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(54) **A hinge with an integrated variable-angle lock**

(57) A hinge comprising a main portion suitable for connecting to a fixed part of an object, an auxiliary portion suitable for connecting to a movable part of an object, a pin connecting said main portion to said auxiliary portion, and partial opening means (5) active between the main portion and the auxiliary portion to position said movable

part of an object in a given number or intermediate opening configurations; said partial opening means comprise a first selective lock interface and a second selective lock interface simultaneously and respectively taking effect between the fixed part of the object and the movable part of the object.

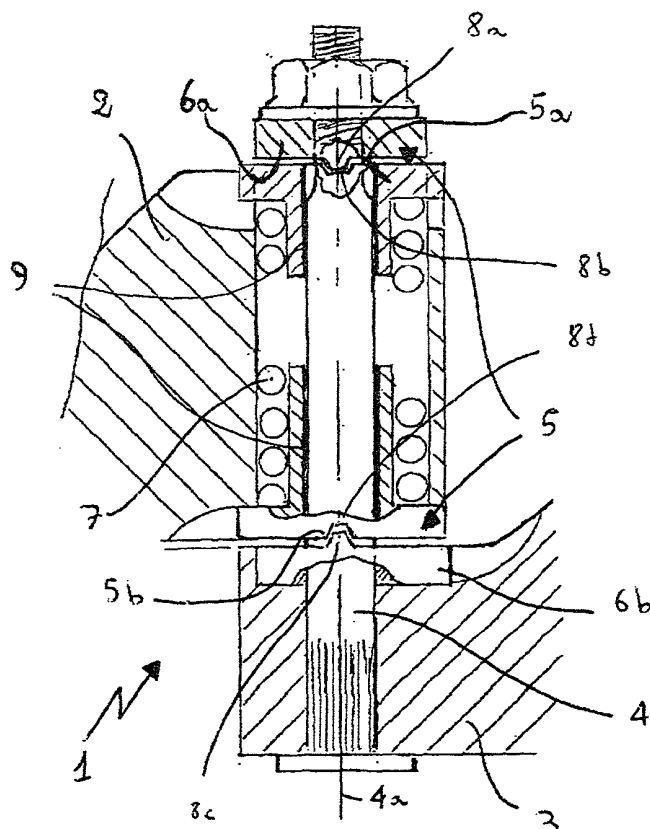


Fig. 3

Description

[0001] The present invention relates to a hinge with an integrated variable-angle lock for use, for instance (but not only), on side and/or rear doors of vehicles.

[0002] It is common knowledge that the mechanism for opening side and/or rear doors of vehicles may need to assure relatively stable intermediate opening positions, e.g. in the case of the space available being insufficient to open the door completely, or if it is essential for the door to remain firmly in an intermediate opening position during loading/unloading procedures.

[0003] There are currently various known types of hinged devices that allow for such intermediate opening positions: for instance, there is a known type of hinge wherein the intermediate opening positions are achieved by means of a tie on the outside of the hinge, that has an axial profile of variable thickness on which rollers and/or cams come to bear (pressed by suitable elastic means) to selectively detain the hinge in one or more intermediate positions.

[0004] Alternatively, there is a known type of hinge fitted with an angular sector integral with the movable part of the hinge: as in the previous example, this angular sector engages with a roller pressed elastically against it.

[0005] Although it is fairly widespread, the above-described known technique poses several drawbacks.

[0006] First of all, in order to guarantee a suitable degree of "stability" for the intermediate opening positions, it is generally necessary for the hinge to generate a torque corresponding to approximately 4 kgm, when it is in such configurations. However the devices of known type are capable of assuring a far more limited torque (of approximately 1.4 kgm), and this gives rise to an unsatisfactory control of the side and/or rear doors ... with all the related safety and ergonomic problems deriving therefrom.

[0007] On the other hand, if the hinges of known type were to be sized to achieve the ideal torque values, their overall dimensions and production costs would become excessive.

[0008] Moreover, when the hinges of known type are used in the assembly of a vehicle, it may be necessary to complete different or separate manufacturing processes on the vehicle chassis and on the side or rear doors (painting, rust-proofing treatments, etc): in such situations, the hinges of known type have the practical drawback of being made in such a way that, once they have been installed between the chassis and the door, they are difficult and/or time-consuming to dismantle temporarily.

