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(54) Title: BUFFER MEMBERS FOR GLOVE COMPARTMENT

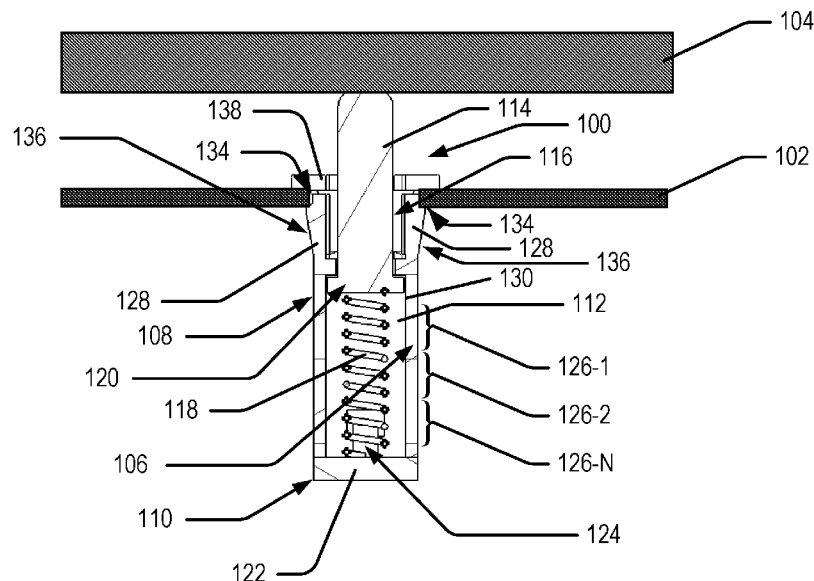


FIGURE 1

(57) Abstract: Examples relating to buffer members for glove compartment are described herein. The buffer member includes a body having a first end, a second end, and a longitudinal cavity therein. The buffer member further includes a plunger slidable in the longitudinal cavity in the body, protruding from the first end of the body and includes a cap disengageably coupled to the second end of the body. The buffer member further includes an elastic member housed inside the longitudinal cavity of the body and coupled at a first end to the plunger and at a second end to the cap. The elastic member can be compressible to a first distance by a first force and compressible beyond the first distance by a second force.



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MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
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BUFFER MEMBERS FOR GLOVE COMPARTMENT

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to India Application No. 201821024826, filed on July 3, 2018, the entire contents of which is incorporated by reference herein in its entirety.

BACKGROUND

[0002] Vehicles, typically, include various movable or pivotally supported structural parts, such as, glove compartment covers, lids for ash-trays, holding grips. The operation of such parts is effected by exerting a force thereon by means of a biasing member and/or gravity. For example, in case of a cover for a glove compartment may include a spring-loaded biasing member to bias the cover away from a closed position. Accordingly, when the cover is brought to a closed position, the biasing member may prevent the cover from being locked with respect to the glove compartment until the cover is forced against the biasing member for being locked. In addition, when actuated for opening from a closed position with respect to the glove compartment, the user may only release a locking mechanism and the cover may open automatically owing to the force of the biasing member.

BRIEF DESCRIPTION OF FIGURES

[0003] The detailed description is provided with reference to the accompanying figures. It should be noted that the description and the figures are merely examples of the present subject matter and are not meant to represent the subject matter itself.

[0004] Figure 1 illustrates a front-cross sectional view of a buffer member for a glove compartment, according to an example of the present subject matter.

[0005] Figure 2 illustrates front-cross sectional view of the buffer member showing one example of fitment, according to the present subject matter.

[0006] Figure 3 illustrates front-cross sectional view of the buffer member showing another example of fitment, according to the present subject matter.

[0007] Throughout the drawings, identical reference numbers designate similar elements, but may not designate identical elements. The figures are not necessarily to scale, and the size of some parts may be exaggerated to more clearly illustrate the example shown. Moreover, the drawings provide examples and/or implementations consistent with the

description; however, the description is not limited to the examples and/or implementations provided in the drawings.

DETAILED DESCRIPTION

[0008] Movable or pivotally supported parts of vehicles, such as, covers for glove compartments, may include a biasing member in order to achieve an effective operation and ease of accessibility for a user. The biasing member may be formed as a spring-loaded plunger which supports the cover of the glove compartment. The spring-loaded plunger may maintain the cover in a slightly open position with respect to the glove compartment until the cover is forced against the spring to be locked or may automatically raise the cover from the unlocked position for convenience of the user.

