Jan. 9, 1968 A. A. SALICE 3,362,042

HINGE FOR DOORS OR THE LIKE

Filed June 22, 1964 3 Sheets-Sheet 1

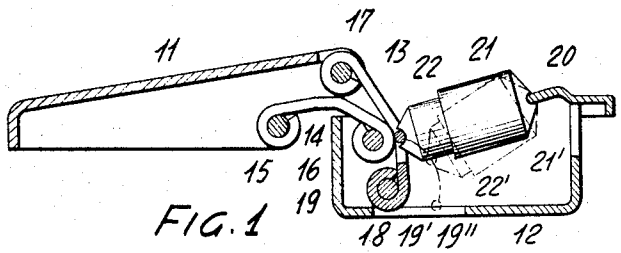


FIG. 1

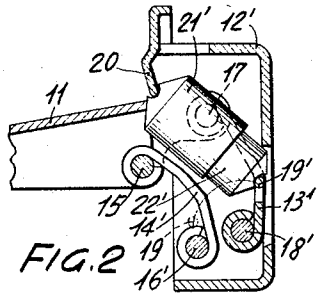


FIG. 2

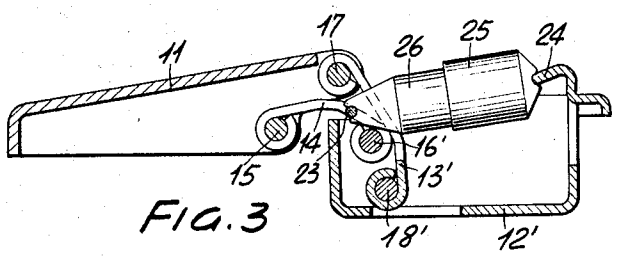


FIG. 3

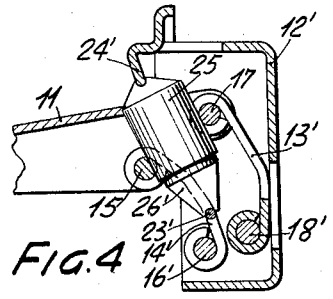


FIG. 4

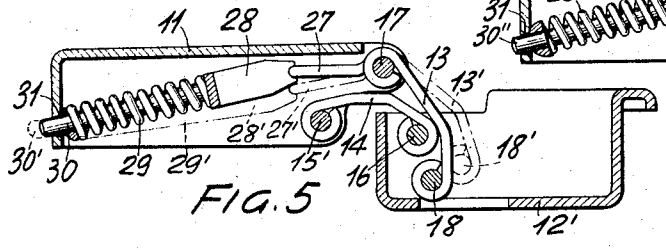


FIG. 5

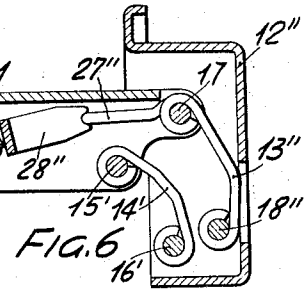


FIG. 6

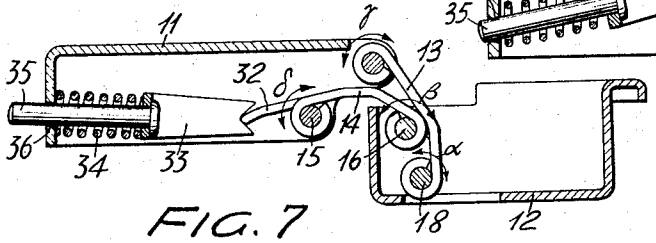


FIG. 7

