June 8, 1965 K. A. LUNDELL 3,187,374

HINGE MECHANISM

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Fig. 1.

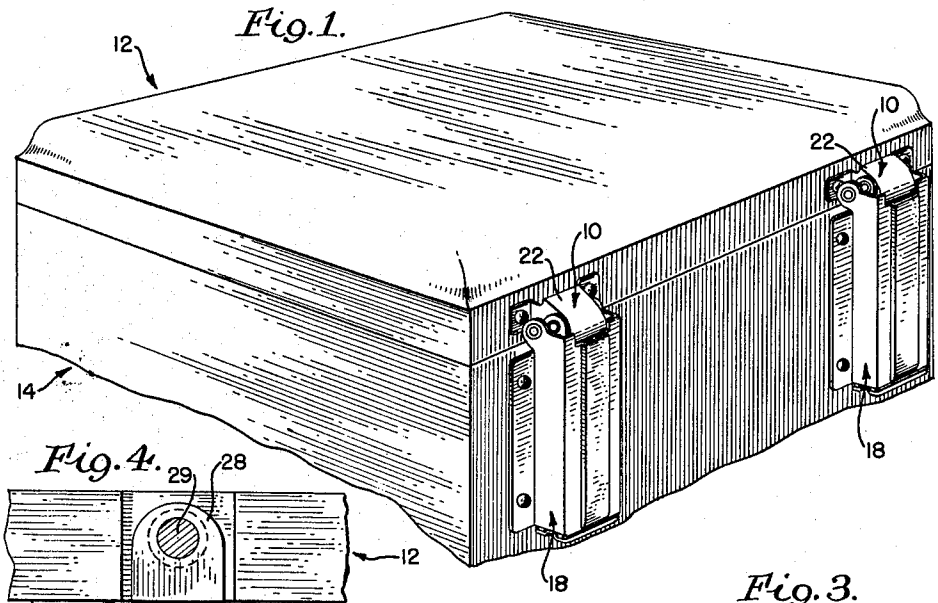


Fig. 4.

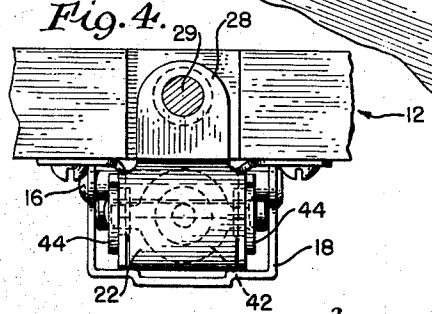


Fig. 2.

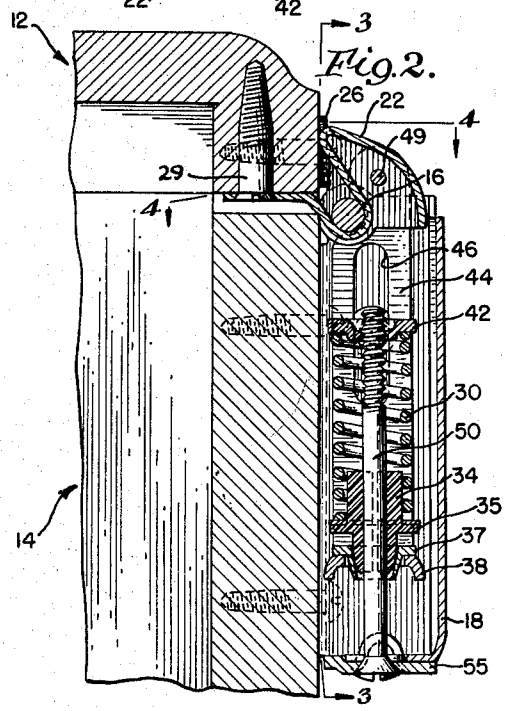
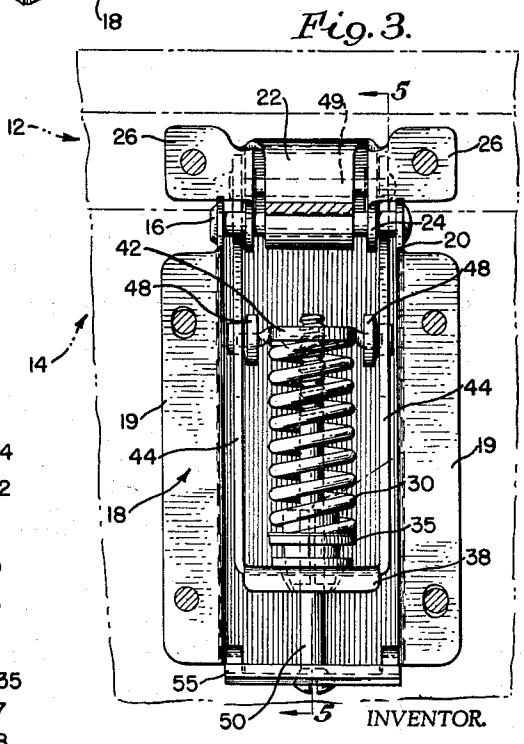


