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(54) **Electromechanical safety switch**

(57) An electromechanical safety switch comprises a boxed casing, inside the casing being present a rod which can move in the longitudinal direction between at least two operating positions, to open or close an electric circuit, through mobile electrical contacts intended to come into contact with fixed electrical contacts and it further comprises a head, equipped with at least two slots for the insertion of an actuator means, where the head is fixed to the boxed casing and contains the actuator mechanism of the switch, which comprises a pair of cams, capable of being locked on a central pin and the introduction of the aforementioned actuator means allows the unlocking of the cams separating them in opposite directions against respective counter springs. The invention also has as its object an actuator means for an electromechanical switch.

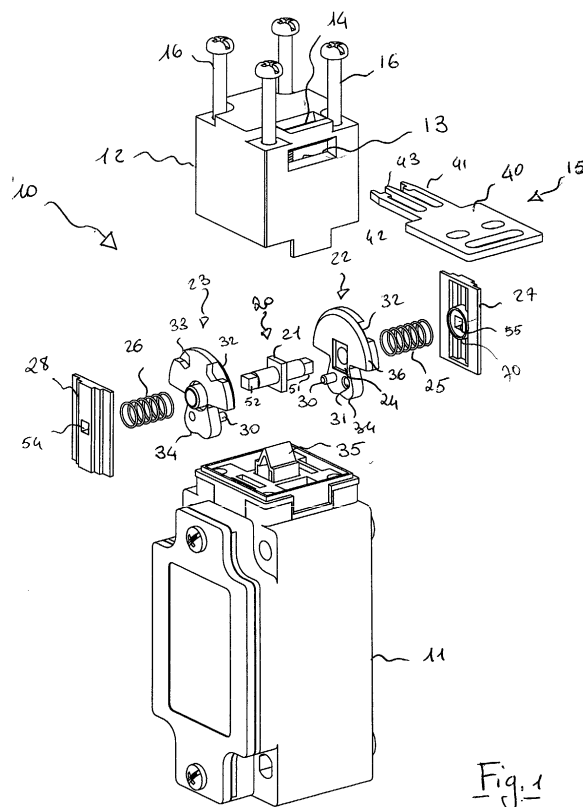


Fig. 1

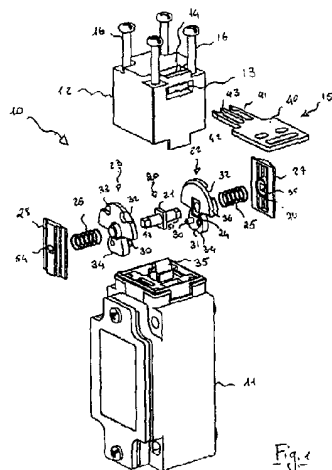


Fig. 2

## Description

**[0001]** The present invention has as its object an electromechanical safety switch.

**[0002]** As is known, there are various types of electromechanical switches used in industrial plants and in the relative machines with protection and safety functions.

**[0003]** For example, such switches can be used to prevent contact with parts under voltage of machinery supplied electrically.

**[0004]** In this context, a known type of safety switch foresees a boxed casing which encloses a plurality of fixed electrical contacts and a mobile rod which carries mobile electrical contacts.

**[0005]** The rod can move in the axial direction to open or close the electrical contacts.

**[0006]** The movement of the rod is obtained through an actuator mechanism, contained inside a switch head, a mechanism which generally comprises a cam, capable of being actuated through a suitable key to be inserted through a slot in the head.

**[0007]** Cam locking means are also foreseen to prevent the accidental actuation of the cam,

**[0008]** More specifically, the locking means consists of a pair of slides which can slide in a direction determined by the direction of insertion of the key.

**[0009]** Such sliding ensures that the slides, however, undergo wear due to such a movement which must be carried out sliding in contact with surfaces opposite the slides.

**[0010]** A further drawback of such switches belonging to the prior art is given from the fact that they must necessarily foresee a certain number of component pieces, including a pin, two locking slides, the relative springs and a cam.

**[0011]** The purpose of the present invention is that of solving the aforementioned problems, realising a switch which has improved reliability and which last longer.

**[0012]** A further purpose of the present invention is that of realising a switch which has greater simplicity of construction and assembly.

**[0013]** Such purposes are accomplished by an electromechanical safety switch, according to claim 1, to which we refer for the sake of brevity.

