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(54) **A retaining device, particularly for a door of a household appliance**

(57) The device (1, 4) comprises a support structure (2) secured to the door (D) and in which a hook member (3) is mounted to oscillate, and a door locking device (4) secured in the domestic electrical appliance (A) facing an opening (5) provided in this appliance (A).

The hook member (3) is mounted in the support structure (2) such that it may move in translation between a retracted position and a forward position, and may oscillate about a moving axis (12a, 12b).

When the door (D) is closed the hook member (3) engages with the retaining formation (6a) of the appliance (A), oscillates about the axis (12a, 12b) against the action of a recall spring (13), leaving the rest position but re-

maining in the retracted position, and thus enters and passes through the opening (5), and then oscillates towards the rest position and engages with the retaining formation (6a) under the action of the recall spring (13).

When the door (D) is urged to open while a locking slider (7) of the door locking device (4) is in the rest position, the hook member (3), initially retained by the retaining formation (6a), moves from the retracted position to the forward position, as a result of the relative displacement of the support structure (2), and oscillates about the axis (12a, 12b) against the action of the recall spring (13), becoming disengaged from the retaining formation (6a) and thus passing through and leaving the opening (5) of the appliance (A).

Fig. 6

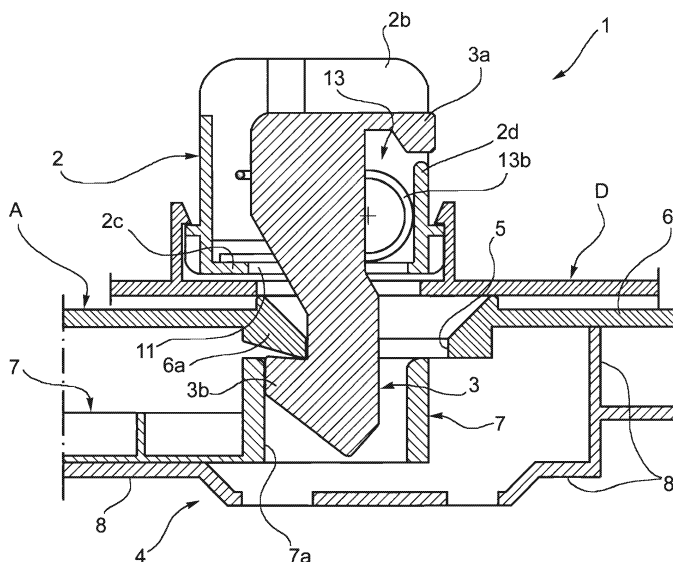
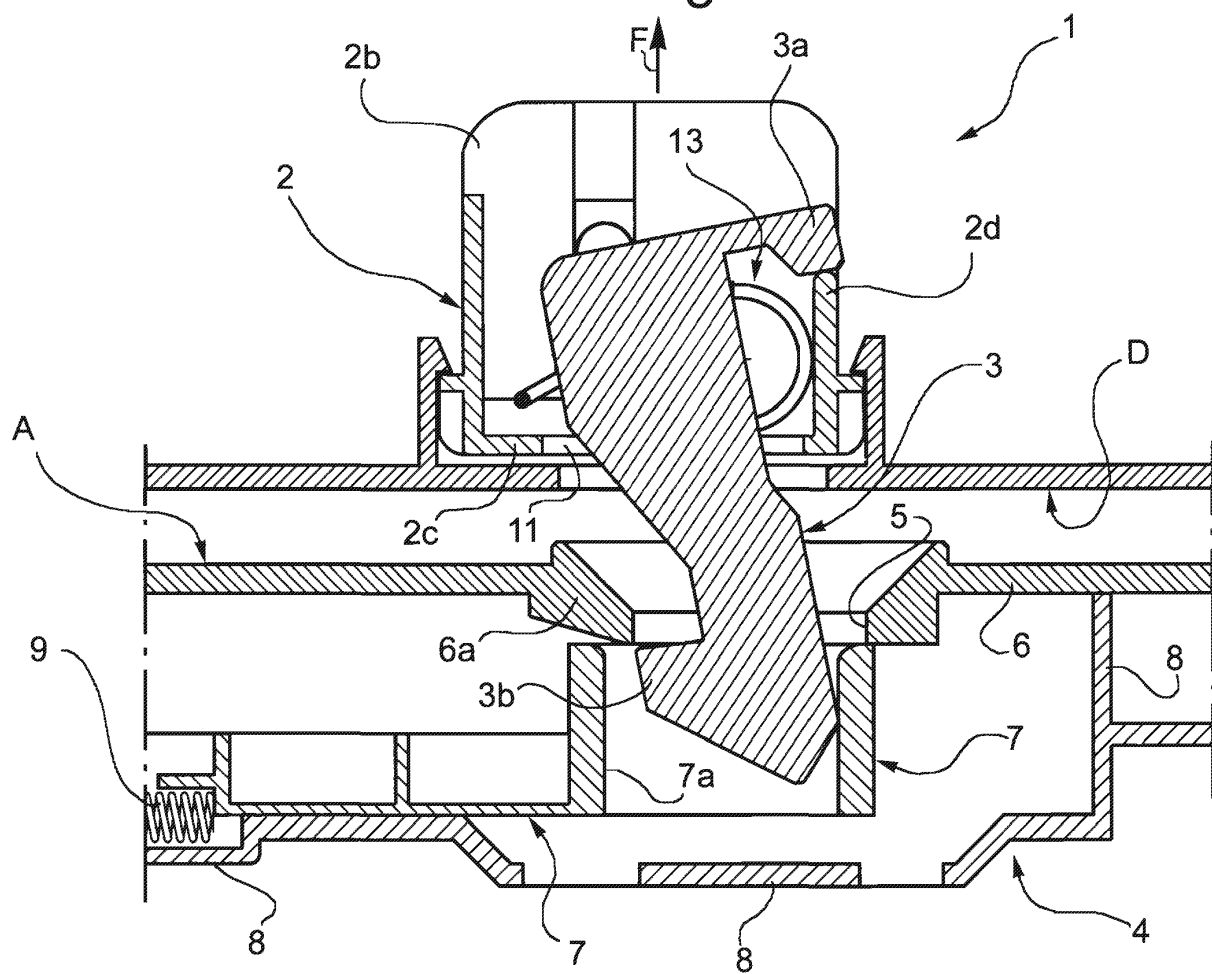