Fig. 3.



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Fig. 5.

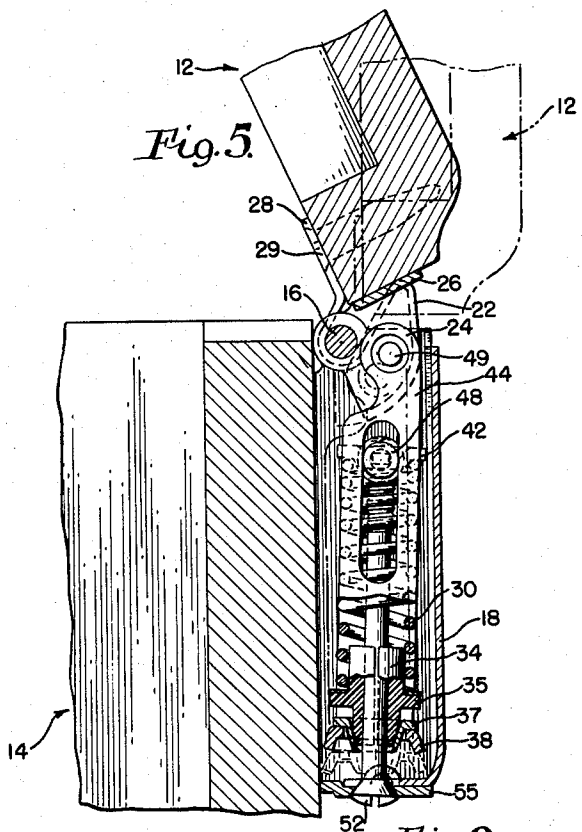


Fig. 6.

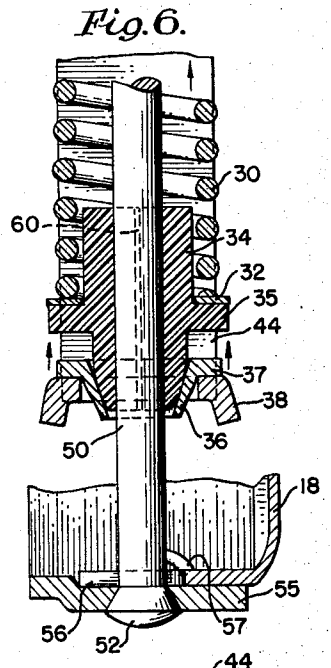


Fig. 7.

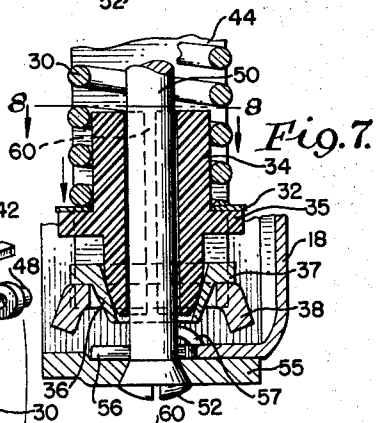


Fig. 9.