[0009] Conventionally, the biasing member may be designed for a type and style of glove compartment assemblies and may not be usable for any other type of glove compartments. For instance, some glove compartments may use a damping member, such as a washer, in addition to the biasing member. Therefore, a biasing member designed for a glove compartment without a damping member may not be usable with a glove compartment having such a damping member. Accordingly, for every different design of the glove compartment, a different biasing member may have to be designed. In other cases, the biasing member may be unable to accommodate variations in tolerances and fits even in the same glove compartment design, thereby leading to a considerable wastage of materials, time, and manufacturing resources. As a result, the manufacturing of such a biasing member may be costly and unproductive.

[0010] In addition, during assembly, the biasing member may be force-fitted into an instrument panel, adjacent to the glove compartment, for cooperating with the cover. For instance, the biasing member may be fitted in a fitment area in the instrument panel by interference fit. However, since the instrument panel is usually made of plastic, such forceful fitting of the biasing member may damage the fitment area during assembly. In addition, the biasing member may cause substantial wear and tear of the fitment area in a considerably less period of operation. Accordingly, the service life of the glove compartment assembly is low and may involve frequent replacement of the biasing member. Additionally, the glove compartment assembly may be unreliable as the biasing member may dislodge from the fitment area during operation.

[0011] Furthermore, in the conventional biasing member, the plunger is formed by a complex process of over moulding which makes the manufacturing time-intensive as well as cost intensive. In addition, surface finish of the manufactured plunger is low, and it may have projections on the portions that mate with the cover of the glove compartment. Such projections may cause wear and damage to the cover over time. Accordingly, a casing made of another material, such as rubber, may have to be used on the plunger on the portion mating with the cover, in order to prevent any damage to the cover. However, the addition of the casing may further drive up the cost of the biasing member.

[0012] Approaches and aspects relating to a buffer member for a glove compartment are described. The buffer member includes a body having a first end, a second end, and a longitudinal cavity therein. In the longitudinal cavity in the body, a plunger is slidably disposed with a portion of the plunger protruding from the first end of the body. The buffer member further includes an elastic member housed inside the longitudinal cavity of the body, the elastic member being coupled at a first end to the plunger. The buffer member may also include a cap coupled to a second end of the elastic member. The cap may also be coupled to the second end of the body. The buffer member may be installed in a glove compartment and may mate with a cover of the glove compartment. In the installed condition, the plunger can mate with the cover of the glove compartment. During operation, when the plunger is actuated due to movement of the cover, it may compress the elastic member and the cap may bear a load due to compression of the elastic member. In addition, the cap may be fitted to the second end of the body in such a way that the cap does not undergo rotation during operation of the buffer member. In other words, the fitting of the cap to the body is anti-rotational in nature.

[0013] The buffer member described herein is compatible with various types of glove compartment designs and is capable of effectively accommodating variations in size due to tolerances in the manufacture of the glove compartments and instrument panels. Accordingly, in an aspect, the elastic member of the buffer member may be compressible to a first distance by a first force and compressible beyond the first distance by a second force. For example, the elastic member can have a plurality of sections and each of the plurality of sections has a different stiffness. With such a design, again, the elastic member may have different forces applicable for different travel of the elastic member during compression. In an example, the elastic member can be a helical spring.

[0014] Therefore, the elastic member may be able to meet different force applications in different glove compartment designs and may even be able to cater to different force applications due to variations in tolerances. For instance, if the glove compartment is designed to use a damper, such as a washer, the elastic member of the present subject matter can allow the application of a large force for overcoming the damper and operating the cover of the glove compartment. In addition, the difference in force to be applied for different extent of movement of the plunger, and therefore, of the cover of the glove compartment, the buffer member can provide a feedback to a user and may enhance feel and usability of the cover of the glove compartment. Therefore, the same buffer member may find application in various designs and parts with different tolerances and fits, and accordingly, substantially less buffer members may find no use or may be wasted.

[0015] Further, according to another aspect, the buffer member of the present subject matter may be easily installable in the instrument panel, with little or no damage to a fitment area, i.e., the location on the instrument panel where the buffer member is to be installed. According to said aspect, the first end of the body comprises a plurality of cantilevered ribs, and each of the plurality of cantilevered ribs extend along a wall of the body in a longitudinal direction of the body. At an end away from the first end of the body, the cantilevered ribs have a tapered element, for example, to serve as a snap fit lock. The cantilevered ribs allow the buffer member to have flexural ability. Therefore, when the buffer member is being installed in the instrument panel, the flexibility due to the cantilevered ribs allows the buffer member to flex enough and be installed without causing any damage at the fitment area. In addition, the tapered element locks against the instrument panel and prevents dislodging of the buffer member from the instrument panel during the course of operation. Accordingly, the buffer member can be conveniently inserted and installed, and can have a robust fit.

