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(54) **HOLD OPEN DEVICE AND DOOR ASSEMBLY**

(57) The invention is related to a hold open device (1) comprising a guide (2), a detent (3) attached to the guide (2) and a sliding element (4) arranged to slide along the guide (2). The sliding element (4) comprises an engaging element (5) and a biasing element (6) arranged to bias the engaging element (5) with a biasing force according to a first direction (d). The detent (3) comprises

a cavity (7) configured to house at least a portion of the engaging element (5) and further comprises an absorber element (8), the absorber element being configured to exert a reaction force when pressed, the reaction force being lower than the biasing force. The invention also comprises a door assembly (10) comprising such a hold open device (1).

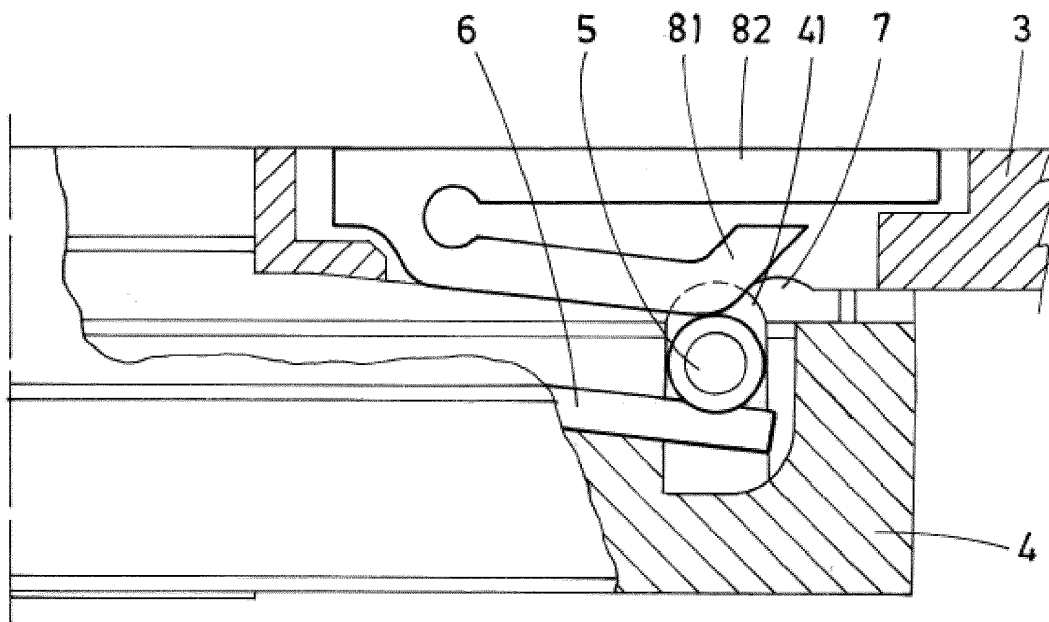


FIG.4b

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Description**TECHNICAL FIELD**

[0001] This invention is related to the field of door closing systems, e. g., those used in doors of residential or commercial buildings, and more particularly, to the devices which are in charge of providing a hold open functionality to those systems.

STATE OF THE ART

[0002] Automated door closing systems are used to make a door close automatically when it has been opened. These systems are usually based on a spring which stores energy when the door is being opened and exerts a return force to close the door.

[0003] Some extra functionalities are often provided with these door closers. The ability to keep the door open in a predetermined angle is often required by some manufacturers. This functionality is often provided by a device which retains an element which is associated with the door bar.

[0004] Document US 5,461,754 A discloses a door closer comprising a detent and a slide element. The slide element slides along a guide until contacting the detent. The detent comprises retention means to hold the slide element in position, thus holding the door open. The retention force is overcome by tugging the door.

[0005] These systems rely on cams or springs, and the tugging movement causes a sudden and often unpleasant noise, due to the disengagement of the retention element.

[0006] An alternative solution for this problem is therefore sought.

SUMMARY OF THE INVENTION

[0007] The invention provides an alternative solution for providing a hold open functionality by a hold open device according to claim 1 and a door assembly according to claim 9. Preferred embodiments of the invention are defined in dependent claims.

[0008] Unless otherwise defined, all terms (including technical and scientific terms) used herein are to be interpreted as is customary in the art. It will be further understood that terms in common usage should also be interpreted as is customary in the relevant art and not in an idealised or overly formal sense unless expressly so defined herein.