**[0014]** The present invention also has as its object an actuator means for an electromechanical switch, according to claim 8.

**[0015]** The invention is described in detail hereafter, as an example and not for limiting purposes, with reference to the attached drawings, in which:

- figure 1 shows an exploded axonometric view of the electromechanical safety switch according to the present invention;
- figure 2 shows a section view according to a longitudinal plane of the electromechanical switch according to the invention;

- figure 3 shows a section view according to a longitudinal plane of the switch in a first operating position;
- figure 4 shows a section view according to a longitudinal plane of the switch in a second operating position;
- figures 5A-5C show views of a shoulder belonging to the switch of the invention;
- figures 6A-6B shows views of the special actuator means of the switch of the invention; and
- figures 7A-7C show views of a cam belonging to the switch of the invention.

**[0016]** The electromechanical switch according to the present invention is globally indicated, in an embodiment, with reference numeral 10.

**[0017]** The electromechanical switch 10 in figure 1 is made up of two parts: a substantially parallelepiped boxed casing 11, which contains the actual switch and a head 12, equipped with two slots 13, 14 for the insertion of an actuator means 15.

**[0018]** The head 12 is fixed to the boxed casing 11 with screws 16.

**[0019]** Inside the casing 11 there is a rod 17 which can move in the longitudinal direction between two operating positions, to open and close an electric circuit.

**[0020]** The rod is thrust by a spring which tends to move it away from one of the two positions.

**[0021]** The rod 17, indeed, integrally carries mobile electrical contacts 18 intended to come into contact with fixed electrical contacts 19 present inside the boxed casing 11 to close an electric circuit.

**[0022]** The head 12 contains the actuator mechanism of the switch 10.

**[0023]** The actuator mechanism is made up of a pin 20, equipped with a central element 21, a pair of cams 22 and 23, each of which is equipped with a recess 24.

**[0024]** The shape of the central element 21 is such as to engage with each of the corresponding recesses 24 of the aforementioned cams 22 and 23, said recesses 24 having a shape substantially corresponding to the shape of the aforementioned central element 21 integral with the pin 20.

**[0025]** On the side of the cams 22 and 23 counter springs 25 and 26 are foreseen which engage against shoulders 27 and 28 each arranged laterally with respect to the cams 22 and 23. The counter springs 25, 26 insert into respective seats 70, 71.

**[0026]** The pin 20 also has, at its ends, elements 51 and 52 of a shape such as to engage in corresponding holes 54 and 55, formed on the shoulders 27 and 28, of a shape suitable for preventing the rotation of the pin 20.

**[0027]** Each of the cams 22 and 23 foresees a pin 30 which can engage in a corresponding hole 31 formed in the opposite cam.

**[0028]** Moreover, each cam 22 and 23 foresees a pair of notches 32 and 33, as well as in a position substantially opposite the aforementioned notches, a shaped

portion 34, suitable for engaging with a protruding portion 35 belonging to the rod 17 of the switch 10.

**[0029]** Each cam 22 and 23 also has a bevelled edge 36.

**[0030]** The actuator means 15 is equipped with a gripping area 40, two side arms 41 and 42 and a central arm 43. On each side arm 41 and 42 there is a small projection 44 and 45, facing inwards.

**[0031]** In the operation of the electromechanical switch according to the present invention, when the actuator means 15 is inserted in one of the two slots 13, 14 of the head 12, the central arm 43 initially touches upon both bevelled edges 36 belonging to the cams 22 and 23.

**[0032]** Such a movement forces the cams 22 and 23 to separate, making them slide in a direction parallel to the pin 20. By means of this movement, the recesses 24 of the aforementioned cams 22 and 23 move away from the central element 21 of the pin 20, whereas the cams 22, 23 compress the counter springs 25 and 26.

**[0033]** Such an operation allows the cams 22 and 23 to be freed for rotation, which takes place through engagement of the projections 44 and 45 belonging to the side arms 41 and 42 of the actuator means 15. Such projections 44 and 45 indeed engage with the notches 32 (or 33) of the cams 22 and 23.

**[0034]** The rotation of the cams 22 and 23 displaces the shaped portion 34 of each cam, freeing them from engagement with the protruding portion 35, belonging to the rod 17 of the switch 10.

**[0035]** This allows a spring (not represented) to thrust the rod in such a way that the mobile contacts 18 touch the fixed contacts 19 of the switch 10.