[0009] In the light of the above considerations, the object of the present invention is to provide a hinge with an integrated variable-angle lock mechanism capable of overcoming the above-described drawbacks, or at least capable of overcoming the practical limits in use of the conventional types of hinge.

[0010] In particular, the object of the present invention is to conceive a hinge that assures excellent perform-

ance, great reliability, ease of installation, and limited overall dimensions and production costs.

[0011] With particular reference to its potential use in the clinical/medical field, an important object of the present invention is also to provide a hinge that can be used not only on vehicles but also in other technical fields (e.g. furniture, mechanical joints, and so on).

[0012] These and other objects are achieved by a hinge with an integrated variable-angle lock according to the present invention, the characteristics of which are illustrated in the attached claims and described below in various embodiments, given as nonlimiting examples, and also in the attached drawings, wherein:

- figures 1 and 2 show partial cross-sectional views of a first embodiment of the hinge according to the invention;
- figure 3 shows a partial cross-sectional view of a second embodiment of the hinge according to the invention;
- figure 4 shows a partial cross-sectional view of a third embodiment of the hinge according to the invention;
- figure 5 shows a partial cross-sectional view of a fourth embodiment of the hinge according to the invention;
- figure 6 shows a partial cross-sectional view of a fifth embodiment of the hinge according to the invention.

[0013] With reference to the attached figures, the hinge according to the invention is generally indicated by the numeral 1 and substantially comprises a main portion 2, suitable for connecting to a fixed part of an object (which may, for instance, be the chassis of a vehicle) and an auxiliary portion 3, suitable for connecting to a movable part of an object (which may, for instance, be the side or rear door of a vehicle).

[0014] The two above-mentioned portions are connected together by means of a pin 4, operatively-active partial opening means 5 being conveniently provided between the main portion 2 and the auxiliary portion 3, to enable the above-mentioned movable part of the object to be positioned in a predetermined number of intermediate opening configurations.

[0015] The partial opening means 5 advantageously comprise a first selective lock interface 5a, and a second selective lock interface 5b, which act simultaneously and respectively between the pin 4 and the fixed part (or main portion 2) of the object and between the pin 5 and the movable part (or auxiliary portion 3) of the object.

[0016] From the structural standpoint, at least one of the first selective lock interface 5a and the second selective lock interface 5b is rotatably integral with the fixed portion 2, while the other is rotatably integral with the movable portion 3: depending on the structural design of the hinge (e.g. it may be a "cantilevered" hinge, as illustrated in figure 2, or a "forked" hinge as shown in figure 4), both the selective lock interfaces 5a and 5b may also

be integral with the same main portion 2 or auxiliary portion 3 of the object.

[0017] It should be noted at this point that the present invention can assure a far better performance than the hinges of known type: in fact, the presence and simultaneous operativity of the previously-mentioned two selective lock interfaces enables a torque to be generated (in the intermediate opening configurations) substantially twice as strong as in the hinges of known type.

[0018] It is also worth noting that the combined presence of the two selective lock interfaces does not add to the structural complexity of the hinge, which remains nonetheless very compact and easy to manufacture.

[0019] Going now into more structural detail, it is clear that the first and second selective lock interfaces 5a, 5b are installed axially in relation to the pin 4 and take effect simultaneously in mutually opposite (typically axial) directions with respect to the longitudinal axis 4a of the pin 4.

[0020] To be able to ensure the necessary resistance to rotation in the intermediate opening configurations, there are also a first selective lock counter-interface 6a and a second selective lock counter-interface 6b, that are connected respectively to the fixed part of the object and to the movable part of the object.

[0021] Accordingly with the constraint type and level of the selective lock interfaces 5a and/or 5b, the selective lock counter-interfaces 6a and/or 6b may be rotatably integral with the fixed part or the movable part of the object: for instance, in the cantilevered hinge illustrated in figure 2, the second counter-interface 6b is rotatably integral with the movable part of the object, while the second interface 5b can be connected to the fixed part of the object. In the forked hinge illustrated in figure 4, both counter-interfaces 6a and 6b are rotatably integral with the movable part, while the interfaces 5a and 5b are rotatably integral with the fixed part.