[0016] In addition, the plunger of the buffer member can be formed in a way that it causes considerably low wear on the cover at the location where the cover mates with the plunger. According to one other aspect, the plunger can be formed by moulding using slider, as a result of which, the plunger has a considerably good surface finish and has no such protrusions that may damage the mating portion of the cover. In addition, with such a surface finish, the plunger can be used as it is and any additional casing or cover for the plunger may not be required. However, in an example, the plunger can be formed to have a predefined tolerance between an outer surface of the plunger and the longitudinal cavity of the body to accommodate a casing, such as a rubber sheath, on the outer surface of the plunger.

[0017] The above aspects are further illustrated in the figures and described in the corresponding description below. It should be noted that the description and figures merely illustrate principles of the present subject matter. Therefore, various arrangements that encompass the principles of the present subject matter, although not explicitly described or shown herein, may be devised from the description and are included within its scope. Additionally, the word “coupled” is used throughout for clarity of the description and may include either a direct connection or an indirect connection.

[0018] Figure 1 illustrates a cross-sectional front view of a buffer member 100 installed in a fitment component 102 to cooperate with a movable component 104, according to an example of the present subject matter. In an example, the buffer member 100 can be installed in a glove compartment in an instrument panel of a vehicle and can cooperate with a cover of the glove compartment. In said example, the buffer member 100 may support the cover of the glove compartment. During operation, the buffer member 100 may maintain the cover in a slightly open position with respect to the glove compartment until the cover is forced against the spring to be locked or may automatically actuate the cover by a small distance when unlocked for convenience of the user.

[0019] The buffer member 100 may include a body 106 having a first end 108, a second end 110, and a longitudinal cavity 112 formed in the body 106. In an example, the body 106 can be a hollow cylinder. In the longitudinal cavity 112, a plunger 114 can be slidably disposed with a portion of the plunger 114 protruding from the first end 108 of the body 106. In the assembled condition, as shown in Figure 1, the plunger 114 can mate with the movable component 104. As an example, Figure 1 illustrates an unlocked condition of the glove compartment where the cover is held slightly ajar by the plunger 114. In said example, upon application of force, the plunger 114 can slide in the longitudinal cavity 112 towards the second end 110 of the body. As mentioned previously, the plunger 114 can be formed by a moulding process which uses a slider.

[0020] Accordingly, the plunger 114 can have a considerably good surface finish and is substantially devoid of protrusions that may damage the mating portion of the movable component 104. In addition, the plunger 114 is usable with the movable component 104 to mate and cooperate therewith without requiring any casing or cover to protect wear or damage to the movable component 104. In another example, however, the plunger 114 can have a predefined tolerance 116 between an outer surface thereof and the longitudinal cavity 112 of the body 106 to accommodate a casing (not shown) on the plunger 114.

[0021] The buffer member 100 further includes an elastic member 118 housed inside the longitudinal cavity 112. The elastic member 118 can be fixed at one end in the longitudinal cavity 112 whereas the other end can be movable for allowing compression of the elastic member 118 along a longitudinal direction, i.e., along a length of the elastic member 118, inside the longitudinal cavity 112. Accordingly, a first end 120 of the elastic member 118 can be coupled to the plunger 114 and is movable. In an example, an end of the plunger 114 coupled to the first end 120 of the elastic member 118 may be provided with a groove (indicated in Figure 3 with reference numeral 202) for receiving the first end 120 of the elastic member 118. The buffer member may also include a cap 122 disengagably coupled to a second end 124 of the elastic member 118, for instance, for serviceability of the buffer member 100. For example, the components of the buffer member 100, such as the elastic member 118 or the plunger 114, can be replaced by disassembling the buffer member 100 by detaching the cap 122 from the second end 124. The cap 122 may also be coupled to the second end 110 of the body 106. During operation, when the plunger 114 is actuated by actuation of the movable component 104 by a user, such actuation may compress the elastic member 118 and the cap 122 may bear a load due to compression of the elastic member 118.

