on the fixed part **F** of the plant, at the predetermined end position, by inserting the projecting portion **10'** of the first adjustment member **10** into the hole **H** of the fixed part **F**.

[0087] The upper passages **23**, **23'** provided for in the case **2** will instead be aligned with the respective upper holes in order to allow the insertion of corresponding screws or pins **24**, **24'**.

[0088] At this point, one can proceed with the adjustment of the position of the case **2**, and thus of the actuation head **5**, along the first adjustment direction **Y** by rotating the second adjustment member **11**.

[0089] The rotation direction will depend on the type of screw **11** used and on the necessary direction for the translation **t₁** of the first adjustment member **10**, depending on whether it is necessary to move the actuation head **5** away from or closer to the end point.

[0090] Once the actuation head **5** has reached the adjusted position, the position of the entire switch **1** will be stabilized by acting on the anchorage screws **24**, **24'** present at the upper passages **23**, **23'**. The slot form of the latter will make the translation of the case **2** possible, even if limited, such case **2** already substantially anchored to the fixed part **F** of the plant.

[0091] The anchoring of the switch **1** to the fixed part **F** of the plant can also be carried out with the interposition of a bracket or similar intermediate support (not illustrated), which can in turn be anchored to the fixed part **F** of the plant according to any one technique.

[0092] The switch according to the invention is susceptible to numerous modifications and variants, all falling within the inventive concept expressed in the enclosed claims. All details can be substituted by technically equivalent elements, and the materials can differ as required, without departing from the scope of the invention.

[0093] Even if the switch has been described with particular reference to the enclosed figures, the reference numbers are used for improving the comprehension of the invention and do not constitute any limitation of the claimed protective scope.

Claims

1. A position switch for a movement or transport plant, wherein the plant has at least one fixed part (F) and one movable part adapted to be moved between at least one start position and at least one end position, wherein the switch comprises:
 - a box-like case (2) anchorable to the fixed part (F) of the plant at the end position of the movable part and designed to house there inside at least one pair of reciprocally movable electric contacts connectable to an electric circuit of the plant;
 - actuator means (3) mounted into said case (2) and operatively associable with said electric contacts to interact with the movable part of the plant as this latter reaches the end position, to cause the reciprocal movement of the contacts for opening and/or closing the circuit;
 - adjustment means (9) for adjusting the position of said actuator means (3);

characterized in that said adjustment means (9) are integrated in said box-like case (2) to cause the translation thereof integrally with said actuator means (3), to allow a precise adjustment of the position of said actuator means (3) with respect of the fixed part (F) of the plant.
2. Switch as claimed in claim 1, **characterized in that** said adjustment means (9) comprise a first adjustment member (10) having a first portion (10') anchorable to the fixed part (F) of the plant and a second portion (10'') inside said case (2) and movable along a first predetermined adjustment direction (Y).
3. Switch as claimed in claim 2, **characterized in that** said adjustment means (9) comprise a second adjustment member (11) movable in said case (2) along a second adjustment direction (Z), said second member (11) being prearranged for being driven from the outside along said second direction (Z) and for interacting with said first member (10), causing the translation (t₁) thereof along said first direction (Y).
4. Switch as claimed in claim 2, **characterized in that** said adjustment means (9) comprise interface means (12) interposed between said first (10) and said second adjustment member (11) and designed to transfer the motion of said second member (11) to said first member (10) with a predetermined transmission ratio.
5. Switch as claimed in claim 3 or 4, **characterized in that** said first direction (Y) and said second direction (Z) are mutually orthogonal.
6. Switch as claimed in claim 4 or 5, **characterized in that** said second adjustment member (11) has a first end (15) adapted to be engaged by an operator in order to cause the translation (t₂) of said second member (11) along said second direction (Z) and a second end (16) susceptible to interact with said first adjustment member (10) through said interface means (12) to promote in turn the translation (t₁) thereof along said first direction (Y).
7. Switch as claimed in claim 6, **characterized in that** said interface means (12) comprise a shaped member (13) having a first section in contact with said first adjustment member (10) and a second section shaped as a inclined plane (14) susceptible to be placed in contact with said second end (16) of said second adjustment member (11).
8. Switch as claimed in claim 7, **characterized in that** said shaped member (13) is monolithic with said first adjustment member (10).
9. Switch as claimed in any claim 2 to 8, **characterized in that** said adjustment means (9) comprise a biasing member (19) acting against said first adjustment member (10) along a predetermined axis (A) to exert thereon an opposing force (F₂) substantially parallel to said first direction (Y) and having opposite sense with respect to the translation (t₁) of said first member (10).
10. Switch as claimed in claim 9, **characterized in that** said biasing member (19) is a spring housed in a seat (20) realized in said case (2) and having a first axial end coil (19') acting against said first adjustment member (10) and a second axial end coil (19'') in contact with the bottom wall (21) of said seat (20).
11. Switch as claimed in any claim 2 to 10, **characterized in that** said second adjustment member (11) is a screw having a thread with a predetermined pitch housed in a cavity (17) realized in said case (2) and having a counter-threaded inner side surface (18).
12. Switch as claimed in any claim 2 to 11, **characterized in that** said actuator means (3) comprise an actuation head (5) rigidly mounted on said case (2) and having an external push button (7) susceptible to being moved following the interaction with the movable part of the plant and an internal transmission (8) susceptible to translate along an actuation direction (X) following the movement of said push button (7) in order to interact with said contacts, said actuation direction (X) being substantially parallel to said first adjustment direction (Y).