[0022] The first and second selective lock counter-interfaces 6a and 6b co-operate respectively and simultaneously with the first and second selective lock interface 5a and 5b to achieve the previously-mentioned increased torque, thereby improving stability in partial opening configurations.

[0023] To guarantee a proper structural consistency in partial opening positions, there are mechanical, preferably elastic, pressure means 7, conveniently provided, designed to ensure the juxtaposition of the first and second selective lock counter-interfaces 6a, 6b simultaneously and respectively with the first and second selective lock interfaces 5a, 5b.

[0024] In the spirit of the present invention, the mechanical pressure means 7 can advantageously comprise at least one elastic element (which may also be a single elastic element, which has the added advantage of simplifying the manufacturing process), which exerts a suitable reaction (tensile or compressive, according to need) on the interfaces, said reaction conveniently having at least one direct component coming to bear in par-

allel with the axis 4a of the pin 4.

[0025] With reference to the attached figures, the mechanical pressure means 7 comprise a spring oriented axially with respect to the pin 4, the opposite ends of which respectively and simultaneously take effect on the partial opening means 5.

[0026] More in general, the mechanical pressure means 7 may comprise an elastic element that is substantially deformable in the direction of the axis 4a of the pin (4), but that is rigid and/or undeformable in the directions of rotation around the axis 4a: the hinge can thus operate more efficiently, avoiding any onset of friction due to axial slipping of the partial opening means 5 (i.e. along the pin 4).

[0027] The particular choice of mechanical pressure means 7 described above enables an improvement in the functionality of their hinge, consequently enabling a smoother opening and/or closing of the side or rear door with less friction and less noise.

[0028] According to another aspect of the present invention, the partial opening means 5 comprise:

- a first interfacing surface belonging to the first interface 5a and presenting at least a first part that is in relief and/or recessed 8a; and
- a second interfacing surface belonging to the first counter-interface 6a and presenting at least a second part that is recessed and/or in relief 8b, mirroring the contours of the corresponding first part in relief and/or recessed 8a on the first interfacing surface.

[0029] The above-mentioned first and second interfacing surfaces are operatively adjacent and come into mutual contact in line with at least one partial opening position, so that a mechanical interference develops between the respective parts in relief and the corresponding recesses.

[0030] At the same time, the partial opening means comprise:

- a third interfacing surface belonging to the second interface 5b, with at least a third part in relief and/or recessed 8c; and
- a fourth interfacing surface belonging to the second counter-interface 6b, with at least a fourth part that is recessed and/or in relief 8d, mirroring the contours of the corresponding third part in relief and/or recess 8c on the third interfacing surface.

[0031] In turn, the third and fourth interfacing surfaces are also adjacent and come into mutual contact in line with at least one partial opening position.

[0032] The shape, number and arrangement of the parts in relief and/or recesses, 8a, 8b, 8c, 8d, may naturally vary according to need and to the type of action and/or movement required of the hinge.

[0033] It should be noted that, in the spirit of the present invention, the various parts in relief and/or recesses (first,

second, third and fourth parts in relief or first, second, third and fourth recesses) belong respectively to four separate bodies, and more particularly, the first part in relief or recess 8a belongs to the first interface 5a, the second part in relief or recess 8b belongs to the first interface counter-interface 6a, the third part in relief or recess 8c belongs to the second interface 5b and, finally, the fourth part in relief or recess 8d belongs to the second counter-interface 6b.

[0034] With reference to the embodiments illustrated, it is clear that the first and second interfaces 5a, 5b are separate bodies lying at opposite ends of the mechanical pressure means 7: in these embodiments, therefore, the partial opening means comprise four distinct elements.

[0035] Should it be necessary to further simplify the hinge, it is also possible to adopt a different configuration of the partial opening means 5, wherein the first and second interfaces 5a, 5b consist of opposite surfaces of the same interfacing body installed coaxially to the pin 4.

[0036] In other words, should it prove necessary to use a smaller number of parts to produce the partial opening means 5, their proper functionality can be guaranteed with just three pieces.

[0037] In the embodiment just described, the mechanical pressure means 7 take effect on the first and second counter-interfaces 6a, 6b to press the latter simultaneously against said interfacing body (typically by means of an action to contract the elastic element); on the other hand, if the first and second interfaces 5a, 5b are two separate pieces, then the mechanical pressure means 7 take effect on the latter to push them against their respective counter-interfaces.