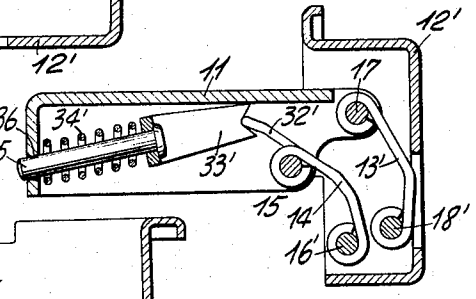


FIG. 8

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HINGE FOR DOORS OR THE LIKE

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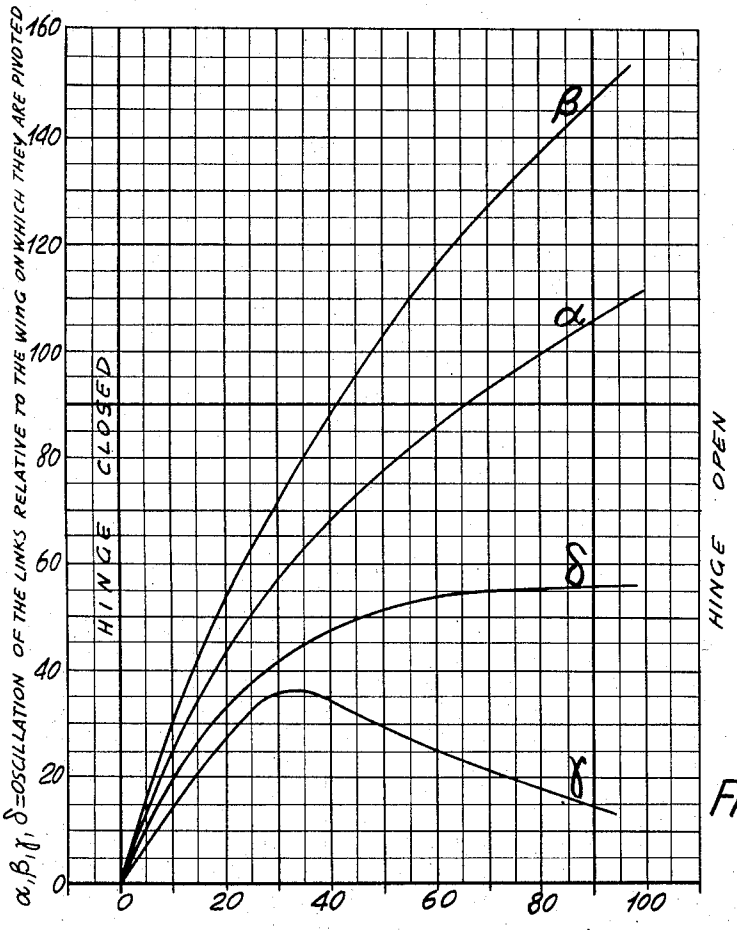


FIG. 9

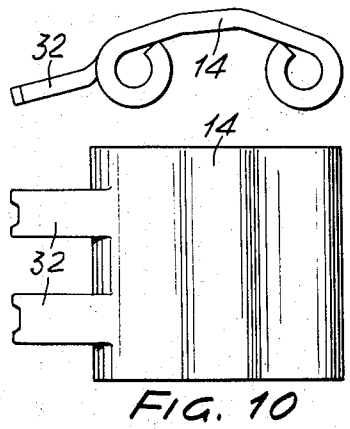


FIG. 10

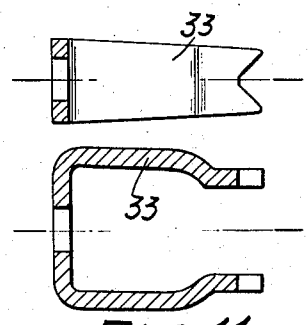


FIG. 11

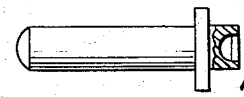


FIG. 12

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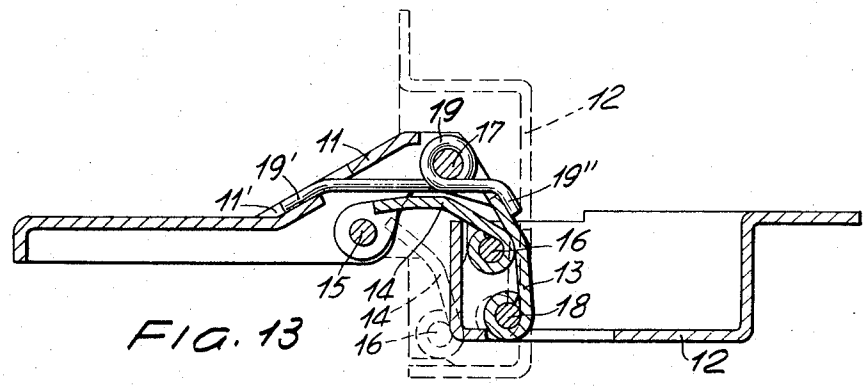


