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CLOSURE HINGING AND COUNTERBALANCE DEVICE

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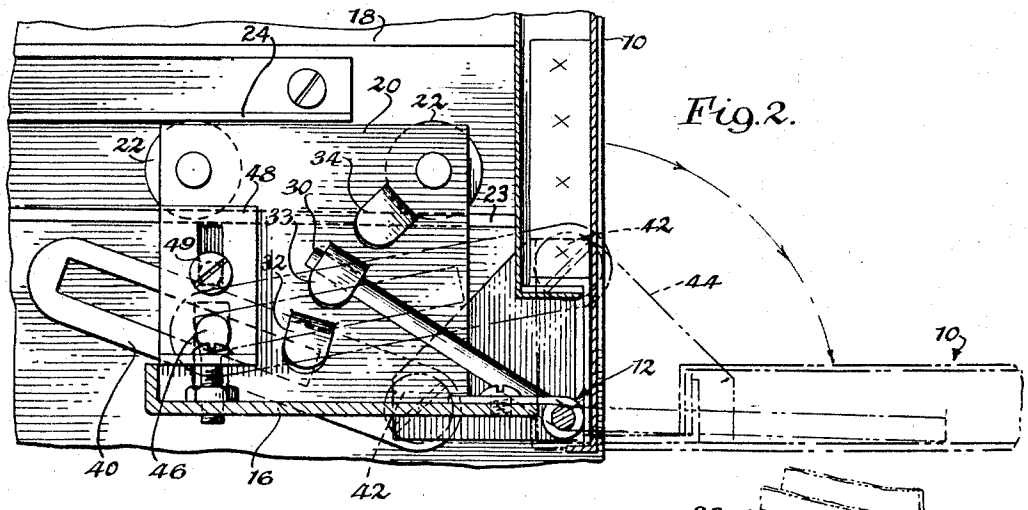


Fig. 2.

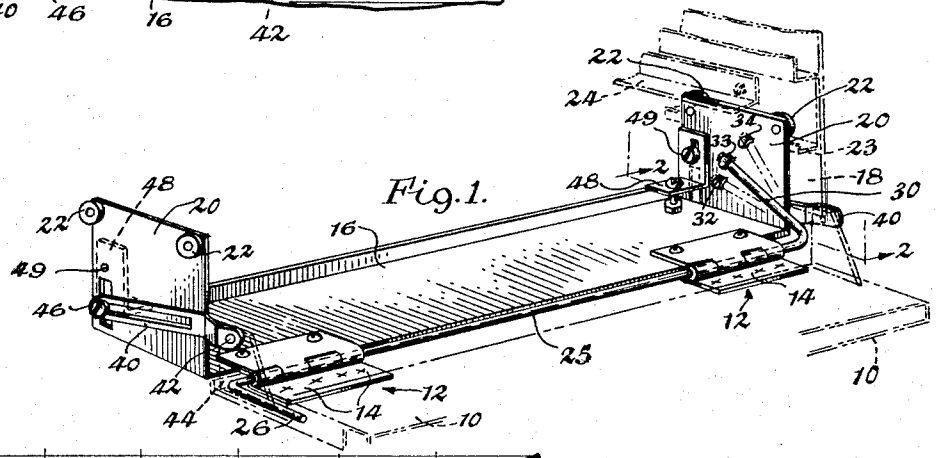


Fig. 1.

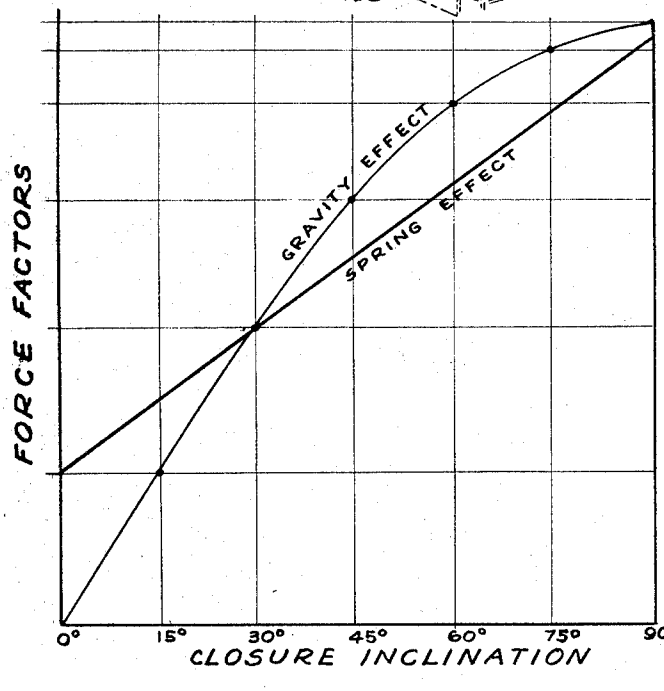


Fig. 3.