[0022] In addition, the cap 122 may be fitted to the second end 110 of the body 106 in such a way that the cap 122 does not undergo rotation during operation of the buffer member 100. In other words, the fitting of the cap 122 to the body 106 is anti-rotational in nature. The fitting of the cap 122 to the body 106 is discussed in detail with reference to Figures 2A and 2B.

[0023] Referring back to Figure 1, the elastic member 118 can be designed in a way to make the buffer member 100 compatible with various designs of the fitment component 102 as well as the movable component 104 and to also effectively accommodate variations in size and tolerances in the manufacture of the components 102, 104. Accordingly, the elastic member 118 may be compressible to a first distance by a first force and compressible beyond the first distance by a second force. For example, the elastic member 118 can have a plurality of sections 126-1, 126-2...126-N, collectively referred to as sections 126 and individually as a section 126.

[0024] Each of the sections 126 of the elastic member 118 can have a different stiffness. In an example, the elastic member 118 can be a spring, such as a helical spring, and the different sections of the spring can have different spring constants to achieve variable stiffness of the spring in different sections. In an example, the variations in the force required,

the stiffness, or the spring constant in different sections of the elastic member 118 can allow for a variable pitch of the elastic member 118. The variable pitch of the elastic member 118 may allow the elastic member 118 to have different forces applicable for different extent of travel of the elastic member 118 during compression.

[0025] As an example, and not as a limitation, the elastic member 118 can have two sections having two different stiffnesses. Accordingly, during operation, for a first distance of travel, the elastic member 118 may have to be applied a first force, and for a second distance of travel, the elastic member 118 may have to be applied a second force. For instance, in a certain case, the elastic member 118 may be designed to have a first distance of travel of 3 millimeter (mm) by application of a force of 5 Newtons (N), whereas for further distance of travel of 5 mm, i.e., the second distance of travel, the force that has to be applied may be 6 N. However, the above values have been provided as examples and the elastic member 118 may be designed for various other values of distances of travel and forces.

[0026] The buffer member 100 can be designed in a way that it is easily installable in the fitment component 102, with little or no damage to the location on the fitment component 102 where the buffer member 100 is to be installed, the location referred to as a fitment area. Therefore, the buffer member 100 may be designed with parts that allow a certain extent of flexibility of the buffer member 100 while being installed. Accordingly, buffer member 100 may be installable in the fitment component 102 using a plurality of cantilevered ribs 128. The cantilevered ribs 128, as the name suggests, are cantilevered at the first end 108 of the body 106 and extend along a wall 130 of the body 106 along a length of the body 106, i.e., along a longitudinal axis of the body 106. In other words, the cantilevered ribs 128 are coupled at one end to the body 106 and the other end of the cantilevered ribs 128 is free. The cantilevered structure of the cantilevered ribs 128 allows them to have flexural ability. Therefore, when the buffer member 100 is installed in the fitment component 102, the flexibility of the cantilevered ribs 128 allows the buffer member 100 to flex and be installed in the fitment component 102 without any damage at the fitment component 102.

[0027] Further, at the free end of the cantilevered ribs 128, i.e., at an end of the cantilevered ribs 128 away from the first end 108 of the body 106, the cantilevered ribs 128 may have a snap-fit lock formed as a tapered element 132 ending in a slot 134. The tapered element 132 may have a taper on a mating surface 136 that is tapered with an increasing incline from the first end 108 of the body 106 to the second end 110, the incline ending at the slot 134. The tapered element 132, due to the taper, may allow the buffer member 100 to slide

easily into the fitment component 102 whereas the slot 134 at the edge of the tapered element 132 can lock with the fitment component 102. The locking of the slot 134 with the fitment component 102 prevents the buffer member 100 from dislodging from the fitment component 102 during the course of operation. Accordingly, the buffer member 100 can be conveniently inserted and installed and can have a robust fit with the fitment component 102.

[0028] In addition, the buffer member 100 can include a cover 138 that can be used to cover the open end of the body 106 at the free end of the cantilevered ribs 128, for example, to prevent entry of dust into the longitudinal cavity 112 of the body 106. In an example, the cover 138 can be installed over the body 106 once the buffer member 100 has been inserted into the fitment member 102. At the other end, i.e., the second end 110, of the body 106, as explained previously, the cap 122 is provided, for example, to couple to the second end 124 of the elastic member 118 as well as to prevent entry of dust into the longitudinal cavity 112. In addition to preventing entry of dust, the cap 122 may be fitted to the second end 110 of the body 106 in such a way that the cap 122 does not undergo rotation during operation of the buffer member 100. A rotation of the cap 122 may otherwise occur due to application of a tangential or circumferential force on the plunger 114, for instance, by the user, and may cause the cap 122 to detach from the second end 110.