FIG. 13

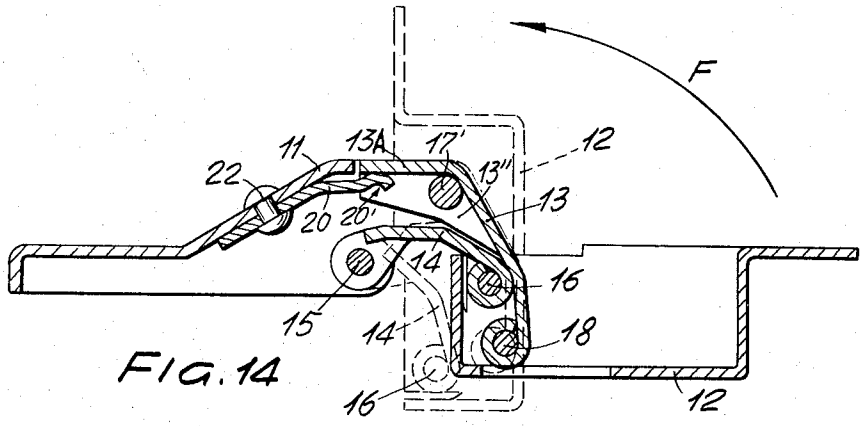


FIG. 14

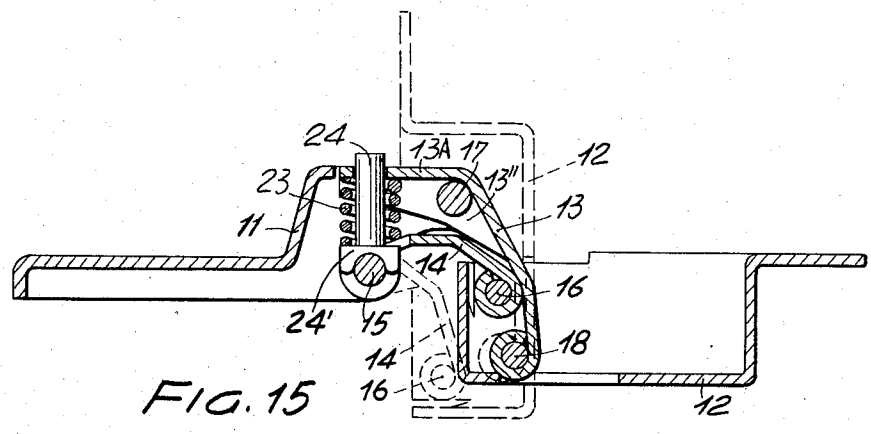


FIG. 15

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United States Patent Office

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HINGE FOR DOORS OR THE LIKE

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Claims priority, application Italy, June 25, 1963,
13,346/63; Nov. 25, 1963, 23,954/63
1 Claim. (Cl. 16—163)

There are known articulated joints or hinges having rotating and translating movement, particularly suitable for opening and closing funiture doors or the like.

Such hinges are constituted by two wings, one of which is secured to the side of the frame (stationary member) and the other one is fast to the door (movable member); said two wings being interconnected by one or more pairs of spacing links so as to form an articulated system, wherein the stationary wing acts as a scaffolding means or frame, and the movable wing as a connecting rod.

The present invention concerns a device apt to allow the automatic closing or opening, or both these operations of a door or wing with linked or articulated hinges of the above mentioned type, called rotating and translating type, through the use of a resilient member.

The description and illustration of some examples of different applications to this same type of hinge will follow: these same applications and different embodiments thereof may be applied also to other types of hinges pertaining to this class. Some improved types have achieved the following objects and advantages:

(1) The containment of the resilient member in a reduced space, to achieve a greater compactness of the device, size reduction of the stationary wing of the hinge, also giving same an aesthetically more convenient shape;

(2) To leave a greater room for eventual other auxiliary devices intended for other purposes, and placed near said resilient member;

(3) The easy replacement of the cylindrical coil spring, mentioned as the preferred (but not exclusive) solution in the first examples, with another simpler and therefore less bulky and also less expensive spring, such as a leaf spring, or a rubber pad, etc. The spring can be free or else can be guided by means of an inner stem or outer casings.

In the attached drawings:

FIGURES from 1 to 8 show the section of some examples of the same type of hinges according to the invention.

FIGURE 9 shows the diagrams of the four angular displacements.

FIGURE 10 shows a front and a top view of a special link with double extensions;

FIGURES 11 and 12 show two details;

FIGURE 13 shows an articulated hinge, in longitudinal section, respectively in the open position (full lines) and the closed position (dashed lines), with the application of a coil spring that works under torque between the stationary hinge wing and the longer one of the two links.

FIGURE 14 shows a similar hinge respectively open and closed, with the application of a flexure spring fast to the stationary wing of the hinge and acting on an apposite extension of the longer one of the links;

FIGURE 15 shows again a hinge of the same type, open and closed, with the application of a guided coil spring placed between the stationary wing, to which it is secured by means of one of the pivots functioning as a beam, and an extension of the longer one of the links.