[0009] In this text, the term "comprises" and its derivations (such as "comprising", etc.) should not be understood in an excluding sense, that is, these terms should not be interpreted as excluding the possibility that what is described and defined may include further elements, steps, etc.

[0010] In a first inventive aspect, the invention provides a hold open device for a door assembly, the hold open

device comprising

a guide intended to be installed in a door frame;
a detent attached to the guide; and
a sliding element intended to receive an end of a door arm, the sliding element being arranged to slide along the guide according to a sliding direction; wherein
the sliding element comprises an engaging element and a biasing element arranged to bias the engaging element with a biasing force according to a first direction;
the detent comprises a cavity configured to house at least a portion of the engaging element and further comprises an absorber element, the absorber element being configured to exert a reaction force when pressed, the reaction force being lower than the biasing force;
the first direction is the direction to keep the engaging element in the cavity when the engaging element enters the cavity.

[0011] The sliding element is intended to slide along the guide while the door is being open or closed. When the door reaches a predetermined opening angle, the detent retains the engaging element of the sliding element in its cavity. But to make this movement smoother, the absorber element advantageously dampens the movement of the engaging element, so that it enters the cavity softly. This lessens the tugging force to get the door closed again and also the noise caused by this disengagement.

[0012] In some particular embodiments, the detent comprises a ramp configured to guide the engaging element from the guide towards the cavity.

[0013] This ramp makes the movement of reaching the cavity easier, so there is no sudden force to apply when the sliding element reaches the cavity.

[0014] In some particular embodiments, the engaging element is a pin comprising a pin axis perpendicular to the sliding direction and substantially perpendicularly to the first direction. A pin is an advantageous element to match with a cavity. A transverse pin as comprised in these embodiments provides a smooth sliding movement, may be easily biased and provides a suitable surface to be kept in the cavity. The relation between the diameter of the pin and the size of the cavity may be tuned for a finer choice of the device behaviour.

[0015] In some particular embodiments, the sliding element comprises a guide slot for the pin, the guide slot being configured to guide the pin when biased by the biasing element.

[0016] This guide slot limits the movement of the pin, so that it may not be pushed out of control by the biasing element.

[0017] In some particular embodiments, the absorber element comprises a cantilever portion attached to a fixed body, so that the reaction force is provided by the

elastic flexion of the cantilever portion.

[0018] This cantilever portion may be designed to provide a tailored reaction force, which is chosen as a function of the biasing force, also taking into account the features required by the door manufacturer.

[0019] In some particular embodiments, the cavity comprises a main slot and at least a portion of the absorber element is introduced in the main slot.

[0020] The position of at least a portion of the absorber element between two portions of the cavity improves the stability of the engaging element when introduced in the cavity.

[0021] In some particular embodiments, the absorber element comprises a spring which provides the reaction force.

[0022] This spring may be also chosen to provided the required reaction force.

[0023] In some particular embodiments, the biasing element of the sliding element is a leaf spring crossed by a bolt.

[0024] A leaf spring is a good option for this element, since it takes little room in the biasing direction, and a very fine biasing force choice is not usually required.

[0025] In a second inventive aspect, the invention provides a door assembly comprising

- a hold open device according to the first inventive aspect;
- a door frame, the guide being arranged in this door frame; and
- a door comprising a door arm which is pivotally attached to the sliding element.

[0026] The door of this door assembly may be hold open in a predetermined position and then be closed again avoiding unpleasant noises and with an easily modulated tugging force.

BRIEF LIST OF DRAWINGS AND REFERENCE NUMBERS

[0027] To complete the description and in order to provide for a better understanding of the invention, a set of drawings is provided. Said drawings form an integral part of the description and illustrate an embodiment of the invention, which should not be interpreted as restricting the scope of the invention, but just as an example of how the invention can be carried out. The drawings comprise the following figures:

Figure 1 shows a first embodiment of a door assembly according to the invention.

Figure 2 shows a detailed description of a sliding element belonging to the hold open device according to the invention.

Figure 3 shows a detailed description of a detent

belonging to the hold open device according to the invention.

Figures 4a to 4c show different stages in the movement of the elements of the hold open device according to the invention, while a door opening process is taking place.

