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(54) DOOR CLOSER ASSEMBLY

(57) This invention is related to a door closer assembly comprising a spring (1), an abutment element (2), a first cam element (3) and a first rod (5). The abutment element (2) is arranged to compress or release the spring (1), the abutment element (2) comprising a plate portion (21) arranged in contact with the spring (1) and a protruding portion (22) which protrudes from the plate portion (21) and comprises a slot (23). The first cam element (3) arranged to rotate around a rotation axis, the first cam element (3) comprising a pin (4) which protrudes from the first cam element (3) according to a protruding axis which is parallel to the rotation axis, the pin (4) being inserted inside the slot (23), the first cam element (3) having a partially circular profile. The first rod (5) solidly attached to the first cam element (3), arranged to rotate coaxially with the first cam element (3), the first rod (5) being intended to be attached to a bar (6) which transmits a swinging movement of an opening and closing door to the door closer assembly.

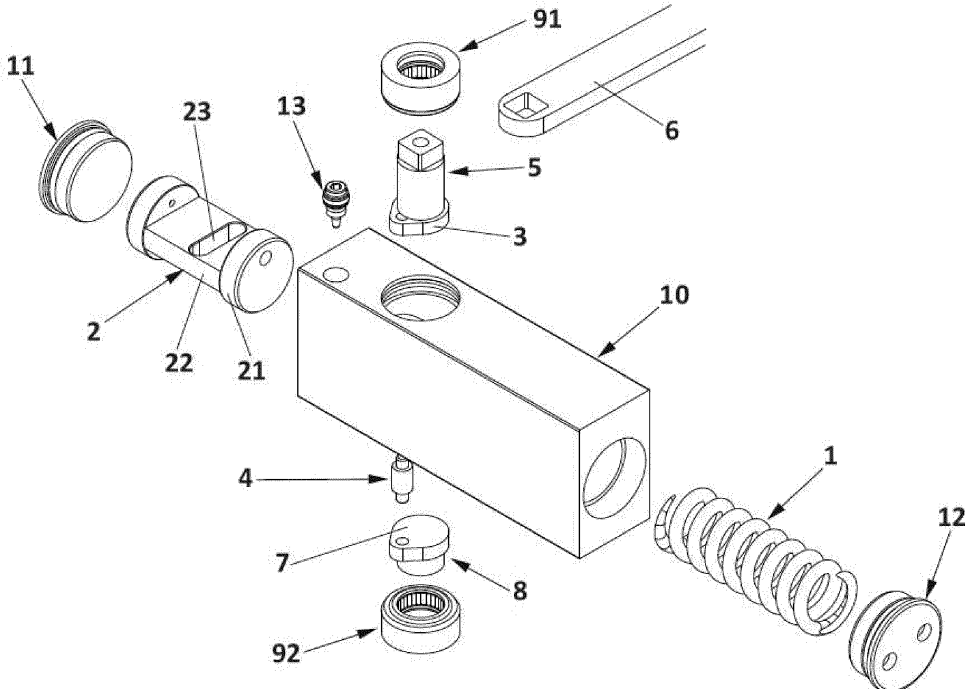

FIG. 1

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Description

TECHNICAL FIELD

[0001] This invention is related to the field of door closing systems, and more particularly, to the door closing systems which use a cam to actuate against a spring.

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] In some current door closers, those using a pinion and a rack, this return force is proportional to the opening angle of the door, so the door may be difficult to be opened by some groups of people such children and elderly, as the opening torque maybe too high.

[0004] Further, if the door needs to be held open in a predetermined position, an additional hold-open device is required, so that the user needs to manually push the door to its hold-open angle and then engage the hold-open function.

[0005] There are other door closers which use a cam which follow an irregular force against the spring, such as the one shown in document US 5,417,013 A, which discloses a door closer having a slide rail linkage. The closer shaft has a first end projecting from the housing to be attached to the slide rail linkage, a cam for providing the closing movement of the door, and a second end which is mounted in a journal bearing disposed within the housing. This type of door closers follows a different torque-angle relation, but still has some drawbacks, since it also requires an additional hold-open device and the torque, despite being lower, may also be important. These devices require a secondary spring and a particular heart-shaped cam to operate, with a notch which is useful to beat the final latch force. This notch present in the cam may lead to cracks with continuous operation.

SUMMARY OF THE INVENTION

[0006] The invention provides an alternative solution for this problem by a door closer assembly according to claim 1. Preferred embodiments of the invention are defined in dependent claims.

[0007] 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.

[0008] 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.