Fig. 7



Description

[0001] The present invention relates to a retaining device, in particular for a door or flap of a domestic electrical appliance, such as a washing machine.

[0002] The invention relates more particularly to a retaining device of the type comprising:

a support structure adapted to be secured to the door and in which an oscillating hook member, projecting at least partially outside this structure, is mounted and, a door locking device adapted to be secured in the domestic electrical appliance facing an opening provided in the appliance, and comprising a slider which is movable in translation and is adapted to occupy a rest position in which it enables the insertion and detachable engagement of the hook member with the retaining formation associated with said opening, so that the door is retained but not locked in the closed position, and a locked position in which the slider prevents the hook member from being disengaged from the retaining formation and locks the door in the closed position.

[0003] Retaining devices of this type are known in which it is possible to open the door by actuating an appropriate handle or grip when the door locking device is in the rest position.

[0004] An object of the present invention is to provide a retaining device of the above-described type which is adapted to enable, when the door locking device is in the rest position, the door to be pulled open, i.e. by manually exerting traction directly thereon.

[0005] These and other objects are achieved by the invention by means of a retaining device of the type described above, characterised in that the hook member is mounted in the support structure such that it is movable in translation along a guided path between a retracted position and a forward position, respectively close to and remote from the appliance, and is adapted to oscillate about a moving axis at right angles to said path, the hook member being associated with resilient recall means tending to maintain it in the retracted position and in a predetermined angular rest position, the arrangement being such that

- when the door is closed the hook member engages with the retaining formation of the appliance, oscillates about the axis against the action of the resilient recall means, leaving the rest position but remaining in the retracted position, and thus enters and passes through the opening, and then oscillates, under the action of the resilient means, towards the rest position and engages with the retaining formation; and
- when the door is urged to open while the slider of the door locking device is in the rest position, the hook member, initially retained by the retaining for-

mation, moves from the retracted position to the forward position, as a result of the relative displacement of the support structure, and oscillates about the axis against the action of the resilient recall means, becoming disengaged from the retaining formation and thus passing through and leaving the opening of the appliance.

[0006] Further characteristic features and advantages of the invention are set out in the following detailed description, given purely by way of non-limiting example, and made with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a hook device forming part of the retaining device of the present invention; Fig. 2 is an exploded perspective view of the hook device shown in Fig. 1;

Fig. 3 is a view in section along the line III-III of Fig. 1; Fig. 4 is a plan view from the top in the direction of the arrow IV of Fig. 3;

Fig. 5 is a partial view in section, showing a retaining device of the present invention in the condition where the door is open and closure is imminent;

Fig. 6 is a view similar to Fig. 5, and shows the device of the invention in the condition in which the door is closed; and

Fig. 7 shows the device of the invention during an operation to open the door by manual traction exerted directly thereon.

[0007] In the drawings, a retaining device of the invention comprises a hook device, shown overall by 1, adapted to be secured to a door D, for instance of a domestic electrical appliance such as a washing machine, as shown, for instance, in Fig. 5.

[0008] The hook device 1 comprises a support structure shown overall by 2 in which a hook member 3 projecting partially outside this structure is mounted to oscillate.

[0009] As shown in Figs. 5 to 7, the self-retaining device of the invention further comprises a door locking device, shown overall by 4 in these Figures. This door locking device 4 is of a type known per se, for instance of the type disclosed in European Patents EP 0 965 677 B1 and EP 1 276 947 B1 and in the European Patent Application EP 1 304 436 A1 in the name of the Applicant.

[0010] The door locking device 4 is secured to a domestic electrical appliance A, for instance a washing machine, so that it faces an opening 5 provided in a wall 6 of this appliance A.

[0011] In a known manner, the door locking device 4 comprises a slider 7 which may move in translation (horizontally when looking at Figs. 5 to 7) relative to a support housing 8 secured to the wall 6.

[0012] Again in a known manner, the slider 7 may occupy a rest position, shown in Fig. 5, in which one of its end openings 7a faces and is aligned with the opening

5 of the wall of the domestic electrical appliance. A helical spring 9 (Figs. 5 and 6) tends to maintain the slider 7 in this position in which, as can be seen from the sequence of Figs. 5 and 6, it enables the hook member 3 to be inserted through the opening 5 of the domestic electrical appliance A so that this hook member 3 may be engaged with a retaining formation 6a provided in the vicinity of the opening 5.

[0013] The methods of coupling and uncoupling of the hook member 3 with respect to the retaining formation 6a will be described in further detail below.

