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(54) **Electric strike**

(57) The electric strike comprises a pivotable keeper (15) having a flap portion (19) arranged to co-operate with a latch bolt, a spring (20) for urging the keeper to its door-locking position, two pivotable lock levers (21, 22) for locking the keeper (15) in its door-locking position, and means for actuating the lock levers (21, 22) comprising springs (33, 34) exerting a force onto the lock levers (21, 22) to urge them to their locking or unlocking positons and two electromagnets (35, 36) arranged to exert by magnetic attraction a counter force onto the lock levers (21, 22) to move them to their opposite positions. To enable a compact and reliable construction notwithstanding the use of electromagnets having a fixed core, the hook-shaped ends of the lock levers (21, 22) are arranged to move up and down and to engage the flap portion of the keeper. The lock levers (21, 22) are further provided with first cam elements (37, 38) and the flap portion (19) second cam elements (39, 40) arranged to co-operate with the first cam elements to move the lock levers (21, 22) to their unlocking positions upon return of the keeper (15) to its door-locking position.

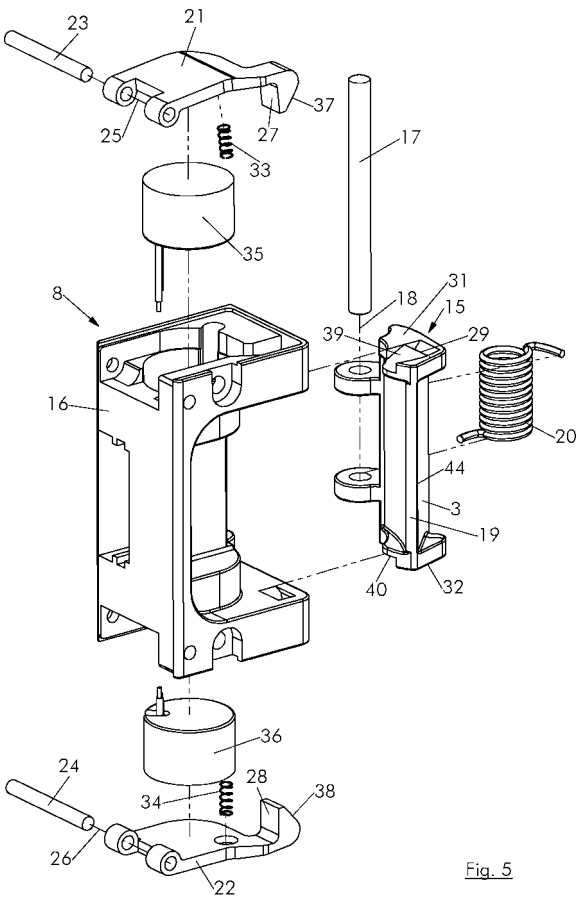

Fig. 5

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Description

[0001] The present invention relates to an electric strike having a bolt cavity arranged to receive at least one bolt of a door lock and comprising a strike frame; a keeper which comprises at least a flap portion forming a side wall of the bolt cavity, the keeper being carried by the frame for pivoting about a first pivot axis, which is substantially vertical in the mounted state of the electric strike, between a door-locking position, wherein the flap portion of the keeper is arranged to withhold said bolt to prevent door opening, and a door-releasing position, wherein the flap portion is arranged to release the bolt to allow door opening, the keeper being arranged to pivot, in a first rotational direction, from the door-locking position to the door-releasing position by a door opening force transmitted thereto by said bolt; a lock lever for locking the keeper in said door-locking position, which lock lever is carried by the frame for pivoting about a second pivot axis between a locking position and an unlocking position and is provided with a first abutment element arranged to co-operate, in the locking position of the lock lever, with a second abutment element provided on the keeper, the first and second abutment elements mutually engaging one another in the locking position of the lock lever, when the keeper is in said door-locking position, to prevent rotation of the keeper in said first rotational direction and are disengaged in the unlocking position of the lock lever to enable rotation of the keeper in said first rotational direction; and means for actuating the lock lever comprising at least one spring means exerting a force onto the lock lever to urge it to one of said locking position and said unlocking position, and at least one electromagnet having a fixed core arranged to exert by magnetic attraction a counter force onto the lock lever to move the lock lever against the spring force to the other one of said locking position and said unlocking position.

[0002] Such an electric strike is disclosed in FR-A-2 711 715. The keeper of this electric strike is arranged to co-operate with a dead bolt of a door lock. When opening the door, the keeper is pivoted by the dead bolt to the door-releasing position and, when closing the door, the keeper is pivoted back by the dead bolt to its door-locking position. The lever by means of which the keeper is locked in its door-locking position extends in a substantially vertical direction above the keeper. To unlock the keeper, the lock lever is pivoted by means of an electromagnet about a horizontal pivot axis so that the abutment element on the lower extremity of the lock lever is displaced horizontally out of engagement with the abutment element on the keeper. When the keeper is subsequently pivoted to its door-releasing position, the lock lever is moreover lifted upwards by a cam element provided on its lower extremity. The lock lever is maintained in this lifted position when the keeper pivots further to its door-releasing position and also when it pivots back to its door-locking position. In this way, the electromagnet needs only to be energised very shortly since the lock lever is maintained in its unlocking position until the keeper has returned to its door-locking position. For maintaining the lock lever in its lifted or unlocked position during the pivoting of the keeper, the keeper is provided opposite its flap portion, i.e. opposite its portion which engages the dead bolt, with a further keeper portion having a top surface which slides underneath the lower extremity of the lock lever so that the lock lever is continuously supported by this portion of the keeper.

[0003] A drawback of the electric strike disclosed in FR-A-2711 715 is that the lock lever and the electromagnet require quite a lot of space above the keeper. Consequently, a relatively large recess has to be provided in the door frame or in the upright wherein the strike is to be mounted to receive the strike. Moreover, the electric strike cannot be used for left and right turning doors. A strike which is provided for a left turning door has indeed to be mounted upside down onto the door frame when it is used for a right turning door. However, due to the fact that a door lock usually contains a latch bolt and a dead bolt, the strike disclosed in FR-A-2 711 715 cannot be used upside down. In practice, there is indeed only a limited distance between both bolts of a lock so that the lock lever and the electromagnet cannot be arranged between both bolts.

[0004] A further drawback of the electric strike disclosed in FR-A-2711 715 is that it cannot be used for receiving only a latch bolt since a latch bolt is not able to return the keeper to its door-locking position. Still another drawback of this known electric strike is that the lock lever has to co-operate with a portion of the keeper that is situated opposite the flap portion of the keeper. As a result thereof, the keeper and thus the electric strike are quite voluminous.

[0005] Another electric strike is disclosed in US-A-5 735 559. A difference between the strike according to the invention and the strike disclosed in this US patent is that it uses a quite voluminous solenoid with a movable metal core to actuate the lock lever. This solenoid requires quite a lot of space underneath the keeper. Moreover, a solenoid with a movable core is more subjected to malfunctions, in particular when used outdoors, than an electromagnet with a fixed core. An electromagnet with a fixed core is easy to be made watertight whereas a solenoid with a movable core is not watertight. The core of a solenoid is moreover made of iron which is electroplated to avoid oxidation. However, after a while the electroplated coating is worn off and the iron core still starts to oxidise. After some while, the movable core gets thus stuck in the solenoid.

[0006] A further drawback of the electric strike disclosed in US-A-5 735 559 is that it requires a number of micro-switches. One of these micro-switches is used to control whether the keeper has returned to its door-locking position. Only when the return of the keeper to its door-locking position has been detected, the necessary control signals are given to lock the keeper by means of the lock lever. Micro-switches are however quite sensi-

tive to malfunctions, especially when the electric strike is used outdoors, and in particular for garden gates or doors. Moreover, a complex electronic circuit has to be provided for controlling the operation of the electric strike.

[0007] In the electric strike disclosed in US-A-4 917 425 the actuation means also comprise a solenoid having a movable core. The solenoid is moreover not used to actuate the lock lever to move it to its unlocking position but it is used to displace a blocking arm enabling the keeper to push the lock lever to its unlocking position. An advantage of the electric strike disclosed in US-A-4 917 425 is that the height thereof can be reduced due to the fact that the solenoid is arranged next to instead of above or underneath the keeper. Due to this location of the solenoid, the actuation of the lock lever requires however a number of additional actuation arms which renders the lock more complex and more sensitive to malfunctions. A further drawback of this known electric strike is again that the lock lever acts onto a portion of the keeper which is situated opposite the flap portion. In this way, not only a quite voluminous construction is obtained but, in order to be able to provided the required space for the solenoid and the different actuation arms, the flap portion of the keeper is hook-shaped and is situated in such a position with respect to the lock bolt that only a small force moment is exerted by the lock bolt onto the flap portion when trying to open the door. The operation of the keeper may thus quickly be hampered by the presence of for example dirt or ice.