[0009] In a first inventive aspect, the invention provides a door closer assembly comprising

a spring;
an abutment element arranged to compress or release the spring, the abutment element comprising a plate portion arranged in contact with the spring and a protruding portion which protrudes from the plate portion and comprises a slot;
a first cam element arranged to rotate around a rotation axis, the first cam element comprising a pin which protrudes from the first cam element according to a protruding axis which is parallel to the rotation axis, the pin being inserted inside the slot, the first cam element having a partially circular profile;
a first rod solidly attached to the first cam element, arranged to rotate coaxially with the first cam element, the first rod being intended to be attached to a bar which transmits a swinging movement of an opening and closing door to the door closer assembly.

[0010] This door closer provides a door closing torque which ensures proper closing of the door at the first half of opening angle and also makes the door swing towards the full open angle at the second half of the door opening angle. The arrangement of its elements makes the door closing torque being highest around initial door opening and gradually dropping to zero force at the middle of opening range, continuing to drop to negative torque such that the door will swing to its hold open angle by itself.

[0011] This door closer also provides a hold-open functionality, since the spring presses the pin against the slot so that a positive torque is required to bring the door back to the original position.

[0012] In some particular embodiments, the first cam element has a symmetric profile.

[0013] This profile is easier to manufacture and install, and works advantageously well with the rest of the element of the door closer assembly.

[0014] In some particular embodiments, the first cam element has a profile comprising a first portion which is a circumference arc having an arc centre and a second portion with a curved line, wherein all the points of the curved line are farther from the arc centre than the points of the circumference arc, wherein the pin protrudes from the second portion of the profile.

[0015] The combination of this cam profile with the slot makes that the pin may run the path of the slot creating a torque-angle relation which includes a zero-torque zone.

[0016] In some particular embodiments, the door closer assembly further comprises a second cam element which is arranged to receive the pin, the protruding por-

tion being arranged between the first cam element and the second cam element so that the pin protrudes from the first cam element, then goes through the slot of the protruding portion and is received by the second cam element.

[0017] This second cam element provides a stronger and more robust mechanical structure, thus being able to endure a harder operation environment.

[0018] In some particular embodiments, the protruding portion is substantially plane, with a first face and a second face, so that the first cam element faces the first face and the second cam element faces the second face.

[0019] This arrangement saves some space and allows a better support between the cam elements and the protruding portion.

[0020] In some particular embodiments, the door closer assembly further comprises a second rod which is coaxial with the first rod, the second rod being solidly attached to the second cam element and arranged to rotate coaxially with the second cam element.

[0021] These two rods forms the two ends of the whole transmission system, which comprises the two rods, the cam elements and the pin. The torque is transmitted from the door bar and moves the transmission system as a crankshaft.

[0022] In some particular embodiments, the door closer assembly further comprises a first bearing arranged around the first rod and a second bearing arranged around the second rod.

[0023] These two bearings provide a greater stability to the rods, thus making the system able to support a higher load.

[0024] In some particular embodiments, the path of the slot comprises a continuous curved portion oriented towards the plate portion.

[0025] This curved portion creates a free swing zone, so that when the roller pin goes into the curved portion, the effective arm is reduced, due to the fact that a smaller movement is requested at the abutment element.

[0026] In some particular embodiments, the curved portion is an arc of circumference with a radius which is equal to the distance between the pin and the rotation axis.

[0027] This particular shape of the curved portion achieves a zero-torque zone.

[0028] In some particular embodiments, the door closer assembly further comprises a housing with two sealing caps.

[0029] This housing provides a support for all the elements and improves the installation conditions.

[0030] In some particular embodiments, the door closer assembly further comprises a venting valve which provides a venting communication to a region between the abutment element and one of the sealing caps.

[0031] This venting valve creates a hydraulic damping, which is useful to provide soft closing and backcheck.

BRIEF LIST OF DRAWINGS AND REFERENCE NUMBERS

[0032] 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 perspective exploded view of a door closer assembly according to the invention.

Figures 2a to 2c shows top views of a first embodiment of a door closer assembly according to the invention, in three different positions.

Figure 3 shows a theoretical graphic representation of the torque needed to move the door closer assembly of figures 2a to 2c as a function of the door angle.

Figure 4 shows a detail of an abutment element of a different embodiment of a door closer assembly according to the invention.

Figures 5a to 5d shows top views of a second embodiment of a door closer assembly according to the invention, in four different positions.

Figure 6 shows a theoretical graphic representation of the torque needed to move the door closer assembly of figures 5a to 5d with respect to the door angle.

