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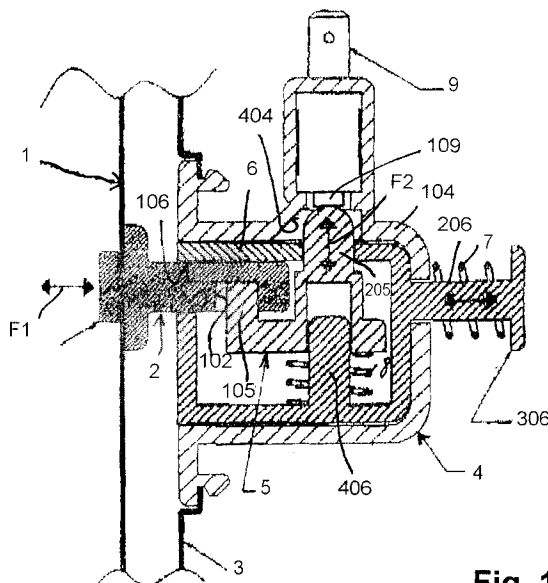
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(54) **Device for the opening and closing of doors or the like, especially in electrical domestic appliances or the like**

(57) A device for the closure of doors or the like, especially in electrical domestic appliances, comprising cooperative engaging means (2,5) for immobilising at least one door leaf (1) or the like in a closed position and for opening the same. The engaging means (2,5) are associated with the door leaf (1) and the stationary portion (3) bounding the opening and the said means (2,5) act together with electrical switch means (9) switching the latter to a make or break condition corresponding to the closed and open positions of the door leaf (1). In accordance with the invention the engaging means (2

or 5) are slidably mounted in a slide (6) which moves against a predetermined force (7) and provides control means (404,205) in a disengaged position of the associated engaging means (2,5) and control means (205) for a switch (9). When slide (6) is in the extended condition switch means (9) are in the break condition and engaging means (2,5) are disengaged, while when slide (6) is in the retracted position switch means (9) may be in either the make or break condition and engaging means (2,5) may be in the engaged or disengaged position.

**Fig. 1****EP 0 833 027 A2**

Description

The invention relates to a device for opening and closing doors or the like, especially in electrical domestic appliances or the like, of the type comprising cooperating engaging means which can be mutually engaged in a releasable manner to secure the door or the like in the closed position and to open the same, the complementary engaging means being associated with the door leaf and the stationary part bounding the opening closed by the said leaf, while the said means act together with electrical switch means to activate the latter in a make or break condition corresponding to the closed and open positions of the door leaf.

The object of the invention comprises providing a closure and opening device of the type described at the outset which offers maximum safety in the use of electrical domestic appliances or the like in particular, allowing the door to be opened or released while at the same time switching the switch means into a break condition and applying a predetermined force from the inside. All this is achieved by means which are inexpensive to construct, easy to actuate and appreciably robust and reliable in operation.

The invention accomplishes the above objectives through a device of the type described at the outset in which the engaging means associated with the stationary part of the door which surrounds the opening and/or the cooperating engaging means which are associated with the leaf itself are mounted on a slide which is guided to move against a predetermined force in the direction of opening of the door leaf, this slide providing in combination control means in the position in which the associated engaging means and control means of a switch are disengaged so that when the slide is in the extended condition the switch means are in a break condition and the engaging means are in a disengaged condition, while in the position in which the slide is retracted the switch means are in a make condition and the engaging means are in the engaged position.

In accordance with the preferred embodiment the engaging means associated with the stationary part surrounding the opening and/or the door leaf are supported on the slide in such a way that in the disengaged condition they can be moved away from those corresponding to the other part, in at least one predetermined direction, with actuator means being provided to displace the engaging means activated by the sliding movement of the slide itself.

When the movement disengaging the engaging means, at least in the condition when it is activated by an outwardly directed thrust against the door, comprises a displacement of the engaging means in a direction transverse to that in which the slide moves - which is substantially tangential to the opening swing of the door - then the actuator means may comprise stationary inclined planes which act on thrust members of the engaging means mounted on the slide itself.

The engaging means or the thrust members may be provided with control members of at least one switch.