[0029] Figure 2 and Figure 3 illustrate examples of the coupling of the cap 122 to the body 106 of the buffer member 100. Figure 2 illustrates a cross-sectional front view of the buffer member 100, according to one example of the present subject matter. In the example shown in Figure 2, the second end 110 of the body 106 can have a plurality of slots 204 formed in the wall 130 thereof. In other words, the wall 130 can have slots 204 that can extend laterally across the width of the wall 130. The cap 122, in said example, can include a plurality of snap-fit lugs 206. A snap-fit lug 206 can disengageably fit into a slot 204 in the wall 130 at the second end 110 of the body 106. For instance, the snap-fit lug 206 can be formed as having a tapered, cantilevered lug with an increasing taper in the direction from the second end 110 to the first end 108 of the body 106 and ending with a wedge. Accordingly, while assembly, the snap-fit lug 206 can flex with respect to the wall 130 and as the cap 122 is moved towards the first end 108, to lock the cap 122, the wedge can lock with the slot 204. The cap 122 so locked with the slot 204 is unable to rotate, since the width of the slot 204 is almost equal to the width of the snap-fit lug 206, for example, with due margin for tolerances.

[0030] Figure 3 illustrates the cross-sectional front view of the buffer member 100, according to another example of the present subject matter. In the present example shown in

Figure 3, the second end 110 of the body 106 can have a plurality of j-shaped slots 302 through the width of the wall 130 of the body 106. The j-shaped slots 302 can be open at an edge of the second end 110 and progress into the wall 130 in the direction towards the first end 108, then extend along the circumference of the wall 130, and end with an extension from the first end 108 towards the second end 110. In said example, the cap 122 can include a plurality of protrusions 304, for example, extending in a radial direction from the cap 122. One protrusion 304 can sit in one j-shaped slot 304 and traverse the j-shaped slot 302 to lock the cap 122 with the body 106, using the protrusions 304 and the j-shaped slots 304. For instance, the protrusion 304 can be first inserted into the body 106 from the open end of the j-shaped slot 302 by traversing the j-shaped slot 302 in the direction along the second end 110 to the first end 108. Then, the cap 122 can be rotated with respect to the body 106 in the j-shaped slot 302, and to lock the cap 122, the cap can be moved towards the second end 110, i.e., in the direction opposite to the direction of insertion.

[0031] Further, in the example shown in Figure 3, a portion of the cap 122 can be coupled to the second end 124 of the elastic member 118. For instance, the cap 122 can include a slot 306 to receive the second end 124 of the elastic member 118. The provision of the slot 306 also allows the plunger 114 to afford a long travel, and high compression of the elastic member 118, thereby making the buffer member 100 further ubiquitous in use.

[0032] In yet another example, besides those illustrated in Figure 2 and Figure 3, the cap 122 can be coupled to the second end 110 of the body 106 by a hinge mechanism, which can allow the cap 122 to hinge about the body 106. At the diametrically opposite, unhinged end of the cap 122, the cap 122 can be provided with a snap-fit lug, similar to the snap-fit lug 206 explained with reference to Figure 2. In such a case, the second end 110 can also be provided with a slot similar to the slot 204 explained with reference to Figure 2, to lock the cap 122 when engaged with the body 106.

[0033] Although examples for the buffer member 100 for a glove compartment have been described in language specific to structural features and/or methods, it is to be understood that the appended claims are not limited to the specific features described. Rather, the specific features are disclosed as examples of the buffer member 100.

I/We claim:

1. A buffer member for a glove compartment, the buffer member comprising:
a body having a first end, a second end, and a longitudinal cavity therein;
a plunger slidable in the longitudinal cavity in the body and protruding from the first end of the body;
a cap disengageably coupled to the second end of the body; and
an elastic member housed inside the longitudinal cavity of the body and coupled at a first end to the plunger and at a second end to the cap, the elastic member having a plurality of sections, each of the plurality of sections having a different stiffness.
2. The buffer member as claimed in claim 1, wherein the first end of the body comprises a plurality of cantilevered ribs, each of the plurality of cantilevered ribs extending along a wall of the body in a longitudinal direction of the body, each of the plurality of cantilevered ribs comprising a tapered element.
3. The buffer member as claimed in claim 1, wherein the second end of the body comprises a plurality of j-shaped slots, and wherein the cap comprises a plurality of protrusions, wherein one protrusion to sit in one j-shaped slot in the second end of the body.
4. The buffer member as claimed in claim 1, wherein the second end of the body comprises a plurality of slots, wherein the cap comprises a plurality of snap-fit lugs, one snap-fit lug to disengageably fit into one slot in the second end of the body.
5. The buffer member as claimed in claim 4, wherein the cap is coupled to the second end of the body by a hinge mechanism to hinge about the body.
6. The buffer member as claimed in claim 1, wherein a portion of the cap coupled to the second end of the elastic member comprises a slot to receive the second end of the elastic member.
7. The buffer member as claimed in claim 1, wherein the plunger is formed by moulding using slider.