[0038] For the purpose of functional completeness, the present invention can also comprise at least one stop, operatively enabled between the main portion 2 and the auxiliary portion 3 to define at least one maximum opening position of the side or rear door.

[0039] Another innovative and original aspect of the hinge according to the invention lies in that the pin 4 (which is monolithic in figures 3 and 4) can also consist of first and second portions 4b, 4c that are separable from one another and respectively suitable for connecting to the main portion 2 and to the auxiliary portion 3.

[0040] The presence of the two separable portions 4b and 4c effectively makes the hinge easy to dismantle and, in particular, it enables the hinge to be separated into two sub-assemblies that nonetheless remain fitted to and integral with the fixed and movable parts of the object: the present invention thus offers the opportunity to dismantle the hinge 1 quickly and easily, with the advantage of being able to separate the fixed and movable parts of the object.

[0041] The division of the pin 4 into two separable portions can be designed so that one of the two portions includes the selective opening means 5, while the other portion is reversibly separable from the fixed portion 2, or from the movable portion 3.

[0042] The portion 4b (or, more in general, the portion

of the pin 4 that is reversibly separable from the fixed part 2, or from the movable part 3) is conveniently shaped so as to engage simultaneously with the partial opening means 5 (and, more specifically, with a selective lock interface 5a or 5b and/or with a selective lock counter-interface 6a and/or 6b) and with the fixed part 2 or the movable part 3: by engaging simultaneously with said interface(s) and parts, the partial opening means are unequivocally oriented during the assembly of the parts and, at the same time, the two portions of the pin (and consequently the two corresponding portions of the hinge) can be separated without altering the configuration of the partial opening means during the separation of the movable part from the fixed part of the hinge.

[0043] According to need, the reversibly separable portion 4b of the pin 4 can be attached to the fixed part 2 or to the movable part 3 of the hinge 1.

[0044] To facilitate the displacement of the hinge during its opening and closing, anti-friction means can conveniently be inserted between the pin 4 and the fixed part 2, or between the pin 4 and the movable part 3: with reference to the attached drawings, said means may be in the form of a bushing made of suitable material (e.g. Teflon or the like).

[0045] Figure 6 shows the anti-friction bushing 9 installed so that it is integral with the fixed part 2, while the pin 4 is integral with the movable part 3: the anti-friction bushing 9 may nonetheless be installed integral with the movable part 3, while the pin 4 is integral with the fixed part 2.

[0046] It is also worth noting that, for the purposes of structural consistency, the pin 4, the anti-friction means 9 and/or the other parts of the hinge 1 can engage with the fixed part and/or the movable part either directly or indirectly: for instance, a connector element 8 may be provided between the pin 4 and the other parts of the hinge 1.

[0047] Again with a view to improving the quality of the hinge's movement, and particularly for the purposes of improving stability in intermediate opening positions, suitable means may be provided for unloading the weight of the movable part 3 onto the partial opening means: the friction reactions that develop inside the partial opening means 5 thus increase and thereby make the "selective locks" within the hinge 1 more effective.

[0048] As for the possible applications of the invention, the present hinge can be used to advantage in at least two different types of connection between a fixed part and a movable part: for instance, figures 2 and 3 show a so-called "cantilevered" hinge, wherein the fixed and movable parts are offset in relation to one another, on horizontal planes at a different height.

[0049] Figure 4, on the other hand, shows a so-called "forked" hinge, wherein the movable part is connected both above and below the fixed part (or, to be more precise, it is attached simultaneously to a suitable tab on the fixed part by means of a "C-" or "U-"shaped connection that forms an interface on two parallel planes, one above

and the other below the plane on which the fixed part of the object lies). In the above-described embodiments, to enable the parts in relief or recesses (provided and coupled on the interfaces and on the counter-interfaces) to engage and disengage during the relative rotation of the fixed part with respect to the movable part, it is advisable for a relative axial movement (i.e. along the axis 4a of the pin 4) to take place between at least one interface and the corresponding counter-interface: said relative movement conveniently coincides with a variation in the axial dimensions of the mechanical pressure means 7.