[0008] An object of the present invention is therefore a new electric strike which comprises an electromagnet for actuating the lock lever and which can be constructed in such a manner that it is compact and reliable and moreover in such a manner that it can be used upside down so as to be suitable for both left and right turning doors.

[0009] To this end, the electric strike according to the invention is characterised in that the electric strike comprises further spring means for returning the keeper to said door-locking position upon release of the bolt by the flap portion of the keeper when the keeper has been moved by said bolt to said door-releasing position; in that said second pivot axis is directed in such a manner that the first abutment element provided on the lock lever moves up and down when the lock lever pivots between the locking and unlocking positions; in that said second abutment element is provided on the flap portion of the keeper; and in that the lock lever is provided with a first cam element and the flap portion of the keeper with a second cam element, the first and second cam elements being arranged to co-operate with one another to move the lock lever to said unlocking position and back to said locking position upon return of the keeper to the door-locking position after the lock lever has already been returned by said actuating means to the locking position before the keeper has returned to said door-locking position.

[0010] Due to the fact that the electric strike comprises further spring means for returning the keeper to its door-locking position, the keeper may co-operate with only a latch bolt. In this way, the door lock may be provided with a dead bolt which cannot be unlocked with the electric strike and which can thus provide for an additional secure closure of the door. This may for example be advantageous in a fail-safe arrangement wherein the latch bolt is unlocked upon a power failure. The compact and reliable construction can be achieved by making the first abutment element on the lock lever to move up and down, by providing the second abutment element onto the flap portion of the keeper and by enabling the keeper to return to its door-locking position even when the lock lever has already been returned to its locking position by providing a first cam element on the lock lever and a second cam element on the flap portion. By making the first abutment element on the lock lever to move up and down, the lock lever can indeed be arranged in a substantially horizontal position, more particularly above or below the keeper, so that it requires only a small amount of space. By the presence of the cam elements on the lock lever and the keeper, the keeper has moreover not to be provided with arms or further portions to keep the lock lever in its unlocking position until the keeper has returned to its door-locking position. Such arms or further keeper portions do not only occupy additional space but, since they rotate together with the keeper, they also prevent the electromagnet from being arranged close to the keeper. In the electric strike according to the invention, the electromagnet or magnets can on the contrary be arranged next to the keeper on a very small distance therefrom.

[0011] In a preferred embodiment of the electric strike according to the invention, the flap portion of the keeper has an upper and a lower end face, said second abutment element and said second cam element being both provided on the upper or on the lower end face of the flap portion and, when the second abutment element and the second cam element are provided on the upper end face of the flap portion, the electromagnet is provided underneath the lock lever and, when the second abutment element and the second cam element are provided on the lower end face of the flap portion, the electromagnet is provided above the lock lever.

[0012] When the height of the strike has to be kept within certain limits, in particular to be able to use it for left and for right turning doors, this embodiment enables to increase the height of the keeper, or in other words the height of the bolt cavity. This is especially important when the electric strike is used in outdoor applications, in particular in garden applications, wherein the door or gate is fixed to a post which is placed in the ground so that the door or gate often sags after a while.

[0013] In a preferred embodiment of the electric strike according to the invention, it comprises two lock levers, two spring means which are each arranged for exerting a force onto a respective one of said lock levers to urge the lock levers to one of said locking position and said unlocking position, and two electromagnets which are each arranged to exert by magnetic attraction a counter

force onto a respective one of said lock levers to move the lock levers against the spring force to the other one of said locking position and said unlocking position.

[0014] In this embodiment a very secure locking of the keeper can be achieved, even when the first cam elements on the lock levers are only displaced a relatively small distance by means of the electromagnets and thus engage the second cam elements on the keeper to a relatively small extent.

[0015] Other particularities and advantages of the invention will become apparent from the following description of some particular embodiments of the electric strike according to the present invention. The reference numerals used in this description relate to the annexed drawings wherein:

Figure 1 shows an exploded view of an electric strike for a right turning door mounted in a tubular post;
Figure 2 shows a top plan view on the electric strike illustrated in Figure 1 and mounted in a tubular post and on the door lock co-operating therewith and mounted against the upright of a garden gate;
Figures 3 and 4 illustrate the same electric strike as illustrated in Figures 1 and 2 but mounted now on the post for a left turning door;
Figure 5 shows an exploded view of the electric strike itself in a fail-safe arrangement;
Figure 6 shows a perspective view with partial cutaways of the electric strike illustrated in Figure 5 with the keeper in its door-locking position;
Figures 7 to 9 are respectively a front elevational view, a side elevational view and a top plan view on the electric strike illustrated in Figure 6;
Figure 10 shows the same view as Figure 6 but showing the electric strike with the keeper in its door-releasing position;
Figure 11 is a view similar to Figure 6 but showing the electric strike in a fail-secure arrangement, with the keeper in its door-locking position;
Figure 12 shows the same view as Figure 11 but showing the electric strike with the keeper in its door-releasing position; and
Figure 13 shows an exploded view of a variant embodiment of the electric strike in a fail-secure arrangement.

[0016] The invention relates to an electric strike, i.e. a strike comprising a keeper which can be operated electrically. This can be done from a distance, for example from within the house, or it can be done by means of a code system. The electric strike is arranged to co-operate with a door lock 1 having at least a latch bolt 2 and optionally a dead bolt. The door lock has on at least one side of the door no handle or otherwise a fixed handle so that from that side the latch bolt 2 can only be released by unlocking the keeper of the electric strike. Optionally, the latch bolt can also be opened by means of a second turn of the key used to unlock the dead bolt. In the embodiment illustrated in Figures 2 and 4, the door lock 1 has two fixed handles, i.e. handles which cannot be rotated.

[0017] The electric strike illustrated in the drawings is arranged to be mounted to a tubular post 4 which is for example part of a garden fence and which is often placed in the ground. The door or gate 5 (called hereinafter in general door) onto which the door lock 1 is mounted is hinged on a post situated opposite the tubular post 4. This post is also often placed in the ground. A problem of such an arrangement is that the posts may start to sag so that the relative positions of the electric strike and the door lock may change. In order to assure the functioning of the lock, the electric strike has to show an elongate bolt cavity 6 having a minimum height for the latch bolt 2 and also an elongate bolt cavity 7 having a minimum height for the dead bolt.

[0018] Instead of mounting the electric strike in a tubular post 4, it can of course also be mounted in a door frame which is either formed of a hollow metal extrusion but which may also be constructed of wood or other materials and mortised to define a cavity for the electric strike. Moreover, the electric strike can also be mounted in a cavity made in a wall.

[0019] As illustrated in Figures 1 to 4 the electric strike shown in the figures can be used for both a left and a right turning door 5. It comprises two parts 8, 9 which are arranged to be mounted onto one another. The first part 8 forms the latch bolt cavity 6 and the second part 9 the dead bolt cavity 7. Both electric strike parts 8 and 9 are mounted onto one another by means of a cover plate 10 which is fixed by means of bolts 11 onto both parts 8 and 9. The cover plate 10 is subsequently screwed by means of bolts 12 to the tubular post 4 so that the electric strike extends through a hole 13 into the tubular post 4. An angular abutment plate 14 is preferably fixed between the cover plate 10 and the post 4 to form a stop for the door. The first strike part 8 is preferably constructed in such a manner that it can be mounted upside down onto the second strike part 9. In this way the electric strike can be used for both a left and a right turning door 5. It is clear that in order to be able to mount the first strike part 8 upside down, it may have only a limited height.

[0020] The embodiment illustrated in Figures 1 to 4 is suitable for posts having different thicknesses and is even suitable for mounting the electric strike in a cavity made in a wall. The cover plate 10 provides indeed a raised part onto the side of the post or wall providing the necessary space for the latch bolt when closing the door. In an alternative embodiment, the hole 13 could also be made in the corner of the tubular post, which is especially advantageous in case the post has a relatively small thickness.

[0021] The above-described ways of mounting an electric strike to a tubular post are already applied in practice. The electric strike used in these applications comprises a keeper 15 which can pivot about a vertical pivot axis between a door-locking and a door-releasing posi-

tion. The keeper has an axial cavity containing a solenoid with a movable core for locking the keeper in its door-locking position. Due to the fact that the solenoid is contained in the keeper itself, the height of the electric strike can easily be reduced to enable it to be mounted upside down.

[0022] Since a solenoid with a movable core is much more subjected to malfunctions than an electromagnet with a fixed core, an electromagnet is used in the electric strike according to the invention instead of a solenoid. However, in view of the larger cross section of an electromagnet and the smaller displacement which can be achieved therewith, it is not possible to simply replace the solenoid in the keeper of the known electric strike by an electromagnet. In the electric strike according to the invention an other arrangement is thus required which still enables to mount the strike upside down whilst maintaining a minimum height of the bolt cavity to be able to allow some sagging of the door.

