

[54] SELF-CLOSING PIVOTAL JOINT WITH CONCEALED HINGE

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[58] Field of Search ..... 16/163, 164, 182, 183; 49/350

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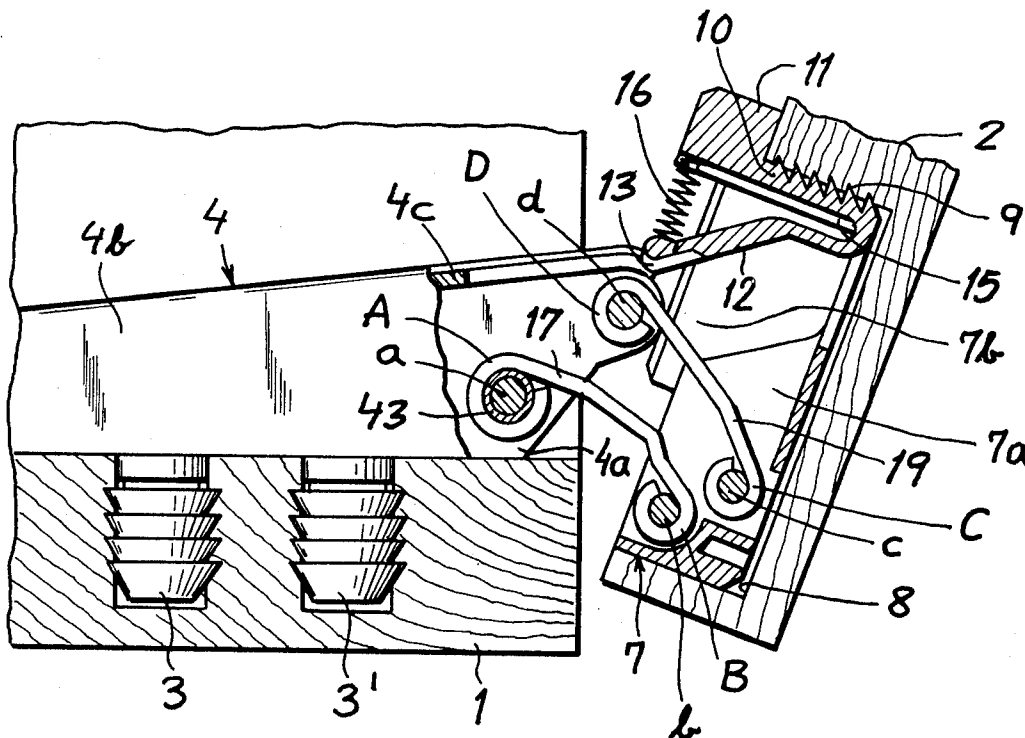
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[57] ABSTRACT

A pivotal joint for a cabinet door, receptacle lid or the like comprises two members interconnected by an articulated linkage, including two parallel pintles on each member serving as anchors for a pair of hinge straps, so as to be relatively swingable through about 90° between an open and a closed position. Upon approaching the closed position, a resilient tongue integral with one member engages one of the pintles on the other member and exerts on it a camming pressure tending to complete the swing. The tongue is loaded by an elastic insert bearing upon a wall of the first-mentioned member.