**[0036]** When the actuator means is removed, the projections 44 and 45, through their engagement with the notches 32 (or 33), make the cams 22 and 23 rotate until the projections themselves disengage and the counter springs 25 and 26 again thrust the cams 22 and 23 against each other, ensuring that the central element 21 of the pin 20 prevents a further rotation.

**[0037]** Consequently, the rotation of the cams 22, 23 ensures that their shaped portions 34 engage with the protruding portion 35 belonging to the rod 17 of the switch 10 compressing its relative spring and separating the mobile contacts 18 from the fixed contacts 19.

**[0038]** From the description above it can be deduced that the cams 22 and 23 interact with the central element 21 of the pin 20 such as to remain locked if the actuator means is removed.

**[0039]** The invention has numerous and important advantages with respect to the prior art.

**[0040]** Firstly, the shape of the central element of the pin, and of the corresponding recesses of the cams, ensures that locking slides are not necessary for the switch of the invention.

**[0041]** This allows possible problems of wear due to the sliding of the slides to be avoided, as well as allowing such pieces to be eliminated, simplifying the assembly

of the switch.

**[0042]** Secondly, the special configuration of the actuator means with its central arm and of the cams with their bevelled edges, ensures that the actuation of the switch is possible from many sides, giving flexibility and versatility of use to the switch itself.

**[0043]** Indeed, it is also possible to foresee a switch head with four slots to be applied instead of the one represented in the figures to realise a different embodiment of the same invention, or else it is furthermore possible to rotate the head equipped with two slots by 90° arranging them in another position with respect to the one represented. It is also Clear that the head can be rotated by 180° or 270° instead of 90°, in such a way configuring the possibility of using the switch in four different operating configurations.

**[0044]** Moreover, the cost-effectiveness of the switch of the present invention is clear from the fact that the cams consist of two equal pieces, reducing the cost of the moulds. In the same way, the shoulders are also made up of two equal pieces.

**[0045]** A further advantage of the invention, connected to these considerations, derives precisely from the fact that since the cams and the shoulders are the same as each other the risk of errors in the assembly step is reduced.

**[0046]** The lower number of pieces also serves to make the management of stock easier with a lower number of codes being necessary.

**[0047]** From that which has been described, it is clear that the expressed inventive concepts are not limited to the illustrated example of application, but can advantageously be adapted to other analogous applications.

**[0048]** The field of use of the invention is not limited to the examples shown in the previous description.

**[0049]** The present invention is therefore susceptible to numerous modifications and variants all covered by the inventive concept expressed in the attached claims, whereas the technical details can vary according to requirements.

## Claims

1. Electromechanical safety switch (10), comprising a boxed casing (11), inside the aforementioned casing (11) being present a rod (17) which can move in a longitudinal direction between at least two operating positions, to open or close an electric circuit, through mobile electrical contacts (18) intended to come into contact with fixed electrical contacts (19) and further comprising a head (12), equipped with one or more slots (13, 14) for the insertion of an actuator means (15), where the aforementioned head (12) is fixed to the boxed casing (11) and contains the actuator mechanism of the switch, **characterised in that** it comprises:

- a pair of cams (22, 23) capable of being engaged and disengaged with/from each other;
  - a fixed pin (20) supporting the aforementioned cams (22, 23) and carrying a mutual engagement piece of the cams (22, 23) to lock the rotation thereof, said engagement means being arranged between the aforementioned cams (22, 23) and being able to be coupled and/or decoupled with respect to the aforementioned cams (22, 23);
  - side support elements of the aforementioned pin (20) suitable for preventing the rotation thereof;
  - means for pressing the aforementioned cams (22, 23) against each other; and
  - an actuator means to separate the aforementioned cams (22, 23) from each other, in contrast with the aforementioned pressing means, in order to disengage the cams (22, 23) from the aforementioned mutual engagement means to allow the angular rotation thereof.
2. Electromechanical safety switch (10), according to claim 1, **characterised in that** each of the aforementioned cams (22, 23) has a bevelled edge (36), the aforementioned edges (36) facing each other.
3. Electromechanical safety switch (10), according to claims 1 and 2, **characterised in that** the aforementioned mutual engagement means interacts with recesses (24) foreseen in each of the aforementioned cams (22, 23), the aforementioned recesses (24) having a shape such as to prevent the rotation of the aforementioned cams (22, 23) and the aforementioned engagement means consisting of a central element (21), belonging to the aforementioned pin (20), and having a shape corresponding to the recesses (24) of the aforementioned cams (22, 23) to block the rotation of the cams (22, 23).
4. Electromechanical safety switch (10), according to the previous claims, **characterised in that** each of the aforementioned cams (22, 23) foresees male and female elements (30, 31) which can engage in corresponding elements (30, 31) formed in the opposite cam.
5. Electromechanical safety switch (10), according to the previous claims, **characterised in that** each of the aforementioned cams (22, 23) foresees a pair of notches (32, 33) for engagement with elements of the aforementioned actuator means (15).
6. Electromechanical safety switch (10), according to the previous claims, **characterised in that** each of the aforementioned cams (22, 23) foresees in a position substantially opposite the aforementioned notches (32, 33), a shaped portion (34), suitable for engaging with a protruding portion (35) belonging to the aforementioned rod (17) of the switch (10).
7. Electromechanical safety switch (10), according to the previous claims, **characterised in that** the aforementioned pin (20) has at its ends, elements with a shape suitable for engaging in the aforementioned side support elements.
8. Actuator means (15) for an electromechanical switch, consisting of a key of the type equipped with a gripping area (40), with two side arms (41, 42), **characterised in that** it has a further central arm (43) with a tapered end and **in that** on each side arm (41, 42) there is a small projection (44, 45) facing inwards.
9. Actuator means (15) for an electromechanical switch, according to claim 8, **characterised in that** the aforementioned projections (44, 45) facing inwards are suitable for engaging with notches (32, 33) present on the cams (22, 23).
10. Actuator means (15) for an electromechanical switch, according to claims 8 and 9, **characterised in that** the aforementioned central arm (43) is capable of acting upon bevelled edges (36) belonging to the cams (22, 23) to cause the moving away thereof.
11. Assembly consisting of an electromechanical switch, according to claims 1 to 7, and of an actuator means according to claims 8 to 10.