In accordance with an improvement the engaging means have at least two degrees of freedom, one in the direction transverse to the direction of movement of the slide and the other a rotational movement about an axis parallel to the transverse direction of movement of the engaging means themselves.

It is possible to provide only one switch which is controlled by the engaging means, either directly or by suitable transmission, the two degrees of freedom being combined, or two switches, each controlled by one movement, rotation of the engaging means being effected during the stages of engaging and disengaging the engaging means associated with the door leaf and the stationary part surrounding the opening, while translational movement along the axis transverse to the direction of movement of the slide is effected only during the stage of safe opening with an outwardly directed thrust.

The invention has further features which are the subject of subsidiary claims. The characteristics of the invention and the advantages deriving therefrom will be more apparent from the following description of a preferred embodiment illustrated in the appended drawings, in which:

Figure 1 illustrates a cross-section of the device according to the invention along a plane parallel to the hinge axis of the door and with the door in the closed position.

Figure 2 is a view similar to Figure 1 with the door in the open position as a result of safe activation by means of an outwardly directed thrust.

Figure 3 illustrates a cross-section of the device according to the invention along a plane perpendicular to the door hinge axis and with the door in the closed position and in the open position (shown by dashed lines).

With reference to the figures, an electrical domestic appliance or the like has a door 1 which closes an opening. Engaging means 2 which project from the posterior side of door 1 are attached thereto, while an engaging and disengaging mechanism 4 of the said engaging means 2, which is also provided with additional engaging means 5, is mounted in a position coinciding with said engaging means 2 in the stationary part of wall 3 surrounding the opening.

Engaging means 2 associated with the door project in a direction which is tangential to or substantially tangential to the arc of the circle through which door 1 swings, while engaging mechanism 4 has a first enclosure 104 of substantially tubular shape which is directed with its axis parallel to or substantially parallel to engaging means 2 of door 1. Enclosure 104 is open on the side facing door 1, while it is enclosed on the opposing head side. Within tubular enclosure 104 there is housed a slide 6 which is also substantially tubular and which on the head side facing door 1 has an opening 106 for the passage of engaging means 2 associated with door 1. Slide 6 can slide in the direction of the axis of tubular

enclosure 104 which is tangential to the arc of movement of door 1, at least in the position in which the latter is substantially closed.

On the opposite head side slide 6 has an extension 206 parallel to the direction of movement thereof which slides within an opening 204 in enclosure 104.

Extension 206 is of sufficient length for it to project beyond the head end of enclosure 104 opposite door 1 even in the position when slide 6 is fully extended.

Free terminal end of extension 206 has an enlarged head 306 and a spring 7, preferably a helicoidal spring wound on extension 206, is provided between the enlarged head and the outer wall of enclosure 104.

Spring 7 is dimensioned in such a way that it has an elastic compression coefficient which requires a predetermined force and which in accordance with current safety standards must not exceed 70 Nm.

Engaging means 5 acting together with engaging means 2 mounted on door leaf 1 are supported on a pin 406 in such a way that they can rotate around it and slide axially along it within tubular slide 6, on said pin 406 which is orientated transverse to the direction of movement of said slide 6, in particular parallel to the hinge axis of door leaf 1. On the side facing the door leaf these engaging means bear an engaging tooth 105 which projects parallel to pin 406, that is transverse to the direction of movement of slide 6, which is intended to engage engaging tracks 102 in engaging means 2 of door leaf 1 which comprise channels open on the side facing the said tooth and on the head side of engaging means 2. As a result the engaging tooth can become engaged in and disengaged from the channels either by sliding axially along pin 406, or by means of a movement transverse to the longitudinal length of the channels, or through movement in the direction of the axes of the said channels.

In a position which is substantially but not necessarily coaxial with pin 406, engaging means 5 have a pin 205 which slidably engages an opening 506 in slide 5. The engaging means can be displaced in the axial direction of supporting pin 406, towards the interior of slide 6, and in a position which does not project beyond the outer surface thereof, against the action of a spring 8, which also has a predetermined compressibility coefficient.

With reference to Figure 1, and in a position coinciding with pin 205, with slide 6 completely withdrawn into guide enclosure 104, the slide bears in a transverse radial housing a switch 9 whose switching members 109 are orientated so that their actuating movement is parallel to the movement of pin 205 of engaging means 5.