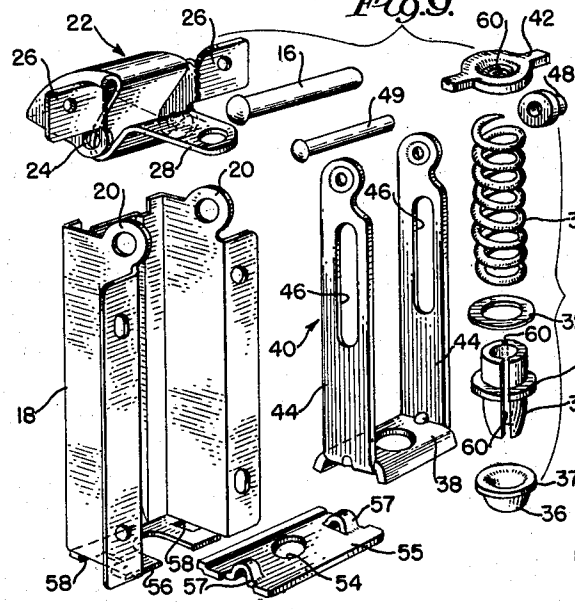
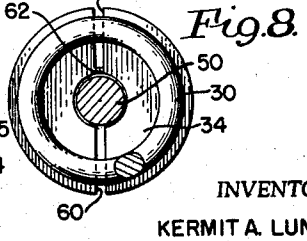


Fig. 8.



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HINGE MECHANISM

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Fig. 10.

LID GOING DOWN

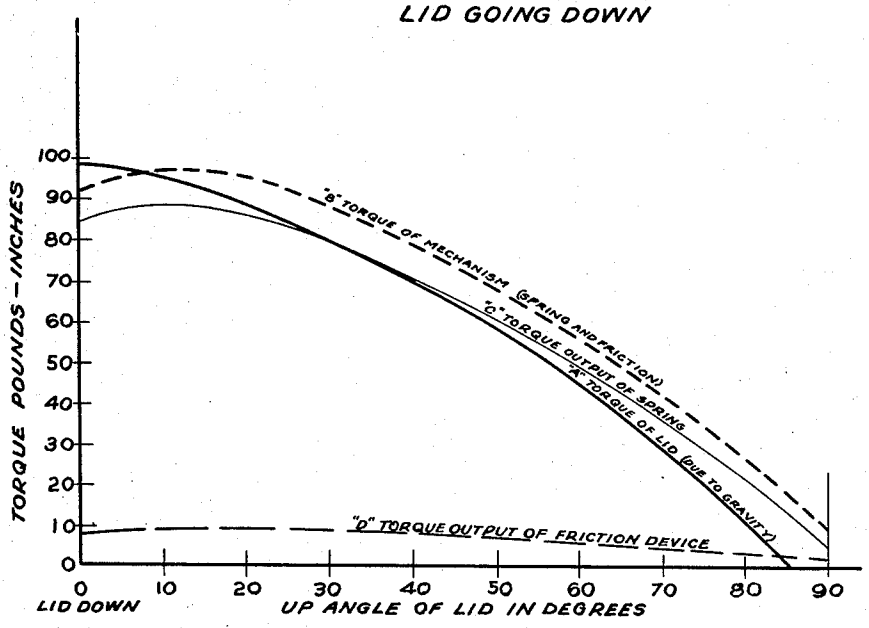
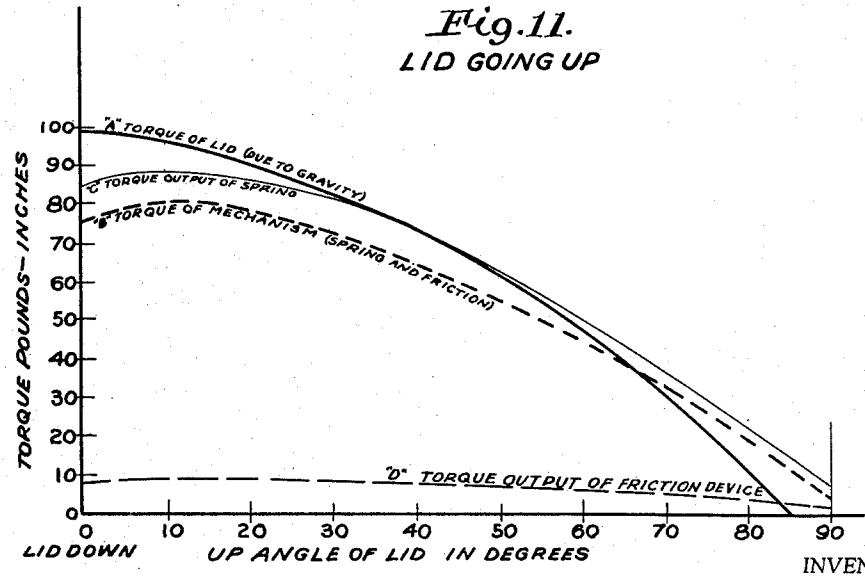