[0023] In the embodiment of the electric strike according to the invention illustrated in Figures 5 to 10, the electric strike comprises a frame 16 having a size and a shape enabling the strike to be mounted in the tubular post 4. By means of a first shaft 17 a keeper 15 is mounted onto the frame 16 so that it can pivot about a first pivot axis 18 which is substantially vertical in the mounted state of the strike. The keeper 15 has a flap portion 19 which forms a side wall of the latch bolt cavity 6 and which has a free edge which is substantially parallel to the first pivot axis 18. The keeper 15 can pivot between a door-locking position, wherein the flap portion 19 of the keeper 15 withholds the latch bolt 2, and a door-releasing position, wherein the flap portion 19 releases the latch bolt to allow door opening. A torsion spring 20 is applied over the first shaft 17, one of the extremities of the torsion spring 20 engaging the frame 16 and the other extremity the keeper 15 to urge this keeper towards its door-locking position. When exerting a door opening force onto the closed door, this force is transmitted by the latch bolt 2 onto the flap portion 19 of the keeper so that the keeper can be pivoted against the pressure exerted thereon by the torsion spring 20 to its door-releasing position. On its back side the flap portion 19 of the keeper 15 has an inclined surface 3 arranged to co-operate with the latch bolt 2 so that the door can be closed without having to withdraw the latch bolt.

[0024] In order to be able to lock the keeper 15 in its door-locking position, the electric strike further comprises two lock levers 21 and 22. These lock lever 21, 22 are each mounted by means of a second shaft 23, 24 on the frame 16 so that they can pivot about second pivot axes 25, 26, which are preferably substantially horizontal in the mounted state of the strike. The lock levers 21, 22 can more particularly pivot between a locking position wherein, as illustrated in Figure 6, the keeper 15 is locked by means of the lock levers and an unlocking position wherein, as illustrated in Figure 7, the keeper 15 is unlocked.

[0025] For locking the keeper 15, the lock levers 21 and 22 are each provided with a first abutment element 27, 28 which co-operate with a second abutment element 29, 30 on the flap portion 19 of the keeper. The first abutment elements 27, 28 are more particularly hook-shaped elements which hook in a recess on the upper and lower end faces 31 and 32 of the keeper 15 and move up and down when the lock levers 21, 22 pivot between their locking and unlocking positions. When a door opening force is transmitted by the latch bolt 2 to the flap portion 19 of the keeper 15, a pulling force F is exerted onto the lock levers 21, 22 when the hook-shaped first abutment elements 27, 28 are hooked into the recesses 29, 30 on the keeper. The second pivot axes 25, 26 preferably extend in such a direction that said pulling force F forms an angle of greater than 45°, preferably greater than 70°, with the second pivot axes 25, 26 of the lock levers 21, 22.

[0026] For enabling to move the lock levers 21, 22 between their locking and unlocking positions actuating means are provided which comprise for each locking lever a compression spring 33, 34 and an electromagnet 35, 36. In the fail-safe arrangement illustrated in Figures 6 to 10, the compression springs 33 and 34 urge the lock levers 21, 22 to their unlocking positions, away from the keeper 15, whilst when energised, the electromagnets 35, 36 draw the lock levers 21, 22, by direct magnetic attraction of these lock levers towards their locking positions. The electromagnets 35, 36 preferably attract a plate-like portion of the lock levers 21, 22 which is situated between the second pivot axes 25, 26 and the first abutment elements 27, 28 on the lock levers 21, 22 since in this way a greater displacement of these first abutment elements can be achieved.

[0027] When the electromagnets are de-energised, the lock levers 21, 22 move outwardly to their unlocking positions and the keeper can be rotated by the door opening force transmitted by the latch bolt 2 to the flap portion 19 thereof. After a certain period of time, which may be controlled by the person who unlocks the door from a distance or by a control circuit, the electromagnets are again energised. In practice, it is possible that this occurs when the keeper has not yet returned to its door-locking position. In order to enable the torsion spring 20 to still return the keeper to its door-locking position, the lock levers 21, 22 are provided with first cam elements 37, 38 which co-operate with second cam elements 39, 40 on the flap portion 19 of the keeper to move the lock levers 21, 22 to their unlocking positions when they were already brought into their locking positions before the keeper 15 has returned to its door-locking position. It has been found that notwithstanding the fact that, in their locking positions, the lock levers 21, 22 are quite strongly attracted to the electromagnets 35, 36, the cam elements enable to retract the lock levers from the electromagnets by the force exerted onto the keeper 15 by the torsion spring 20.

[0028] An important advantage of the presence of the cam elements on the lock levers and on the keeper is

that the keeper 15 has not to comprise additional portions which continuously support the lock levers 21, 22 when the keeper 15 is rotated out of its door-locking position to keep the lock levers in their unlocking positions until the keeper has returned to its door-locking position. In this way, the upper electromagnet 35 can be provided underneath the upper lock lever 21 whilst the lower electromagnet 36 can be provided above the lower lock lever 22 thus enabling to maintain a maximum height of the latch bolt cavity 6, or in other words of the keeper 15.

[0029] In order to enable to achieve a compact electric strike, the latch bolt cavity of which is moreover relatively high, the electromagnets are arranged in the illustrate embodiment in the following ways:

- The electromagnets 35, 36 are located, in the door-locking position of the keeper 15, at least partially between two planes α, β (see Figures 6 to 9) which are perpendicular to a plane χ defined by the first pivot axis 18 of the keeper 15 and by the free edge 44 of the flap portion 19 of the keeper 15 and which pass respectively through this first pivot axis 18 and through the free edge 44 of the keeper.
- The electromagnets 35, 36 are located at least partially in a geometric volume V generated by a revolution of the free edge 44 of the keeper 15 around the first pivot axis 18 of the keeper 15.
- The electromagnets 35, 36 are located at least partially in a space defined between two flat planes δ, ε which are perpendicular to the first pivot axis 18 of the keeper 15, a first one of which being tangent to an upper extremity of the flap portion 19 of the keeper 15 and a second one being tangent to a lower extremity of the flap portion 19 of the keeper 15.

[0030] For a skilled person it is clear that one of the lock levers 21 or 21 and the pertaining actuation means could be omitted. However, the use of two lock levers 21 and 22 enables to achieve a more reliable and stronger locking of the keeper 15, especially in view of the more restricted displacement of the lock levers which can be achieved by means of an electromagnet compared to a solenoid.

[0031] For changing the fail-safe arrangement illustrated in Figures 5 to 7 into a fail-secure arrangement, the upper lock lever 21 could be arranged underneath the upper electromagnet 35 and the lower lock lever 22 could be arranged above the lower electromagnet 36 (the compression springs 33, 34 remaining between the lock levers and the respective electromagnets). In this way, the electromagnets 35 and 36 have to be energised to unlock the keeper 15. A possible way of doing these changes is illustrated in Figure 13. As appears from this figure, a drawback of such an arrangement is however that, since the lock levers are now considerably closer to one another, the height of the keeper 15 or in other words of the latch bolt cavity 6 is considerably reduced.

[0032] In order to obviate this drawback, another embodiment is proposed in Figures 11 and 12. In this embodiment the lock levers 21, 22 and the electromagnets 35, 36 are in the same positions as in the embodiment illustrated in Figures 5 to 10. Consequently, the same compact construction is achieved. To achieve the fail-secure arrangement the compression springs 33, 34 are however now arranged between the lock levers 21, 22 and the frame 16 so that they urge the lock levers 21, 22 towards the respective electromagnets 35, 36. In order to enable the electromagnets 35, 36 to push the lock levers 21, 22 away instead of attracting them, the fixed cores of the electromagnets 35, 36 are each provided with a longitudinal hole 41 containing a pin 42 which is slidably mounted in this hole 41. This pin 42 extends between the lock lever 21, 22, which is situated on one side of the electromagnet 35, 36, and a plate-like element 43 which is situated on the opposite side of the electromagnet 35, 36 and which is magnetically attracted by the electromagnet. The pin 42 has such a length that when the plate-like element 43 is attracted by the electromagnet, the lock lever is push away from the electromagnet against the pressure exerted thereon by the compression spring 33, 34. In contrast to the previous embodiment, the lock levers are made in this embodiment of a material which is not attracted by the electromagnets.

[0033] An advantage of the embodiments illustrated in Figures 5 to 10 and in Figures 11 and 12 is that the fail-safe and fail-secure arrangements can easily be interchanged since only the lock levers and the electromagnets (or even only the plate-like elements) have to be changed. Notwithstanding the fact that more reliable electromagnets are used, which require a larger surface to attract the lock levers than a solenoid, and the fact that a same electric strike is suited both for right and for left turning doors, a compact construction is obtained and the latch bolt cavity can moreover be kept sufficiently high to allow for some sagging of the door.

