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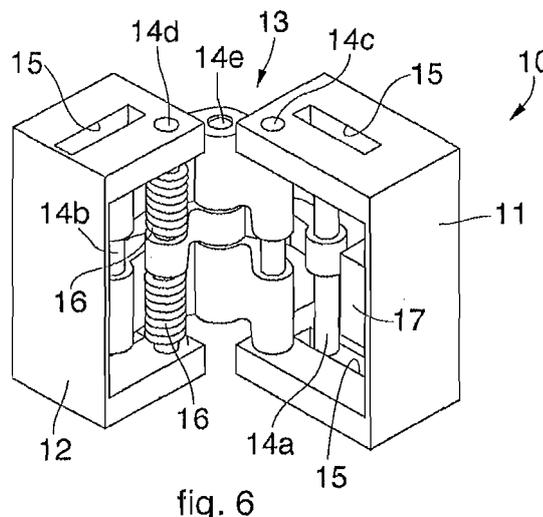
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(54) **Concealed hinge with an automatic return device toward a closed position**

(57) Concealed hinge comprising two containing bodies (11, 12) hollow inside, a hinging kinematism (13) disposed inside the two containing bodies (11, 12), in an articulated manner with respect thereto, and at least one elastic element (16) associated to the hinging kinematism (13) in order to apply to the latter a force tending to maintain, or to return, the two containing bodies (11, 12) in a

closed position. A magnetic element (17) is disposed inside at least one of the two containing bodies (11, 12), and acts on at least one of the mobile parts which make up the hinging kinematism (13), in order to contribute to maintain, or return, the two containing bodies (11, 12) in a closed position.



Description

FIELD OF THE INVENTION

[0001] The present invention concerns a hinge of the so-called concealed or invisible type, since it is not visible from the outside when it is mounted in a door or window frame or piece of furniture, which is in a closed position. The hinge comprises two hinging units, articulated to each other by means of a central articulation pin and pivoted on two corresponding containing bodies, one insertable in a seating of a fixed structure, such as the frame of a window or door or piece of furniture for example, and the other in a seating of a corresponding mobile structure, such as for example a door, a window, a shutter or a panel of a door or window, or a piece of furniture. The hinge allows to open the mobile structure by 180° with respect to the fixed structure. Moreover, the hinge according to the present invention is provided with a device which tends to maintain it or return it automatically constantly toward a closed position.

BACKGROUND OF THE INVENTION

[0002] In the field of door and window frames and furniture, concealed or invisible hinges are known, that is, the type in which, in the closed position, all the elements that make it up are completely inserted inside the door or window frame or piece of furniture on which they are mounted, so that they are not visible from the outside.

[0003] Known concealed hinges can be substantially divided into three main categories, depending on the number of fixed and mobile fulcrums of the kinematism that allows them to move between a closed position and a position of maximum opening, usually rotated by 180° with respect to the closed one. These three categories are: A) invisible hinges with 5 fulcrums, 2 of which are sliding, which is shown schematically in figs. 1 and 1a; B) those with 6 fulcrums, of which one is sliding, which is shown schematically in figs. 2 and 2a; C) those with 7 fulcrums, of which 4 are in a fixed position and the other three constrained to move according to the kinematism, which is shown schematically in fig. 3.

[0004] Hereafter the three categories of hinge will also be called respectively "5+2", "6+1" and "7".

[0005] It is also known that in each of these known hinges it is possible to obtain an automatic return action, that is, an automatic closing, thanks to the application of elastic elements, such as traction springs, torsion springs, leaf springs or other type, on the elements that make up the kinematisms of the hinges, which vary depending on the type of elastic element used and the type of hinge. Hereafter, some examples are shown of known solutions to the problem of the automatic closing of doors or frames using invisible hinges which have elastic elements. Moreover, some possible alternative dispositions will also be shown, which in any case guarantee the function of an automatic return of the hinges, and thus of the

automatic closing of the doors on which such devices are installed.

[0006] It is known, for example, to obtain a closing effect with traction springs. With reference to a "5+2" configuration (figs. 1 and 1a), a traction spring, acting between each of the sliding fulcrums f_a and f_b and the bottom of the corresponding containing body, exerts an opposite action to that which allows the sliding of the fulcrums f_a and f_b starting from the closed position, shown in fig. 1. For this reason, traction springs have a closing effect on the hinge and hence on the corresponding mobile part, for example a door or a window of a frame or of a piece of furniture.

[0007] Examples of this known application are described in the American patent US-A-3,004,280 and in the European patent application EP-A-0352912.

[0008] Also in a hinge of the "6+1" type (figs. 2 and 2a), it is possible to obtain a closing effect by means of a traction spring, which opposes the translation of the fulcrum f_b . An example of a "6+1" type hinge is described in the European patent application N° 12188173.4 in the name of the present Applicants.

[0009] Torsion springs have also been widely used to obtain an automatic return function in hinges, above all in "not invisible" hinges, such as those described in the American patent US-A-1,892,584. Torsion springs can be used for the same purpose in invisible hinges too. For example, with reference to a "5+2" category hinge, one or more torsion springs can be inserted in order to exploit the rotation of one of the two fixed fulcrums f_c and f_d (figs. 1 and 1a). These torsion springs, with one shaft solid with the elements in rotational motion and one inserted in the housing of the hinge, tend to exert an opposite moment to that which opens the hinge.

[0010] Another possible application of torsion springs is where the two ends of the spring are made solid to the two arms which make up the kinematism of the hinge, with the spring coaxial to the central fulcrum f_e of the hinge, as shown in figs. 1 and 1a. In this case too a torsion spring would exert an opposite moment to that which opens the hinge.

[0011] With regard to a category "6+1" hinge (figs. 2 and 2a), a torsion spring can be applied in correspondence to the three fixed fulcrums f_c , f_d and f_f , acting between a rotation arm and the containing body of the hinge, or in correspondence to the central fulcrum f_e , acting thanks to the relative rotation of the two arms. Moreover, it is also possible to insert a torsion spring in correspondence to the fulcrum f_a that connects the crank-type lever to the corresponding arm of the kinematism.