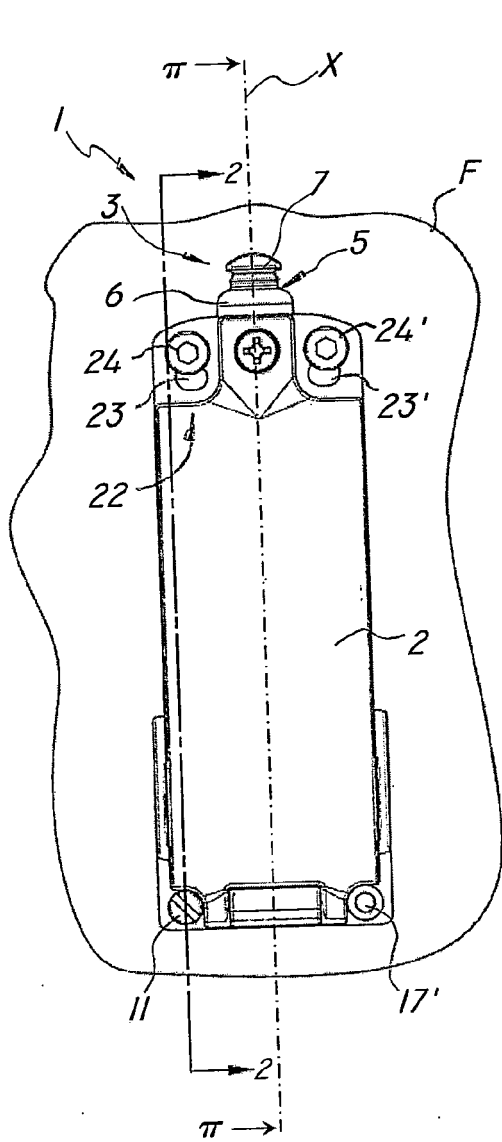


FIG. 1

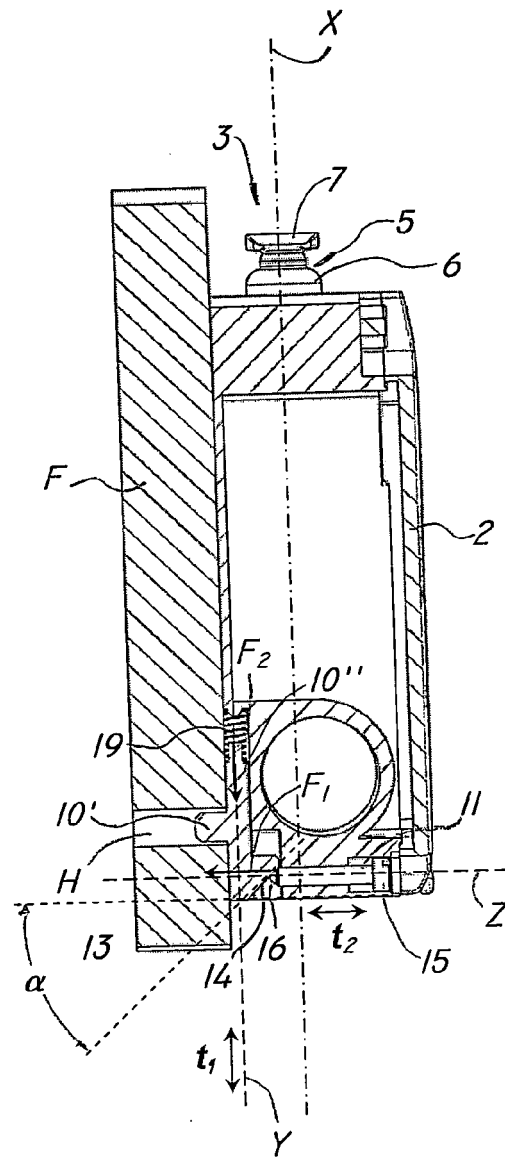


FIG. 2

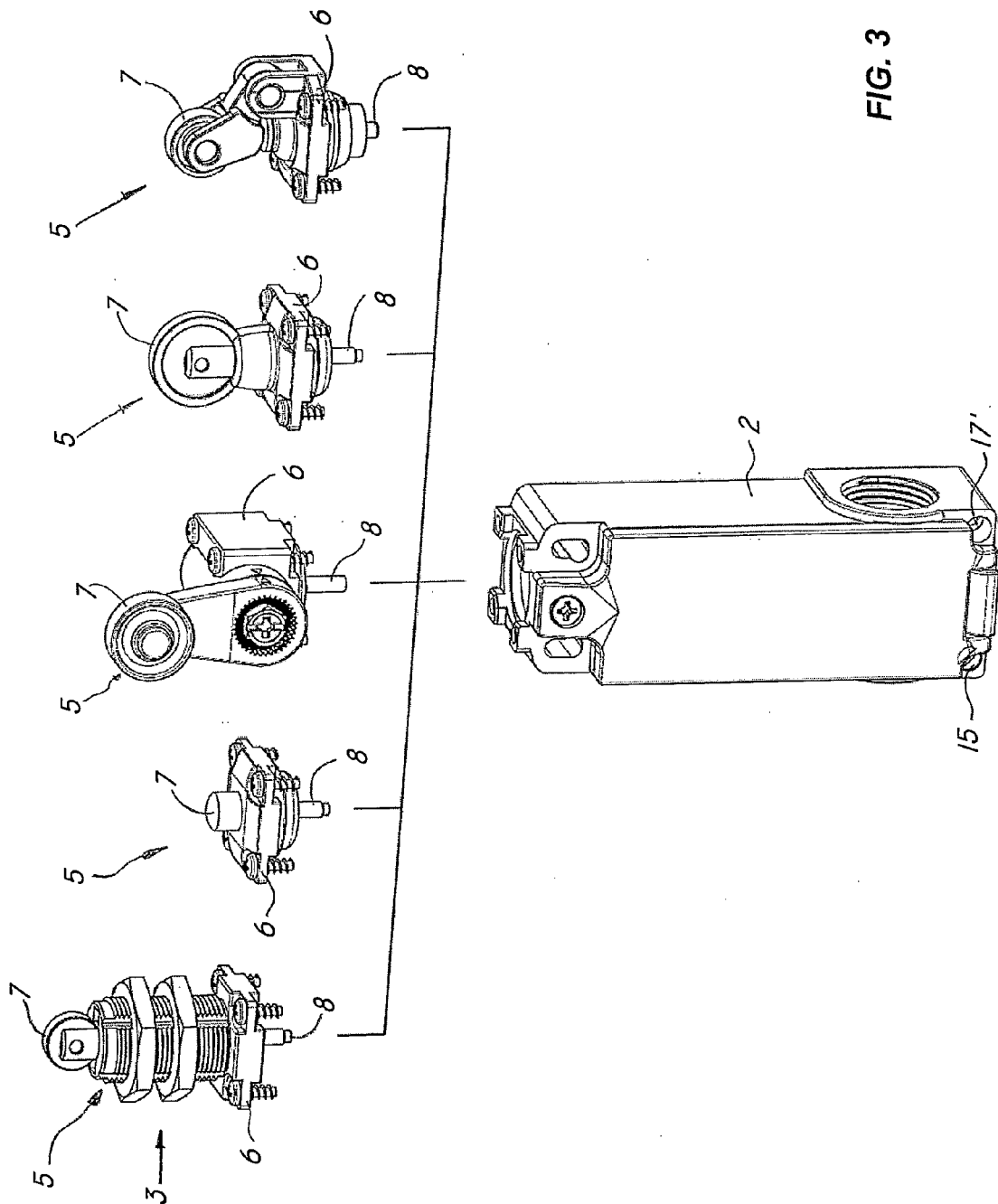


FIG. 3