Claims

1. An electric strike having a bolt cavity (6) arranged to receive at least one bolt (2) of a door lock (1) and comprising:

- a strike frame (16);
- a keeper (15) which comprises at least a flap portion (19) forming a side wall of the bolt cavity (6), the keeper (15) being carried by the frame (16) for pivoting about a first pivot axis (18), which is substantially vertical in the mounted state of the electric strike, between a door-locking position, wherein the flap portion (19) of the keeper (15) is arranged to withhold said bolt (2) to prevent door opening, and a door-releasing position, wherein the flap portion (19) is arranged to release the bolt (2) to allow door opening, the keeper (15) being arranged to pivot, in

a first rotational direction, from the door-locking position to the door-releasing position by a door opening force transmitted thereto by said bolt (2);

- a lock lever (21, 22) for locking the keeper (15) in said door-locking position, which lock lever (21, 22) is carried by the frame (16) for pivoting about a second pivot axis (25, 26) between a locking position and an unlocking position and is provided with a first abutment element (27, 28) arranged to co-operate, in the locking position of the lock lever (21, 22), with a second abutment element (29, 30) provided on the keeper (15), the first and second abutment elements (27 - 30) mutually engaging one another in the locking position of the lock lever, when the keeper (15) is in said door-locking position, to prevent rotation of the keeper (15) in said first rotational direction and are disengaged in the unlocking position of the lock lever (21, 22) to enable rotation of the keeper (15) in said first rotational direction; and
- means for actuating the lock lever (21, 22) comprising at least one spring means (33, 34) exerting a force onto the lock lever (21, 22) to urge it to one of said locking position and said unlocking position, and at least one electromagnet (35, 36) having a fixed core arranged to exert by magnetic attraction a counter force onto the lock lever (21, 22) to move the lock lever against the spring force to the other one of said locking position and said unlocking position,

characterised in that

the electric strike comprises further spring means (20) for returning the keeper (15) to said door-locking position upon release of the bolt (2) by the flap portion (19) of the keeper (15) when the keeper (15) has been moved by said bolt (2) to said door-releasing position;

in that said second pivot axis (25, 26) is directed in such a manner that the first abutment element (27, 28) provided on the lock lever (21, 22) moves up and down when the lock lever (21, 22) pivots between the locking and unlocking positions;

in that said second abutment element (29, 30) is provided on the flap portion (19) of the keeper (15); and

in that the lock lever (21, 22) is provided with a first cam element (37, 38) and the flap portion (19) of the keeper (15) with a second cam element (39, 40), the first and second cam elements (37 - 40) being arranged to co-operate with one another to move the lock lever (21, 22) to said unlocking position and back to said locking position upon return of the keeper (15) to the door-locking position after the lock lever (21, 22) has already been returned by said actuating means (33 - 36) to the locking position before the keeper (15) has returned to said door-locking position.

2. An electric strike according to claim 1, **characterised in that** the lock lever (21, 22) is arranged to be attracted directly by the electromagnet (35, 36) against said spring force, the electromagnet (35, 36) acting preferably on a portion of the lock lever (21, 22) situated between said second pivot axis (25, 26) and the first abutment element (27, 28) on the lock lever (21, 22).

3. An electric strike according to claim 1, **characterised in that** the fixed core of the electromagnet (35, 36) is provided with a longitudinal hole (41) containing a pin (42) which is slidably mounted in said hole (41) and which extends between the lock lever (21, 22), situated on one side of the electromagnet (35, 36), and an element (43) which is situated on the opposite side of the electromagnet (35, 36) and which is magnetically attracted by the electromagnet (35, 36).

4. An electric strike according to any one of the claims 1 to 3, **characterised in that** the flap portion (19) of the keeper (15) has an upper (31) and a lower end face (32), said second abutment element (29, 30) and said second cam element (39, 40) being both provided on the upper (31) or on the lower end face (32) of the flap portion (19) and, when the second abutment element (29) and the second cam element (39) are provided on the upper end face (31) of the flap portion (19), the electromagnet (35) is provided underneath the lock lever (21) and, when the second abutment element (30) and the second cam element (40) are provided on the lower end face (32) of the flap portion (19), the electromagnet (36) is provided above the lock lever (22).

5. An electric strike according to any one of the claims 1 to 4, **characterised in that** the second pivot axis (25, 26) extends in such a direction that a pulling force (F) is exerted onto the lock lever (21, 22) which forms an angle greater than 45°, preferably greater than 70°, with the second pivot axis (25, 26) of the lock lever (21, 22) when a door opening force is transmitted by the bolt (2) onto the flap portion (19) of the keeper (15).

6. An electric strike according to any one of the claims 1 to 5, **characterised in that** opposite said first pivot axis (18) the flap portion (19) of the keeper (15) has a free edge (44) which is substantially parallel to the first pivot axis (18), the electromagnet (35, 36) being located, in the door-locking position of the keeper (15), at least partially between two planes (α, β) which are perpendicular to a plane (χ) defined by the first pivot axis (18) and by said free edge (44) and

which pass respectively through the first pivot axis (18) and through said free edge (44).

7. An electric strike according to any one of the claims 1 to 6, **characterised in that** opposite said first pivot axis (18) the flap portion (19) of the keeper (15) has a free edge (44), the electromagnet (35, 36) being located at least partially in a geometric volume (V) generated by a revolution of said free edge (44) around the first pivot axis (18).

8. An electric strike according to any one of the claims 1 to 7, **characterised in that** the electromagnet (35, 36) is located at least partially in a space defined between two flat planes (δ, ε) which are perpendicular to said first pivot axis (18), a first one (δ) of which being tangent to an upper extremity of the flap portion (19) of the keeper (15) and a second one (ε) being tangent to a lower extremity of the flap portion (19) of the keeper (15).

9. An electric strike according to any one of the claims 1 to 8, **characterised in that** it comprises two lock levers (21, 22), two spring means (33, 34) which are each arranged for exerting a force onto a respective one of said lock levers (21, 22) to urge the lock levers to one of said locking position and said unlocking position, and two electromagnets (35, 36) which are each arranged to exert by magnetic attraction a counter force onto a respective one of said lock levers (21, 22) to move the lock levers (21, 22) against the spring force to the other one of said locking position and said unlocking position.

10. An electric strike according to claim 9, **characterised in that** the flap portion (19) of the keeper (15) has an upper extremity (31) and a lower extremity (32) which are each provided with a second abutment element (29, 30) and with a second cam element (39, 40), the first abutment element (27) and the first cam element (37) on a first one (21) of said two lock levers (21, 22) co-operating with the second abutment element (29) and with the second cam element (39) on the upper extremity (31) of the flap portion (19) and the first abutment element (28) and the first cam element (38) on a second one (22) of said two lock levers (21, 22) co-operating with the second abutment element (30) and with the second cam element (40) on the lower extremity (32) of the flap portion (19).

11. An electric strike according to claim 10, **characterised in that** a first one (35) of said two electromagnets (35, 36), which exerts a counter force on the first lock lever (21), is located underneath said first lock lever (21) and a second one (36) of said two electromagnets (35, 36), which exerts a counter force on the second lock lever (36), is located above said second lock lever (22).

12. An electric strike according to any one of the claims 1 to 11, **characterised in that** it comprises two parts (8, 9) which can be mounted onto one another, a first part (8) comprising said keeper (15) and forming together with the keeper (15) said bolt cavity (6) which is arranged to receive a latch bolt (2) of said door lock (1) and a second part (9) forming a further bolt cavity (7) which is arranged to receive a dead bolt of said door lock (1), the first part (8) being mountable in a first position and in an upside down position onto the second part (9) to enable to adjust the strike to a left and to a right turning door (5).