Fig. 11.

LID GOING UP



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United States Patent Office 3,187,374 Patented June 8, 1965

3,187,374

HINGE MECHANISM

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Filed Dec. 17, 1963, Ser. No. 331,295
6 Claims. (Cl. 16—190)

This invention relates to improvements in counterbalance and self-braking type hinge mechanisms for pivotally supporting and balancing and otherwise positionally controlling the lid or cover of an open top type cabinet or the like. Thus the invention relates more specifically to motion control hinge mechanisms such as are useful for example in connection with top covers of record player cabinets, freezer cabinets, filing cabinets, or other receptacles having hinged covers or lids swingable from horizontal "closed" positions to vertically standing "open" positions.

It is a primary object of the present invention to provide an improved motion controlling hinge device as aforesaid which will effectively counterbalance the weight of a cover or lid member at all positions throughout the operative arc of its movement; automatically compensating in improved manner for the varying torque forces due to gravity effects on the cover as it moves between horizontally extending and vertically standing attitudes.

Another object is to provide in a hinge mechanism as aforesaid improved means for snubbing the hinged cover motion as it swings between horizontal and vertically standing positions, whereby to prevent the cover from "coasting" when released after manual starting of a cover moving operation.

Another object is to provide in a mechanism as aforesaid a novel friction-brake mechanism which is automatically variably operable to compensate for varying torque forces due to gravity effect changes as the cover moves between horizontal extending and vertically standing positions; and which also provides a novel cover hold-down effect preventing undesirable vibrations thereof against the cabinet.

Another object of the invention is to provide a hinge mechanism as aforesaid which is of structurally simple and compact form; the parts of which are rugged and fail-proof in operation and yet which may be relatively inexpensively fabricated.

Another object is to provide an improved hinge mechanism as aforesaid which is adapted to be mounted on the outside of the cabinet back wall and below the level of the cabinet top surface, and which permits the cover to be opened to a vertically standing position, thereby leaving the interior of the cabinet fully accessible for installation of components and totally unobstructed, while still being inconspicuous from all angles from which the cabinet is usually viewed.

Another object is to provide an improved hinge mechanism as aforesaid which may be readily adjusted to cause it to operate to provide improved counterbalancing effects in connection with cabinet covers of various weights and/or dimensions.

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

FIG. 1 is a fragmentary top perspective view of a cabinet having its cover mounted thereon by means of a pair of hinges of the present invention;

FIG. 2 is a fragmentary vertical sectional view, on enlarged scale, through one of the hinges of FIG. 1;

FIG. 3 is a section taken on line 3—3 of FIG. 2;

FIG. 4 is a fragmentary sectional view taken on line 4—4 of FIG. 2;

FIG. 5 is a view corresponding to FIG. 2 but showing

the hinge parts when the cabinet cover is in various "open" positions;

FIGS. 6, 7 are fragmentary sectional views, on enlarged scale, showing the hinge counterbalance and variable brake mechanisms in different conditions of operation;

FIG. 8 is a sectional view taken on line 8—8 of FIG. 7;

FIG. 9 is an "exploded" view in perspective of the parts of the hinge mechanism;

FIG. 10 is a graphical comparison of the torque effect curves of the lid and mechanism actions in the case of a typical mechanism of the invention when the lid is moving towards closed position; and

FIG. 11 corresponds to FIG. 10 but shows the action when the lid is moving towards open position.