[0028] Elements of the example embodiments are consistently denoted by the same reference numerals throughout the drawings and detailed description where appropriate:

- 1 Hold open device
- 2 Guide
- 3 Detent
- 4 Sliding element
- 41 Guide slot
- 5 Pin (engaging element)
- 6 Biasing element
- 7 Cavity
- 71 Main slot
- 8 Absorber element
- 81 Cantilever portion
- 82 Fixed body
- 9 Ramp
- 10 Door assembly
- 11 Door frame
- 12 Door
- 13 Door arm
- a Axis of the pin
- d First direction
- sd Sliding direction

DETAILED DESCRIPTION OF THE INVENTION

[0029] The example embodiments are described in sufficient detail to enable those of ordinary skill in the art to embody and implement the systems and processes herein described. It is important to understand that embodiments can be provided in many alternate forms and should not be construed as limited to the examples set forth herein.

[0030] Accordingly, while embodiment can be modified in various ways and take on various alternative forms, specific embodiments thereof are shown in the drawings and described in detail below as examples. There is no intent to limit to the particular forms disclosed. On the contrary, all modifications, equivalents, and alternatives falling within the scope of the appended claims should be included.

[0031] Figure 1 shows a first embodiment of a door assembly 10 according to the invention. This door assembly 10 comprises

- a hold open device 1;
- a door frame 11,
- a door 12 comprising a door arm 13.

[0032] The hold open device 1 is in charge of providing some hold open functionality to the door 12. To achieve this aim, the hold open device comprises, as seen in this figure, a guide 2 and a sliding element 4 which is arranged to slide along the guide 2 according to a sliding direction sd. This sliding element 4 is pivotally attached to the door arm 13 so that when the door 12 opens and closes, the door arm 13 joins a point of the door 12 with the sliding element 4. Since the position of this point changes while the door turns, and the door arm 13 has a fixed length, the sliding element 4 is forced to slide along the guide 2 to meet the boundary conditions.

[0033] The guide 2 is arranged in the door frame 11 to keep the hold open device 1 as concealed as possible.

[0034] The hold open device also comprises a detent 3 which is attached to the guide 2 and provides a stable position for the sliding element 4 corresponding to a predetermined opening angle of the door 12. When the sliding element 4 reaches the detent 3, it may be kept in this position if the door is set free.

[0035] Figure 2 shows a detailed description of a sliding element 4 belonging to the hold open device 1 seen in the previous figure.

[0036] This sliding element 4 comprises a pin 5 and a biasing element 6, which in this case comprises a leaf spring crossed by a bolt. This biasing element 6 is arranged to bias the pin 5 with a biasing force according to a first direction d.

[0037] The pin 5 comprises a pin axis a which is perpendicular to the sliding direction sd and substantially perpendicularly to the first direction d. It is thus arranged transversally to the sliding direction.

[0038] The sliding element 4 comprises a guide slot 41 for the pin 5, thus providing a vertical guidance for the pin 5, so that it may move along the guide slot 41 when is biased by the biasing element 6.

[0039] When the sliding element 4 moves along the guide (which is not represented in this figure), the biasing element 6 pushes the pin 5 upwards, so that the pin slides in contact with the upper wall of the guide.

[0040] Figure 3 shows a detailed description of a detent 3 belonging to the hold open device 1 seen in figure 1.

[0041] This detent 3 comprises a cavity 7, an absorber element 8 and a ramp 9.

[0042] The cavity 7 is configured to house at least a portion of the pin. When the sliding element approaches the detent 3, the pin first encounters the ramp 9. This ramp 9 is intended to guide the pin towards the cavity 7.

[0043] The absorber element 8 comprises a cantilever portion 81 attached to a fixed body 82. The cantilever portion 81 is introduced inside a main slot 71 in the middle of the cavity 7, and stands out from this main slot 71. As a consequence, the cantilever portion 81 is arranged to receive the pin 5 when it arrives at the cavity 7.

[0044] Figures 4a to 4c show different stages in the movement of the elements of the hold open device according to the invention, while a door opening process is taking place.

[0045] Figure 4a shows a first stage in this process. The sliding element 4 slides along the guide 2 and approaches the ramp 9. The biasing element 6 will bias the pin 5 against the ramp 9.