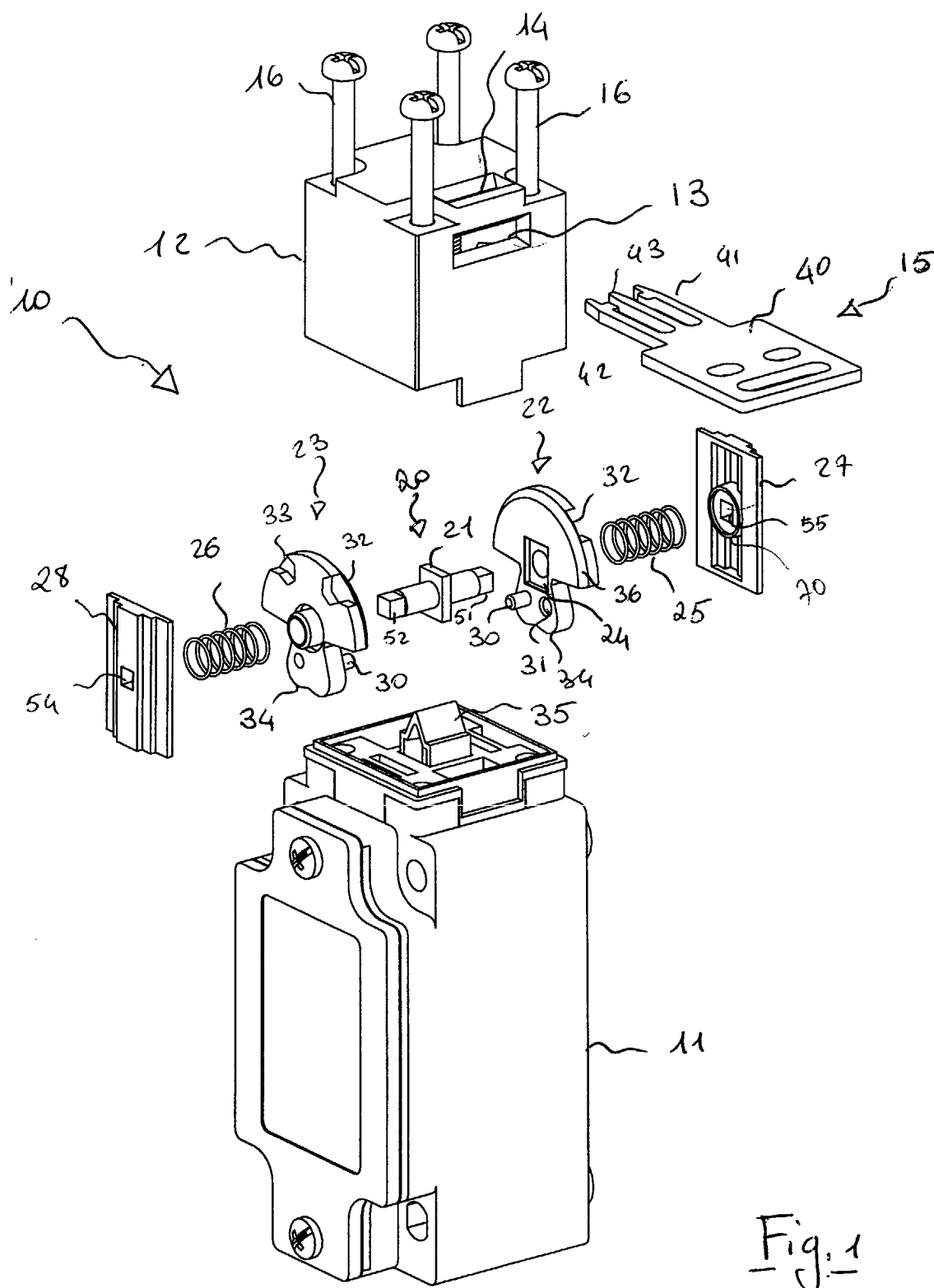


Fig. 1

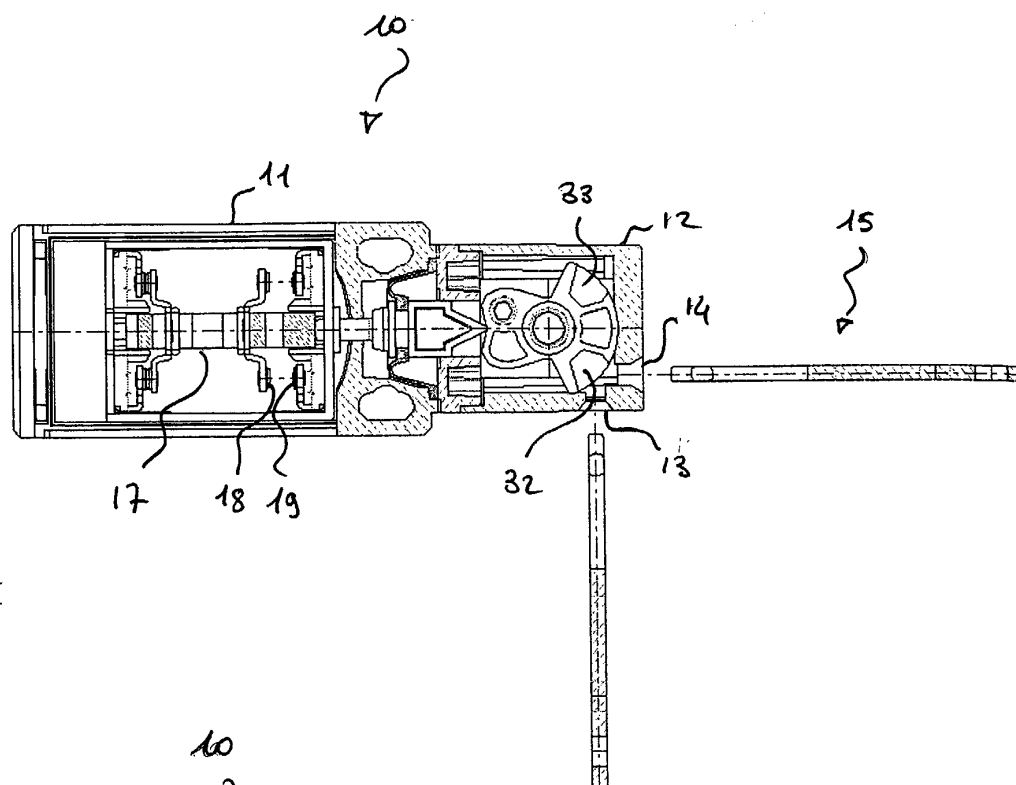


Fig. 2