[0012] Finally, with regard to a category "7" hinge (fig. 3), a torsion spring can be inserted in correspondence to one of the four fixed fulcrums f_c , f_d , f_f and f_g with respect to the containing bodies, in correspondence to the central fulcrum f_e , or again in one of the two fulcrums f_a and f_b that articulate the arms of the kinematism with respect to each other.

[0013] Leaf springs are another elastic element poten-

tially able to exert a closing action. Their application is possible in all three of the above categories of hinge. The only difference with respect to the solutions analyzed heretofore is that for the application of leaf springs the profile of the rotating body must be suitably profiled to exert the action of compression on the spring itself, mounted in contact on one or more faces of the containing bodies of the hinge.

[0014] The known hinges described above all have at least the following disadvantage. Whichever type of spring is used, in proximity to the closed position of the hinge, that is, with an angle of opening near to 0°, the force exerted by the spring is minimal. In other words, for low angles of opening any spring exerts an action only equal to that of a possible preloading of the spring itself. This means that, in the case of high preloading, it is possible to have an effective closing action, but with the disadvantages that a great effort is needed to open the hinge, there is increased complexity in mounting, and greater loads in action. On the contrary, with lower preloading, it is certainly easier to open the hinge, and there is also a reduction in technical complexity, but the closing action is less effective.

[0015] From the patent application for a Japanese utility model JP-U-05 52181 a concealed hinge is known that comprises two containing bodies, hollow inside and suitable to be associated one to a fixed structure and the other to a mobile structure. A hinging kinematism with a plurality of mobile parts is disposed inside the two containing bodies, in an articulated manner with respect thereto. A pair of springs cooperate with the hinging kinematism in order to apply to the latter a force tending to keep the two containing bodies in a closed position. A magnetic element is also provided, disposed in correspondence to the external part of one of the two containing bodies, and configured to cooperate with a corresponding ferromagnetic element, mounted on the other of the two containing bodies, when the two containing bodies are in the closed position. The concealed hinge described in document JP-U-05 52181 has the disadvantage that the magnetic element acts on the corresponding ferromagnetic element only when the two containing bodies are in their closed position, or in proximity thereto, whilst it has practically no effect when the two containing bodies are in the open position. Indeed, as is known, the magnetic attraction of the magnetic element reduces with the square of the distance from the corresponding ferromagnetic element. Moreover, another disadvantage of the concealed hinge described in document JP-U-05 52181 is that, in its open position, the magnetic element could attract other metallic objects which might be near the hinge.

[0016] The European patent application EP-A-1 857 624 describes a hinge for motor vehicles that comprises two containing bodies in each of which an arm is pivoted having one end provided with a portion sliding in an aperture in the other containing body. In each containing body, in correspondence to said aperture, a friction ele-

ment is provided, with a high friction coefficient, in order to contrast the movements of the corresponding portion of the arm. EP-A-1-857 624 neither provides nor suggests to use any magnetic element in order to promote the closing of the hinge or to keep it in the closed position.

[0017] One purpose of the present invention is to obtain a concealed hinge that is provided with an automatic return device toward a closed position of the hinge and that said automatic return device is simple, reliable and inexpensive.

[0018] Another purpose of the present invention is to obtain a concealed hinge that is provided with an automatic return device that on the one hand guarantees that the hinge is properly maintained in the closed position, and on the other does not require the user to exert great force in order to pass from the closed position to any open position, with a rotation of a few degrees up to 180° with respect to the closed position.

[0019] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0020] The present invention is set forth and characterized in the independent claim, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0021] In accordance with the above purposes, a concealed hinge according to the present invention, for door and window frames or pieces of furniture, with a mobile structure articulated with respect to a fixed structure, comprises two containing bodies, hollow inside and one suitable to be associated to the fixed structure and the other to the mobile structure, or vice versa. A hinging kinematism with at least one mobile part is disposed inside the two containing bodies, in an articulated manner with respect thereto. At least one elastic element and one magnetic element are associated to the hinging kinematism in order to apply to the latter a force tending to return the two containing bodies in a closed position.

[0022] According to a characteristic feature of the present invention, both the at least one elastic element and the at least one magnetic element are inserted inside at least one or both the containing bodies, in order to act at least on the mobile part of the kinematism, in order to contribute to maintain, or return, the two containing bodies in their closed position.

[0023] According to another characteristic feature of the present invention, the magnetic element comprises a magnet, installed in contact with an internal wall of one of the containing bodies.

[0024] The use of a magnetic element disposed inside at least one of the two containing bodies introduces a supplementary force precisely in the functioning field in which the action of the elastic element is most lacking, that is, for small angles of opening of the hinge, without

affecting the force needed to open it. This is because the force exerted by a magnetic element on a metal body decreases to the square with the distance of the body. For this reason, once the opening of the hinge has begun, the magnetic element does not cause the user extra work due to the rapid decrease of its action with the increase in distance.

[0025] It is possible to insert magnetic elements in all three categories of hinge described heretofore, that is "5+2", "6+1" and "7".