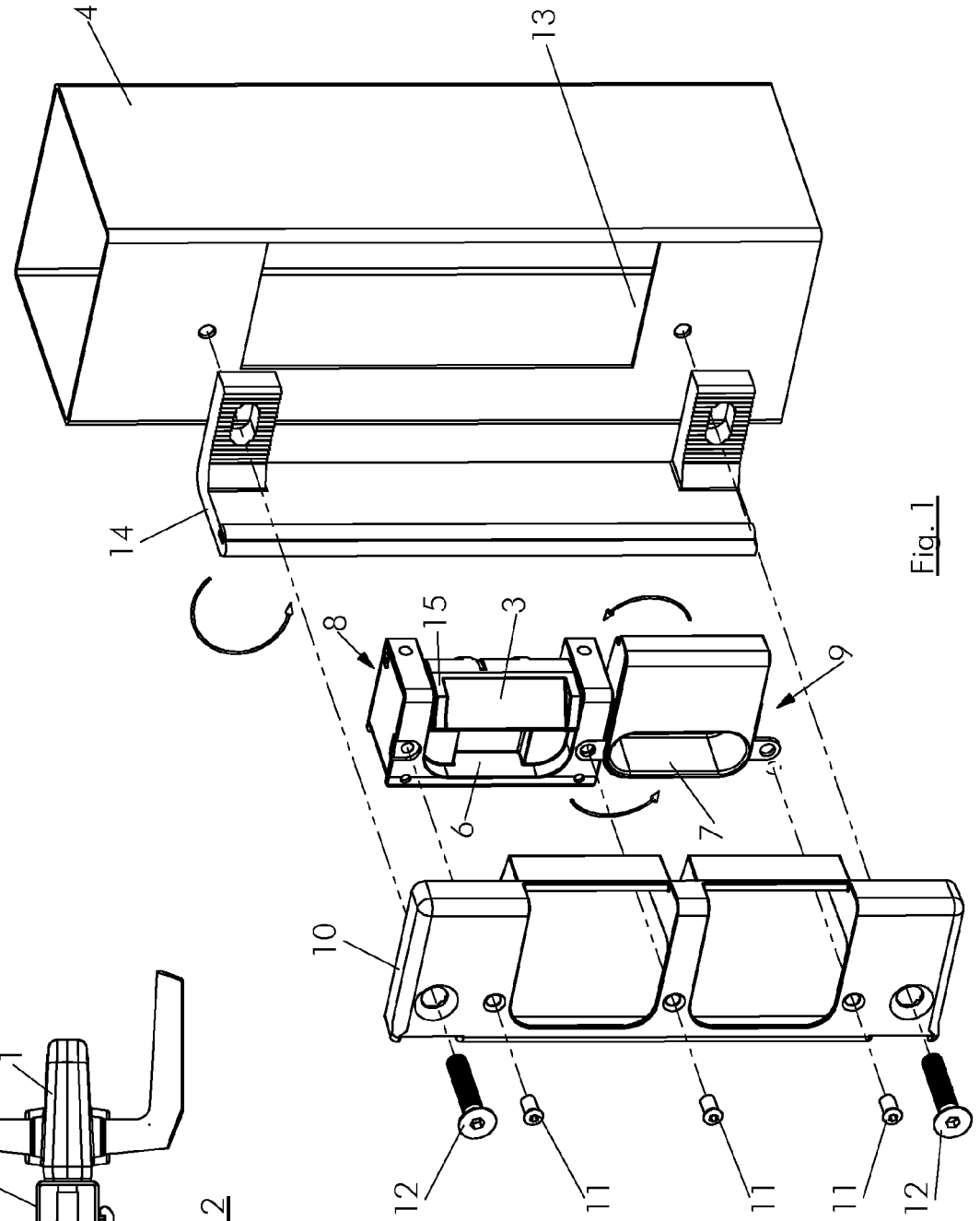

Fig. 1

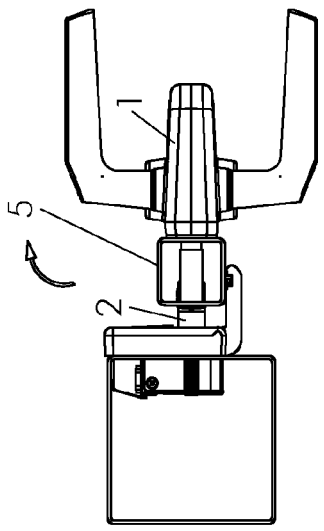

Fig. 2

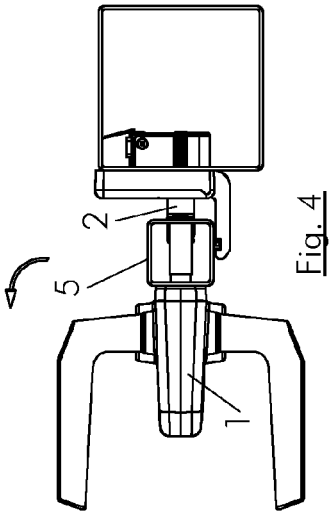

Fig. 4

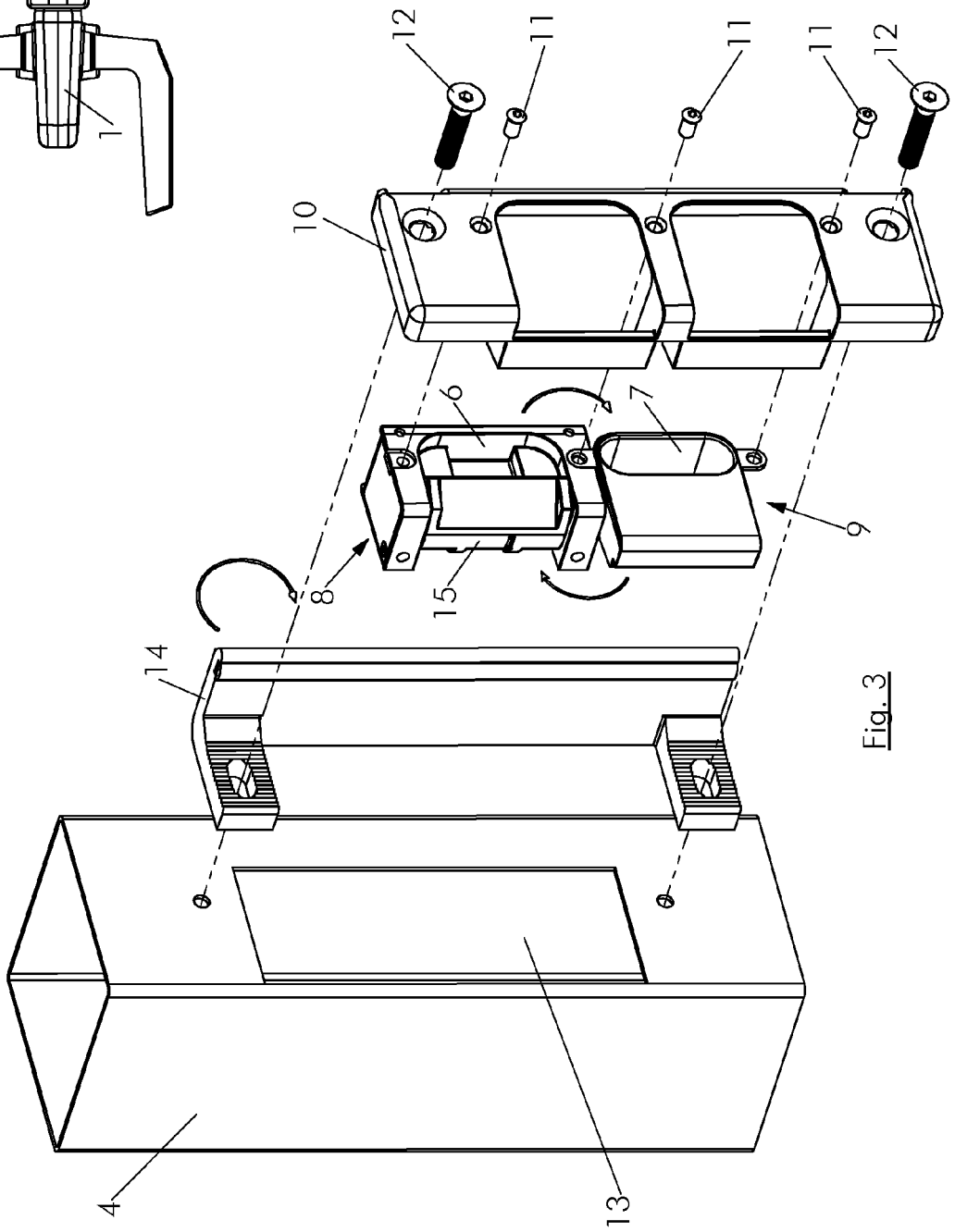

Fig. 3

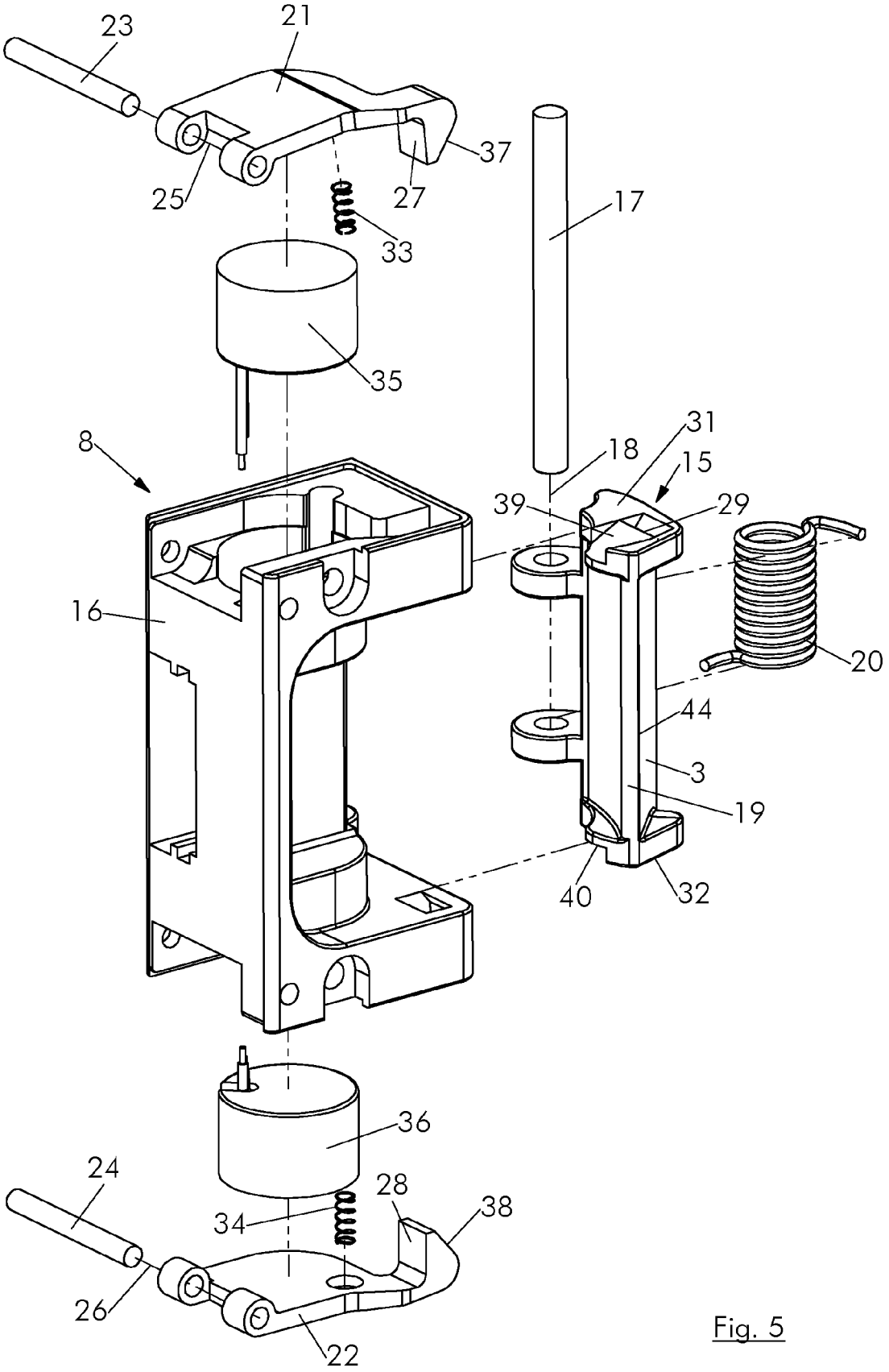
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Fig. 5