When slide 6 is completely retracted, engaging means 5 are subjected to a stable thrust through the action of spring 8 in the direction of switch 9 and in a position such that pin 205 switches the switch into the make condition by pressing against the switching actuators 109 of switch 9.

With reference to the direction of movement of slide

6 in the direction in which the latter is removed from guide enclosure 104, an inclined leading-in wall 404 which is connected to the wall of enclosure 104 along which slide 6 moves is provided in front of the part of pin 205 which projects beyond slide 6 and against the switching members 109 of switch 9 through an opening 304 in enclosure 104. When an attempt is made to open door 1 by means of an outwardly directed thrust against its leaf, engaging means 2 and 5 which engage each other cause slide 6 to be drawn out towards the exterior. This obviously takes place once a predetermined force threshold has been exceeded. The outward movement of slide 6 results in an inward compression of pin 205 of engaging means 5 along supporting pin 406 as a result of the effect of inclined plane 404. Pin 205 is then moved away from switching members 109 of switch 9 which thus changes into the break condition.

At the same time tooth 105 of engaging means 5 is displacer with a transverse movement away from engaging guides 102, that is the channels forming the said guides, as a result of which engaging means 2 associate with door leaf 1 are released and the door is free to be opened fully.

This situation is illustrated in Figure 2.

The movements of the individual parts are indicated by arrows F1, F2, F3, F4.

It will be seen that as a result of the effect of spring 7 slide 6 automatically returns to a withdrawn position within enclosure 104. In this case switch 9 is returned to the make position by pin 205. However, engaging means 5 have been released from engaging means 2 and in this case the second switches, which are not illustrated in detail because they are generically known, are in the break condition.

These second switches can be provided in any position appropriate to their operation, for example alongside engaging means 2 associated with the door. Also they may be connected in series to the first switches 9, if provided.

It is also possible to provide a combination of the swinging movement around pin 406 supporting the engaging means and the axial movement thereof along the supporting pin, so that only one switch 9 is sufficient. In this case however the return of slide 6 to its original position will only occur when door leaf 1 is again closed.

Figure 3 illustrates the particular embodiment of engaging means 2 and 5. Tooth 105 is provided at the end of a radial arm 305 and has a substantially cylindrical cross-section. The radial arm is directed towards door leaf 1, preferably in line with the median axis of slide 6. Engaging tracks 102 have two branches arranged symmetrically with respect to the axis of radial arm 305 bearing engaging tooth 205. The two branches are substantially straight in the part thereof at the free end of engaging means 2, while they are curved in a direction converging together in their terminal parts where the corresponding ends are attached together by means of a substantially V-shaped length. The overall appearance of

engaging tracks 102 is that of a relatively rounded M. This embodiment of the tracks makes it possible to engage and disengage door leaf 1 by merely pressing it in the direction of closure. As indicated by 105, for closure engaging means 102 penetrate slide 6, while engaging tooth 105 engages engaging track 102 and as a result of slight pressure reaches the central vertex of the V-shaped portion. Further pressure on door leaf 1 in the closing direction causes the engaging tooth to pass into the other symmetrically opposite branch of engaging track 102, as indicated by 105', into a position into which it can be slid to allow displacement in the opening direction of door leaf 1. During these operations of normal closing and opening slide 6 is stably secured in its position.

Obviously slide 6 also permits safety opening by pulling on door leaf 1 when the pressure disengaging mechanism is jammed as a result of damage or malfunction.

The device according to the invention may be constructed of any materials, such as e.g. plastics or the like.

The invention is of course not restricted to the embodiments described and illustrated but may be varied extensively particularly in the form of its construction without thereby going beyond the scope of the protection described above and claimed below.