[0026] The magnetic elements, located for example on the bottom of the containing bodies, can exert a recall action both on the translating parts, as in the "5+2" hinge, or in the sliding pin of the "6+1" hinge, and in the crank-type levers in rotary motion, as in the kinematics of the "6+1" or "7" hinges.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a schematized and plan view of a concealed hinge according to the state of the art, type A, that is the "5+2" type, in a closed position;
- fig. 1a is a schematized and plan view of the hinge in fig. 1 in an open position at 90°;
- fig. 2 is a schematized and plan view of a concealed hinge according to the state of the art, type B, that is the "6+1" type, in a closed position;
- fig. 2a is a schematized and plan view of the hinge in fig. 2 in an open position at 90°;
- fig. 3 is a schematized and plan view of a concealed hinge according to the state of the art, type C, that is the "7" type, in a closed position;
- fig. 4 is a front schematized view of a concealed hinge according to the present invention, "5+2" type, in a closed position;
- fig. 5 is a section from V to V in fig. 4;
- fig. 6 is a three-dimensional view of the hinge in fig. 4 in an open position at 90°;
- fig. 7 is a front view of the hinge in fig. 6;
- fig. 8 is a section from VIII to VIII in fig. 7;
- fig. 9 is a three-dimensional view of the hinge in fig. 4 in a position of maximum opening at 180°;
- fig. 10 is a front view of the hinge in fig. 9;
- fig. 11 is a section from XI to XI in fig. 10;
- fig. 12 is a schematized front view of a concealed hinge according to the present invention, "6+1" type, in a closed position;
- fig. 13 is a section from XIII to XIII in fig. 12;
- fig. 14 is a three-dimensional view of the hinge in fig. 12 in an open position at 90°;
- fig. 15 is a front view of the hinge in fig. 14;
- fig. 16 is a section from XVI to XVI in fig. 15;

- fig. 17 is a three-dimensional view of the hinge in fig. 12 in a position of maximum opening at 180°;
- fig. 18 is a front view of the hinge in fig. 17;
- fig. 19 is a section from XIX to XIX in fig. 18;
- 5 - fig. 20 is a schematized front view of a concealed hinge according to the present invention, "7" type, in a closed position;
- fig. 21 is a section from XXI to XXI in fig. 20;
- 10 - fig. 22 is a three-dimensional view of the hinge in fig. 20 in an open position at 90°;
- fig. 23 is a front view of the hinge in fig. 22;
- fig. 24 is a section from XXIV to XXIV in fig. 23;
- fig. 25 is a three-dimensional view of the hinge in fig. 20 in a position of maximum opening at 180°;
- 15 - fig. 26 is a front view of the hinge in fig. 25;
- fig. 27 is a section from XXVII to XXVII in fig. 26.

[0028] To facilitate comprehension, the same reference numbers have been used, where possible, to identify identical common elements in the drawings. It is understood that elements and characteristics of one form of embodiment can conveniently be incorporated into other forms of embodiment without further clarifications.

25 DETAILED DESCRIPTION OF THREE PREFERENTIAL FORMS OF EMBODIMENT

[0029] In figs. 4 to 11, a "5+2" type hinge 10 of the concealed type according to the present invention and in accordance with a first form of embodiment, is shown schematically but sufficiently clearly and completely so that a person of skill can make it.

[0030] The hinge 10 comprises two containing bodies 11 and 12, hollow inside and one suitable to be associated to a fixed structure and the other to a mobile structure of a door or window frame or a piece of furniture, or vice versa. A hinging kinematism 13, of the known type and therefore not described in detail, is disposed inside the two containing bodies 11 and 12, in an articulated manner with respect thereto. The hinging kinematism 13 comprises five fulcrums 14a, 14b, 14c, 14d and 14e. The fulcrums 14a and 14b are able to slide on pairs of rectilinear grooves 15 made on the two containing bodies 11 and 12. The fulcrums 14c and 14d are fixed, whilst the fulcrum 14e acts as a central fulcrum of the hinging kinematism 13.

[0031] A pair of torsion springs 16, which act as elastic elements, are disposed in a spiral around the fixed fulcrum 14d, and constantly apply a force on the latter that tends to maintain, or to return, the two containing bodies 11 and 12 and therefore the hinge 10, into a closed position, shown in figs. 4 and 5.

[0032] A magnet 17 is mounted in the containing body 11, for example on one of its internal walls, so as to cooperate with the sliding fulcrum 14a and in particular to attract it toward itself, until it contacts it, when the hinge 10 is in the closed position. According to a variant, not shown in the drawings, but easily understood by a person

of skill, a ferromagnetic element can be associated to the sliding fulcrum 14a, so that the magnet will directly contact the former rather than the sliding fulcrum 14a.

[0033] The action of the magnet 17 increases to the square as the sliding fulcrum 14a gets near to it. Therefore, since the minimum distance is reached when the hinge 10 is almost closed, the magnet 17 will exert the maximum action precisely for low angles of opening of the hinge 10, that is, when the action of the torsion spring 16 is least effective.

[0034] When the hinge 10 is in the open positions, and in particular those from 90° to 180°, shown in figs. 5 to 8 and respectively 9 to 11, the action of the magnet 17 loses effectiveness, but that of the torsion spring 16 increases.

[0035] In figs. 12 to 19 a "6+1" type hinge 10 of the concealed type according to the present invention and in accordance with a second form of embodiment, is shown schematically but sufficiently clearly and completely so that a person of skill can make it. The hinge 110 is similar to that described in the European patent application N° 12188173.4 of the present Applicant, which is cited here for reference.

[0036] With respect to the hinge 10 as described above, the hinge 110 has the following differences.

[0037] The fulcrum 14a, instead of sliding, is pivoted at the end of a crank-type lever 18, which in turn is pivoted on a fixed fulcrum 14f mounted on the containing body 11.

[0038] Only the fulcrum 14b is able to slide on a pair of grooves 15 made on the containing body 12, which instead of being rectilinear are curved.

[0039] The pair of torsion springs 16 is disposed in a spiral around the fixed fulcrum 14f.

[0040] The magnet 17 is mounted in the containing body 11 so as to cooperate with the crank-type lever 18 and in particular to attract it toward itself, until it is in contact, when the hinge 110 is in the closed position (figs. 12 and 13). According to a variant, not shown in the drawings but easily understood by a person of skill, a ferromagnetic element 17 can be associated to the crank-type lever 18, so that the magnet 17 will directly contact the former rather than the crank-type lever 18.

[0041] Similarly to the hinge 10, when the hinge 110 is in open positions, and in particular those from 90° to 180°, shown in figs. 14 to 16 and respectively 17 to 19, the action of the magnet 17 loses effectiveness, but that of the torsion springs 16 increases.

[0042] In figs. 20 to 27, a "7" type hinge 210 of the concealed type according to the present invention and in accordance with a third form of embodiment, is shown schematically but sufficiently clearly and completely so that a person of skill can make it.