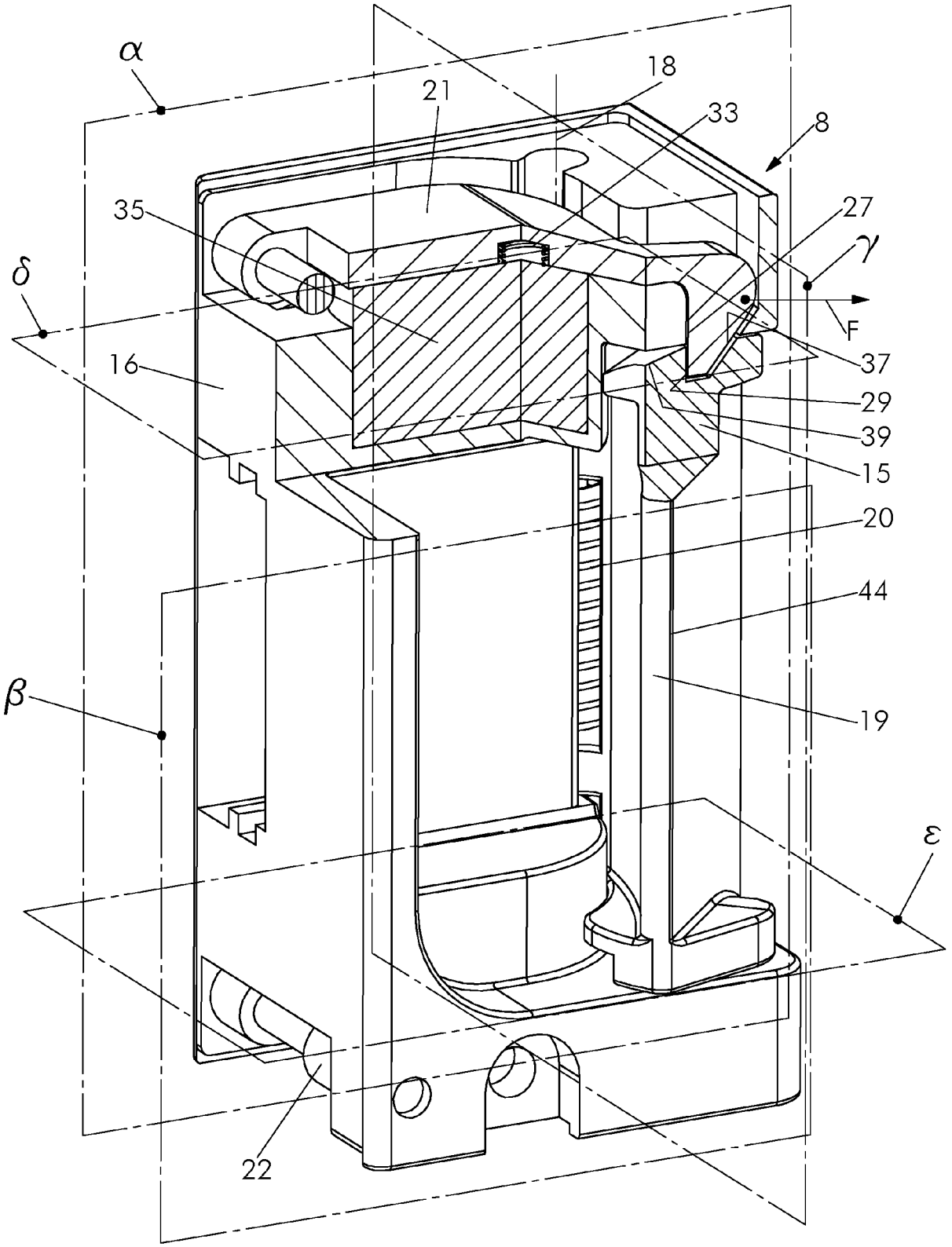

Fig. 6

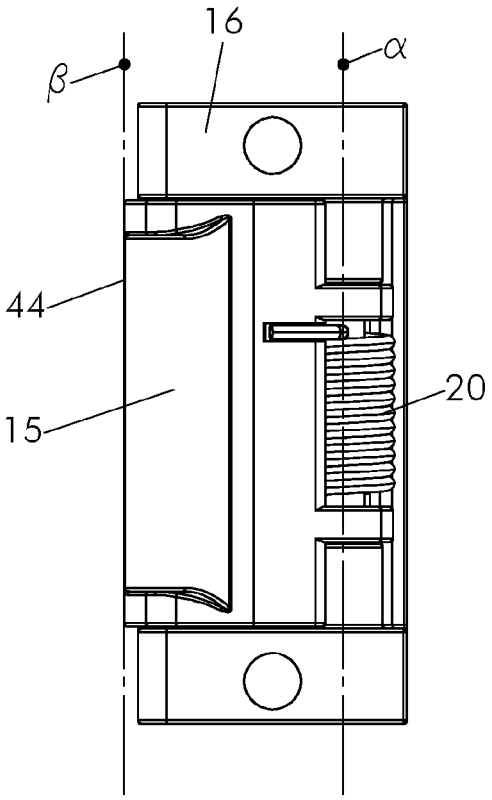

Fig. 8

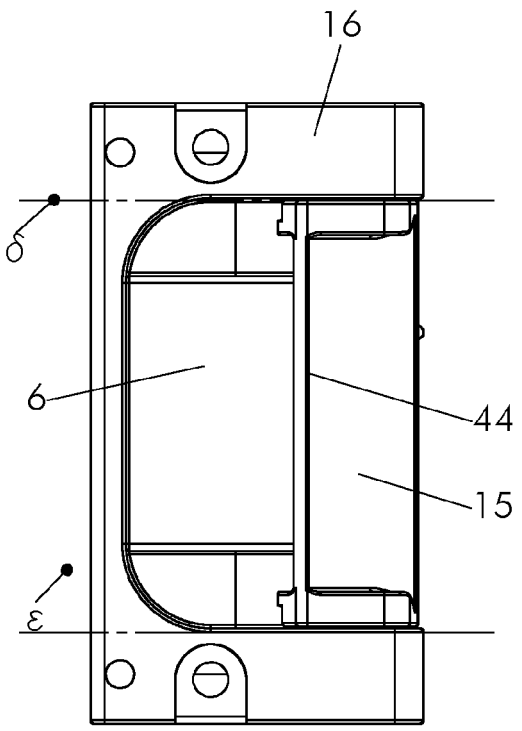

Fig. 7

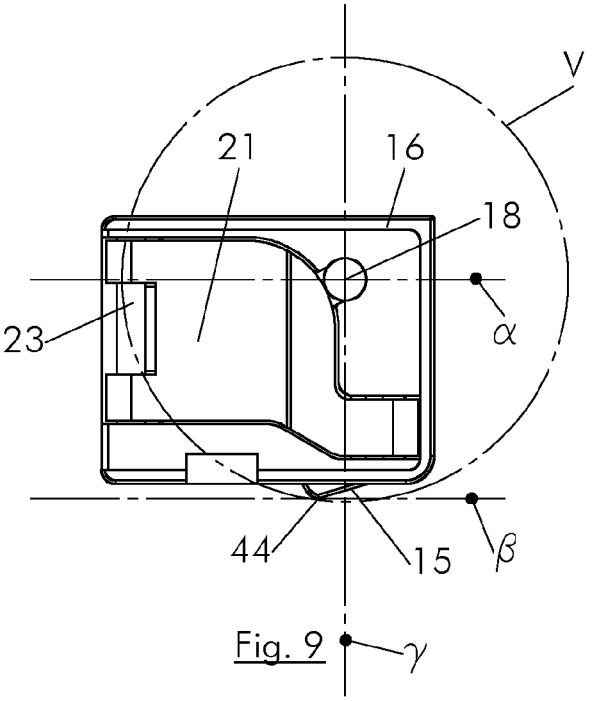

Fig. 9 γ