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CLOSURE HINGING AND COUNTERBALANCE DEVICE

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ABSTRACT OF THE DISCLOSURE

A cradle and a drawer slidably mounted in a cabinet, the cradle carrying a closure panel for the drawer opening and movable between horizontal and vertical positions. The closure panel is mounted on the cradle by a torsion spring to allow the cradle and horizontally swung closure panel to clear the drawer.

This invention relates to vertically swinging cabinet closures, such as doors or other closure panels mounted upon horizontal hinge devices and swingable thereon for opening and closing purposes.

It is a primary object of the present invention to provide for an improved combination hinging and counterbalancing device for such door panels or the like.

Another object is to provide an improved device as aforesaid employing a torsion rod type counterbalancing spring member which functions also as the hinge pintle mechanism.

Another object is to provide an improved device as aforesaid including improved means permitting adjustments of the counterbalance spring tension.

Still another object of the invention is to provide in a cabinet-closure arrangement as aforesaid an improved spring-powered closure counterbalance mechanism which automatically fuctions when "triggered" manually in one direction to softly draw the closure panel into its vertically standing "closed" position and to retain it thereat against accidental displacement; and also when "triggered" manually in opposite direction to softly draw the closure member downwardly into a horizontally disposed "cabinet-open" attitude, and to retain it thereat against accidental dislodgment.

Brief summary of the invention

The invention is directed to the combination of a cabinet structure, a drawer, a cradle assembly and a closure plate carried by the cradle assembly. The cradle assembly includes a horizontally disposed support plate extending between the side walls of the cabinet and such side walls carry vertically spaced tracks, one pair of which support the drawer and the other pair of which support the cradle assembly. The closure panel is hinged to the support plate and a combined torsion spring and pintle pin serves simultaneously to establish the pivotal connection between the closure plate and support plate and to counterbalance the weight of the closure plate. The disposition of the component parts is such as to allow the cradle assembly and associated closure plate when the latter is horizontally disposed to clear the drawer assembly which overlies same.

Other objects and advantages of the invention will appear from the specification hereinafter and the accompanying drawing wherein:

FIG. 1 is a perspective view of a cabinet closure hinge support and spring counterbalance arrangement of the present invention;

FIG. 2 is a close-up fragmentary sectional view thereof as indicated by lines 2—2 on FIG. 1; and

FIG. 3 is a graphical representation of the functional relationship of gravity vs. spring force effects on a closure member equipped with a spring support and counterbalance device of the invention.

As shown in FIGS. 1 and 2 herewith, the device of the invention may be typically employed to hingedly mount a door or other closure panel member designated 10 upon a cabinet or the like in such manner that the closure member is thereby mounted to swing about a horizontal axis upon hinge members such as are designated generally at 12, 12. As shown herein, one leaf of each hinge member is fixed to the bottom edge of the closure panel 10 as indicated at 14, and the other leaf of each hinge member is fixed to a support plate 16 which is mounted upon the cabinet which is indicated at 18. In the drawing herewith, which illustrates application of the invention by way of one example only, the plate 16 comprises a cradle device having integral upturned end portions 20, 20 which carry rollers 22 arranged to run between vertically spaced track members 23, 24, carried by the side walls of the cabinet structure 18. Hence, the panel 10 is adapted to hingedly swing between vertically standing "cabinet closed" position, and a horizontally extending "open" position, whereupon it may then be manually pressed rearwardly into retracted position within the cabinet.