[0046] Figure 4b shows the next stage in this process. The sliding element continues towards the cavity 7, but the cantilever portion 81 of the absorber element receives the pin 5 first. The biasing element 6 biases the pin 5 against the cantilever portion 81 of the absorber element. This biasing force flexes the cantilever portion 81, so that the absorber element provides a reaction force in a direction opposite to the biasing force. This softens the movement of the pin 5, avoiding sudden noises.

[0047] Figure 4c shows a final stage in this process. While the sliding element is approaching the final position in the cavity, the cantilever portion 81 flexes and allows the pin 5 to be housed in its final position inside the cavity. The pin 5 is then installed in the hold open position, and is kept in this position by the biasing force, which biases the pin 5 towards the stable position in the cavity, but it has arrived there without sudden or unpleasant noises. The tugging will be performed in a similar sense. The reaction force of the cantilever portion 81 of the absorber will help a smooth transition for the pin 5 just after exiting the cavity, so that the process of closing the door does not comprise any sudden or unpleasant noises.

Claims

1. Hold open device (1) for a door assembly (10), the hold open device (1) comprising
 - a guide (2) intended to be installed in a door frame (11);
 - a detent (3) attached to the guide (2); and
 - a sliding element (4) intended to receive an end of a door arm, the sliding element (4) being arranged to slide along the guide (2) according to a sliding direction (sd); wherein
 - the sliding element (4) comprises an engaging element (5) and a biasing element (6) arranged to bias the engaging element (5) with a biasing force according to a first direction (d);
 - the detent (3) comprises a cavity (7) configured to house at least a portion of the engaging element (5) and further comprises an absorber element (8), the absorber element being configured to exert a reaction force when pressed, the reaction force being lower than the biasing force;
 - the first direction (d) is the direction to keep the engaging element (5) in the cavity (7) when the engaging element enters the cavity.
2. Hold open device (1) according to claim 1, wherein the detent (3) comprises a ramp (9) configured to guide the engaging element (5) from the guide (2) towards the cavity (7).