Let us consider, for instance, a hinge having rotating and translating movement, as shown in the FIGURES from 1 to 8, during the transition from the closed position (FIGURES 1, 3, 5 and 7) to the open position (FIGURES 2, 4, 6 and 8), the link **13** performs a rotation α (FIGURE 7) about the pivot **18**, relative to the movable wing

12, and an angular displacement γ about the pivot **17**, relative to the stationary wing **11**; the link **14** performs a rotation β about the pivot **16**, relative to the movable wing **12**, and an angular displacement δ about the pivot **15**, relative to the stationary wing **11**.

The typical diagrams of these four angular displacements are illustrated in FIGURE 9.

A first application of the device according to the invention is shown in FIGURES 1 and 2, wherein a resilient compression member (for instance a coil spring) is contained inside two casings **21–22**, sliding one inside the other, and it is freely swinging between the two pivots consisting of the lug **20**, formed in the box **12** constituting the movable wing; and of the rod member **19**, fast with the link **13**, shaped as a fork to allow the passage of the assembly **21–22**.

During the closing of the hinge, while the casing **21** swings about its pivot **20**, the end of casing **22**, abutting in **19**, passes from the position shown in FIGURE 1 to that of FIGURE 2 in **19'**, causing a compression of the resilient assembly **21–22** at the expenses of an external work (slight effort to start the closing of the open door) and storing resilient potential energy; the door being in this first arc tends to open spontaneously. Once moved beyond the point **19'**, travelling over the remaining arc as far as **19''** (FIGURE 1), the resilient member tends again to stretch itself out, giving back the greater part of the stored energy and supplying therefore the work necessary for the spontaneous closing of the door.

A second similar application is illustrated in the FIGURES 3 and 4, wherein the resilient member **25–26** is pivoted between the lug **24**, on the movable wing **12'**, and the rod **23** of the shorter link **14**, operating like that in FIGURE 1.

In both these first two instances, it is matter of a double acting device, that is a bistabile one, since during its motion the potential resilient energy affords a maximum in an intermediate position, that will therefore be unstable, while it affords two points of relative minimum in the extreme open and closed positions, that result thus stable. The casing of the resilient member so far foreseen, besides concealing it to the sight, has the object of protecting it from external agents and of allowing to provide it with a supply of lubricant. At any rate, there can also be foreseen unconcealed, simple or multiple resilient members.

A third case of application is illustrated in the FIGURES 5 and 6, wherein the longer link **13** is provided with one or more extensions **27** constituting, relative to the pivot **17**, a suitably oriented lever arm, against which act one or more compression springs **29**, directly or by means of a bridging member **28** having the object to limit the spring length, and to constitute a pivot slidable around the end of the arm **27**, and also to allow, thanks to its fork shape, the passage of one or more securing screws. The spring **29** is guided by the axial stem **30**, slidable in a hole **31**, provided in the terminal part of the stationary wing **11**.

Since the link **13**, during the operation of the hinge, performs an oscillation γ comprising an advancing from **18** to **18'**, and a successive withdrawal from **18'** to **18''** (FIGURES 5 and 6), the device will accordingly be bistable.

Even in this instance the spring **29** can eventually be protected by a suitable casing, that will remain concealed inside the wing **11**.

A last and more interesting example of application is illustrated in the FIGURES 7 and 8. The shorter link **14** is provided with one or more extensions **32**, forming lever arms relative to the pivot **15**, serving as a fulcrum, while the link itself, in the section between the pivots **15** and **16**, constitutes the other lever arm. Against the ex-

tension 32 acts the compression spring 34, directly or by means of the bridging member 33; the spring is guided by the axial stem 35, fast with the bridging member, and slidable inside the hole 36 of the stationary wing 11. Since during the rotating and translating hinge movement, the longer link 13 performs, relative to the stationary wing, an oscillation γ that, over a wide arc around the open position is stationary, the result will be that over a remarkable portion of the arc around its open position, the door will not be urged by the spring 34, inasmuch as the axis of rotation of the spring itself, the point of rotation of the two members 32 and 33, and the pivot 15 will remain almost aligned, and therefore the lever arm will be null, as also the torque which the spring, although in its state of maximum stress, will exert through the levers 32–15–14 on the movable wing 12 of the hinge, and therefore on the door. When proceeding to close by hand the door itself, the link 14 will begin an almost imperceptible at first, and then more and more accentuated rotation as it moves towards the closed position of the door. The increase in the torque applied by the spring 34 to the link 14 is due to the combination of two causes; the increase in the lever arm of the extension 32 and the concurrent inclination that the spring axis takes up as a consequence. There will therefore occur an increase of the closing force more than proportional to the performed rotation, thus affording a very good closure of the door. The device shown in the FIGURES 7 and 8 allows not only to provide hinges keeping a door closed, without need of using any other device (such as locks, latches, spring or magnetic locks, etc.) but to obtain also the remarkable advantage that the door provided with such a hinge, after a short opening arc, remains entirely free to swing, thus avoiding the teasing and harmful slamming open that occurs with all the doors using other types of spring hinges heretofore known.