The combination hinge pintle and torsion spring counterbalance device is illustrated herein to comprise a spring steel rod designated generally at 25 which is slip-fitted at opposite ends of the device through the cooperating eye portions of the hinge members 12, 12; thereby functioning as the pintle mechanisms for both hinges. At one of its ends the spring bar 25 extends through one of the hinges and is thereupon bent at right angles to provide a finger portion 26 which slip-fits through an apertured wall portion of the closure structure and is thereby disposed flatwise inside the closure panel 10 and anchored thereto. At its other end the spring rod 25 extends beyond its hinge device and is bent again at right angles to provide a control arm portion 30. As shown more clearly in FIG. 2, the adjacent end portion 20 of the cradle 16 is provided with a series of arcuately aligned hook portions as indicated at 32, 33, 34; said hook portions being conveniently provided by simply stamping and pressing out the metal of the end plate to provide the hook fingers as shown. Hence, it will be appreciated that the control arm portion 30 may be hooked under any one of the hook portions shown in the drawing, to adjust the spring force to be exerted by the bar 25, as will be explained more fully hereinafter. However, it is also to be understood that any other suitable form of control arm adjustment device may be employed. For example, a finger hook may be provided to engage the control arm; said hook being slidably mounted upon the cradle plate 20 so as to be positionally adjustable thereon at any desired degree of adjustment; thereby providing for "fine" adjustments of the spring tension, as may be required.

Thus, it will be appreciated that the spring bar 25 functions simultaneously as a hinge pintle mechanism for both hinge devices, and as a torque force supply device for counterbalancing the weight of the closure panel 10 as it swings between its vertically standing (cabinet closed) position as shown by solid lines in FIG. 2, to its down-swung horizontally extending "cabinet-open" position as shown by broken lines in FIGS. 1 and 2. The spring bar is so fabricated and positionally adjusted at its control arm portion 30 relative to the support plate 16 as to exert its maximum resilient torque effect upon the closure member when the latter is in its cabinet-open or broken line position as shown in FIGS. 1, 2. Furthermore, the spring device is so selected and designed that when the cabinet closure is in this horizontal "open" position, the gravity effects operating upon the closure member and tending to swing it further downwardly only

slightly overcome the spring torsion effects of the member 25 which is then acting to bias the closure upwardly about its hinge axis. Also, the spring material is so selected and designed that when the closure 10 is in its upstanding "cabinet-closed" position the spring effects thereon overcome any vibration or other effects such as may tend to cause the closure to swing open and downwardly, thereby retaining the closure in its cabinet-closed position.

It is another feature of the invention that a novel arrangement is made for stopping the downward swinging motion of the closure panel 10 at any desired position. Thus, whereas in FIGS. 1, 2, it is apparent that when the closure panel 10 is to be retracted horizontally into the mounting cabinet (by slide-rolling motion of the cradle 16 on tracks 23, 24) it is essential that the closure panel be then disposed truly horizontally. Accordingly, a stop device interrelating the closure panel to the cradle member must be provided, and as shown herein the stop mechanism is illustrated to comprise a pair of slotted links 40 each of which is pivotally connected at one end as indicated at 42 to a horn 44 extending at right angles from the plane of the closure panel 10 at opposite ends thereof. The slotted portion of each link 40 slidably rides on a headed pin 46 which is fixedly carried by an angle bracket 48 mounted in vertically slidable, positionally adjustable, relation on the cradle end plate 20 by means of a machine screw 49. The brackets 48 are vertically slotted as shown to permit them to be vertically adjustable on the cradle end plate 20.

Thus, it will be appreciated that the parts will be so proportioned and dimensioned that when they are relatively assembled as shown in the drawing herewith, the anchor pins 46, 46 may be finally adjusted vertically on the cradle end plates so as to permit the slide arms 40—40 to travel relative to the anchor pins when the door is moving downwardly, to just the right amount so as to stop the door down motion when the plane of the door is exactly parallel to the plane of the cradle member 16. It should also be noted that the operative parts referred to hereinabove are so designed and relatively arranged as to compactly nest together throughout all operative positions of the mechanism, thereby providing a smoothly operating yet compact and minimum space occupying mechanism for the stated purposes.

FIG. 3 illustrates how the counterbalance spring is arranged to function as the closure panel moves between vertically standing and horizontally extending positions. The graphical illustration depicts use of a spring of typical lineal spring-force curve characteristics. The spring member is installed in such manner that when the panel 10 is in its vertically standing "cabinet-closed" position the spring is only slightly tensioned, so as to insure against any accidental opening of the closure. Hence, in the graph of FIG. 3 the "spring effect" curve is illustrated as starting above the zero force coordinate and constantly rising as the door panel swings outwardly and downwardly.