14 Claims, 13 Drawing Figures



SHEET 1 OF 3

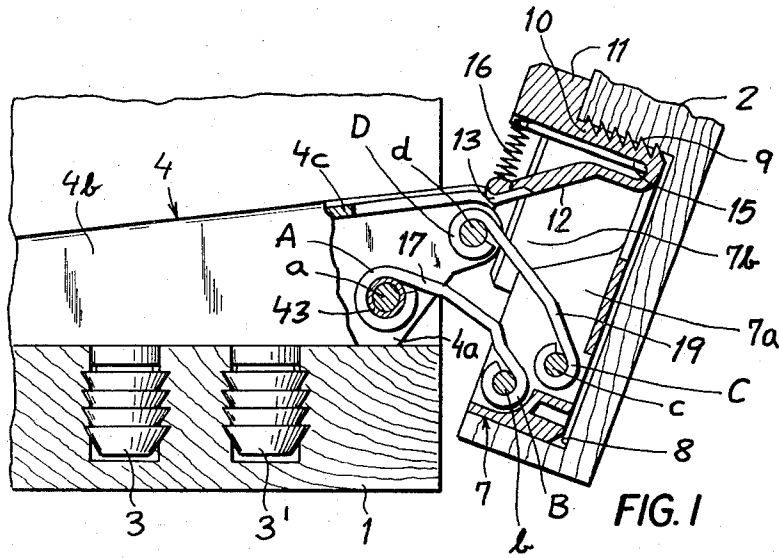


FIG. 1

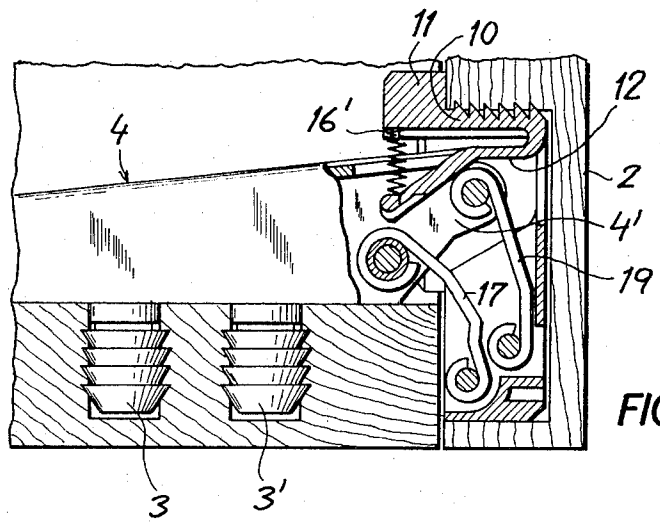


FIG. 2

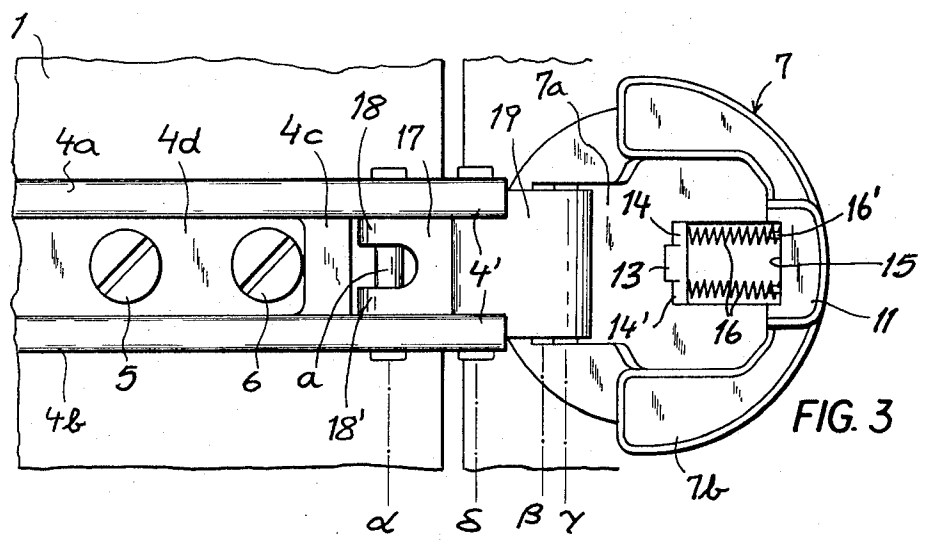


FIG. 3



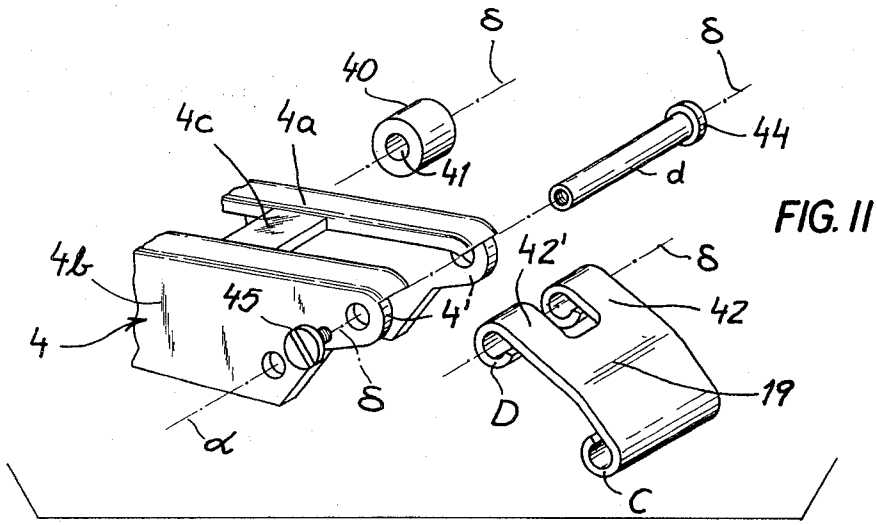


FIG. 11

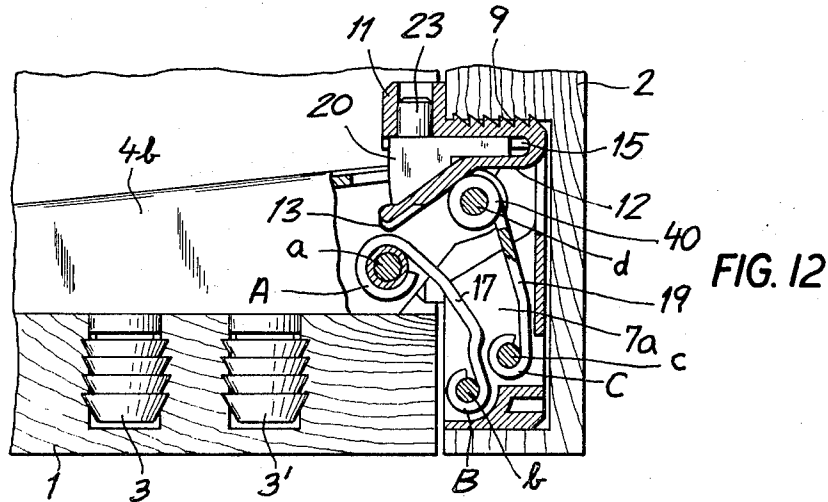