[0033] Elements of the example embodiments are consistently denoted by the same reference numerals throughout the drawings and detailed description where appropriate:

1	Spring
11, 12	Sealing caps
13	Venting valve
2	Abutment element
21	Plate portion of the abutment element
22	Protruding portion of the abutment element
23	Slot of the abutment element
3	First cam
31	First portion of the first cam profile
32	Second portion of the first cam profile
4	Pin
5	First rod
6	Door bar
7	Second cam
8	Second rod
91	First bearing

92 Second bearing

DETAILED DESCRIPTION OF THE INVENTION

[0034] 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.

[0035] 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.

[0036] Figure 1 shows a perspective exploded view of a door closer assembly according to the invention.

[0037] This door closer assembly comprises

a spring 1;
an abutment element 2 arranged to compress or release the spring 1,
a first cam element 3; and
a first rod 5 solidly attached to the first cam element 3;
a second cam element 7;
a second rod 8 solidly attached to the second cam element 7;
a pair of bearings 91, 92;
a housing 10;
a pair of sealing caps 11, 12; and
a venting valve 13.

[0038] The abutment element 2 comprises a plate portion 21, which is arranged in contact with the spring 1 and is intended to press or release the spring 1. This abutment element 2 also comprises a protruding portion 22 which protrudes from the plate portion 21. This protruding portion, which is plane, comprises a slot 23.

[0039] The first cam element 3 is arranged to rotate around a rotation axis, and comprises a pin 4 which is intended to be inserted in the slot 23 of the abutment element. This pin 4 protrudes from the first cam element 3 according to a protruding axis which is parallel to the rotation axis. The pin 4 is intended to be inserted in the slot 23 so that the movement of the first cam element 3 is transmitted by means of the pin 4 to the slot 23, so that the abutment element 2 may move linearly when the first cam element 3 rotates.

[0040] The second cam element is arranged at the other side of the protruding element 2, to receive the pin 4, which has passed across the slot 23. The protruding portion 22 is therefore arranged between the first cam element 3 and the second cam element 7 so that the pin 4 protrudes from the first cam element 3, then goes through the slot 23 of the protruding portion 22 and is received by the second cam element 7. The protruding portion 22 is substantially plane, with a first face and a second face, so that the first cam element 3 faces the first face and the second cam element 7 faces the second face.

[0041] There are first and second rods 5, 8, which are solidly attached to the first cam element 3 and to the second cam element 7 respectively. Both rods 5, 8 and cam elements 3, 7 are arranged to rotate coaxially all together.

[0042] A pair of bearings 91, 92 are arranged around the rods 5, 8, so as to provide a smooth rotation movement of the assembly comprising the rods 5, 8 and the cam elements 3, 7, which are limited by the insertion in the housing 10.

[0043] The first rod 5 is intended to be attached to a bar 6 which transmits a swinging movement of an opening and closing door to the door closer assembly. The bar 6 rotates when the door is being opened or closed, and transmits this rotation movement to the door closer assembly of the figure. The door closer assembly offers a feedback torque in response to this rotation movement, which affects to the force the user has to provide to open the door.

[0044] The housing 10 is sealed by two sealing caps 11, 12, thus creating a closed region, which is open by a venting valve 13, which provides a venting communication to a region between the abutment element 2 and one of the sealing caps. The venting valve 13 thus provides a hydraulic damping, by the control of the venting communication. If the venting valve 13 is set to provide tight ventilation, the damping will be higher, and if the venting valve 13 is set to provide a loose ventilation, the damping will be lower.

[0045] Figures 2a to 2c shows top views of a first embodiment of a door closer assembly according to the invention, in three different positions.

[0046] Figure 2a shows this door closer assembly in a first position, where the door is deemed to be closed. In this position, the torque is maximum, since the moment arm is maximum and the force, which is not maximum, is still high enough.

[0047] The first cam element 3 has a profile comprising a first portion 31 which is a circumference arc having an arc centre and a second portion 32 with a curved line, wherein all the points of the curved line are farther from the arc centre than the points of the circumference arc. The pin 4 protrudes from the second portion 32 of this profile.

[0048] Figure 2b shows this door closer assembly in a second position, where the bar angle is 90º. The moment arm decreases while the angle goes from 0º to 90º, as in this figure, so that when the pin 4 reaches the 90º position, the moment arm is 0, and hence the torque becomes 0 as well.

[0049] Figure 2c shows this door closer assembly in a third position. When the bar angle goes from 90º to 180º, the torque es even negative, since the recovery force of

the spring helps the door to continue their opening process.

[0050] Figure 3 shows a theoretical graphic representation of the torque T needed to move the door closer assembly of figures 2a to 2c with respect to the door angle α.

[0051] The door angle does not correspond with the bar angle. The bar angle is the angle that the door bar forms with respect to the compressing direction of the spring, which corresponds to the rotation angle of the cam elements. The door angle is the angle that the door forms with respect to the closed position. Due to the shape of the door bar, the correspondence between these two angles may be selectively chosen. For this example, a bar angle of 90º corresponds to a door angle of 60º, and a bar angle of 180º corresponds to a door angle of 120º.