[0043] With respect to the hinge 10 described above, the hinge 210 has the following differences.

[0044] The fulcrums 14a and 14b, instead of sliding, are each pivoted to the end of an arm 19, respectively 20 of the hinging kinematism 13, which in turn is pivoted on a fixed fulcrum 14f mounted on the containing body

11, respectively 14g, mounted on the containing body 12.

[0045] The pair of torsion springs 16 is disposed in a spiral around the fixed fulcrum 14g.

[0046] The magnet 17 is mounted in the containing body 11 so as to cooperate with the arm 19 and in particular to attract it toward itself, until it is in contact, when the hinge 210 is in the closed position (figs. 20 and 21). According to a variant, not shown in the drawings but easily understood by a person of skill, a ferromagnetic element can be associated to the arm 19, so that the magnet 17 will directly contact the former rather than the arm 19.

[0047] Similarly to the hinges 10 and 110, when the hinge 210 is in the open positions, and in particular those from 90° to 180°, shown in figs. 22 to 24 and respectively 25 to 27, the action of the magnet 17 loses effectiveness, but that of the torsion springs 16 increases.

[0048] From the previous description it is clear that the concealed hinges 10, 110, 210 comprise at least one elastic element (torsion springs 16) associated to the hinging kinematism 13 in order to apply to the latter a force tending to maintain or return the two containing bodies 11 and 12 in a closed position, and that at least one magnetic element (magnet 17) is provided inside at least one of the containing bodies 11 and 12 and acts on at least one of the mobile parts (sliding fulcrum 14a, crank-type lever 18, or arm 19) which make up the hinging kinematism 13, in order to contribute to maintaining or returning the two containing bodies 11 and 12 in a closed position.

[0049] It is clear that modifications and/or additions of parts may be made to the hinges 10, 110, 210 as described heretofore, without departing from the field and scope of the present invention.

[0050] For example, other torsion springs or traction springs, or even leaf springs can be provided in addition to or in substitution of torsion springs 16, as explained in the part concerning the background of the invention.

[0051] Moreover, adjustment members can be provided that allow the reciprocal adjustment of the two containing bodies 11 and 12.

[0052] In addition, adjustment members can also be provided to adjust the position of the magnetic element 17, so as to be able to distance it from or bring it nearer to the sliding fulcrum 14a, the crank-type lever 18 or the arm 19.

[0053] It is also clear that, although the present invention has been described with reference to some specific examples, a person of skill in the art shall certainly be able to achieve many other equivalent forms of concealed hinges, having the characteristics as set forth in the claims and hence all coming within the field of protection defined thereby.

Claims

1. Concealed hinge comprising two containing bodies

- (11, 12) hollow inside and one suitable to be associated to a fixed structure and the other to a mobile structure, or vice versa, a hinging kinematism (13) having at least one mobile part and disposed inside said two containing bodies (11, 12), in an articulated manner with respect thereto, and at least one elastic element (16) and one magnetic element (17) associated to said hinging kinematism (13) in order to apply to the latter a force tending to maintain, or to return, said two containing bodies (11, 12) in a closed position, **characterized in that** both said at least one elastic element (16) and said at least one magnetic element (17) are inserted inside at least one or both of said containing bodies (11, 12), in order to act on said at least one mobile part of said hinging kinematism (13), in order to contribute to maintain, or return, said two containing bodies (11, 12) in said closed position.
2. Concealed hinge as in claim 1, **characterized in that** said magnetic element comprises a magnet (17), mounted on an internal wall of one of the containing bodies (11, 12).
3. Concealed hinge as in claim 1 or 2, **characterized in that** said elastic element comprises at least a torsion spring (16) disposed in a spiral around a fixed fulcrum (14d, 14f, 14g) of said hinging kinematism (13).
4. Concealed hinge as in claim 1, 2 or 3, wherein said hinging kinematism (13) comprises two sliding fulcrums (14a, 14b), **characterized in that** said magnetic element (17) is configured to cooperate with a first sliding fulcrum (14a) of said sliding fulcrums (14a, 14b).
5. Concealed hinge as in claim 4, **characterized in that** said magnetic element (17) is configured to contact said first sliding fulcrum (14a), or a ferromagnetic element solid therewith, when said containing bodies (11, 12) are in said closed position.
6. Concealed hinge as in claim 1, 2 or 3, wherein said hinging kinematism (13) comprises at least a crank-type lever (18) pivoted on one of said containing bodies (11, 12), **characterized in that** said magnetic element (17) is configured to cooperate with said at least one crank-type lever (18).
7. Concealed hinge as in claim 6, **characterized in that** said magnetic element (17) is configured to contact said at least one crank-type lever (18), or a ferromagnetic element solid therewith, when said containing bodies (11, 12) are in said closed position.
8. Concealed hinge as in claim 1, 2 or 3, wherein said hinging kinematism (13) comprises at least two arms (19, 20) each pivoted on one of said containing bodies (11, 12), **characterized in that** said magnetic element (17) is configured to cooperate with a first arm (19) of said at least two arms (19, 20).
9. Concealed hinge as in claim 8, **characterized in that** said magnetic element (17) is configured to contact said first arm (19), or a ferromagnetic element solid therewith, when said containing bodies (11, 12) are in said closed position.