In FIGURE 10 there is shown a particular form of the link 14, with two extensions 32, suitably shaped for an efficient coupling to the bridging member 33 and for allowing a rational distribution of the hinge securing screws.

In the three instances shown in FIGURES 13, 14 and 15 there is shown an articulated hinge formed by a stationary wing 11, a movable wing 12, interconnected by two links, that is a shortest one 14, and a longest one 13, the pivots 15 and 17, secured on the stationary wing 11, and the pivots 16 and 18, secured to the movable wing 12, forming the vertices of the articulated quadrilateral having as opposite sides once the two wings 11 and 12 of the hinge, and then the two links 13 and 14.

In all of these last three instances, the resilient member acts between the stationary wing 11 and the longer link 13. Supposing the hinge is open, the resilient member tends to keep it open, inasmuch as it urges the link 13 against the pivot 16 of the link 14, that defines the position of maximum opening of the hinge; the force required for this action has been stored at the time of the assembling, applying a pre-loading to the spring.

If, with an external force, applied through the door that upon application of the hinge has been secured thereto, there is started the closing movement in the direction of the arrow F (FIGURE 14), the link 13 begins a counterclockwise swing, as looking to one of the figures, that brings about a deformation of the resilient member, storing potential energy, that will be given back in the last successive stage. Upon continuing said closing movement, the link completes its first oscillating phase and starts the back movement, tending to take up again the position it had when the hinge was open, and therefore bringing about the spontaneous closing of the door, as desired.

Similarly, if it is wanted to open the door that the spring force keeps closed, it will be necessary to overcome the resistance of the spring itself along a first opening arc, during which the spring will be deformed by the action of the link against the stationary wing; whereafter, the oscillating movement of the link being reversed, will cause the spontaneous and stable opening of the door; it is thus obtained a bistable device with an intermediate neutral zone.

As examples of practical constructive embodiment there are shown three different systems:

In FIGURE 13, one or more flexure spring members are constituted by one or more turns 19 through which extends the pivot 17 keeping them in place; the two ends 19′ and 19″ of each member are bent so as to remain firmly anchored, the end 19′ in an apposite slot 11′ provided in the stationary wing 11, and end 19″ against the outer surface of the link 13. The link 13 at one end is wound around the pivot 18, while at its other end it engages around the axis 17, in order to receive the cylindrical portion of the spring 19 and to allow a clearance for the end 19″ thereof; it has a forked shape and terminates with two apertured side lugs wherein extends the pivot 17.

In the FIGURE 14 a flexure leaf spring 20 is made fast to the stationary wing 11 by means of the rivet 22 or by means of a folded seam or fixed joint, formed in the wing itself; its end 20′, shaped so as to easily allow a relative sliding motion, abuts an apposite extension 13A of the link 13, extension that constitutes a lever arm which acts against the link 13, while the pivot 17, which in the figure is shown as being of a greater cross-section, operates as a fulcrum. Even in this instance the two links, if obtained through punching and cold forming of sheet metal, will have a sleeve-shaped rolled end, while the other end is straight, further the link 13 is provided with the stiffening sides 13″ wherein there will be formed the holes for the pivot 17.

In the FIGURE 15, the resilient member is a standard cylindrical coil spring 23, guided by a stem 24 which, with one fork-shaped end 24′ rests against the pivot 15, fast with the stationary wing 11, while at its other end it is guided within a hole provided in the extension 13A acting as a lever arm of the link 13; the pivots, carrying more directly the spring reactions are conveniently enlarged, while the two links are built in the way already described.

What is claimed is:

1. An articulated invisible hinge for a door comprising a stationary hinge element to be secured to the internal surface of a stationary member having the shape of a polyhedric box opened on at least one side, a swingable hinge element to be secured in a cavity of the door to be opened and closed, a first pair of spaced pivots fast to said stationary hinge element, a second pair of spaced pivots fast to said swingable hinge element, a pair of arch-shaped spacing links interconnecting one pivot of one pair to one pivot of the other pair, the innermost spacing link being provided with an extension beyond the stationary pivot which acts as a lever with the stationary pivot as the fulcrum, said extension being connected to an elastically compressible means guided by a shaft sliding in a guide of the stationary hinge element whereby the door will be pushed closed when near the closed position and is free to swing after a short opening arc wherein the swingable hinge element has the shape of a cylindrical box with a flange shaped rim.

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