[0052] As mentioned above, the torque decreases for the first part of the opening process (which would correspond to a bar angle from 0º to 90º) and then becomes zero. For bar angles greater than 90º (which correspond to door angles greater than 60º), the torque becomes negative, thus providing a hold-open functionality without any additional element.

[0053] Figure 4 shows a detail of an abutment element 2 of a different embodiment of a door closer assembly according to the invention. In the slot 23 of this abutment element 2 there is a curved portion 24 oriented towards the plate portion 21.

[0054] This curved portion has an impact in the torque response of the door closer, as will be shown below.

[0055] Figures 5a to 5d shows top views of a second embodiment of a door closer assembly according to the invention, which comprises the abutment element 2 shown in the previous figure. Four different positions are illustrated in these figures.

[0056] Figure 5a shows this door closer assembly in a first position, where the door is deemed to be closed. In this position, the torque is maximum, since the moment arm is maximum and the force, which is not maximum, is still high enough. The conditions at this position are substantially the same as in the embodiment shown in figure 2a.

[0057] Figure 5b shows this door closer assembly in a second position, where the bar angle is close to 90º. The moment arm decreases while the angle goes from 0º to this position, since the moment arm decreases. However, in this figure, when the pin reaches the start of the curved portion, the torque becomes 0, since the shape of the curved portion is a circumference arc which follows the trajectory of the pin without causing any movement in the abutment element 2.

[0058] Figure 5c shows this door closer assembly in a third position. In this figure, the pin is exiting the curved portion 24, but the abutment element remains in the same position as in figure 5b, due to the shape of this curved portion. As a consequence, the torque is still 0.

[0059] Figure 5d shows this door closer assembly in a fourth position. When the bar angle goes through the last zone, until reaching 180º, the torque es even negative, since the recovery force of the spring helps the door to continue their opening process.

[0060] Figure 6 shows a theoretical graphic representation of the torque needed to move the door closer assembly of figures 5a to 5d with respect to the door angle.

[0061] The result has some parts in common with the graphic of figure 3 but, in this case, the smooth slope in the vicinity of the 60º (which corresponds to a door angle of 90º) are replaced by a sharp slope and a relatively big zero-torque zone. After this zone, the negative torque appears, until the end of the opening zone.

Claims

1. Door closer assembly comprising

   a spring (1)
   an abutment element (2) arranged to compress or release the spring (1), the abutment element (2) comprising a plate portion (21) arranged in contact with the spring (1) and a protruding portion (22) which protrudes from the plate portion (21) and comprises a slot (23);
   a first cam element (3) arranged to rotate around a rotation axis, the first cam element (3) comprising a pin (4) which protrudes from the first cam element (3) according to a protruding axis which is parallel to the rotation axis, the pin (4) being inserted inside the slot (23), the first cam element (3) having a partially circular profile;
   a first rod (5) solidly attached to the first cam element (3), arranged to rotate coaxially with the first cam element (3), the first rod (5) being intended to be attached to a bar (6) which transmits a swinging movement of an opening and closing door to the door closer assembly.

2. Door closer assembly according to claim 1, wherein the first cam element (3) has a symmetric profile.

3. Door closer assembly according to claim 2, wherein the first cam element (3) has a profile comprising a first portion (31) which is a circumference arc having an arc centre and a second portion (32) with a curved line, wherein all the points of the curved line are farther from the arc centre than the points of the circumference arc, wherein the pin protrudes from the second portion of the profile.

4. Door closer assembly according to any of the preceding claims, further comprising a second cam element (7) which is arranged to receive the pin (4), the protruding portion (22) being arranged between the first cam element (3) and the second cam element (7) so that the pin (4) protrudes from the first

cam element (3), then goes through the slot (23) of the protruding portion (22) and is received by the second cam element (7).

5. Door closer assembly according to claim 4, wherein the protruding portion (22) is substantially plane, with a first face and a second face, so that the first cam element (3) faces the first face and the second cam element (7) faces the second face.

6. Door closer assembly according to any of claims 4 or 5, further comprising a second rod (8) which is coaxial with the first rod (5), the second rod (8) being solidly attached to the second cam element (7) and arranged to rotate coaxially with the second cam element (7).

7. Door closer assembly according to claim 6, further comprising a first bearing (91) arranged around the first rod (5) and a second bearing (92) arranged around the second rod (8).

8. Door closer assembly according to any of the preceding claims, wherein the path of the slot comprises a continuous curved portion (24) oriented towards the plate portion (21).