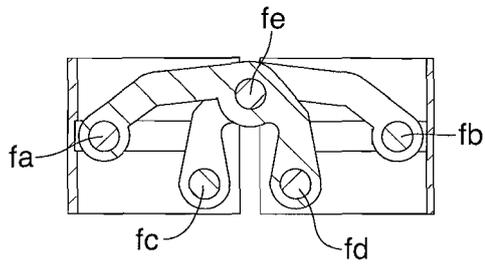


fig. 1
STATE OF THE ART

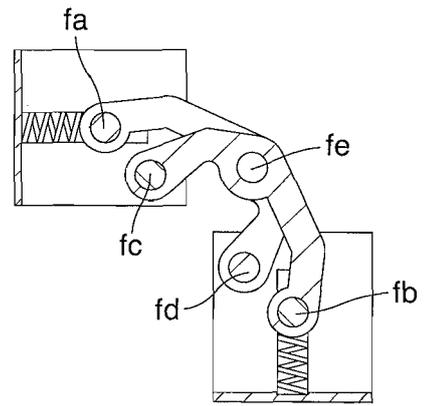


fig. 1a
STATE OF THE ART

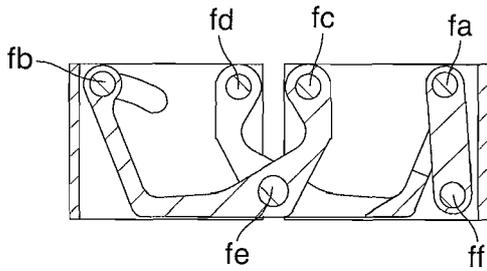


fig. 2
STATE OF THE ART

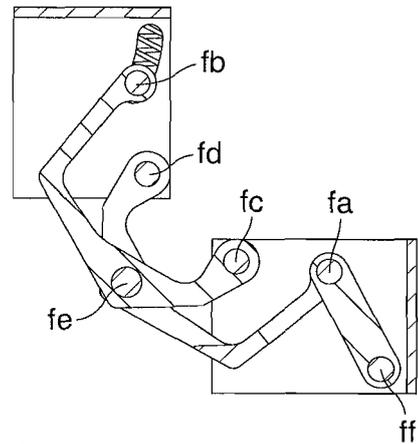


fig. 2a
STATE OF THE ART

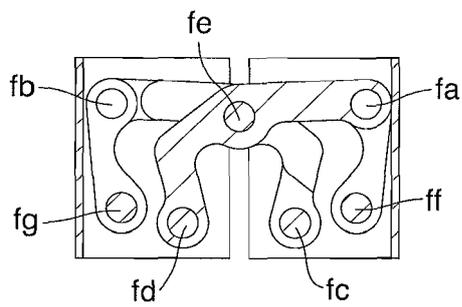


fig. 3
STATE OF THE ART

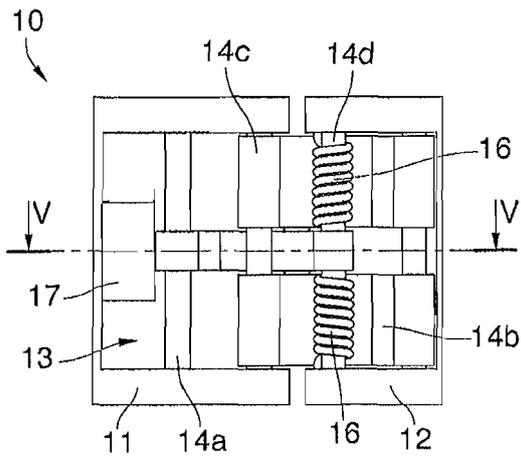


fig. 4

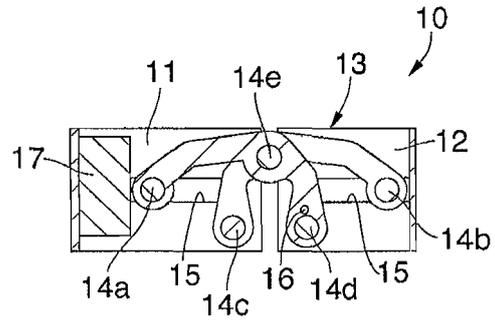


fig. 5

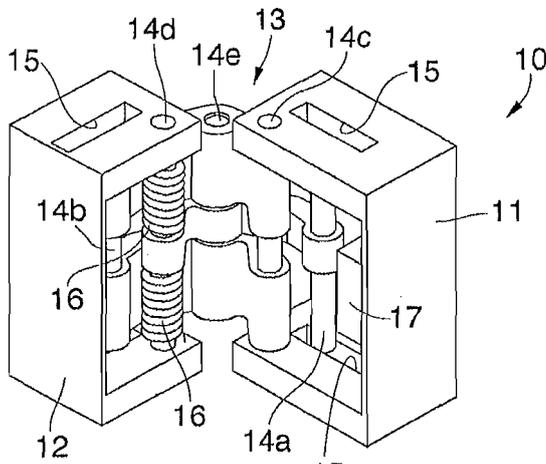