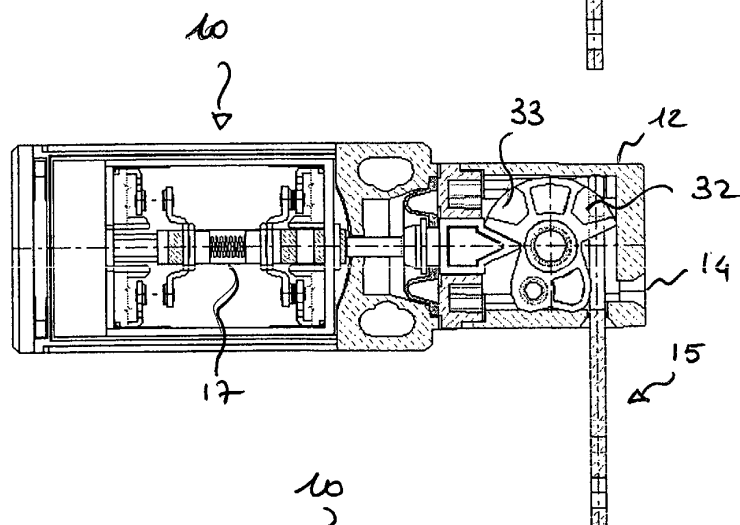


Fig. 3

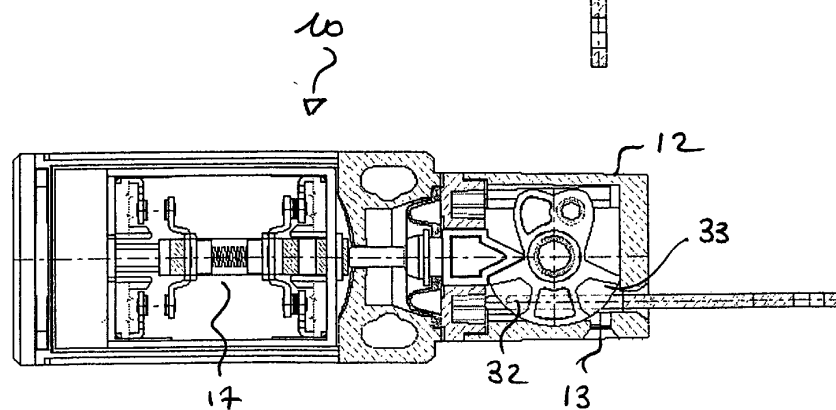
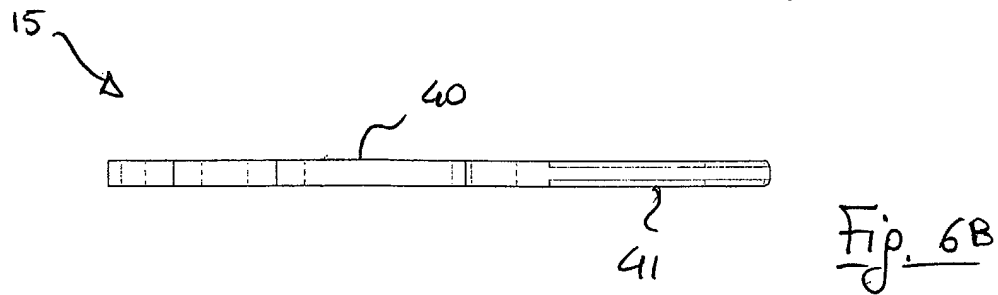