[0050] To facilitate said axial movement, while also minimising the effects of the radial friction that would develop between the surfaces of the parts in relief and recesses during the rotation of the one with respect to the other, auxiliary means 10 can also be advantageously provided, that operatively take effect between the fixed part 2 (or the movable part 3) and at least one of the interfaces 5a and/or 5b or the counter-interfaces 6a and/or 6b, to induce their relative axial movement.

[0051] These auxiliary means are conveniently deformable in the direction of the axis 4a of the pin 4, but they are substantially undeformable in the sense of any rotations in planes perpendicular to said axis 4a: in the embodiment shown in figure 6, the auxiliary means 10 are implemented by means of a metal foil with one end attached to the movable part 3 and the other end inserted between the mechanical pressure means 7 and the first selective lock interface 5a.

[0052] Depending on the structural design required in a given context, the ends of the above-mentioned metal foil can be attached to the fixed part 2 or to the second selective lock interface 5b, or to the first selective lock counter-interface 6a, or to the second selective lock counter-interface 6b.

[0053] The present invention enables important advantages to be obtained.

[0054] First of all, it should be noted that the particular structural design of the hinge described herein and in the following claims enables the right degree of torque to be obtained so as to guarantee a substantial stability for the side or rear door in any intermediate opening configuration; at the same time, the hinge according to the invention enables the user of the vehicle to close or open the side or rear door without having to apply excessive effort.

[0055] It should likewise be noted that the hinge according to the invention is extremely compact and can consequently be installed even in very small spaces.

[0056] It is also worth noting that, thanks to the particular structure of the pin, the hinge can be separated into two parts (one integral with the vehicle chassis and the other integral with the side or rear door), which carries the advantage of a greater processing flexibility during the manufacturing of the vehicle and/or the painting of its bodywork.

[0057] Finally, it is worth adding that the present invention enables low manufacturing costs to be achieved and offers a great flexibility of application, even in settings

other than the installation of hinges on vehicles.

Claims

1. A hinge, preferably for use in vehicles, comprising:

- a main portion (2) suitable for connecting to a fixed part of an object, said fixed part of an object preferably being the chassis of a vehicle;
- an auxiliary portion (3) suitable for connecting to a movable part of an object, said movable part of an object preferably being the side or rear door of a vehicle;
- a pin (4) connecting said main portion (2) to said auxiliary portion (3); and
- partial opening means (5) operatively taking effect between the main portion (2) and the auxiliary portion (3) to position said movable part of an object in a given number or intermediate opening configurations,

characterised in that said partial opening means (5) comprise a first selective lock interface (5a) and a second selective lock interface (5b) simultaneously and respectively taking effect between the fixed part (2) of the object and the movable part (3) of the object.

2. A hinge according to claim 1, wherein the partial opening means (5) comprise a first selective lock interface (5a) and a second selective lock interface (5b) simultaneously and respectively taking effect between the pin (4) and the fixed part (2) of the object, and between the pin (4) and the movable part (3) of the object.

3. A hinge according to claims 1 or 2, wherein the first and second selective lock interfaces (5a, 5b) are installed axially in relation to the pin (4) and take effect simultaneously, in preferably the axial direction, one opposite the other, with respect to the longitudinal axis (4a) of the pin (4).

4. A hinge according to any of the previous claims, also comprising a first selective lock counter-interface (6a) and a second selective lock counter-interface (6b) connected respectively to the fixed part of the object and to the movable part of the object, said first and second selective lock counter-interfaces (6a, 6b) respectively and simultaneously co-operating with the first and second selective lock interfaces (5a, 5b).

5. A hinge according to any of the previous claims, also comprising preferably elastic, mechanical pressure means (7) designed to simultaneously and respectively juxtapose the first and second selective lock

counter-interfaces (6a, 6b) with the first and second selective lock interfaces (5a, 5b).