9. Door closer assembly according to claim 8, wherein the curved portion (24) is an arc of circumference with a radius which is equal to the distance between the pin (4) and the rotation axis.

10. Door closer assembly according to any of the preceding claims, further comprising a housing (10) with two sealing caps (11, 12).

11. Door closer assembly according to claim 10, further comprising a venting valve (13) which provides a venting communication to a region between the abutment element (2) and one of the sealing caps.

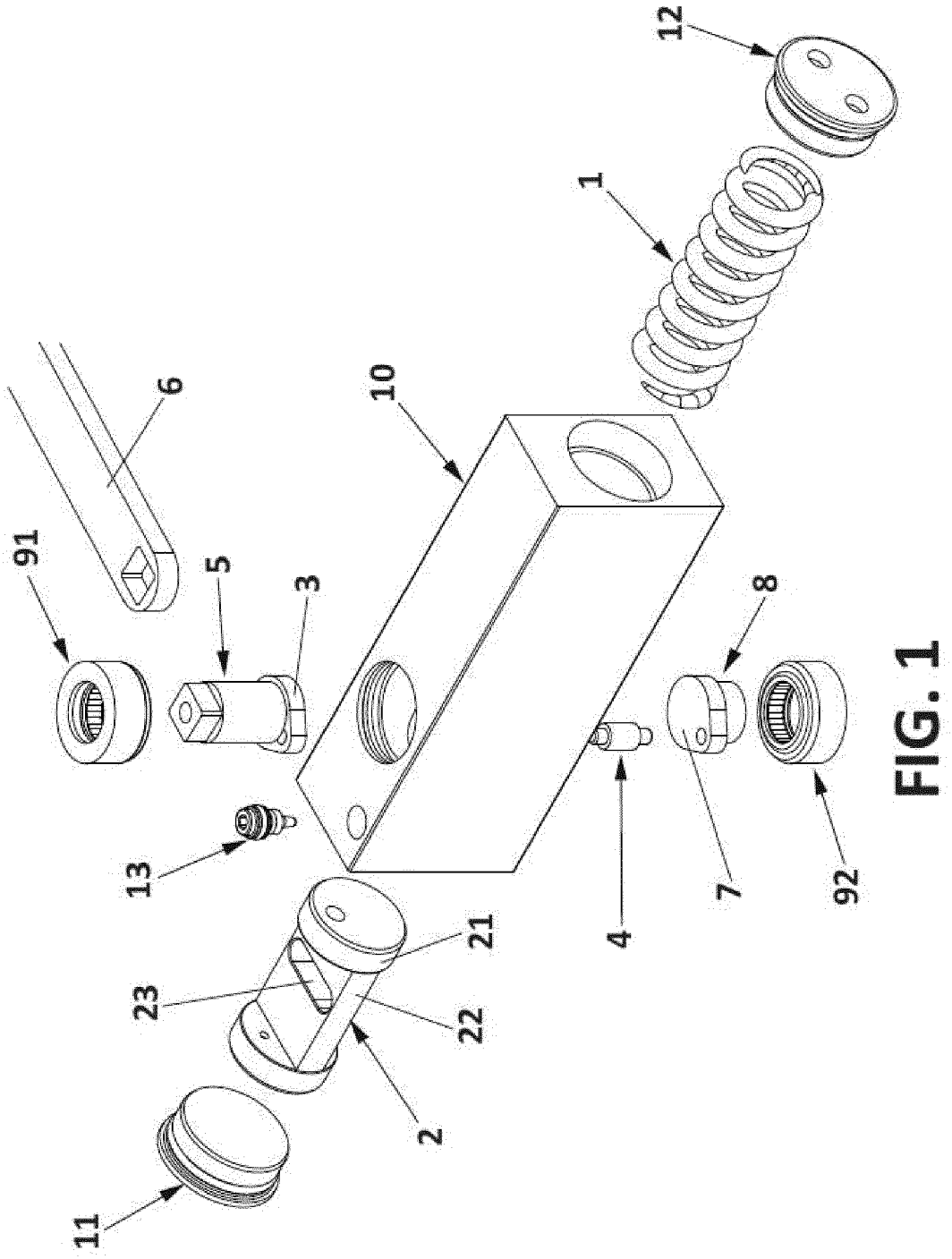

FIG. 1

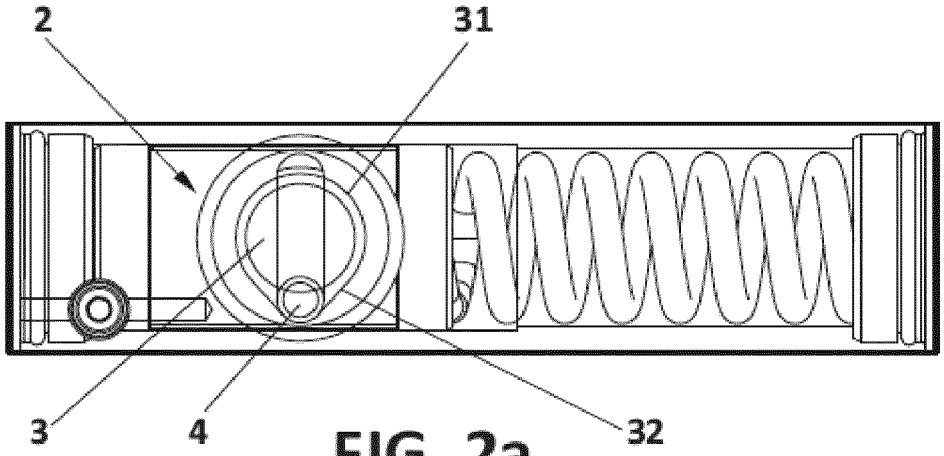

FIG. 2a

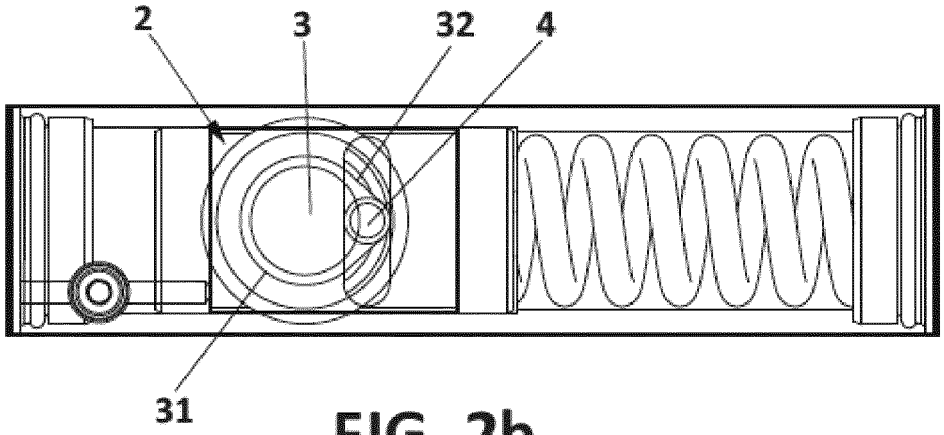

FIG. 2b

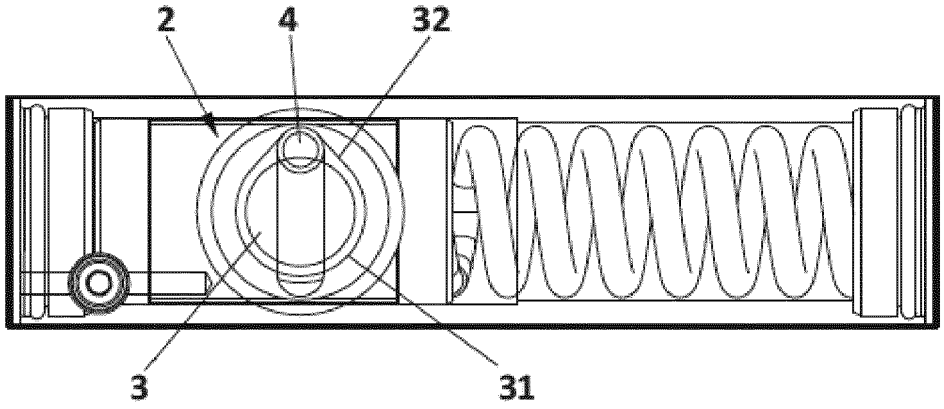

FIG. 2c

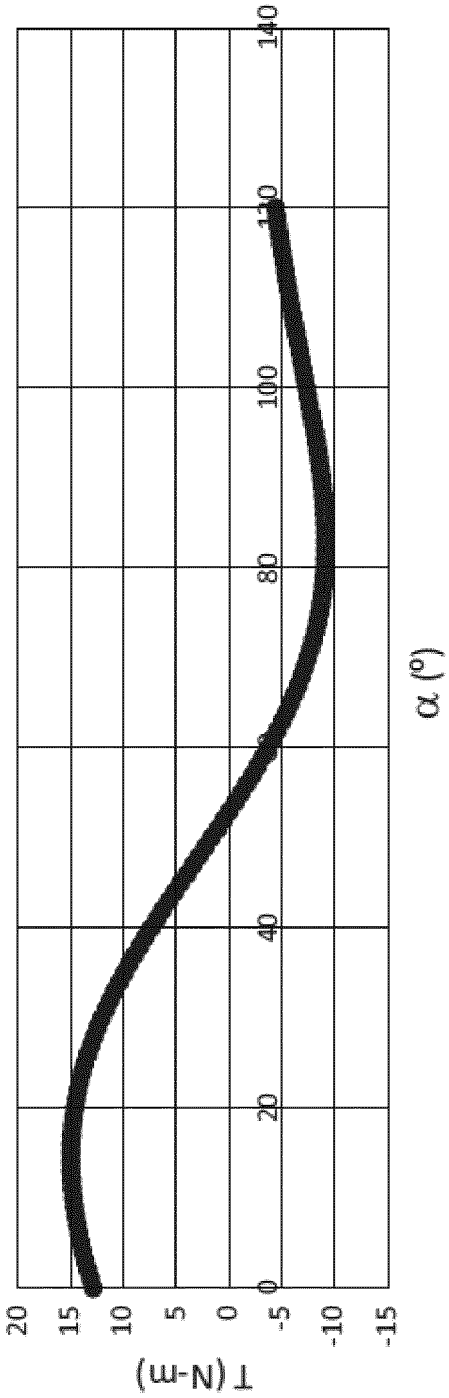

FIG. 3

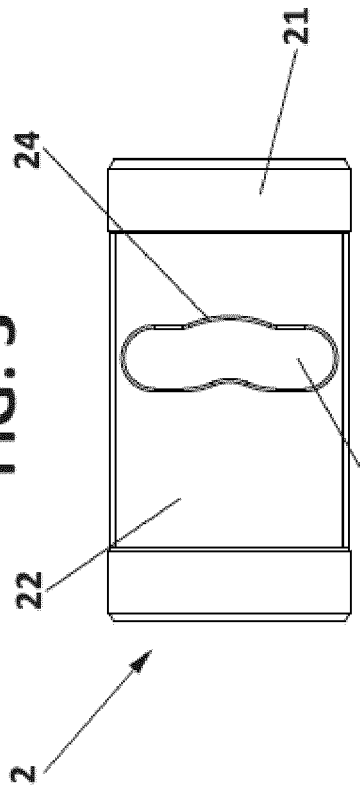

FIG. 4

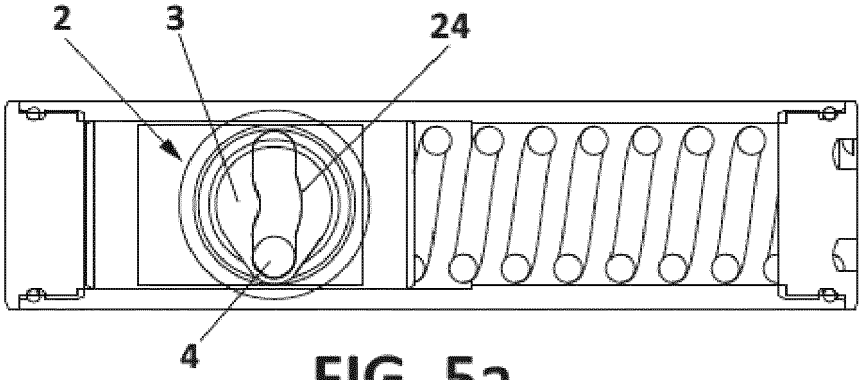

FIG. 5a

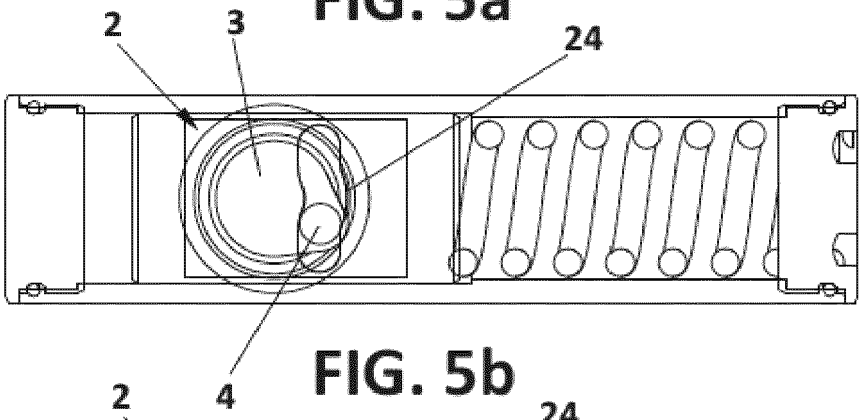

FIG. 5b

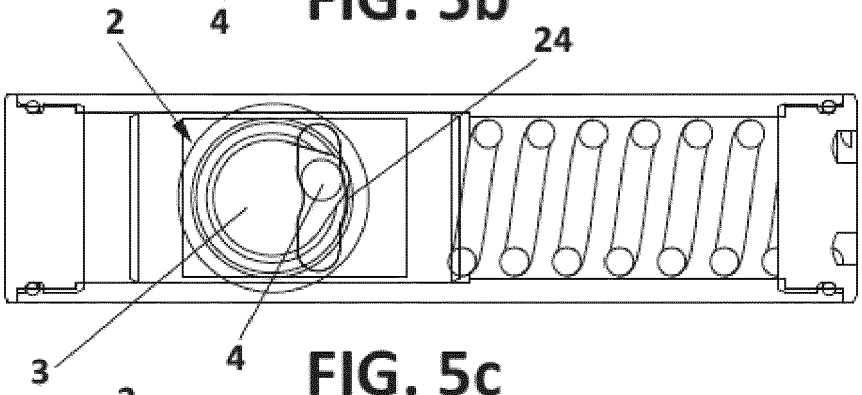

FIG. 5c

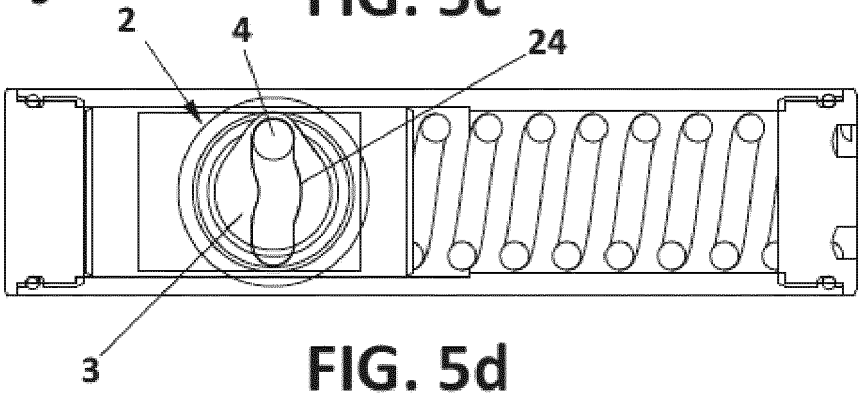

FIG. 5d