[0014] With further reference to Figs. 1 to 4 in particular, the support structure 2 of the hook device 1 is advantageously made from stamped plastics material and has respective substantially vertical eyelet slots 10a and 10b at two facing lateral ends 2a and 2b (see Fig. 2 in particular). Advantageously, the upper ends of the slots 10a and 10b have an arcuate, substantially semi-circular, profile.

[0015] The support structure 2 comprises a base wall 2c in which an opening 11 is provided, through which the hook member 3 extends (see Figs. 3 and 5-7 in particular).

[0016] In the embodiment shown, the hook member 3 has a substantially S-shaped general configuration, with an upper end arm 3a and a lower end arm 3b. The latter arm acts as a hook for engagement with the retaining formation 6a of the domestic electrical appliance A.

[0017] The end arms 3a and 3b of the hook member 3 are interconnected by an intermediate portion 3c (Figs. 2 and 3). Two opposing projecting transverse formations, shown by 12a and 12b, project from opposite sides in the upper portion of this intermediate portion 3c. These projecting formations, which, overall, form a kind of pin of the hook member 3, are engaged in the slots 10a and 10b of the support structure 2, as can be seen in Figs. 1 and 4 in particular.

[0018] As it can be seen in Figs. 2 to 4, the proximal portions of the projecting formations 12a and 12b have respective transverse lugs shown by 12c and 12d in these Figures (see Fig. 4 in particular).

[0019] The hook device 1 further comprises a double flexion spring (double pin spring) shown overall by 13 and comprising two sections or portions 13a and 13b. These sections or portions of the spring 13 are disposed on opposite sides with respect to the hook member 3 (Figs. 1 to 4) and have respective lower arms 14a and 14b (Figs. 2-4) which act on the base wall 2c of the support structure 2, and respective upper arms 15a and 15b interconnected by an intermediate arm 16. As shown in Figs. 2 to 4, the intermediate arm 16 and the upper arms 15a and 15b of the double spring 13 form, overall, a kind of U which embraces the intermediate portion 3c of the hook member 3 below the projecting formations or pins 12a and 12b and the relative lugs 12c and 12d.

[0020] The spring 13 tends, overall, to maintain the hook member 3 in the retracted position shown in Figs. 1 and 3-6, in which its projecting formations or pins 12a

and 12b are urged against the upper arcuate ends of the associated guide slots 10a and 10b of the support structure 2. The engagement of the upper arms 15a and 15b of this spring 13 with the formations 12a, 12b and the relative lugs 12c, 12d is such that, in the position shown in Figs. 1 and 3 to 6, the hook member 3 is retained in a predetermined angular rest position.

[0021] As a result of the arrangement described above, the hook member is mounted in the support structure 2 such that it may move in translation along a guided path defined by the slots 10a and 10b between the retracted position shown in Figs. 1 and 3-6 and a forward (and rotated) position shown in Fig. 7 which will be described in detail below. The hook member 3 may also oscillate about the axis of its projecting formations or pins 12a and 12b, which axis is at right angles to the translation path defined by the slots 10a, 10b and which, like the hook member 3 itself, may move along this path.

[0022] The recall spring 13 tends, overall, to maintain the hook member 3 in the retracted position of Figs. 1 and 3-6 and in the angular rest position shown in these Figures.

[0023] With reference to Figs. 1 and 3-6, it should also be noted that when the hook member 3 is in the above-mentioned retracted position and in the angular rest position illustrated therein, its upper arm 3a is spaced from the upper edge of a lateral wall 2d of the support structure 2.

[0024] The retaining device described above substantially operates as follows.

[0025] When the door D is closed, it is brought towards the wall 6 of the domestic electrical appliance A, as shown in Fig. 5. In this position, the end 3b of the hook member 3 engages with the retaining formation 6a. This engagement advantageously takes place at respective surfaces inclined with respect to the direction of closing of the door D towards the appliance, so that the hook member 3 consequently oscillates about the axis of its projecting formations or pins 12a and 12b, in a clockwise direction when looking at Fig. 5, against the action of the recall spring 13.

[0026] The hook member 3 thus enters and passes through the opening 5 of the domestic electrical appliance A and penetrates into the opening 7a of the slider 7. As soon as the end 3b of the hook member 3 passes beyond the lower edge of the retaining formation 6a of the domestic electrical appliance A, this member 3 is caused to oscillate by the recall spring 13 into its angular rest position so that its end 3b engages below the retaining formation 6a as shown in Fig. 6. Following this oscillation of the member 3, the slider 7 moves a certain distance in translation (towards the left starting from the position of Fig. 5) against the action of the spring 9.

[0027] The position shown in Fig. 6 is a stable position, in which the door D is held, but not locked, in the closed position.

[0028] In this position, it is still possible to open the door D by exerting traction on the door D to move it away

from the appliance A. When this happens, the traction applied to the door D, for instance in the direction of the arrow F of Fig. 7, initially causes a relative displacement of the door D and of the support structure 2 relative to the hook member 3 which is held by the retaining formation 6a. This relative movement is enabled by the fact that the projecting formations or pins 12a and 12b of the member 3 may slide in the respective guide slots 10a and 10b against the action of the recall spring 13.

[0029] After a certain relative displacement between the support structure 2 and the hook member 3, the wall 2d of the structure comes into abutment against the end 3a of the hook member. From this position, the subsequent displacement of the door D and the support structure 2 in practice causes the hook member 3 to oscillate (in the anticlockwise direction looking at Fig. 7) about its pin formations 12a and 12b, again against the action of the spring 13. As a result of this oscillation, the end 3b of the hook member 3 is disengaged at a certain point (Fig. 7) from the retaining formation 6a and passes through and leaves the opening 5 of the wall 6 of the appliance A enabling the door D to return to the open position.