fig. 6

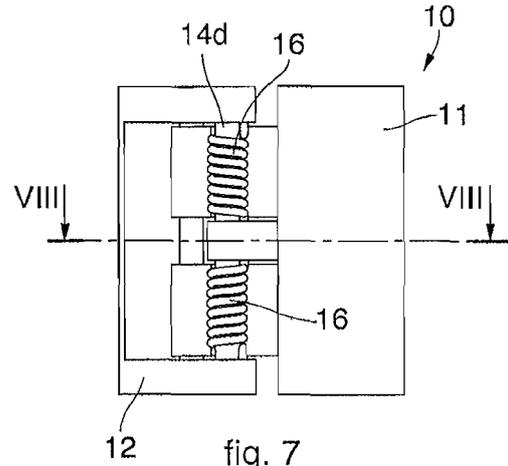


fig. 7

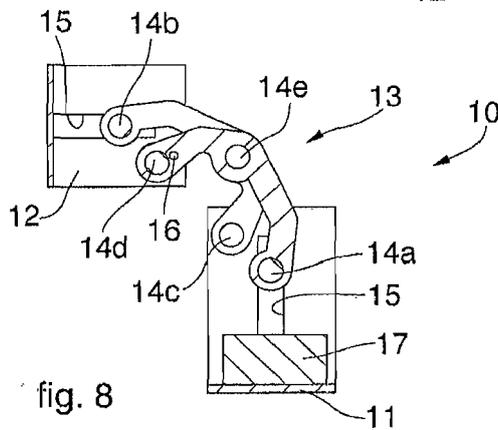


fig. 8

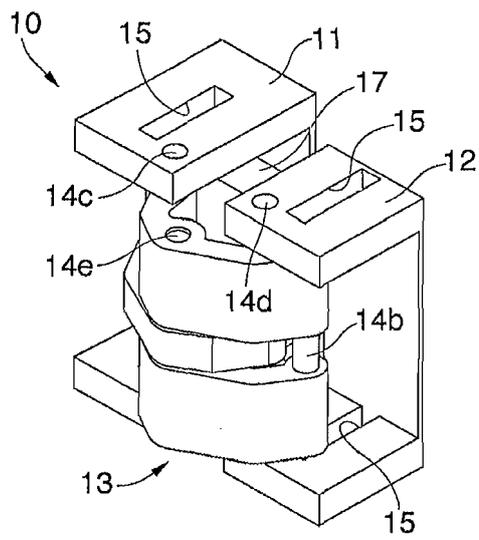


fig. 9

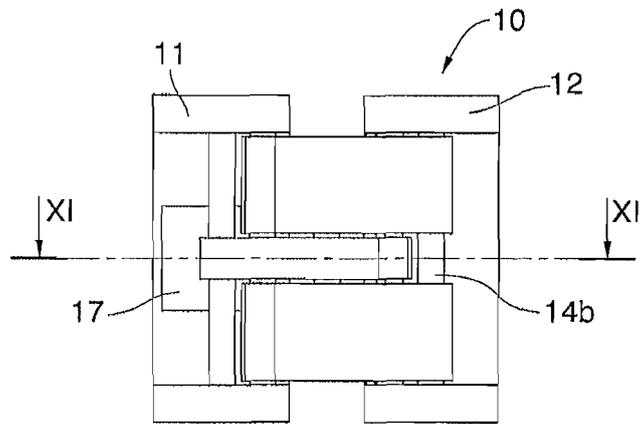


fig. 10

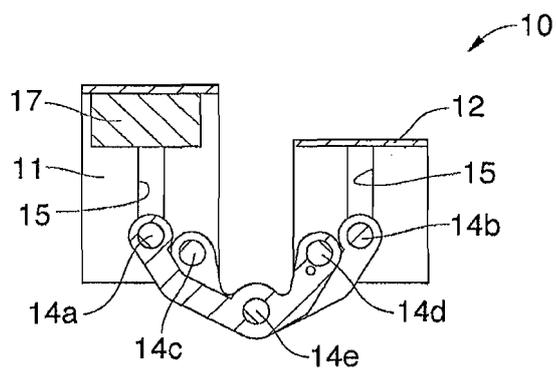
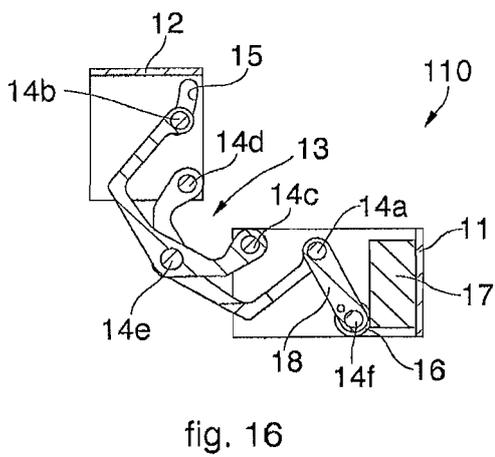
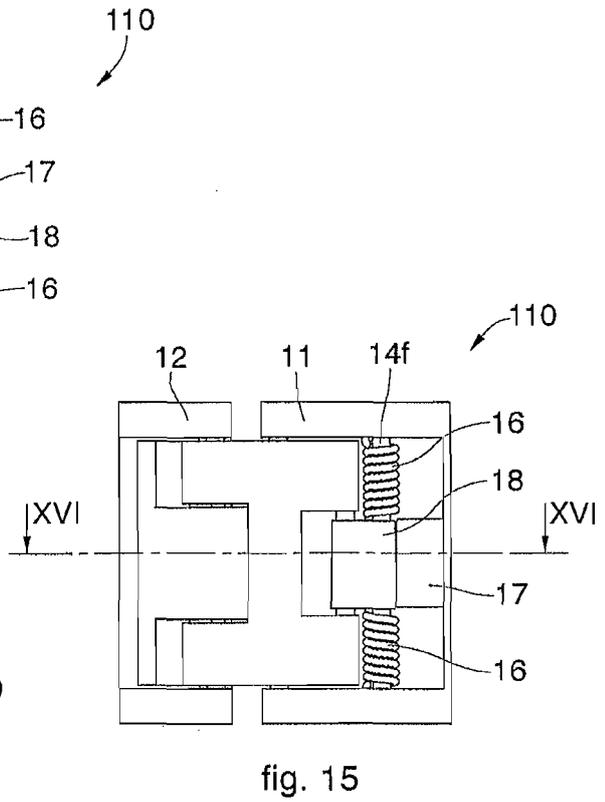
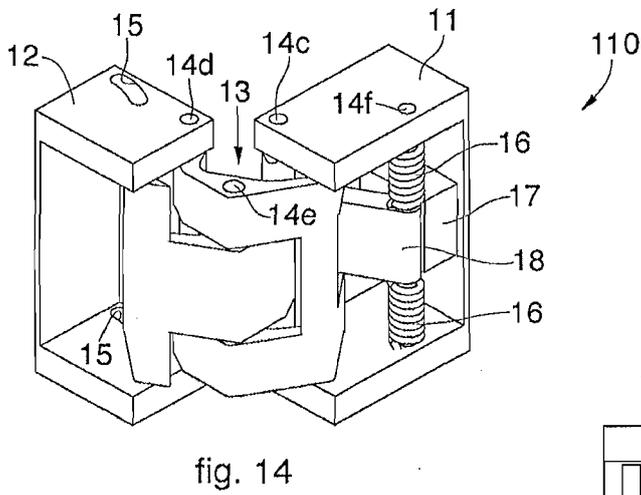
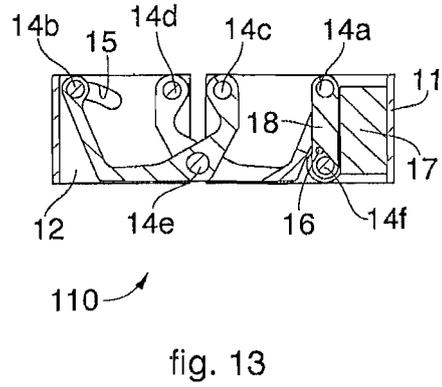
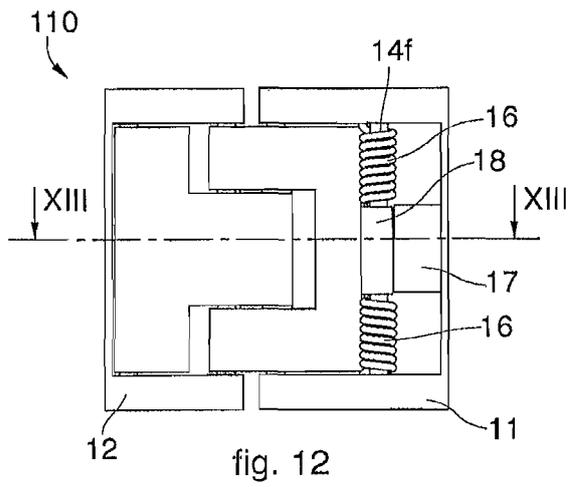