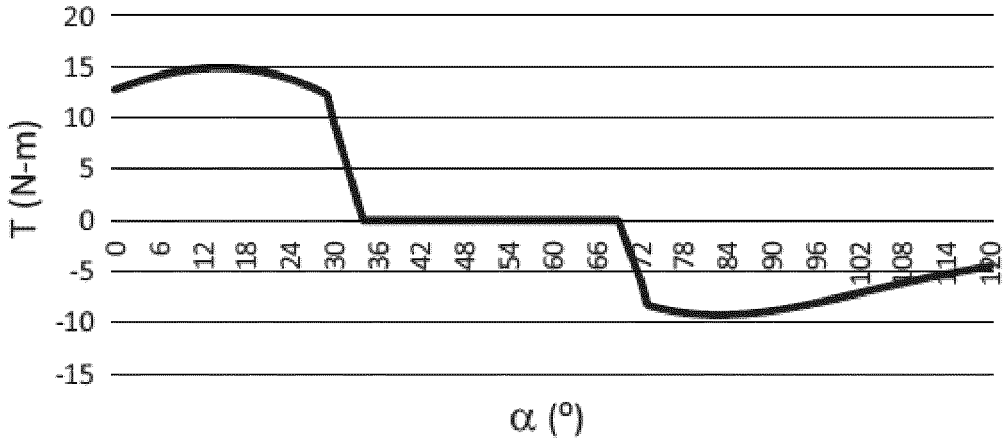
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FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 19 15 7877

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 17 59 958 B1 (FERMAT TUERSCHLIESSER GMBH) 2 December 1971 (1971-12-02)	1-3,8-11	INV. E05F3/10
A	* column 3, line 33 - column 4, line 29; figures 1-7 *	4-7	ADD. E05F3/22

X	US 3 409 934 A (PIERRE LIOGIER) 12 November 1968 (1968-11-12)	1-3,8-11	
A	* column 2, line 23 - column 3, line 20; figures 1-3 *	4-7	

A,D	US 5 417 013 A (TILLMANN HORST [DE]) 23 May 1995 (1995-05-23) * column 5, line 15 - column 8, line 42; figures 1-4 *	1-11	

TECHNICAL FIELDS SEARCHED (IPC)

E05F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	31 July 2019	Rémondot, Xavier

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 15 7877

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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31-07-2019

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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