[0030] As described above, it is therefore possible to "pull" the door D open while the slider 7 of the door locking device is in the rest position.

[0031] When, however, the slider 7 is locked in the position of Fig. 6, with the door closed, the door D can no longer be opened, as the lower end of the hook member 3 can no longer perform the oscillation needed to enable its disengagement from the retaining formation 6a.

[0032] The solution of the invention as described above enables the use of standard door locking devices, of the types currently in use.

[0033] A further advantage of the solution of the invention lies in the resilient thrust exerted by means of the spring 13 which opposes, with appropriate pre-loading, the thrust of the seal associated with the door of the domestic electrical appliance, ensuring appropriate mechanical sealing of the system.

[0034] The door may be "pulled" open by rotating the hook member, as a result of which the opening force is not affected.

[0035] The device of the invention is particularly suited to use in washing machines, of both the top-loading and front-loading types. In the case of the latter machines, the device of the invention is particularly advantageous in so-called "large door" applications in which emergency opening of the door from inside has to be possible.

[0036] Without prejudice to the principle of the invention, its embodiments and structural details may obviously be widely varied with respect to those described and illustrated without thereby departing from the scope of the invention as set out in the accompanying claims.

Claims

1. A retaining device (1, 4) particularly for a door (D) of a domestic electrical appliance (A), such as a washing machine, comprising:

a support structure (2) adapted to be secured to the door (D) and in which a hook member (3), projecting at least partially outside this structure (2), is mounted to oscillate, and, a door locking device (4) adapted to be secured in the domestic electrical appliance (A) facing an opening (5) provided in the appliance (A), and comprising a slider (7) which is movable in translation and is adapted to occupy a rest position in which it enables the insertion and detachable engagement of the hook member (3) with a retaining formation (6a) associated with said opening (5), so that the door (D) is retained but not locked in the closed position, and a locked position in which the slider (7) prevents the hook member (3) from being disengaged from the retaining formation (6a) and locks the door in the closed position,

the device being **characterised in that** the hook member (3) is mounted in the support structure (2) such that it is movable in translation along a guided path (10a, 10b) between a retracted position and a forward position, respectively close to and remote from the appliance (A), and is adapted to oscillate about a moving axis (12a, 12b) at right angles to said path (10a, 10b), the hook member (3) being associated with resilient recall means (13) tending to maintain it in the retracted position and in a predetermined angular rest position, the arrangement being such that

- when the door (D) is closed the hook member (3) engages with the retaining formation (6a) of the appliance (A), oscillates about the axis (12a, 12b) against the action of the resilient recall means (13), leaving the rest position but remaining in the retracted position, and thus enters and passes through the opening (5) and then oscillates, under the action of the resilient recall means (13), towards the rest position and engages with the retaining formation (6a), and

- when the door (D) is urged to open while the slider (7) of the door locking device (4) is in the rest position, the hook member (3), initially retained by the retaining formation (6a), moves from the retracted position to the forward position, as a result of the relative displacement of the support structure (2), and oscillates about this axis (12a, 12b) against the action of the resilient recall

means (13), becoming disengaged from the retaining formation (6a) and thus passing through and leaving the opening (5) of the appliance (A).

2. A retaining device according to claim 1, wherein the support structure (2) has a pair of facing guide slots (10a, 10b) in which projecting formations (12a, 12b) in the form of pins of the hook member (3) engage such that they may move in translation and rotate.
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3. A retaining device according to claim 2, wherein the hook member (3) has a substantially S-shaped general configuration, with a first end arm (3a) which is spaced by a stop member (2d) of the support structure (2) when the hook member (3) is in the retracted position and in the angular rest position and which may abut against the stop member (2d) after an initial relative displacement of the support structure (2) when the door (D) is urged to open, the hook member (3) further comprising a second end arm (3b) adapted to cooperate in operation with the retaining formation (6) of the domestic electrical appliance (A).
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4. A retaining device according to claim 2 or 3, wherein the resilient recall means comprise at least one flexion spring (13a, 13b) with an end arm (14a, 14b) which acts on the support structure (2) and with a further end arm (15a, 15b) which acts on the hook member (3).
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5. A retaining device according to claim 4, wherein the resilient recall means comprise a double flexion spring (13) comprising two sections or portions (13a, 13b) with respective first arms (14a, 14b) which act on the support structure (2) and respective second arms (15a, 15b) which are interconnected and which act on the hook member (3).
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6. A retaining device according to claim 4 or 5, wherein the resilient recall means (13) act on the projecting formations or pins (12a, 12b) of the hook member (3).
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7. A retaining device according to claim 6, wherein the projecting formations (12a, 12b) of the hook member (3) comprises respective transverse lugs (12c, 12d) against which the resilient recall means (13; 13a, 13b) also react.
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8. A retaining device, particularly for the door of a domestic electrical appliance, substantially as described and illustrated and for the purposes specified above.
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Fig. 1