As illustrated by the "gravity effect" curve of FIG. 3, the gravity effect on the closure panel is zero when the panel is in its upright standing position, and increases in a sinusoidal curve pattern as the panel swings toward its horizontally extended position. The spring member 25 is selected and installed so that when the closure panel is in its fully horizontally extending position the gravity effect on the panel is slightly greater than the counterbalancing force effect then being delivered by the spring. Thus, when the panel is in its "open" (horizontally extending) position the gravity force thereon operates to maintain the panel in its fully "open" position, with the stop links 40 holding firmly against the anchor pins 46. However, as illustrated by the graph of FIG. 3, the gravity action effect on the panel is thereby so arranged that it exceeds the spring force effects upon the panel only after the panel has moved from a fully upright position to an intermediate position, say in the region of a 30 degree inclination away from the vertical.

In consequence, to open the closure panel it is only necessary for the operator to initially overcome only the slight spring force holding the panel in its upright "closed" position, and to give it a slight impetus outwardly and downwardly. As the panel passes through the aforesaid "intermediate" position the forces of gravity thereon take over and assist it to continue to fall toward fully opened position. Hence the operator need only "trigger" the action and gravity does the rest; but it is to be particularly noted that as shown graphically at FIG. 3, the degree of dominance of the gravity force effects over the spring force effects decreases as the closure panel approaches its horizontally "fully opened" position. Hence, whereas the panel would otherwise tend to slam into fully horizontal position and against the stop mechanism, in the case of the present invention the downswinging action is inherently damped and softened.

Conversely, when it is desired to close the panel 10 the operator simply applies a finger-tip upward pressure sufficient to "trigger" the panel to move upwardly against the dominant gravity forces until the panel passes again through the aforesaid "intermediate" position whereupon the then dominant spring forces take over control of the panel and cause it to move on up into its fully closed position. Because the spring force effect on the panel "dies out" as the panel approaches its fully closed position, any tendency of the panel to slam is minimized and softened. The spring-force adjustment mechanism referred to hereinabove provides means for initially setting-up the mechanism to provide the "soft" door moving action above referred to, notwithstanding manufacturing variances in the parts comprising the assembly. Also, this permits subsequent readjustments of the counterbalance-force mechanism so as to compensate for any spring metal fatigue effects or other such factors.

It will of course be understood that whereas only one form of the invention has been illustrated and described in detail hereinabove, various changes may be made therein without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. In combination with a cabinet structure having opposite side walls provided with vertically spaced tracks along their inner sides,

a cradle assembly comprising a horizontally disposed support plate extending between said side walls below said tracks and having upturned opposite end plates, rollers journalled on the upper portions of the outer sides of said end plates and received in said tracks,

a pair of hinge plates on said support plate and projecting beyond the outer edge thereof,

a closure panel having a pair of hinge plates on its lower edge and interdigitated with the corresponding hinge plates on said support plate,

a combined torsion spring-pintle pin having an elongate main body portion hingedly connecting said interdigitated hinge plates, and having laterally projecting opposite end portions, one such end portion being fixed to one side of said closure panel and the other end portion lying along the inner side of one of said end plates of the cradle assembly,

a hook finger on said inner side of said one end plate with which said other end portion of the torsion spring is engaged to slightly tension said spring when said closure panel is vertically disposed,

a pair of horn plates fixed to and projecting from the inner side of said closure panel adjacent the lower edge thereof to straddle said end plates of the cradle assembly when said closure panel is vertically disposed,

a link pivotally connected to each horn plate and having an elongate opening,

a stop pin assembly carried by each end plate and including a stop pin received in the elongate opening of the associated link,

and means for vertically adjusting each stop pin assembly to limit downward swinging movement of the closure panel away from said cradle assembly such that when fully swung away, the closure panel is substantially horizontally disposed below the tracks, said torsion spring being provided of such spring characteristics and being so arranged as to apply to said panel when in its upright standing position only slight panel-biasing forces which increase as said panel swings outwardly upon its hinge mounting relative to said cradle assembly toward a horizontally extending position at a spring force increase rate such as to maintain said spring force substantially to coincide with the rate of increase of gravity force effects on said panel as the latter swings progressively towards horizontal attitudes, but so as to be overcome by said gravity force effects as said panel swings through an intermediate (inclined to the horizontal) attitude

so that as said panel approaches a horizontally extending attitude the spring force effects dominate the counterbalance spring effects of said torsion bar to maintain said closure in fully opened position upon arrival thereat.

References Cited

UNITED STATES PATENTS

251,591	12/1881	Jaeger	220—35
822,555	6/1906	Rogers	16—180
2,602,957	7/1952	Anderson	16—180
2,984,517	5/1961	Farrow	16—180
3,307,734	3/1967	Campbell	220—35

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