8. The buffer member as claimed in claim 1, wherein the plunger is formed to have a predefined tolerance between an outer surface of the plunger and the longitudinal cavity of the body to accommodate a rubber sheath on the outer surface of the plunger.
9. The buffer member as claimed in claim 1, wherein an end of the plunger coupled to the first end of the elastic member comprises a groove for receiving the first end of the elastic member.
10. The buffer member as claimed in claim 1, wherein the elastic member is a spring having a plurality of sections, each of the plurality of sections having a different spring constant.

11. A buffer member for a glove compartment, the buffer member comprising:
 - a body having a first end, a second end, and a longitudinal cavity therein;
 - a plunger slidable in the longitudinal cavity in the body and protruding from the first end of the body;
 - an elastic member housed inside the longitudinal cavity of the body, the elastic member being coupled at a first end to the plunger, wherein an actuation of the plunger compresses the elastic member, the elastic member being compressible to a first distance by a first force and compressible beyond the first distance by a second force;
 - a cap coupled to a second end of the elastic member and disengageably coupled to the second end of the body, wherein the cap is to bear a load due to compression of the elastic member.
12. The buffer member as claimed in claim 11, wherein the first end of the body comprises a plurality of cantilevered ribs, each of the plurality of cantilevered ribs extending along a wall of the body in a longitudinal direction of the body, each of the plurality of cantilevered ribs comprising a tapered element.
13. The buffer member as claimed in claim 11, wherein the second end of the body comprises a plurality of j-shaped slots, and wherein the cap comprises a plurality of protrusions, wherein one protrusion to sit in one j-shaped slot in the second end of the body.
14. The buffer member as claimed in claim 11, wherein the second end of the body comprises a plurality of slots, wherein the cap comprises a plurality of snap-fit lugs, one snap-fit lug to disengageably fit into one slot in the second end of the body.
15. The buffer member as claimed in claim 14, wherein the cap is coupled to the second end of the body by a hinge mechanism to hinge about the body.
16. The buffer member as claimed in claim 11, wherein a portion of the cap coupled to the second end of the elastic member comprises a slot to receive the second end of the elastic member.

17. The buffer member as claimed in claim 11, wherein the plunger is formed by moulding using slider.
18. The buffer member as claimed in claim 11, wherein the plunger is formed to have a predefined tolerance between an outer surface of the plunger and the longitudinal cavity of the body to accommodate a casing on the outer surface of the plunger.
19. The buffer member as claimed in claim 11, wherein an end of the plunger coupled to the first end of the elastic member comprises a groove for receiving the first end of the elastic member.
20. The buffer member as claimed in claim 11, wherein the elastic member has a plurality of sections, each of the plurality of sections having a different stiffness.
21. The buffer member as claimed in claim 19, wherein the elastic member is a spring having a plurality of sections, each of the plurality of sections having a different spring constant.