FIG. 12

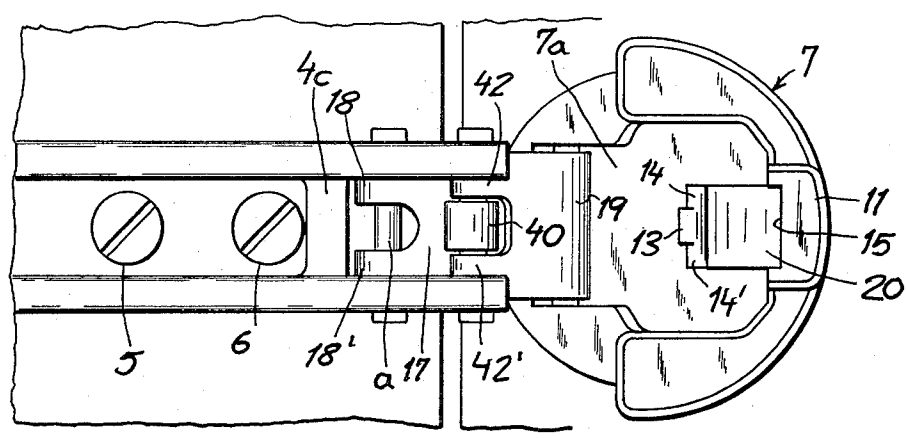


FIG. 13

## SELF-CLOSING PIVOTAL JOINT WITH CONCEALED HINGE

### FIELD OF THE INVENTION

My present invention relates to a self-closing pivotal joint for a door, lid, flap or the like on a cabinet or other receptacle.