Claims

1. A device for the opening and closing of doors or the like, especially in electrical domestic appliances or the like, of the type comprising cooperating engaging means (2,5) which can be mutually engaged in a releasable manner to secure at least one door leaf (1) or the like in the closed position and to open the same, the complementary engaging means (2,5) being associated with the door leaf (1) and the stationary part (3) bounding the opening closed by the said leaf, while the said means (2,5) act together with electrical switch means (9) switching the latter in a make or break condition corresponding to the closed and open positions of door leaf (1), characterised in that the engaging means (5) associated with the stationary part of the door (3) which surrounds the opening and/or the cooperating engaging means (2) which are associated with the leaf (1) itself are mounted on a slide (6) which is guided to move against a predetermined force (7) in the direction of opening of the door leaf (1), this slide (6) providing in combination control means (404,205) in the position in which the associated engaging means (2,5) and control means (205) of a switch (9) are disengaged so that when the slide (6) is in the extended condition the switch means (9) are in a break condition and the engaging means (2,5) are in a disengaged condition, while in the position in which the slide (6) is retracted the switch means (9) can be in the make or break conditions and the engaging means (2,5) can be in the mutually engaged or disengaged position.
2. A device according to claim 1, characterised in that the engaging means (5, 2) associated with the stationary part (3) surrounding the opening and/or the door leaf (1) are supported on the slide (6) in such a way that in the disengaged condition they can be moved away from those corresponding to the other part, in at least one predetermined direction, with actuator means (5,205,404) being provided to displace the engaging means (5) activated by the sliding movement of the slide itself (6).
3. A device according to claims 1 or 2, characterised in that the engaging means (2,5) associated with the stationary part (3) surrounding the opening and/or the door leaf (1) are supported in the slide (6) in such a way that in the disengaged position they can be moved away from those corresponding to the other part in at least one predetermined direction, with actuator means being provided to displace the engaging means (2) activated by the sliding movement of the slide (6).
4. A device according to one or more of the foregoing claims, characterised in that the movement disengaging the engaging means (2, 5), at least in the condition when it is activated by an outwardly directed thrust against the door (1), comprises a displacement of the engaging means (2) associated with the door (1) in a direction transverse to that in which the slide (6) moves - which is substantially tangential to the opening swing of the door (1) - and the actuator means (404) comprise stationary inclined planes which act on the thrust members (205) of the engaging means (5) mounted on the slide (6) itself.
5. A device according to one or more of the foregoing claims, characterised in that the engaging means (5) or the thrust members (205) may be provided with control members (205) of at least one switch (9, 109).
6. A device according to one or more of the foregoing claims, characterised in that the engaging means (5) associated with the stationary part (3) of the perimeter of the opening have at least two degrees of freedom, one in the direction transverse to the direction of movement of the slide (6) and the other a rotational movement about an axis (406) parallel to the transverse direction of movement of the engaging means (5) themselves.
7. A device according to one or more of the foregoing claims, characterised in that it is possible to provide

only one switch (9) which is controlled by the engaging means (5), either directly or by suitable transmission, the two degrees of freedom being combined, or two switches, each controlled by one movement, rotation of the engaging means (5) being effected during the stages of engaging and disengaging the engaging means (2) associated with the door leaf (1) and the stationary part surrounding the opening, while translational movement along the axis transverse to the direction of movement of the slide (6) is effected only during the stage of safe opening with an outwardly directed thrust.

8. A device according to one or more of the foregoing claims, characterised in that the slide (6) comprises a tubular member having at least one opening (106) into which engaging means (2) associated with the door leaf (1) are inserted and are slidably engaged in the direction of their axis in an additional tubular guide which is open on the head side facing the door leaf (1), the slide (6) and the guide enclosure (104) being orientated with their axis in a direction tangential to the swing arc of the door leaf (1).
9. A device according to one or more of the foregoing claims, characterised in that the slide (6) and the guide enclosure (104) have an end stop surface (206, 204) and elastic means to oppose the movement of the slide in the direction of removal from the guide enclosure (104) with a predetermined compressibility coefficient.
10. A device according to one or more of the foregoing claims, characterised in that the slide (6) has a supporting pin (406) orientated transversely to the direction of movement of the slide (6) and for the engaging means (5) which are supported to slide axially around and along the said supporting pin (406), while the engaging means (5) have an engaging tooth (105) which projects towards the engaging means (2) associated with the door leaf (1) and which means have engaging tracks (102) which are open either on the head side of the engaging means (2) or the side facing the engaging tooth (105), in the form of channels, and from which the engaging tooth (105) can be disengaged and engaged either by a movement transverse to the tangential swing of the door leaf (1), i.e. transverse to the direction of movement of the slide (6) or a movement in the direction of movement of the slide (6).
11. A device according to one or more of the foregoing claims, characterised in that the engaging means have a control pin (205) parallel to the supporting pin (406) and that they come into contact through an opening (406) with the switching member (109) of a switch (9), elastic means being provided for compressing the engaging means (5, 205) against

the switching members (109) and an inclined plane for compressing the pin (205) of the engaging means (5) in the withdrawn position of tubular slide (6) is provided immediately in front of the control pin (205) of the engaging means (5) with reference to the direction in which the slide (6) is withdrawn.