fig. 11



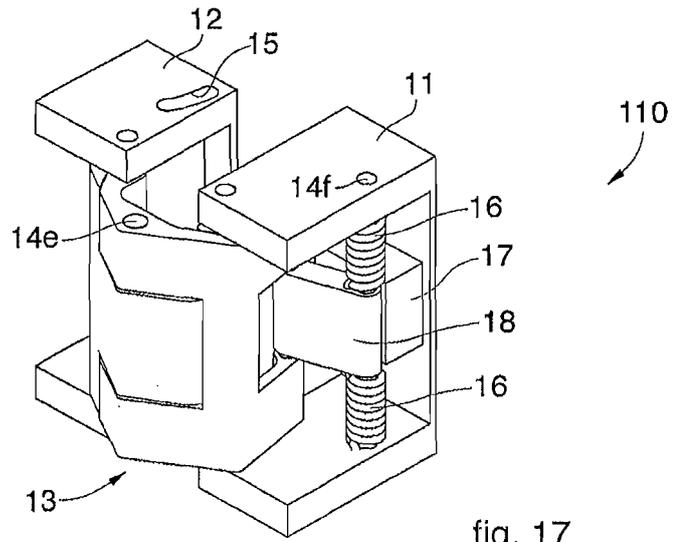


fig. 17

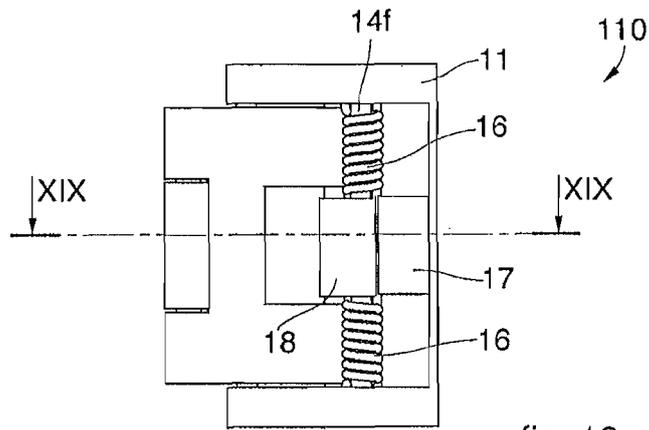


fig. 18

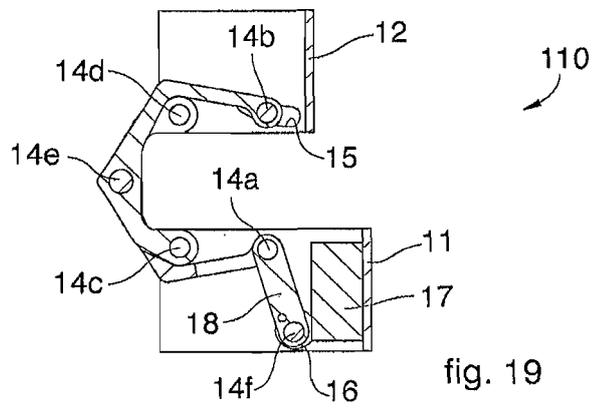
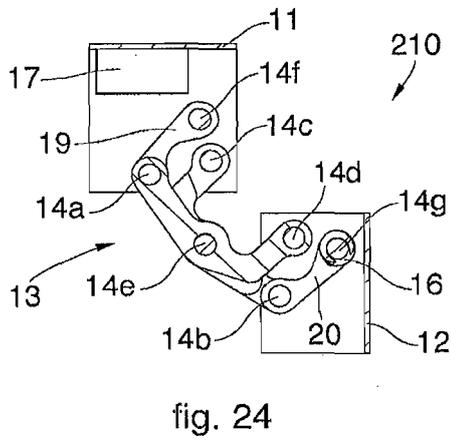
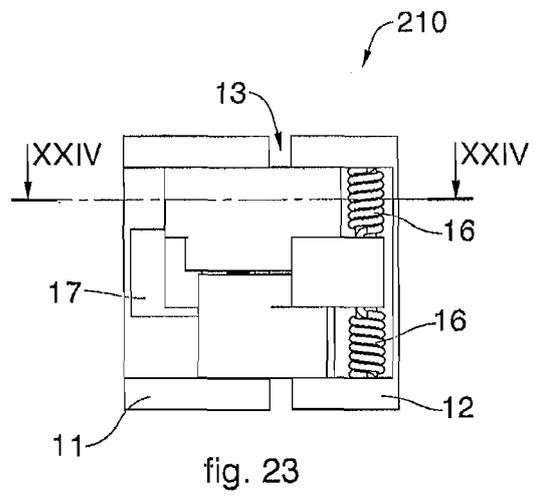
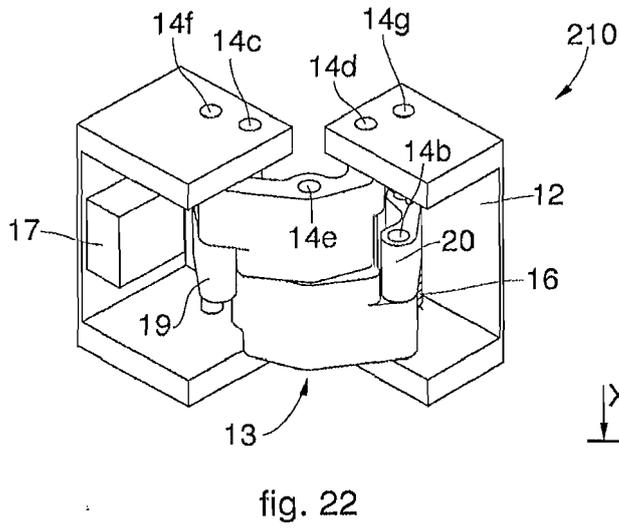
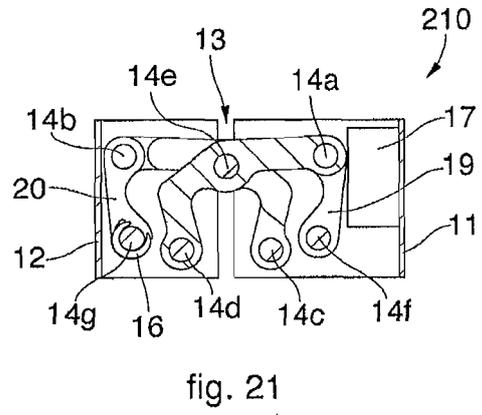