### BACKGROUND OF THE INVENTION

Various devices are known for the purpose of completing the swing of a door or similar component into a fully closed position from a position of partial closure, e.g., in the case of refrigerators whose doors should not be accidentally left ajar. These devices include magnetic detents, which are effective only at close range, as well as toggle mechanisms which are relatively bulky and generally obstruct part of the door opening. Frequently, also, such toggle mechanism requires considerable force in moving the door past dead-center, either in the opening or in the closing direction.

### OBJECTS OF THE INVENTION

The general object of my present invention is to provide a self-closing joint of this character which is easy to operate, is aesthetically pleasing by being fully concealed in the closure position, and occupies little space on the swingably interconnected components.

A more particular object is to provide a joint of this type effective over a substantial fraction of the swing range, e.g., within about 20° from the closure position with doors or the like swingable through at least 90°.

It is also an object of my invention to provide a closure mechanism located at the hinge of the two interconnected components so as to be substantially unaffected by a minor relative deformation of, say, a door and its frame at points remote from that hinge.

### SUMMARY OF THE INVENTION

I realize these objects, in conformity with the present invention, by providing two members interconnected by an articulated linkage of quadrilateral configuration, this linkage including a first pair of parallel pintles on the first member and a second pair of parallel pintles on the second member as well as two hinge straps each anchored to a respective pintle of each pair. The first member carries a resilient tongue, preferably integral therewith, whose free end is so disposed as to engage one pintle of the second pair in an intermediate position upon a relative swinging of these members toward one limiting position, normally the position of closure of the two coacting components (e.g., door and frame) respectively attached to these members, so as to exert upon the second member a force tending to complete the swing; upon a partial swinging of the two members toward the opposite limiting position, the tongue becomes disengaged from the associated pintle on passing through the aforementioned intermediate position. To control the position of the tongue, an elastically compressible insert bears upon the tongue and upon a portion (e.g., a wall) of the first member integral therewith, this insert resisting deflection of the tongue by the associated pintle upon the initial engagement thereof by the free end of the tongue (as well as upon passage through the same relative position during the return swing). This deflection of the tongue results from a camming action occurring as the tip of the tongue is intercepted by the peripheral surface of the pintle or of

an eye formed by an extremity of the associated hinge strap looped around that pintle, the tongue extending generally tangentially to that surface just before engaging same. As the direction of deflection is perpendicular to the tongue motion, the resulting resistance to the closing (or opening) swing is small. This resistance can be even further reduced if, according to another feature of my invention, the strap extremity hugging the co-operating pintle is split so as to form a pair of spaced-apart prongs leaving room for an antifriction roller on the pintle engageable by the tongue.

### BRIEF DESCRIPTION OF THE DRAWING

The above and other features of my invention will now be described in detail with reference to the accompanying drawing in which:

FIG. 1 is a top view, with parts broken away, of a door structure incorporating a pivotal joint according to my invention in a position of incipient closure;

FIG. 2 is a view similar to FIG. 1, illustrating the position of full closure;

FIG. 3 is a side view of the structure of FIGS. 1 and 2 in wide-open position;

FIG. 4 is an axonometric view of an elastically compressible insert adapted to be used in the assembly of FIGS. 1 - 3;

FIG. 5 is a view similar to FIGS. 1 and 2, showing the assembly in its wide-open position and with the insert of FIG. 4 replacing a pair of springs illustrated in FIGS. 1 - 3;