12. A device according to one or more of the foregoing claims, characterised in that the engaging tooth (205) of the engaging means (5) associated with the stationary part surrounding the opening acts together with engaging tracks (102) made in the engaging means associated with the door leaf (1) which follow a course in the shape of an M, while the tooth (105) can oscillate symmetrically within the median axis of the M shape.

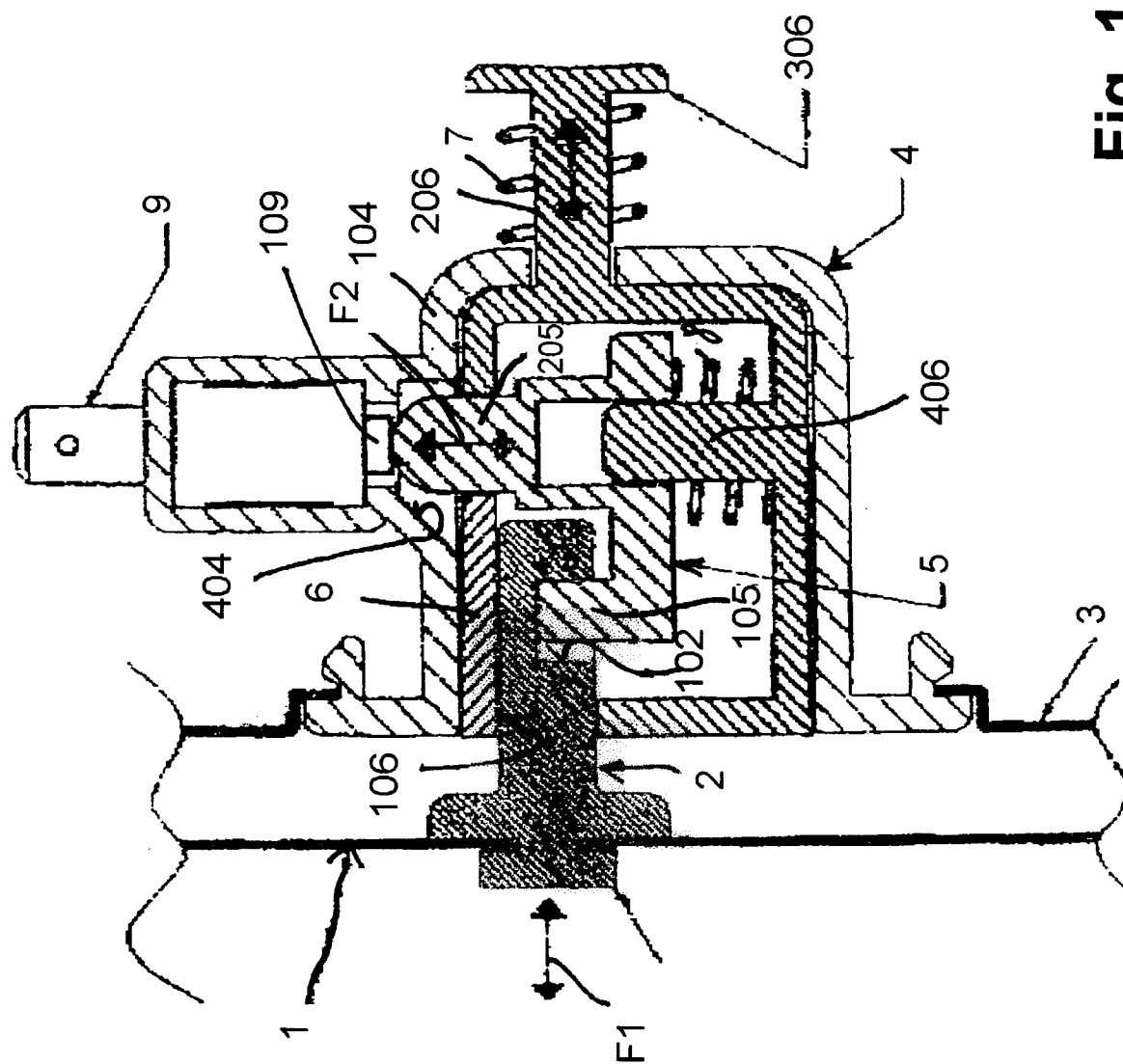


Fig. 1

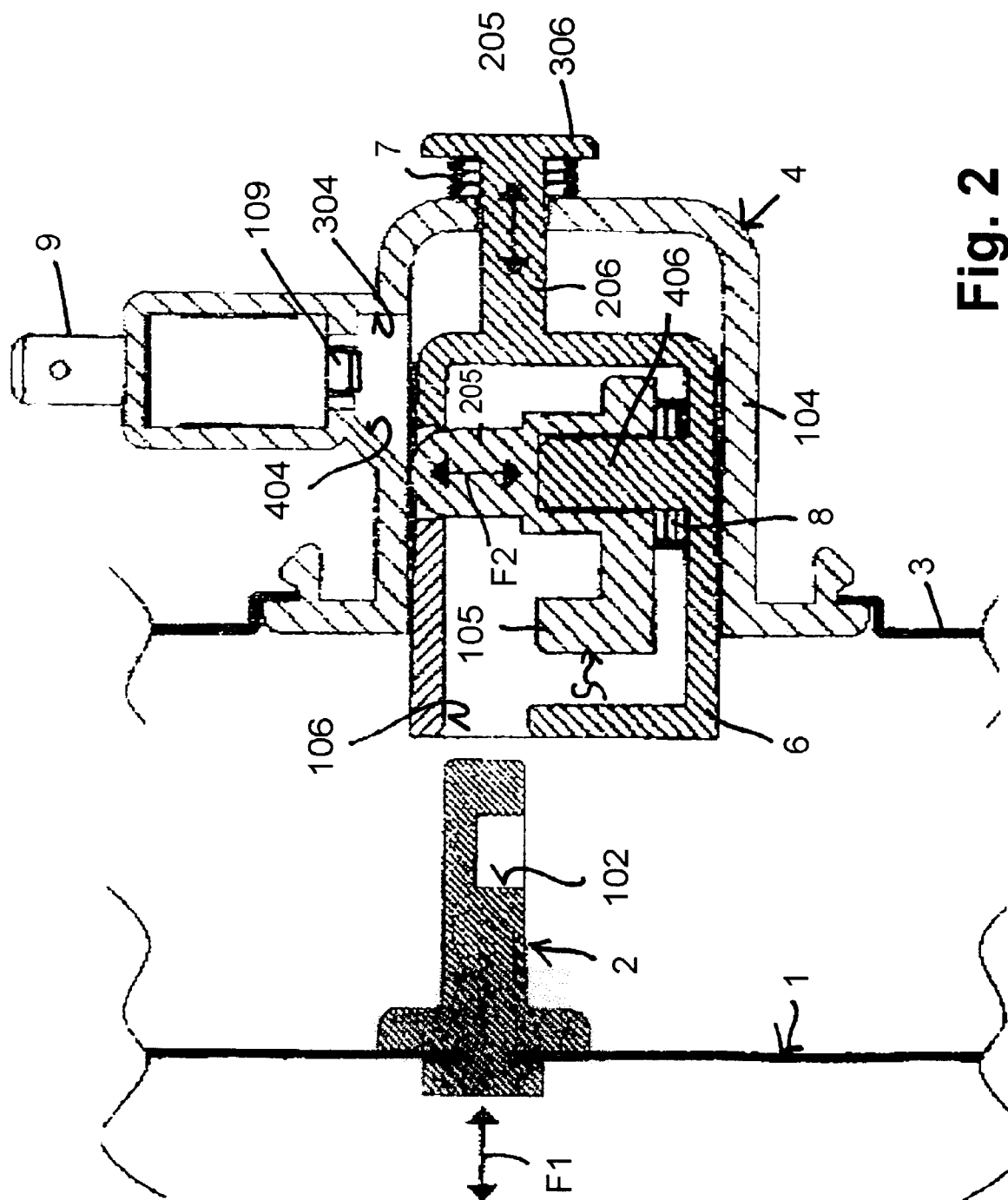


Fig. 2

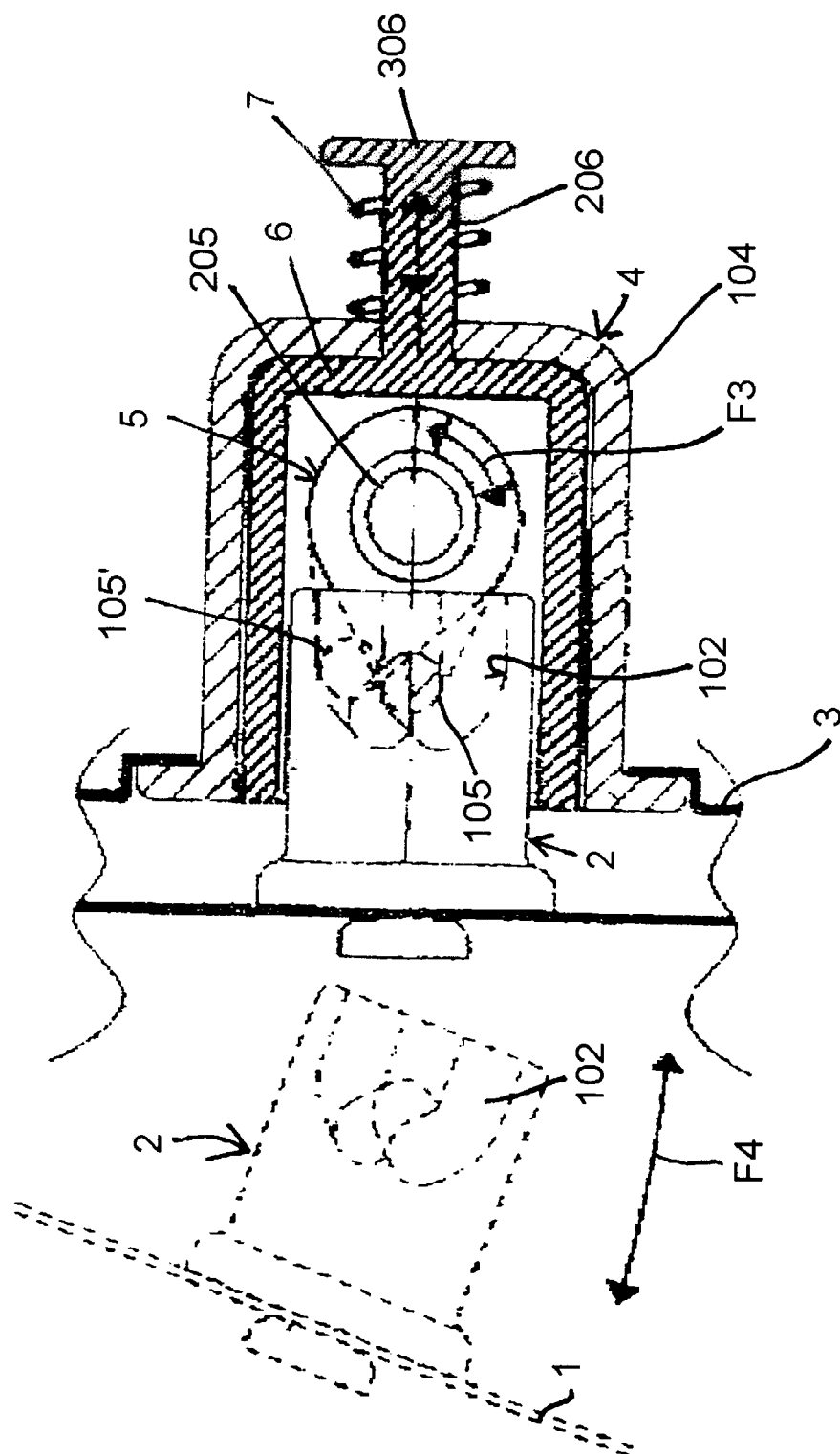


Fig. 3