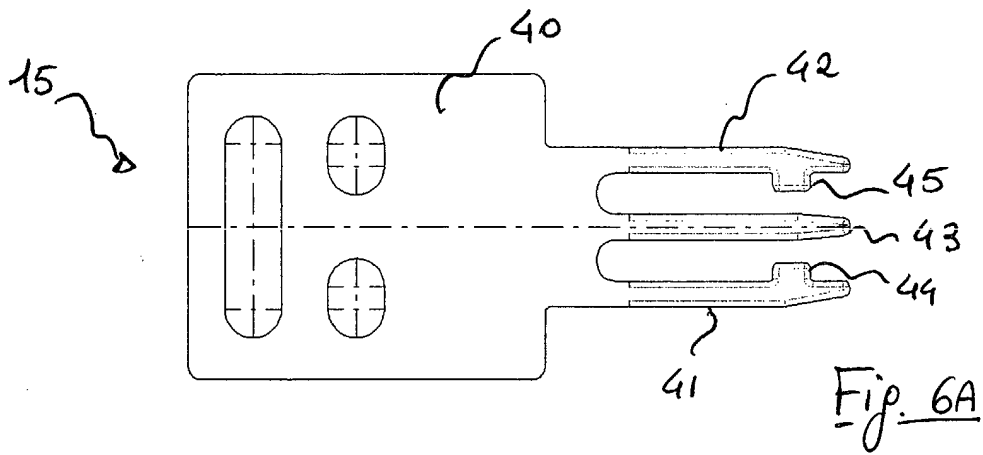
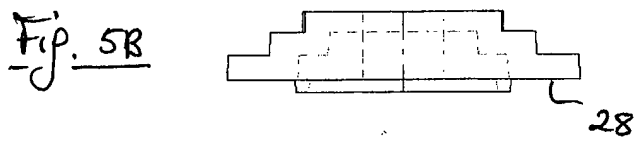
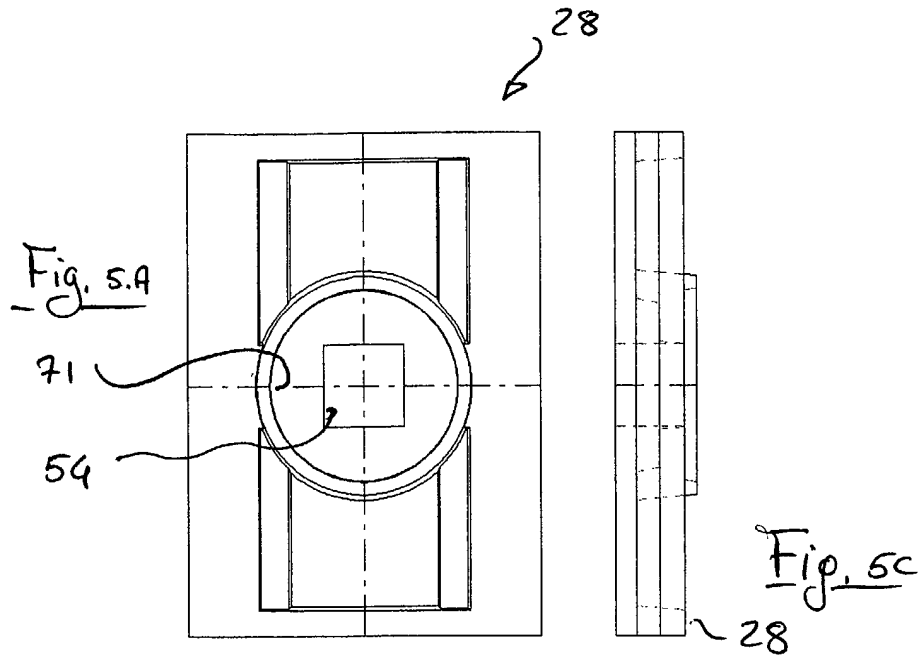