FIG. 6 is a view similar to FIG. 4, showing an alternate insert;

FIG. 7 is a view similar to FIG. 5, showing the assembly with the insert of FIG. 6;

FIG. 8 is a view similar to FIG. 6, illustrating a modification of the insert thereof;

FIG. 9 is a further axonometric view showing still another type of insert;

FIG. 10 is a view similar to FIGS. 5 and 8, illustrating the assembly with the insert of FIG. 10;

FIG. 11 is an exploded axonometric view of part of the assembly of FIGS. 1 - 3 with the addition of an antifriction roller; and

FIGS. 12 and 13 are views respectively similar to FIGS. 2 and 3, showing the assembly with the insert of FIG. 4 and with the antifriction roller of FIG. 11.

### SPECIFIC DESCRIPTION

The basic assembly shown in the several views of the drawing includes a component 1, which may be the frame of a cabinet of an appliance or receptacle, and a coacting component 2 constituting a swingable door therefor. A pivotal joint according to my invention interconnects these components and comprises two relatively swingable members, namely a fixed member 4 and a movable member 7. Member 4 carries two parallel pintles *a* and *d* embraced by curled extremities A and D of a pair of hinge straps 17 and 19 whose opposite extremities B and C are looped about pintles *b* and *c* rigid with member 7. The spacing of the axes  $\alpha$  and  $\delta$  (see FIGS. 3 and 11) of pintles *a* and *d* is substantially larger than the spacing of the axes  $\beta$  and  $\gamma$  of pintles *b* and *c*, the ratio of these distances being about 2 : 1 in the illustrated embodiment. In the wide-open position of FIGS. 3, 5 - 7 and 13, axes  $\beta$  and  $\gamma$  lie in a plane approximately perpendicular to the plane of axes  $\alpha$  and  $\delta$ ; in the closure position of FIGS. 2 and 12, the two

axial planes are substantially perpendicular to each other.

Fixed member 4 comprises two parallel webs 4a and 4b which are bridged by the pintles a and d as well as by an inner plate 4c and an outer plate 4d. Plate 4d rests against the inner peripheral surface of frame 1 having tangs or screw anchors 3, 3' of serrated profile countersunk therein; screws 5 and 6, traversing the plate 4d, engage in threaded bores of these tangs to fasten the member 4 in position. Webs 4a and 4b project forwardly beyond the outline of frame 1 to form an extension 4' carrying the pintle d.

Movable member 7 is generally cylindrical, as seen in FIGS. 3 and 13, and forms a channel 7a accommodating the pintles b and c; this channel is open toward member 4 and, in the closure position of FIG. 2, receives the extension of 4' thereof so that the entire quadrilateral hinge with the exception of pintle a and strap extremity A comes to lie within that channel. In this closure position the hinge is totally invisible from without.

Member 7 has a semicircular peripheral flange 7b overlying the inner door surface and carrying a central boss 11 which projects into the opening of frame 1 in the closure position. A tongue 12 unitary with member 7 has a free end substantially in line with the exposed surface of boss 11. This free end is partly cut back to form a projecting tip 13 flanked by a pair of shoulders 14. Tongue 12 extends generally tangentially of pintle d in the intermediate position of FIG. 1, which is about 20° offset from the closure position of FIG. 2, so that tip 13 upon continuing closure rides up the periphery of eye D and exerts a radially inward pressure thereon. This pressure is intensified, in accordance with an essential feature of my invention, by the presence of an elastically compressive insert between tip 13 and a confronting wall portion 10 of member 7 reinforced by boss 11, that insert being represented in FIGS. 1-3 by a pair of parallel coil springs 16 whose ends remote from tongue 12 are held in place by studs 16' projecting from the wall 10 within a recess 15 of that wall. The other ends of these springs have tails received in small holes of tongue 12. The cylindrical outer periphery of member 7 is serrated (except in the part overlain by strap 19 in the view of FIG. 3), as shown at 9, for positive retention in a recess 8 of door 2.