6. A hinge according to any of the previous claims, wherein said mechanical pressure means (7) comprise at least one elastic element exerting a reaction with at least one direct component parallel to the axis (4a) of the pin (4), said mechanical pressure means (7) preferably comprising at least one spring oriented axially to the pin (4), the opposite ends of said spring respectively and simultaneously coming to bear on the partial opening means (5).
7. A hinge according to claim 6, wherein the mechanical pressure means (7) comprise a preferably elastic element substantially deformable in the direction of the axis (4a) of the pin (4), said elastic element being even more preferably rigid and/or undeformable in the direction of rotation around said axis (4a).
8. A hinge according to any of the previous claims, wherein the partial opening means (5) comprise:
 - a first interfacing surface belonging to the first interface (5a) and presenting at least one part in relief and/or recess;
 - a second interfacing surface belonging to the first counter-interface (6a) and presenting at least one recess and/or part in relief with contours that mirror said at least one part in relief and/or recess on the first interfacing surface, said first and second interfacing surfaces being adjacent and in mutual contact in line with at least one partial opening position;
 - a third interfacing surface belonging to the second interface (5b) and presenting at least one part in relief and/or recess; and
 - a fourth interfacing surface belonging to the second counter-interface (6b) and presenting at least one recess and/or part in relief with contours that mirror said at least one part in relief and/or recess on the third interfacing surface, said third and fourth interfacing surfaces being adjacent and in mutual contact in line with at least one partial opening position.
9. A hinge according to any of the previous claims, wherein the first and second interfaces (5a, 5b) are separate bodies lying at opposite ends of the mechanical pressure means (7).
10. A hinge according to any of the previous claims from 1 to 8, wherein the first and second interfaces (5a, 5b) consist of the opposite surfaces of the same interfacing body installed preferably in a direction coaxial to the pin (4), the mechanical pressure means (7) even more preferably taking effect on the first and second counter-interfaces (6a, 6b) to press them si-

multaneously against said interfacing body.

11. A hinge according to any of the previous claims, wherein there are also auxiliary means (10) operatively taking effect between the fixed part (2) or the movable part (3) and at least one of the selective lock interfaces (5a) and/or (5b) or the selective lock counter-interfaces (6a) and/or (6b) to induce their relative axial movement.
12. A hinge according to claim 11, wherein said auxiliary means (10) are deformable in the direction of the axis (4a) of the pin (4) and substantially undeformable in the sense of rotations in planes perpendicular to the axis (4a), the auxiliary means (10) preferably comprising a metal foil with one end attached to the fixed part (2) or the movable part (3), and the other end inserted between the mechanical pressure means (7) and the first selective lock interface (5a) or the second selective lock interface (5b), or the first selective lock counter-interface (6a) or the second selective lock counter-interface (6b).
13. A hinge according to any of the previous claims, wherein the pin (4) comprises first and second portions (4b, 4c) that are separable from one another and that can be connected respectively to the main part (2) and to the auxiliary part (3), one portion (4b) preferably comprising the selective opening means (5), while the other portion (4c) is even more preferably reversibly separable from the fixed part (2) or from the movable part (3).
14. A hinge according to claim 13, wherein a portion of the pin (4) that is reversibly separable from the fixed part (2) or from the movable part (3) is shaped so as to engage simultaneously with the partial opening means (5) and with the fixed part (2) or the movable part (3), said reversibly separable portion of the pin (4) preferably being suitable for attaching to the fixed part (2) or to the movable part (3) of the hinge (1).
15. A hinge according to any of the previous claims, wherein there are also anti-friction means inserted between the pin (4) and the fixed part (2), or between the pin (4) and the movable part (3), said anti-friction means preferably comprising a bushing (9) made of a suitable material.
16. A hinge according to any of the previous claims, wherein there is also a connector element (8) inserted between the pin (4) and the remaining parts of the hinge (1).
17. A hinge according to any of the previous claims, wherein there are also means for unloading the weight of the movable part (3) onto the partial opening means.

18. A hinge according to any of the previous claims, wherein there is also at least one limit stop that can be operatively enabled between the main part (2) and the auxiliary part (3) to define at least one of maximum opening position.