Fig. 4



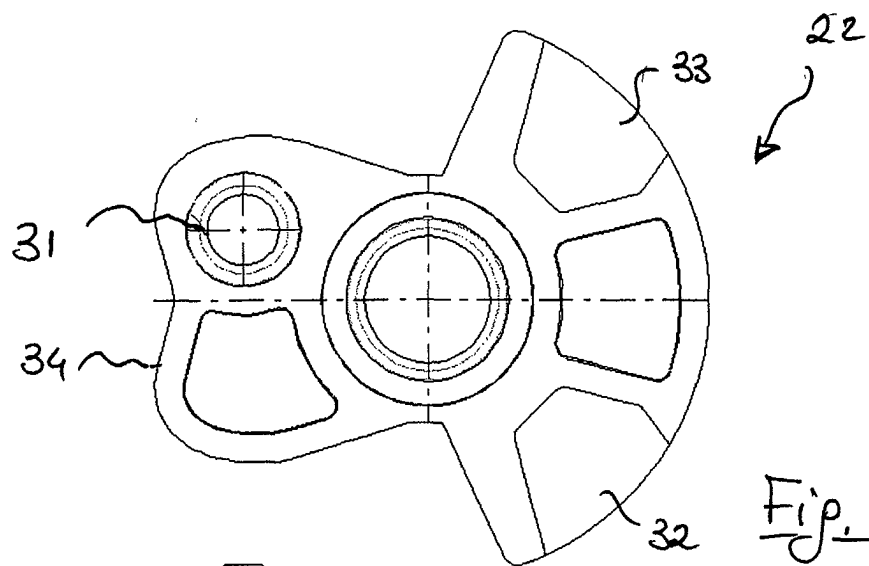


Fig. 7A

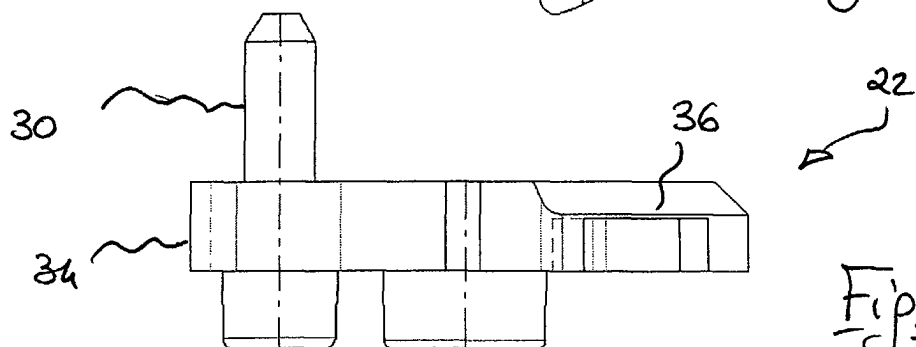


Fig. 7B

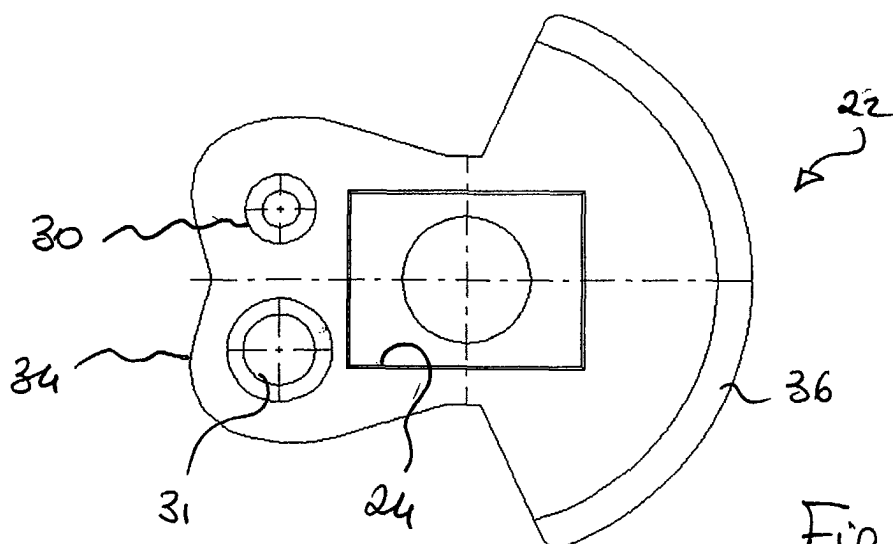


Fig. 7C



European Patent  
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# EUROPEAN SEARCH REPORT

Application Number  
EP 03 42 5191

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                              |                                                           |                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|----------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document with indication, where appropriate, of relevant passages                                                                                                | Relevant to claim                                         | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | PATENT ABSTRACTS OF JAPAN<br>vol. 018, no. 246 (E-1546),<br>11 May 1994 (1994-05-11)<br>& JP 06 036650 A (IDEC IZUMI CORP),<br>10 February 1994 (1994-02-10)<br>* abstract * | 1-11                                                      | H01H27/00                                    |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US 4 963 706 A (MOHTASHAM MEHDI)<br>16 October 1990 (1990-10-16)<br>* abstract *                                                                                             | 1-11                                                      |                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                              |                                                           | TECHNICAL FIELDS SEARCHED (Int.Cl.7)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                              |                                                           | H01H                                         |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                              |                                                           |                                              |
| Place of search<br><b>THE HAGUE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                              | Date of completion of the search<br><b>25 August 2003</b> | Examiner<br><b>Ramírez Fueyo, M</b>          |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>&amp; : member of the same patent family, corresponding document</p> |                                                                                                                                                                              |                                                           |                                              |

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EP 03 42 5191

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25-08-2003

| Patent document<br>cited in search report |   | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---|---------------------|----------------------------|---------------------|
| JP 06036650                               | A | 10-02-1994          | NONE                       |                     |
| -----                                     |   |                     |                            |                     |
| US 4963706                                | A | 16-10-1990          | NONE                       |                     |
| -----                                     |   |                     |                            |                     |

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