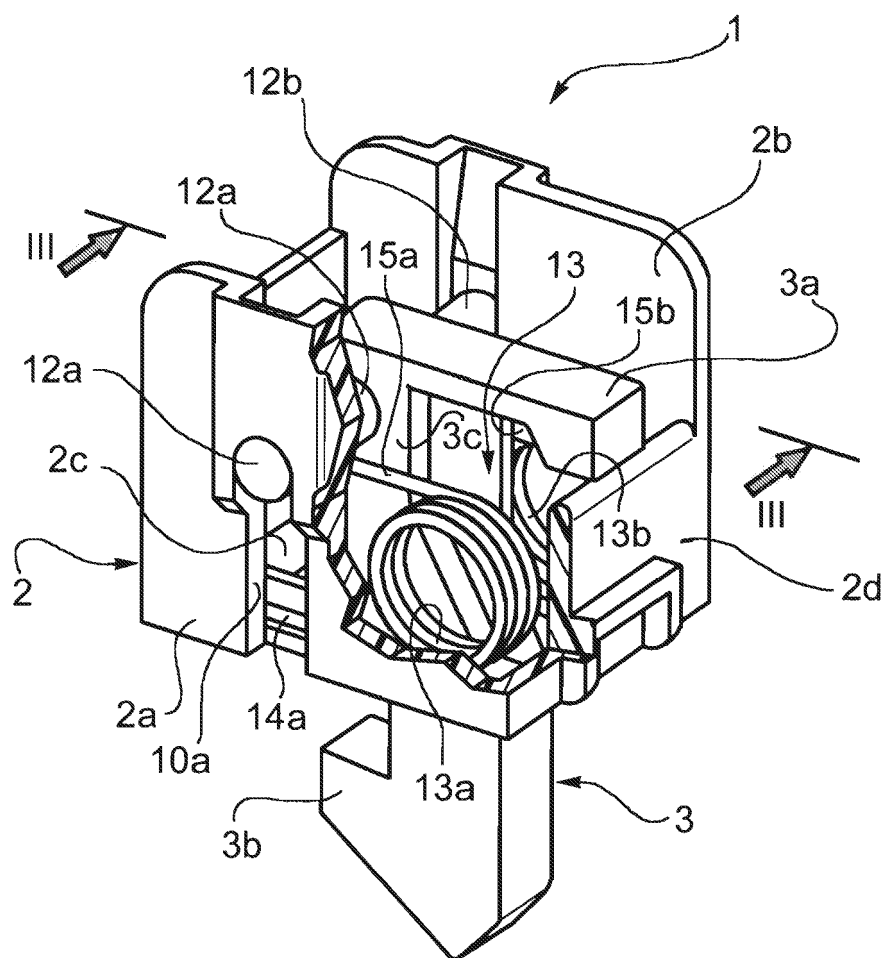


Fig. 2

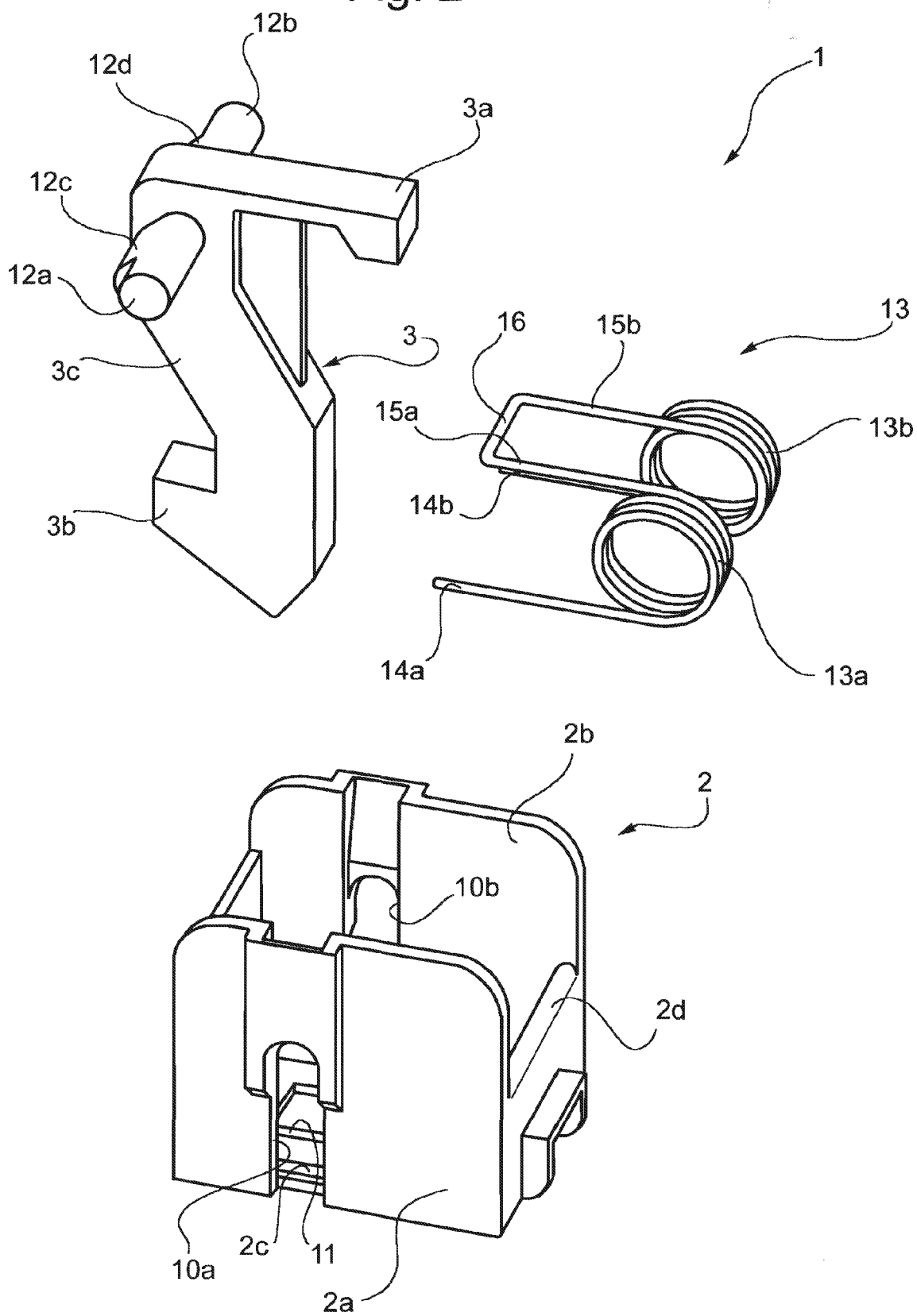


Fig. 3

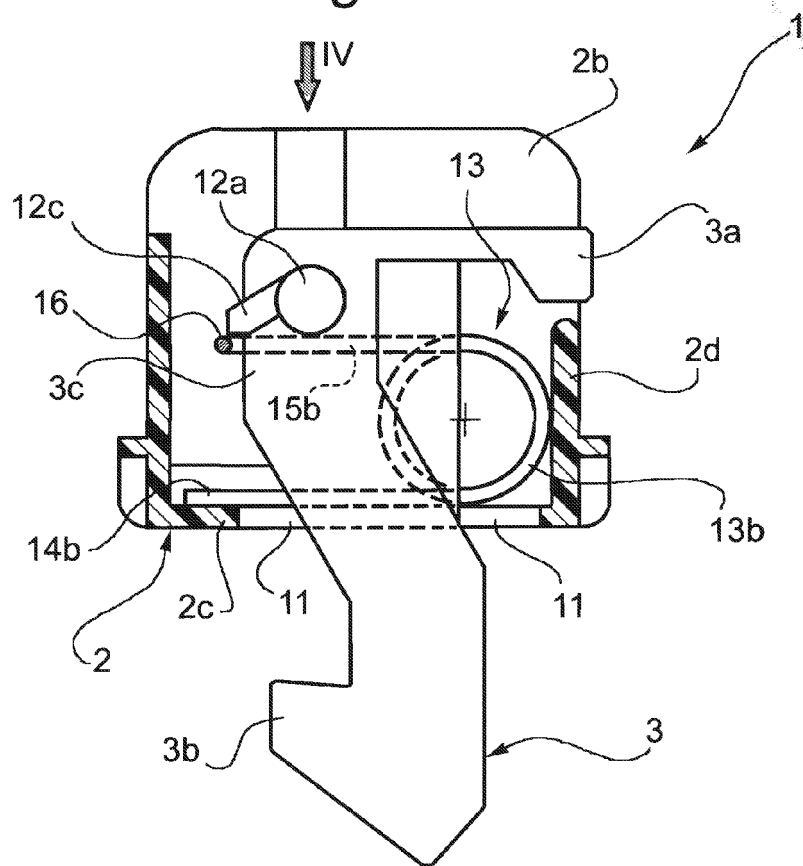


Fig. 4

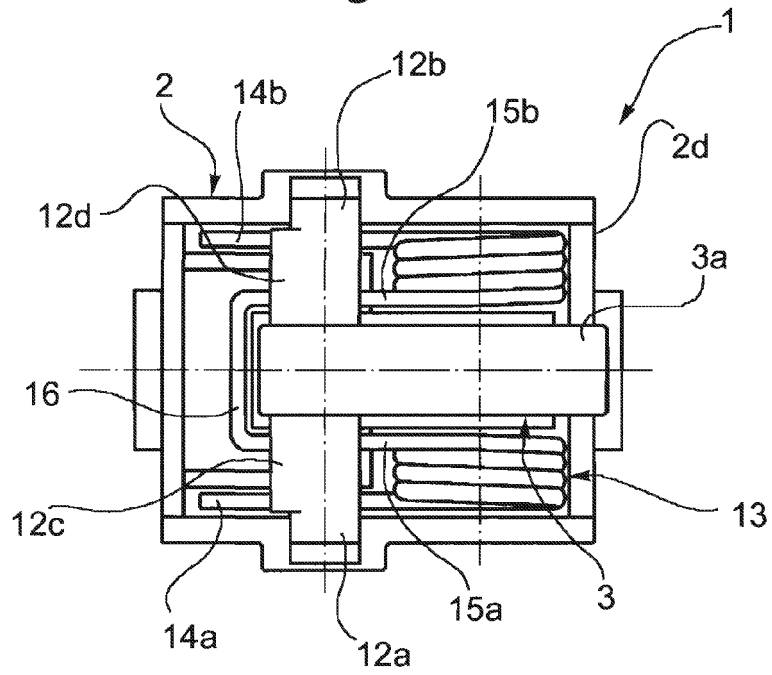