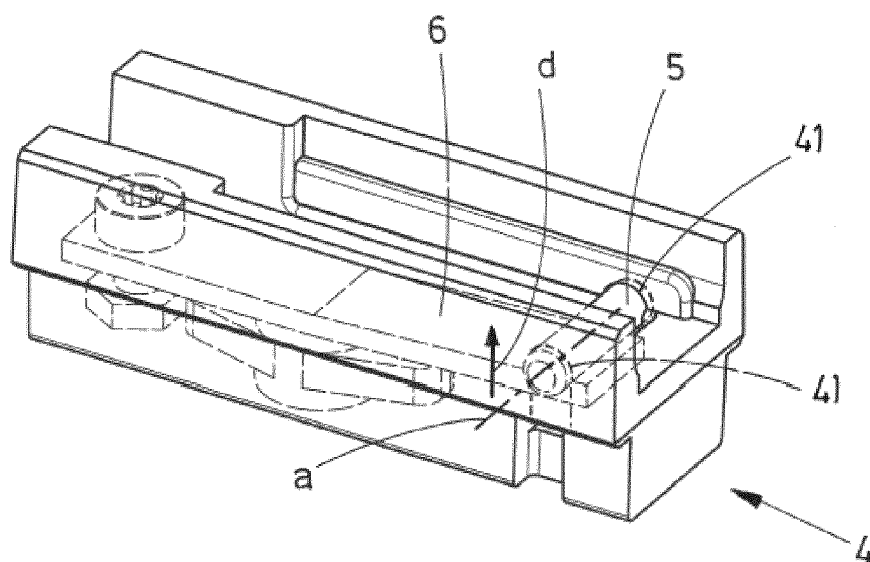
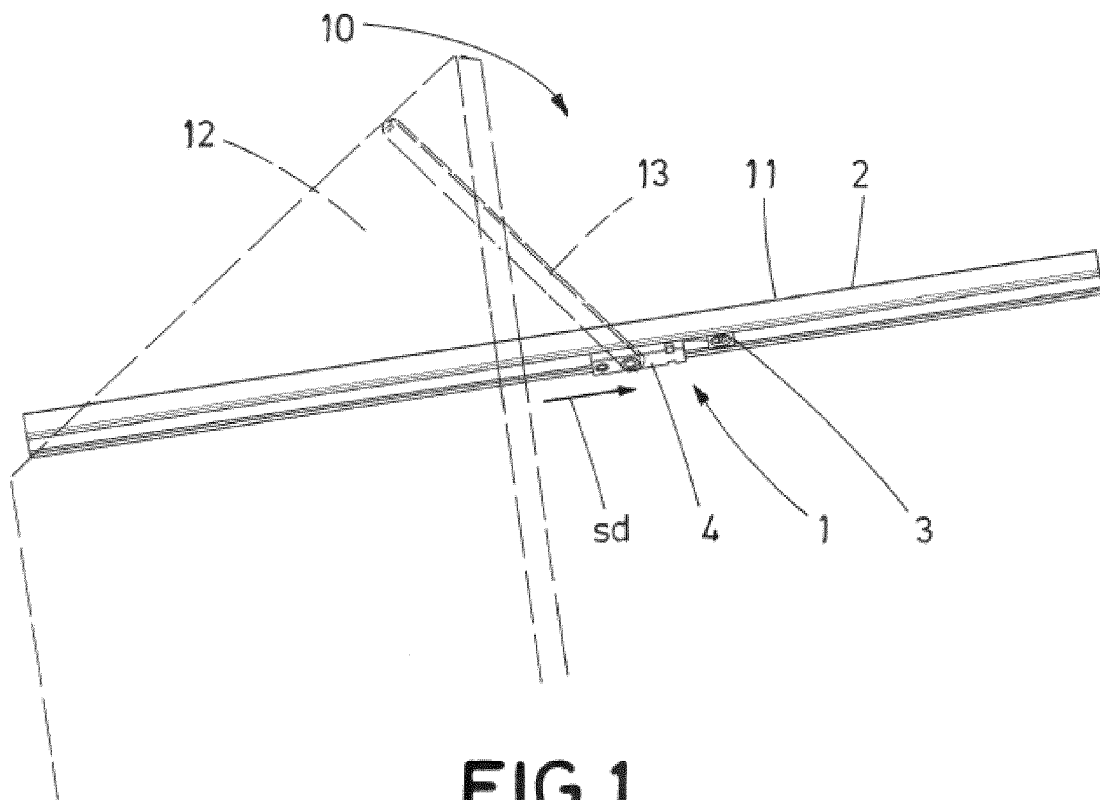
3. Hold open device (1) according to any of the preceding claims, wherein the engaging element (5) is a pin comprising a pin axis (a) perpendicular to the sliding direction (sd) and substantially perpendicularly to the first direction (d). 5
4. Hold open device (1) according to claim 3, wherein the sliding element (4) comprises a guide slot (41) for the pin, the guide slot (41) being configured to guide the pin (5) when biased by the biasing element (6). 10
5. Hold open device (1) according to any of the preceding claims, wherein the absorber element (8) comprises a cantilever portion (81) attached to a fixed body (82), so that the reaction force is provided by the elastic flexion of the cantilever portion (81). 15
6. Hold open device (1) according to any of the preceding claims, wherein the cavity (7) comprises a main slot (71) and at least a portion of the absorber element (8) is introduced in the main slot (71). 20
7. Hold open device (1) according to any of the preceding claims, wherein the absorber element (8) comprises a spring which provides the reaction force. 25
8. Hold open device (1) according to any of the preceding claims, wherein the biasing element (6) of the sliding element (4) is a leaf spring crossed by a bolt. 30
9. Door assembly (10) comprising
 - a hold open device (1) according to any of the preceding claims; 35
 - a door frame (11), the guide (2) being arranged in this door frame (11)
 - a door (12) comprising a door arm (13) which is pivotally attached to the sliding element (4). 40

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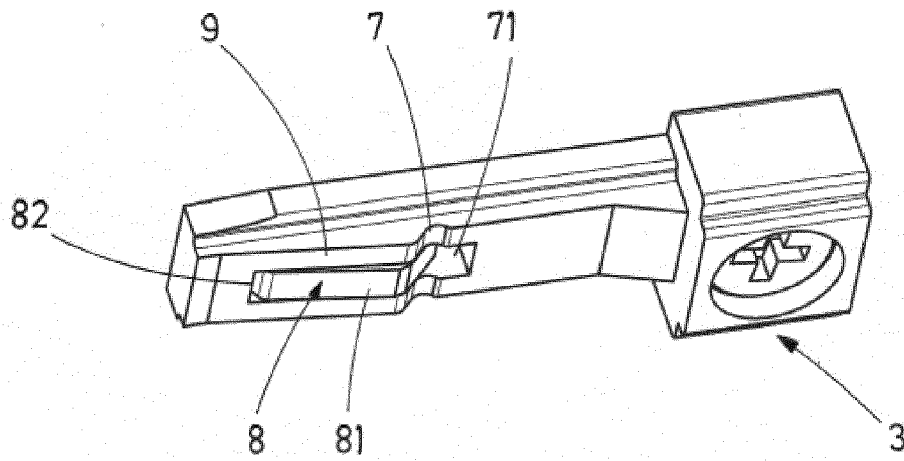