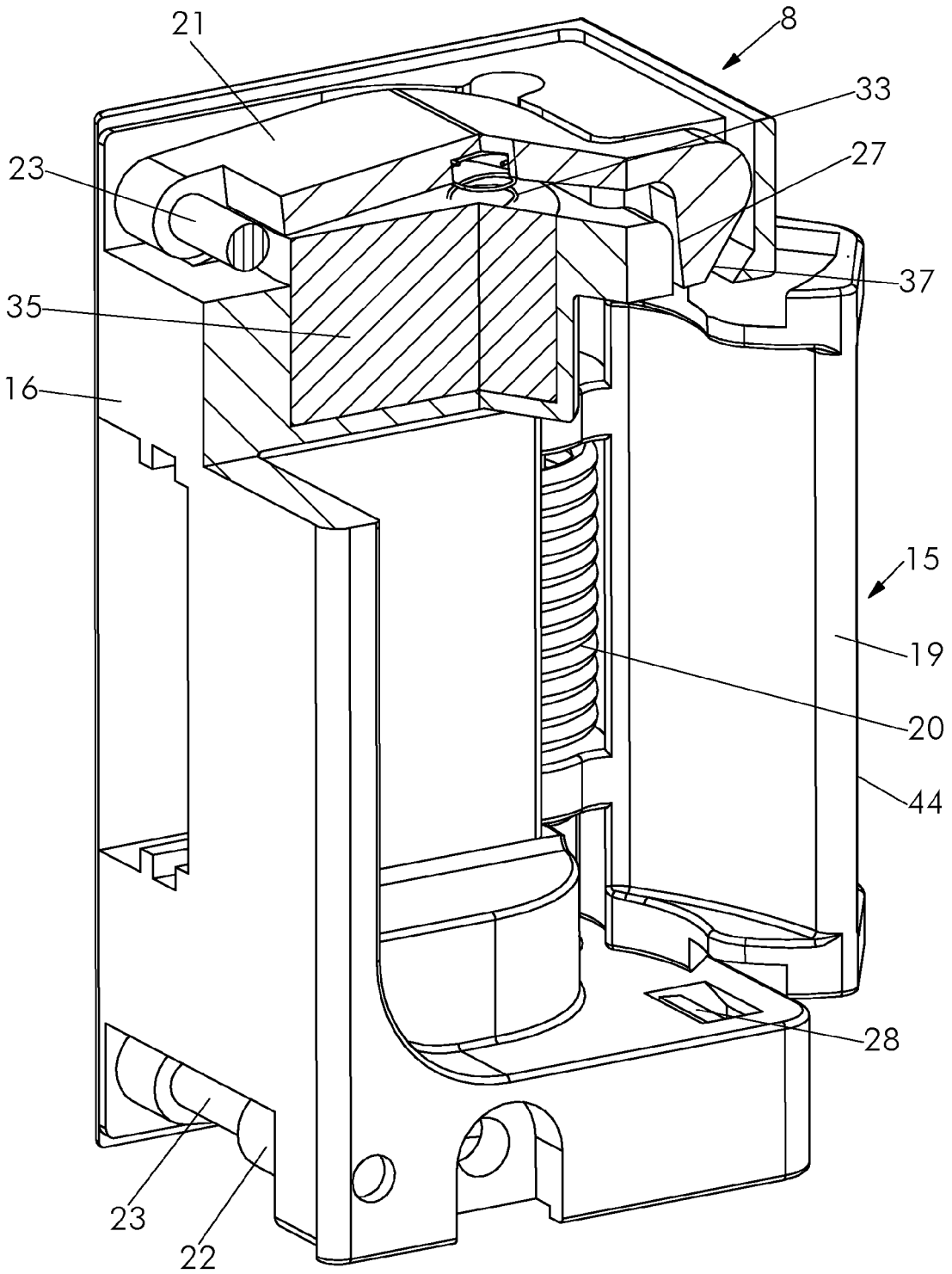

Fig. 10

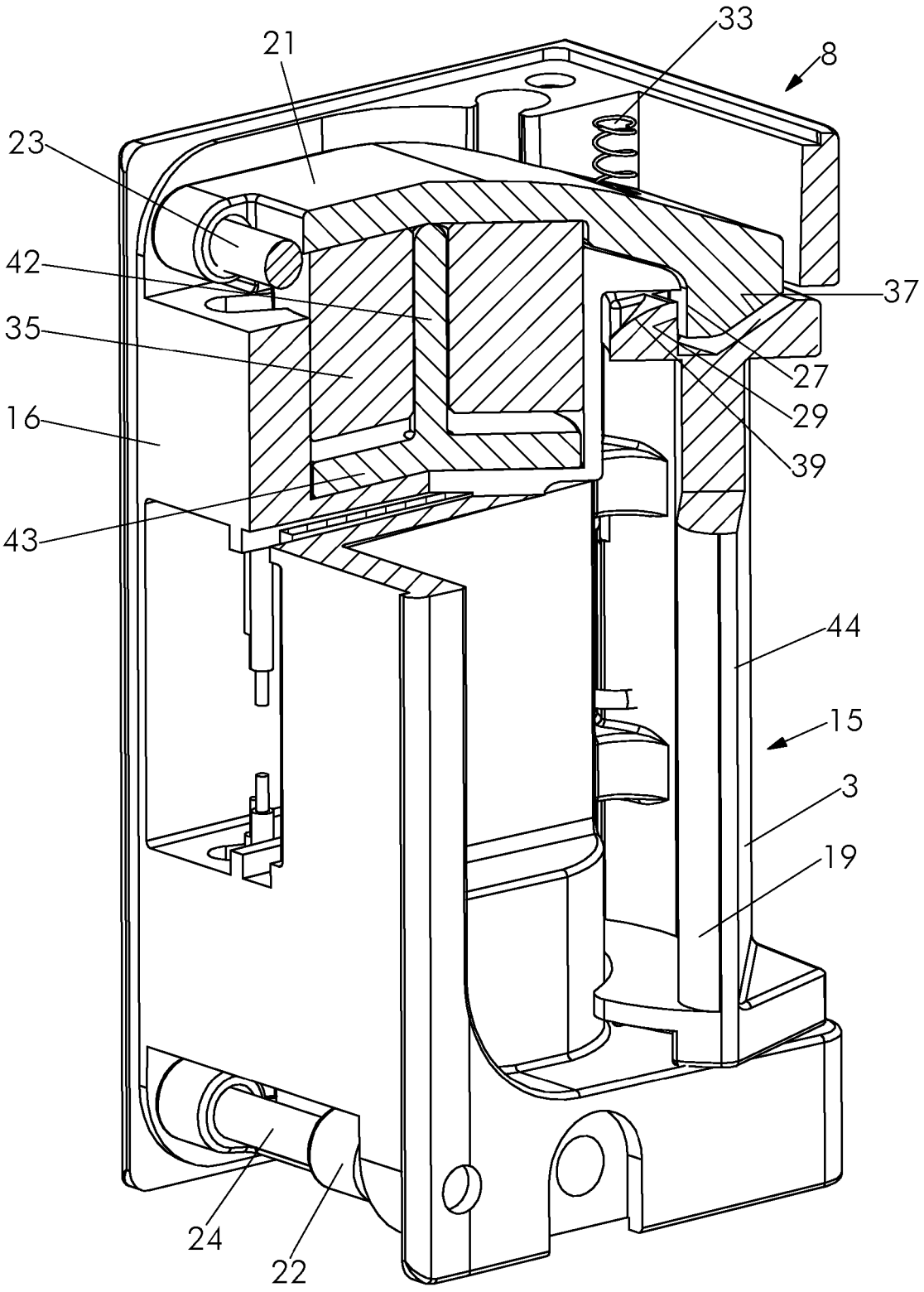

Fig. 11

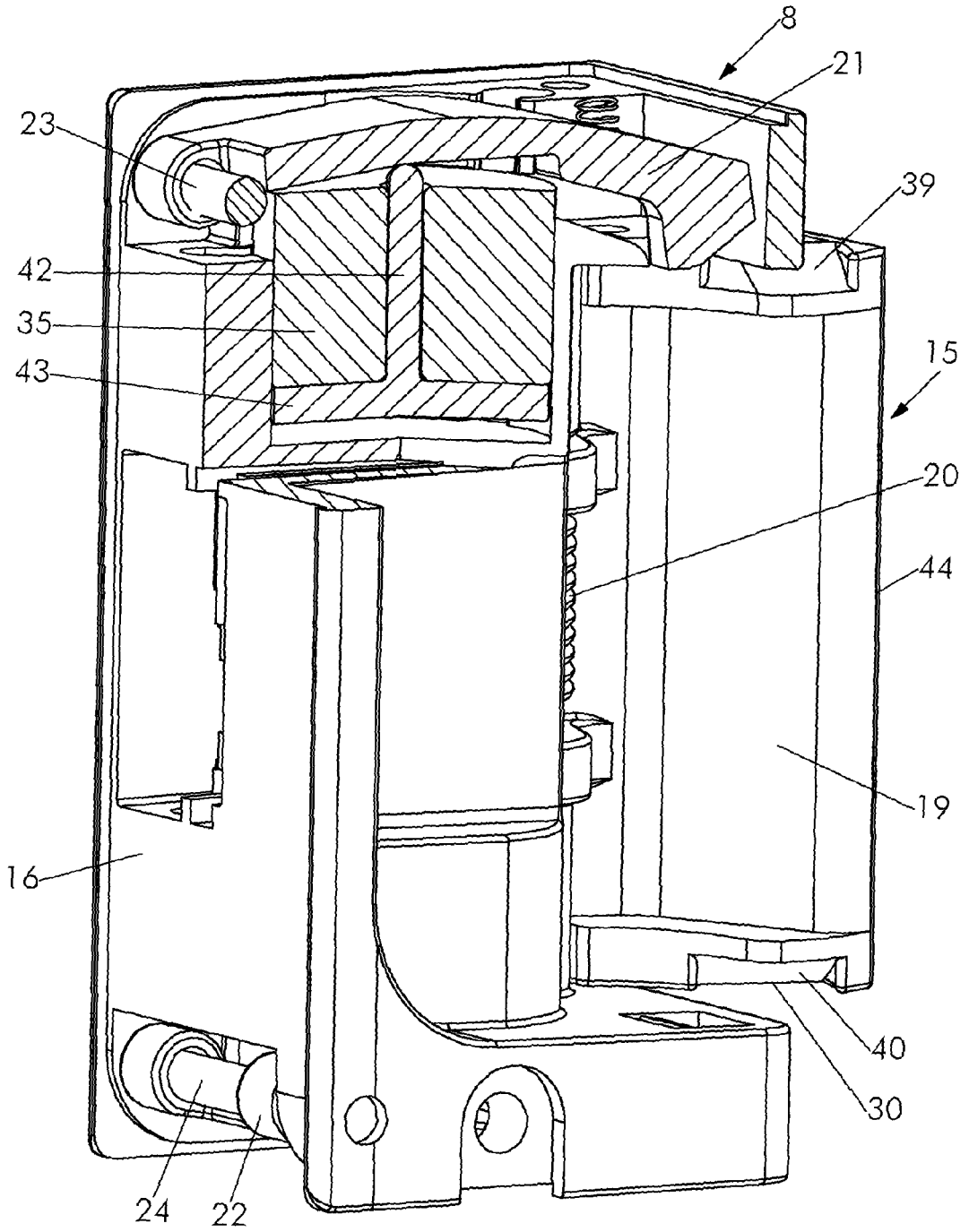

Fig. 12

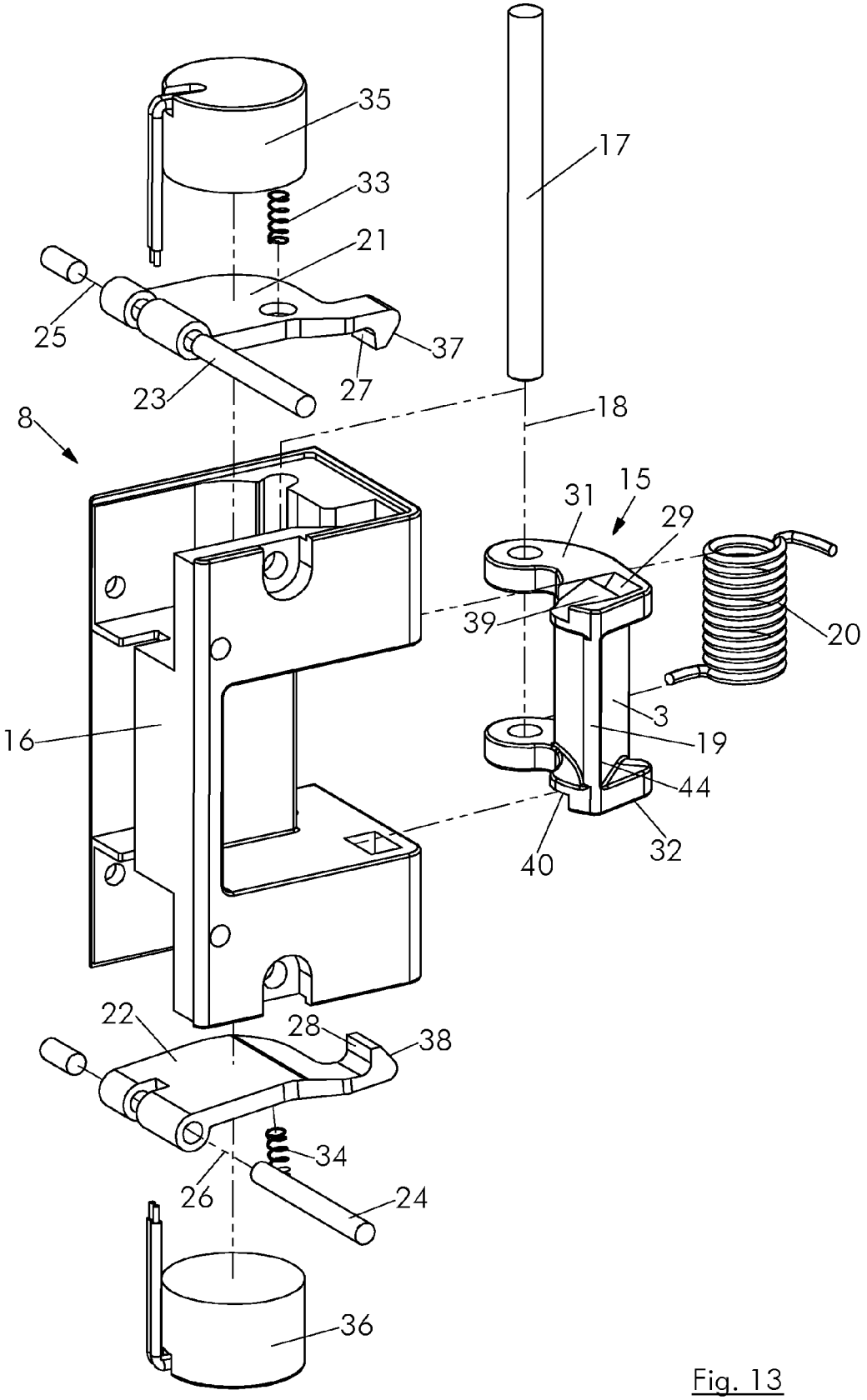
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Fig. 13

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 05 11 0894

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	24 May 2006	Van Beurden, J

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