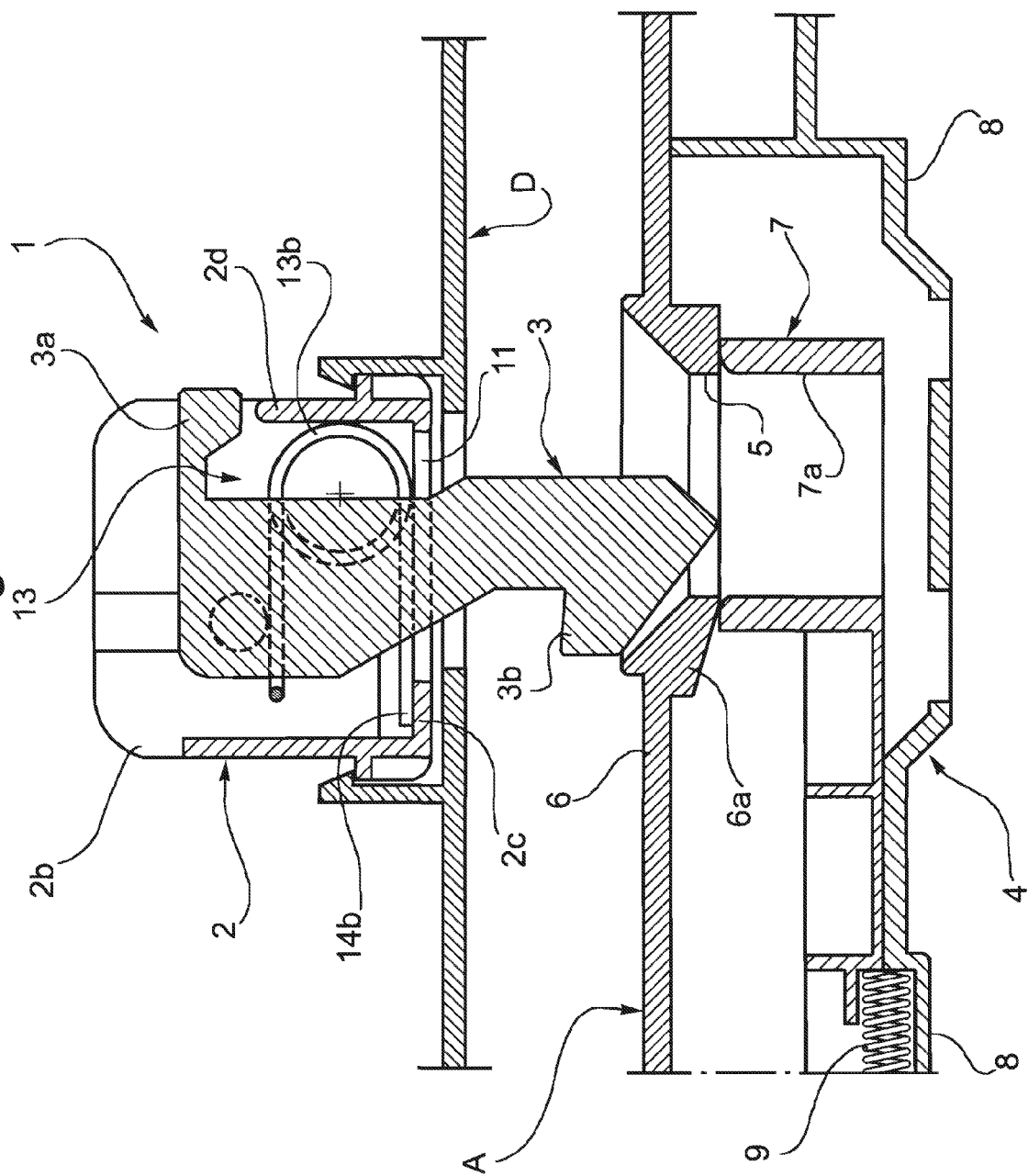
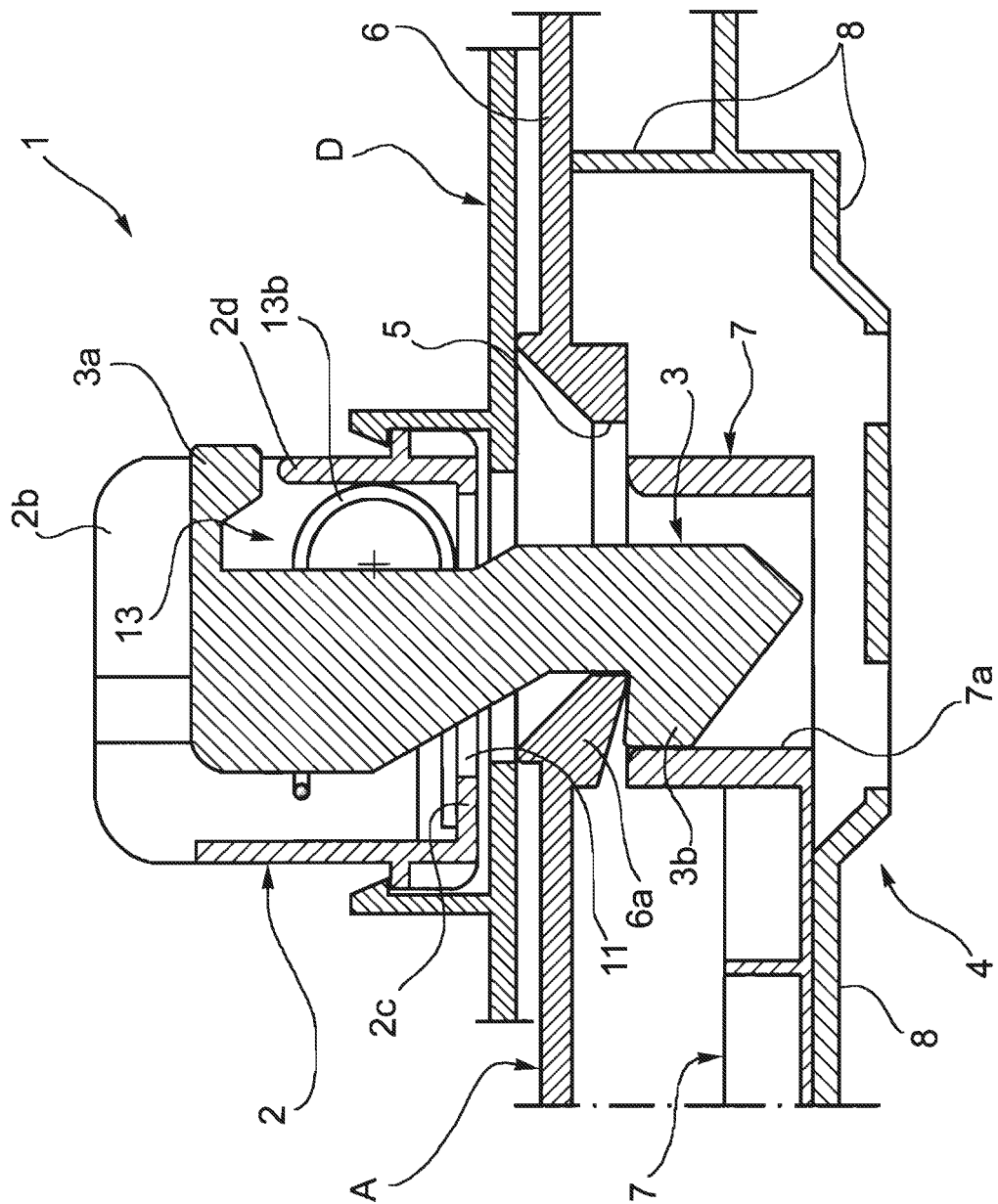
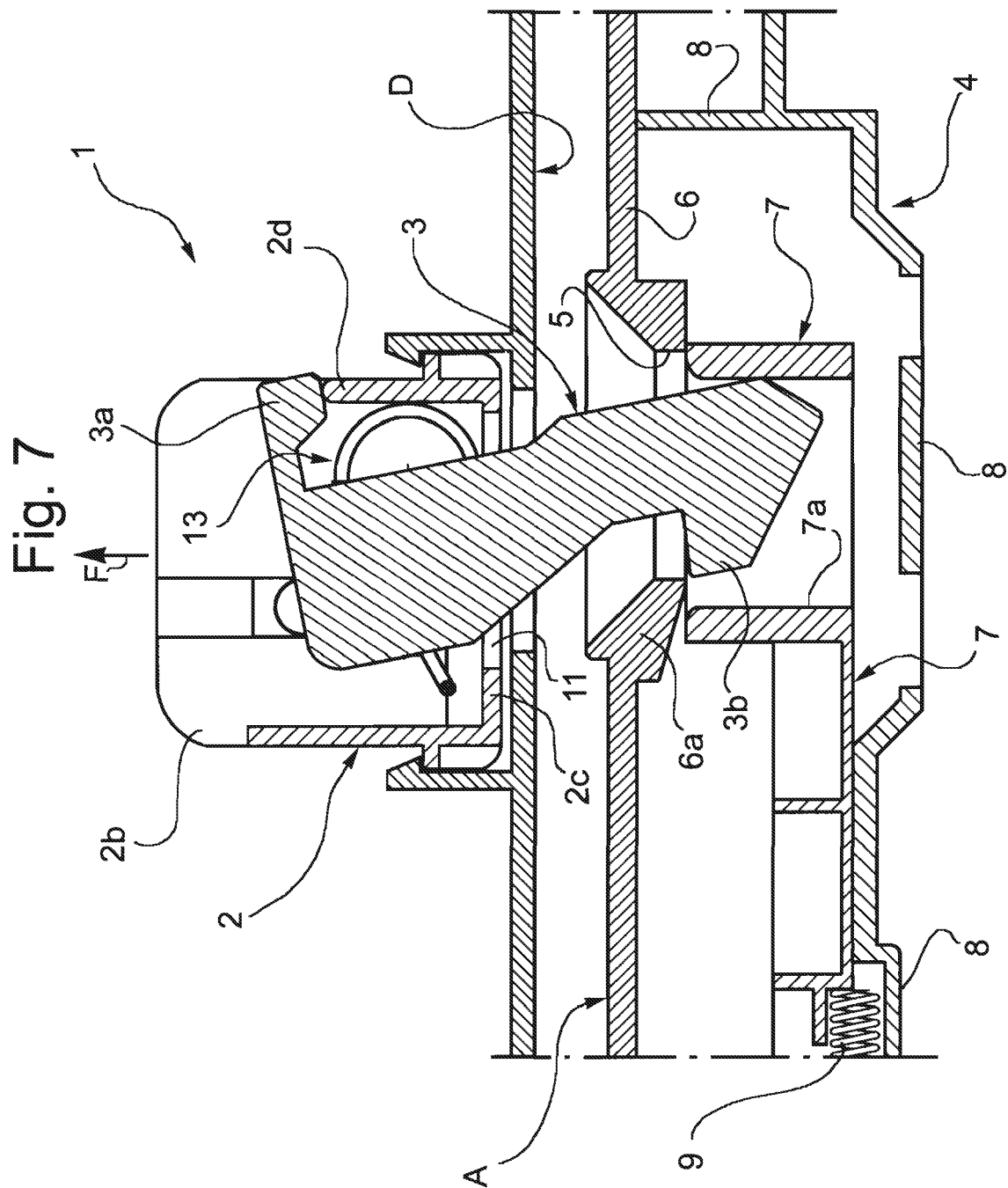


Fig. 5



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European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 06 11 6787

DOCUMENTS CONSIDERED TO BE RELEVANT			
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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Place of search		Date of completion of the search	Examiner
Munich		6 October 2006	Lodato, Alessandra
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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