FIG.3

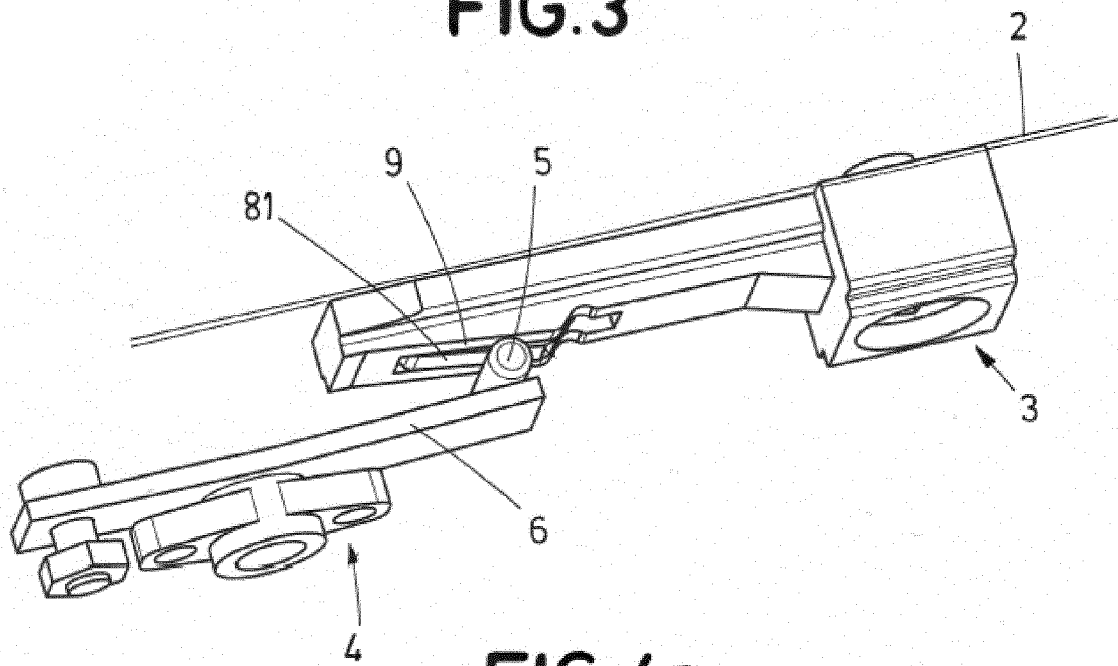


FIG.4a

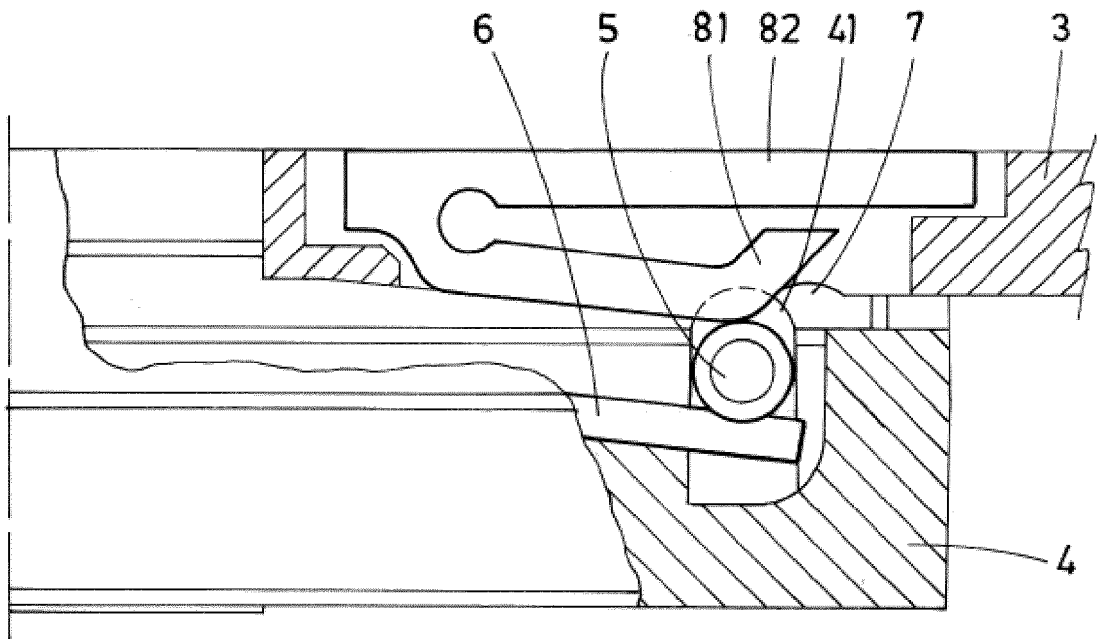


FIG.4b

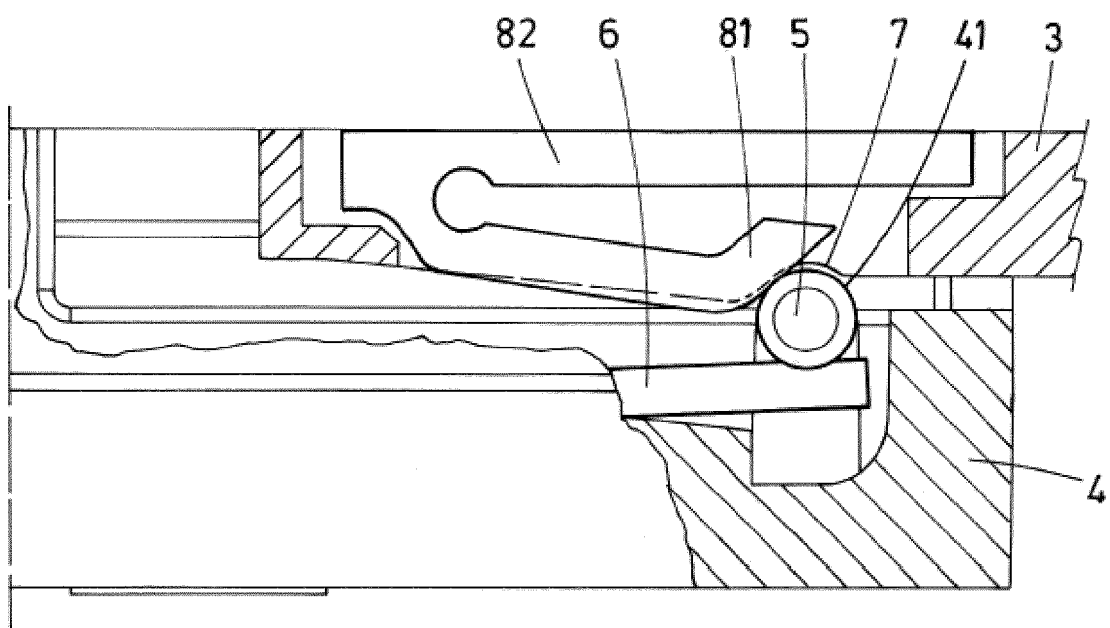


FIG.4c



EUROPEAN SEARCH REPORT

 Application Number
 EP 19 17 4481

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	US 5 446 944 A (COLEMAN MICHAEL D [US] ET AL) 5 September 1995 (1995-09-05) * column 2, line 25 - column 4, line 13 * * figures 1-7 * -----	1-4,6-9	
A	DE 10 2012 104852 A1 (DORMA GMBH & CO KG [DE]) 5 December 2013 (2013-12-05) * paragraph [0026] - paragraph [0039] * * figures 1-5 * -----	5	
A	JP H05 515 U (TOPRE CO., LTD.) 8 January 1993 (1993-01-08) * paragraph [0012] - paragraph [0020] * * figures 1-10 * -----	1-9	
			TECHNICAL FIELDS SEARCHED (IPC)
			E05C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 22 November 2019	Examiner Antonov, Ventseslav
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

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

EP 19 17 4481

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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22-11-2019

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REFERENCES CITED IN THE DESCRIPTION

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