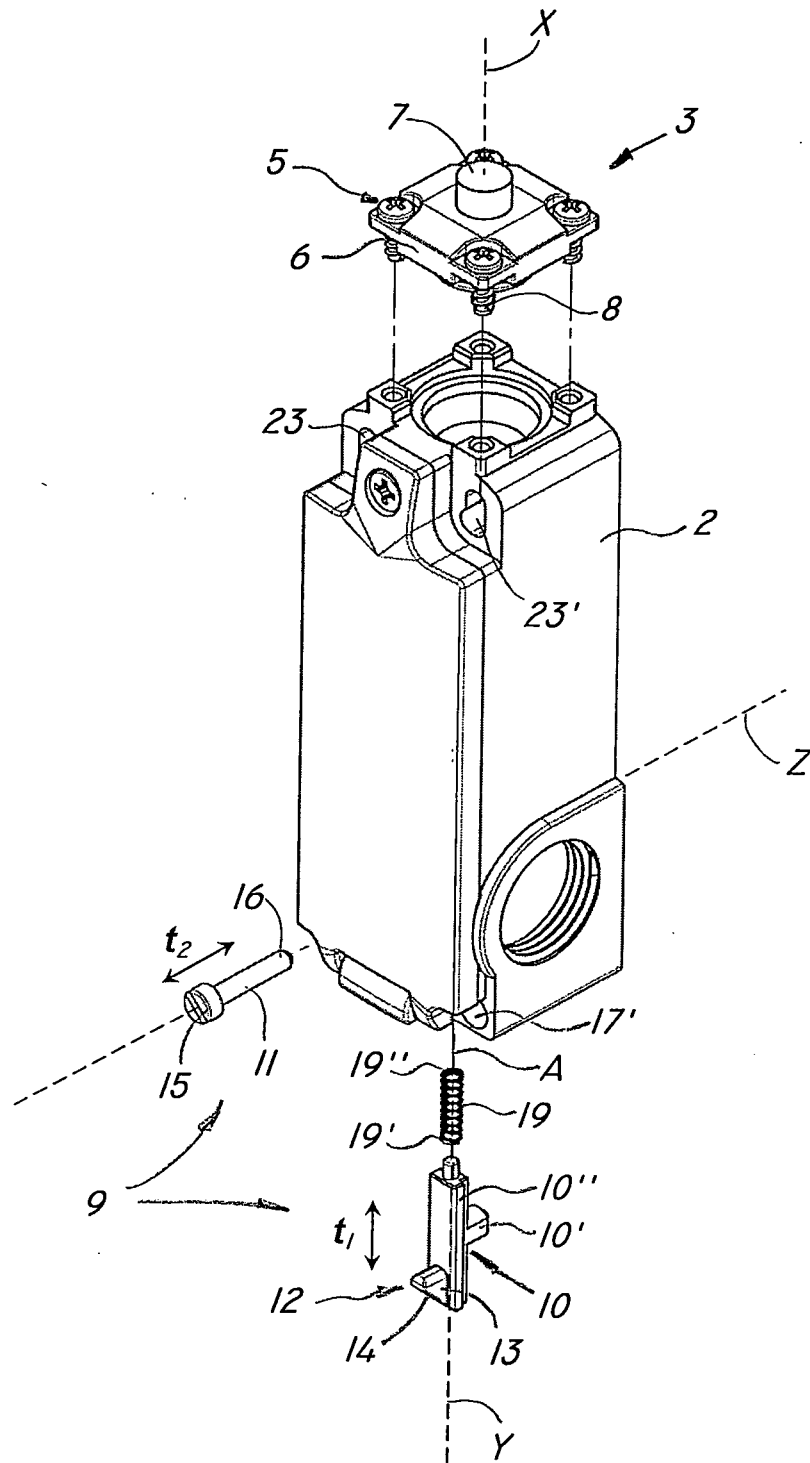


FIG. 4

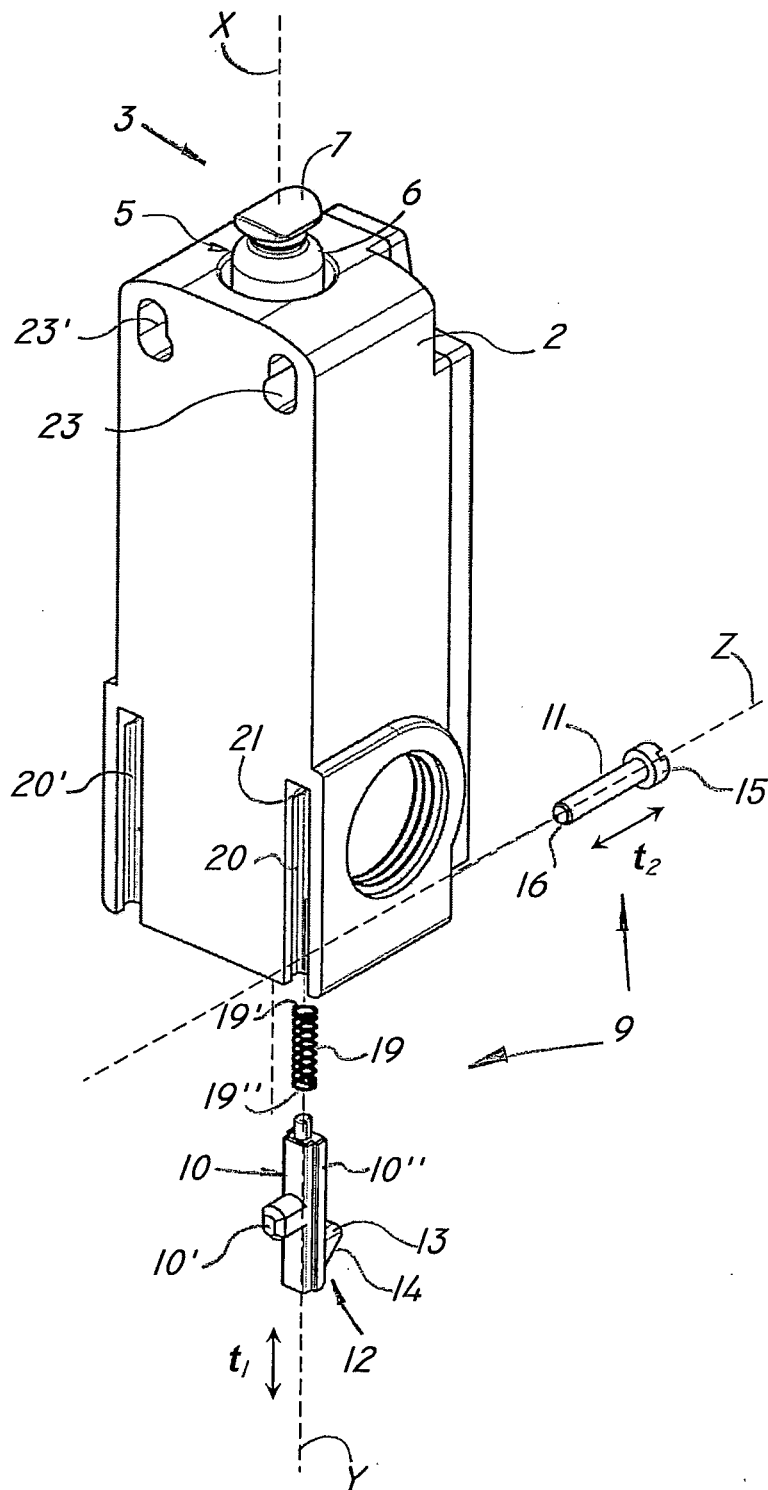


FIG. 5

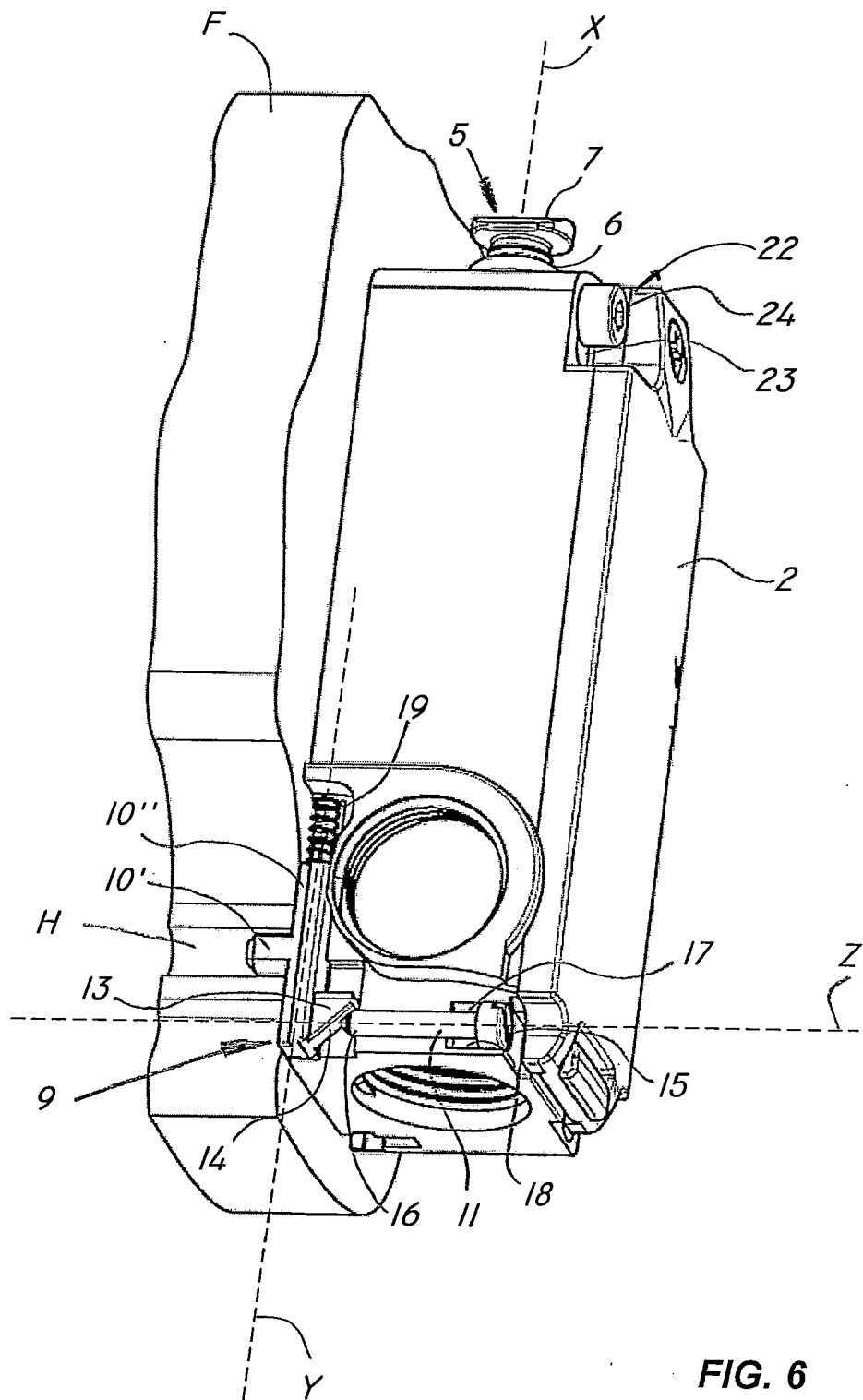


FIG. 6



EUROPEAN SEARCH REPORT

Application Number
EP 11 00 1531

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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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			

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EPO FORM 1503 03.82 (P04C01)

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

EP 11 00 1531

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27-05-2011

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