It will be noted that the tip 13 of tongue 12 lies outside channel 7a so as to encounter the eye D well before the completion of the closure swing of the door 2. In fact, as seen in FIG. 2, the tip 13 closely approaches the other eye A in the closure position (see also FIG. 12). Boss 11, facing the tip 13, likewise projects beyond channel 7a to form a backstop for the springs 16 inserted between that boss and the diverging tongue portion defining the free end thereof.

As will be apparent from FIG. 2, the pressure of springs 16 and the inherent elasticity of tongue 12 exert upon the pintle d a camming action as soon as the tip 13 has cleared that pintle, thereby drawing the member 7 and with it the door 2 into a position of complete closure. Upon the reopening of the door, only a relatively small additional force must be manually exerted for the reverse camming action compressing the springs 16 until the tip 13 stands clear of the pintle d and its eye D. The remaining opening stroke can then be carried out without any intervention of tongue 12. The generally tangential tongue position shown in FIG. 1 repre-

sents the fully expanded condition of springs 16 (or of corresponding inserts shown in subsequent Figures).

In order to prevent any possible disengagement of tongue 12 from eye D by contact between tip 13 and eye A during the final stage of door closure, the extremity of strap 17 forming the eye A has been shown split into two prongs 18 and 18' separated by a gap slightly wider than tip 13.

In FIGS. 4-10 I have illustrated various compressible inserts which advantageously take the place of the simple compression springs 16 of FIGS. 1-3 in order to insure a more uniform stress distribution along tongue 12. Thus, FIGS. 4 and 5 show an insert 20 in the form of a generally wedge-shaped pad of elastomeric material having a sloping surface 21 which rests against tongue 12, the opposite surface 22 of this pad bearing upon the wall 10 of member 7 within recess 15. Boss 11 is formed in this instance with a bore 24 receiving a projection 23 of pad 20 to lock the same in position.

In FIGS. 6 and 7 I have shown a generally V-shaped clip 25 in the form of a bent leaf spring with legs 26, 27 interconnected by a bight portion 28, the leg 26 bearing upon the tongue 12 over virtually the full length thereof while the leg 27 is lodged in recess 15 of wall portion 10. The clip is held in position by a pin 29 received in confronting holes of member 7 and engaging the bight portion 28.

FIG. 8 illustrates a similar but generally C-shaped clip 30 with a sloping leg 31 bearing upon the tongue 12, an end face 31 with a bent-over flange 33, and a bight portion 34 again engageable by a retaining element such as the pin 29 of FIG. 7. This bight portion could also be deformed, as illustrated in dot-dash lines, to terminate in an inclined lip 34' receivable in an undercut of recess 15.

FIGS. 9 and 10 show an insert 35 in the form of a convoluted spring wire with oppositely pointing extremities 36, 35' receivable in a pair of holes of member 7, sloping legs 37, 37' resting against tongue 12 and a central yoke 39 receivable in recess 15, this midportion being joined to the legs 37 and 37' via loops 38 and 38'. The resiliency of this insert could also be enhanced by increasing the arc length of the loops by 360° or multiples thereof so that each loop forms at least one full convolution in addition to the illustrated part-convolution of slightly more than 180°.

In FIGS. 11-13 I have illustrated the possibility of splitting the extremity D of hinge strap 19 into a pair of axially spaced prongs 42, 42' separated by an anti-friction roller 40, e.g., of Teflon, whose central bore 41 is traversed by the pintle d. Tip 13 of tongue 12 in that case coacts with the periphery of roller 40 rather than with that of loop D.

As illustrated for pintle d in FIG. 11, each pintle may be formed at one end with a head 44 and may have its opposite end internally threaded to receive a retaining screw 45. Also, as shown for pintle a in FIGS. 1 and 2, some or all of these pintles may be surrounded by low-friction bushings 43 embraced in turn by the associated strap loop.