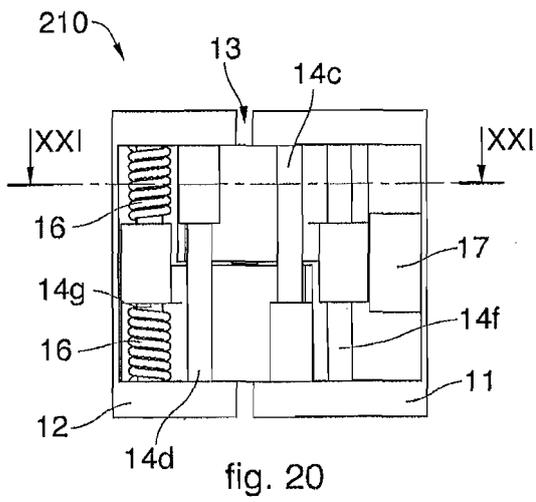


fig. 19



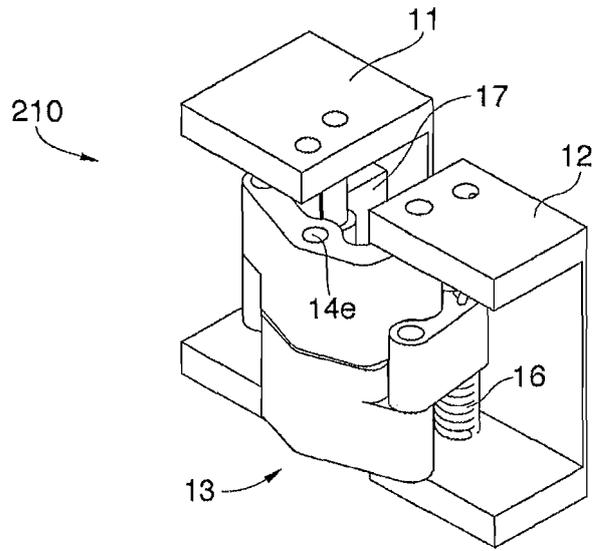


fig. 25

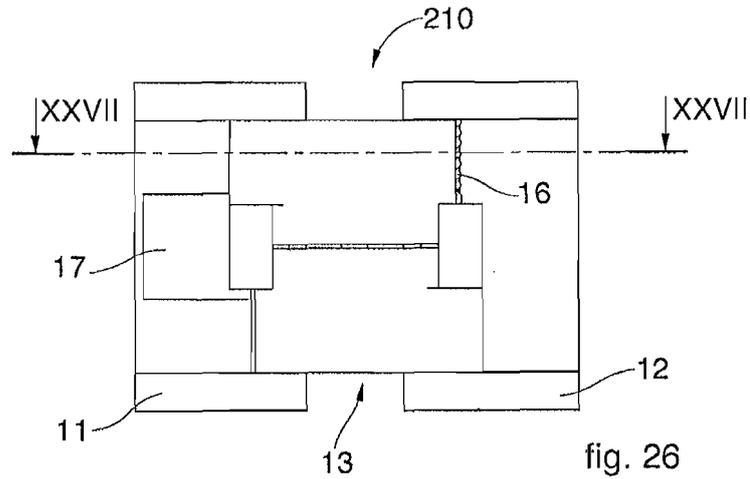


fig. 26

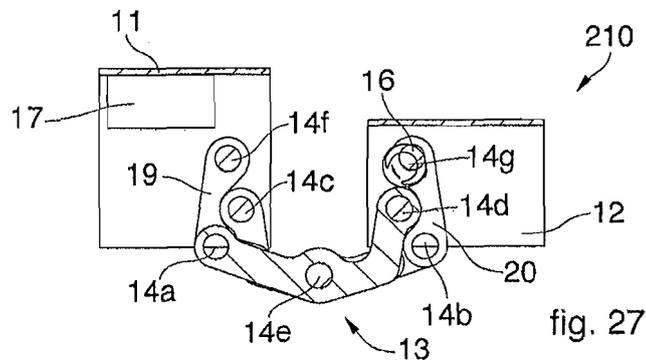


fig. 27



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Application Number
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