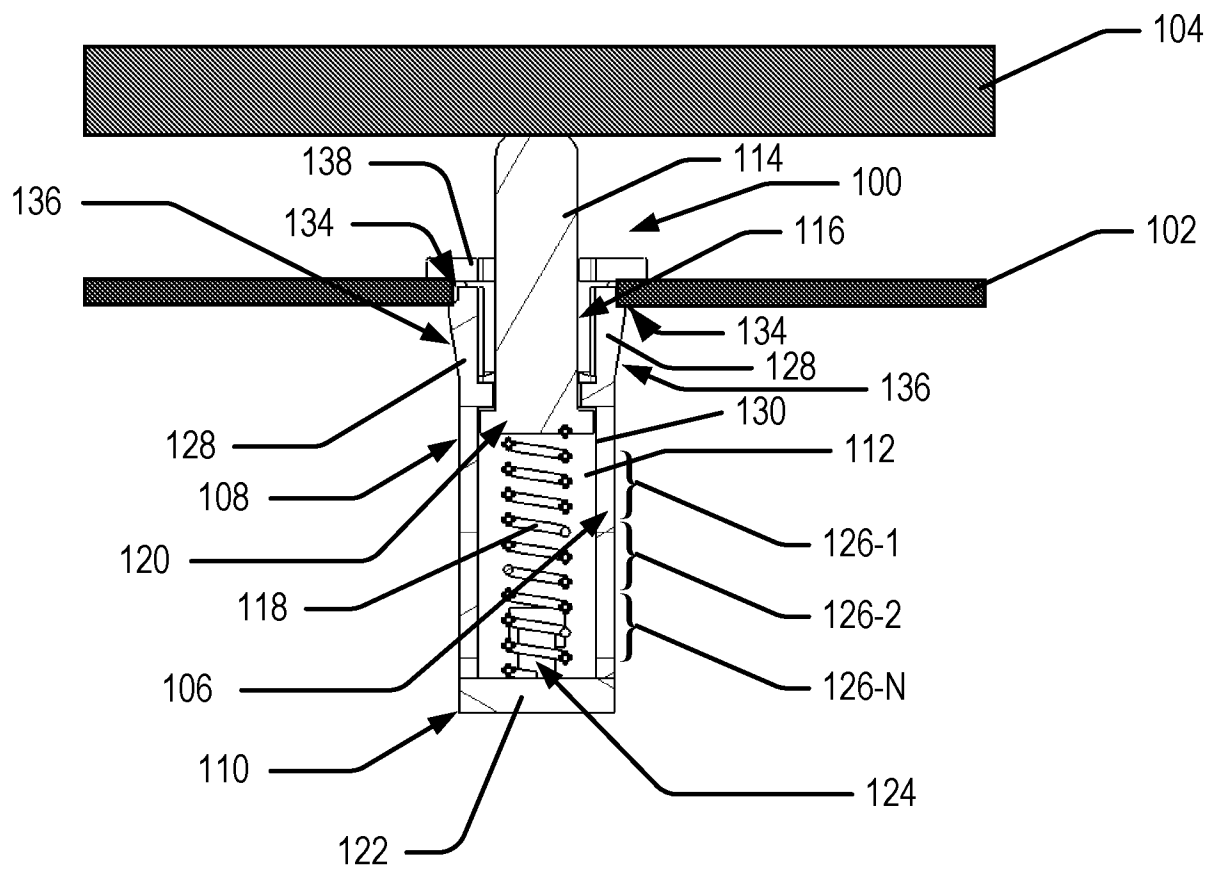


FIGURE 1

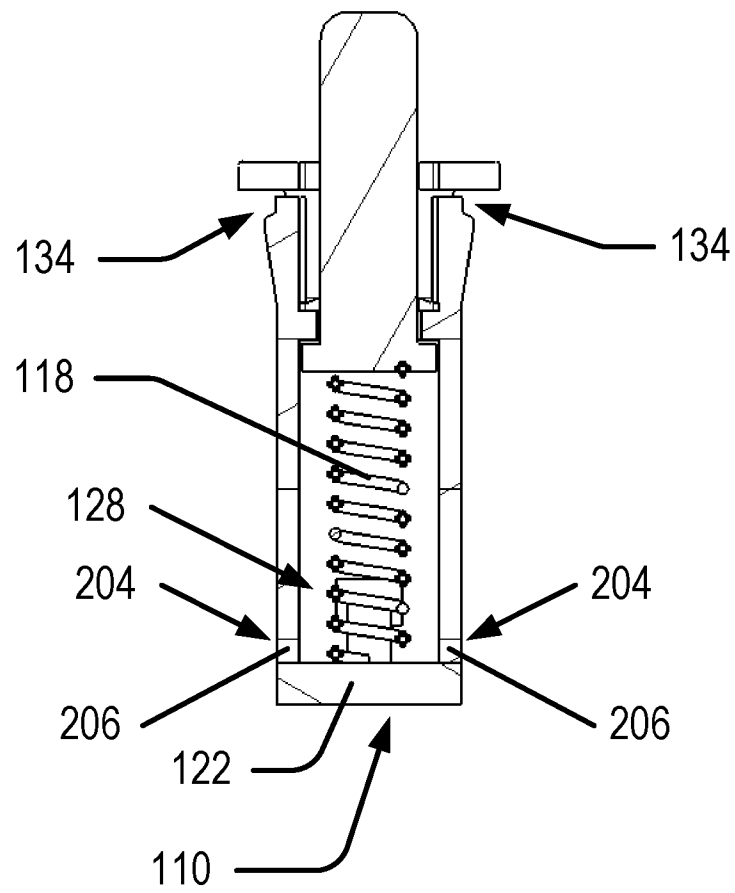


FIGURE 2

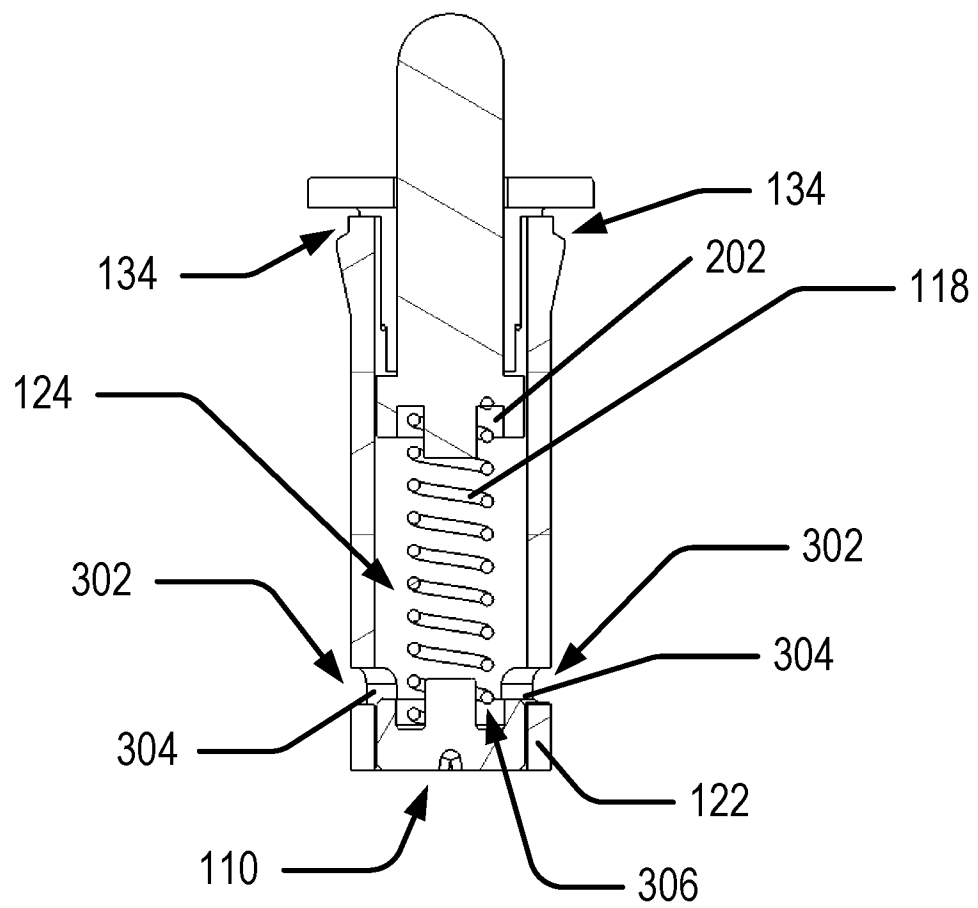


FIGURE 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2019/035708

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16F1/12 B60R7/00 F16F1/04 E05F1/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F16F B60R E05F E05G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2014 105730 A (KOJIMA PRESS KOGYO KK) 9 June 2014 (2014-06-09)	1-4, 6-14, 16-21
A	figures 3, 4 paragraphs [0004], [0013] -----	5,15
X	US 2017/370140 A1 (NAKASONE HISASHI [JP]) 28 December 2017 (2017-12-28)	1,2, 6-12, 16-21
A	figures 2, 6C -----	3-5, 13-15
X	US 9 410 354 B2 (PIOLAX INC [JP]) 9 August 2016 (2016-08-09)	1,6-11, 16-21
A	figure 6 -----	2-5, 12-15
	----- -/-	



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

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A	US 2004/231099 A1 (LI CHIH-HUNG [TW]) 25 November 2004 (2004-11-25) figure 6 paragraph [0026] -----	1-21
A	US 9 212 512 B2 (PIOLAX INC [JP]) 15 December 2015 (2015-12-15) figure 2C -----	1-21

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