I claim:

1. A pivotal joint for two relatively swingable components, comprising:

a first member adapted to be secured to one of said components;

a second member adapted to be secured to the other of said components, said first member being pro-

vided with a channel open toward said second member, said second member having an extension received in said channel in one limiting position of said members;

an articulated linkage interconnecting said members, said linkage including a first pair of parallel pintles on said first member disposed in said channel, a second pair of parallel pintles on said second member and two hinge straps each anchored to a respective pintle of each pair, one pintle of said second pair being mounted on said extension;

a resilient tongue on said first member extending from within said channel toward said second member and having a free end outside said channel disposed to engage said one pintle in an intermediate position remote from said one limiting position upon relative swinging of said members toward said one limiting position for exerting upon said second member a camming force tending to complete the swing, said tongue becoming disengaged from said one pintle upon a partial swinging of said members toward an opposite limiting position, said tongue extending generally tangentially of said one pintle in said intermediate position; and

an elastically compressible insert wedged in between said tongue and a wall portion of said first member bounding said channel, said insert bearing upon said free end in a sense resisting deflection of said tongue by said one pintle upon initial engagement thereof by said free end.

2. A pivotal joint as defined in claim 1 wherein the hinge strap anchored to said one pintle has a bifurcate end with a pair of prongs looped around said one pintle at axially spaced locations, further comprising an anti-friction roller on said one pintle between said prongs disposed for engagement by said tongue.

3. A pivotal joint as defined in claim 1 wherein said insert has a flank contacting said tongue over a substantial part of its length.

4. A pivotal joint as defined in claim 1 wherein said insert comprises a pad of elastomeric material.

5. A pivotal joint as defined in claim 1 wherein said insert comprises a bent leaf spring.

6. A pivotal joint as defined in claim 1 wherein said insert comprises a convoluted spring wire.

7. A pivotal joint as defined in claim 1 wherein the spacing of said first pair of pintles is less than that of said second pair of pintles.

8. A pivotal joint as defined in claim 1 wherein said tongue is secured to said wall portion within said channel and diverges from said wall portion at said free end.

9. A pivotal joint as defined in claim 8 wherein said wall portion terminates in a boss projecting beyond said channel and facing said tip, said insert bearing upon said boss.

10. A pivotal joint for two relatively swingable components, comprising:

- a first member adapted to be secured to one of said components;
- a second member adapted to be secured to the other of said components;

an articulated linkage interconnecting said members, said linkage including a first pair of parallel pintles on said first member, a second pair of parallel pintles on said second member and two hinge straps each anchored to a respective pintle of each pair; a resilient tongue on said first member having a free end disposed to engage one pintle of said second pair in an intermediate position upon relative swinging of said members toward one limiting position for exerting upon said second member a force tending to complete the swing, said tongue becoming disengaged from said one pintle upon a partial swinging of said members toward an opposite limiting position, said tongue extending generally tangentially of said one pintle in said intermediate position, the hinge strap anchored to said one pintle having a bifurcate end with a pair of prongs looped around said one pintle at axially spaced locations; and

an anti-friction roller on said one pintle between said prongs disposed for engagement by said tongue.

11. A pivotal joint as defined in claim 10, further comprising an elastically compressible insert bearing upon said tongue and upon a portion of said first member in a sense resisting deflection of said tongue by said one pintle upon initial engagement thereof by said free end.

12. A pivotal joint as defined in claim 11, wherein said first member is provided with a channel open toward said second member, said insert being wedged in between said tongue and a wall portion of said first member bounding said channel.

13. A pivotal joint as defined in claim 11 wherein said tongue projects integrally inwardly from said wall portion.

14. A pivotal joint as defined in claim 11 wherein said second member has an extension receivable in said channel in said one limiting position, said one pintle being mounted on said extension, said first pair of pintles being disposed in said channel.

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