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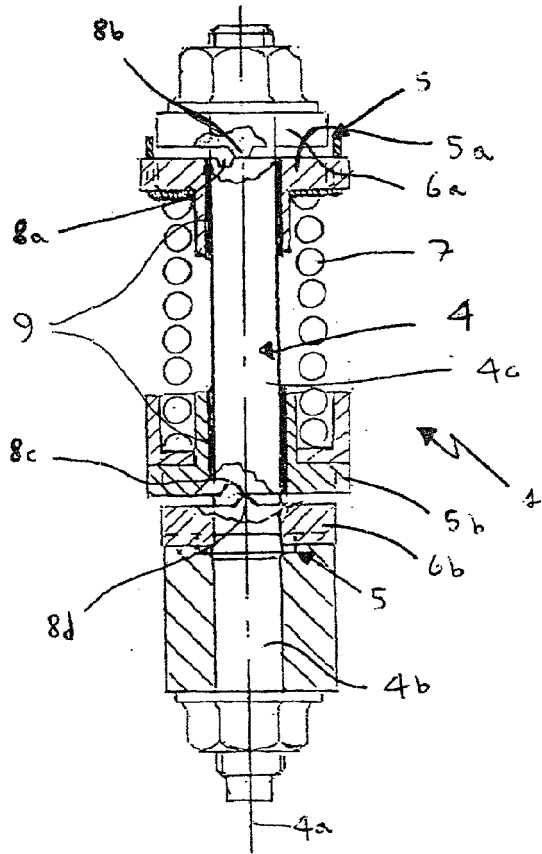
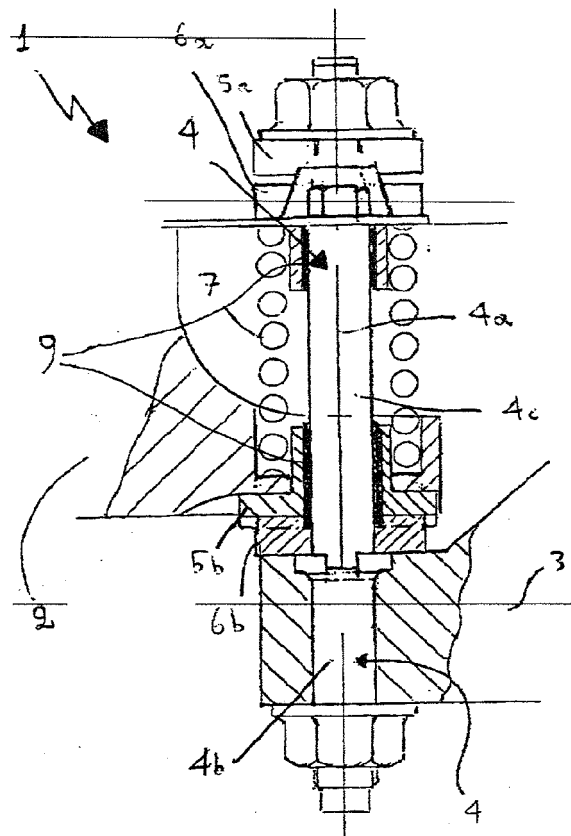


Fig. 1

Fig. 2



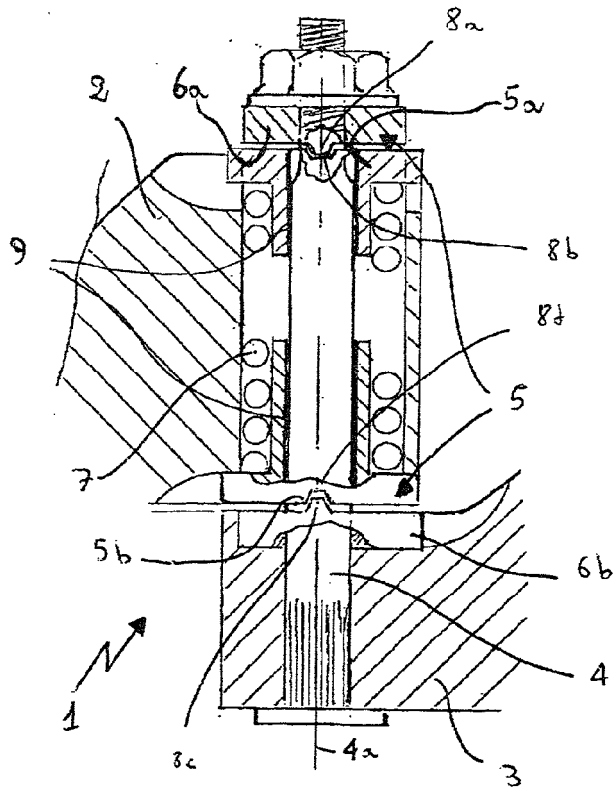


Fig. 4