As shown in the drawing herewith, a pair of hinges embodying the invention; being individually indicated generally at 10—10, FIG. 1, are employed to mount a cover 12 relative to a cabinet 14; it being understood of course that only one or any other number of such hinges may be employed to provide proper hinging support for a cabinet cover, depending upon its weight and/or dimensional characteristics. The hinge or hinges, as the case may be, are adapted to be mounted against the rear wall of the cabinet and against the rear edge of the cover, so as to be thereby unobtrusively disposed from view such as when the cabinet is customarily placed against a wall surface or the like. Hence, when the cover is raised to its full open position as illustrated for example by broken lines at FIG. 5, access to the interior of the cabinet is completely unobstructed by the presence of any hinge parts. This is an important feature for example in connection with record player cabinets or the like. Also the hinge mechanism of the present invention is of such compact dimensional form as to be adequately accommodated in the space between the cabinet and the adjacent wall which is required to permit raising the cabinet cover to its fully vertical standing position. Hence, mounting of the hinge mechanism of the present invention on the outside of the cabinet rear wall is of no detriment, and per se requires no positional shifting of the cabinet relative to the adjacent wall.

As shown by way of example herein, the mechanism of the present invention comprises a pair of relatively pivotable bracket portions interconnected by means of a hinge pin 16. One of the bracket portions comprises a generally channel-shaped housing member 18 adapted to be fixed as by means of wood screws or the like, in vertically standing attitude against the back wall of the cabinet; having apertured side flanges 19—19 for that purpose. The side walls of the bracket 18 are formed at their upper ends with eye portions 20—20 accommodating the pin 16. The second bracket portion comprises a metal stamping as indicated generally at 22, having parallel eye portions 24—24 suitably apertured to also accommodate the pin 16 therethrough; whereby the parts 18, 22 are interconnected in hinged relation. The bracket 22 is also formed with a pair of apertured side flanges 26—26 for fastening the bracket to the rear edge of the cabinet cover 12; and also preferably includes a forwardly extending tab 28 which is apertured to accommodate a wood screw 29 or the like for additional fastening of the device to the underside of the cabinet cover. Thus it will be appreciated that by reason of this arrangement the cover 12 is mounted to pivot relative to the open top of the cabinet 14 between horizontally extending "closed" position and partial or "full open" positions when the cover is in full vertically extending position.

To counterbalance the weight of the cover to which the hinge mechanism is attached, a compression spring 30 is provided to bear at its lower end upon a washer 32 carried by a sleeve-shaped brake shoe 34 at an enlarged

shoulder portion 35 thereof. A rounded bottom end portion of the sleeve 34 rests in a conically bored cup 36 having a top flange 37 which rests upon an apertured sill portion 38 of a stirrup member designated generally by the numeral 40. The upper end of the spring 30 bears against a cross bar 42 which acts as a guide for the upper end of the spring 30, by being held in slotted portions 46 of the arms 44. To facilitate this action the ends of the cross bar 42 are fitted with wear-resistant buttons 48 which ride in the slots 46 to prevent any metal-to-metal sliding contacts. The stirrup arms 44—44 are apertured at their upper ends to accommodate therethrough a hanger pin 49 which also extends through aligned apertures in the side walls of the bracket member 22 at positions radially offset from the axis of the main hinge pin 16. Thus, the stirrup 40 is suspended from the pin 49 which swings through an arc about the axis of the hinge pin 16 as the bracket 22 pivots on the hinge pin 16 as the cabinet cover swings between closed and open positions.

The cross bar 42 is held in position by means of a tie rod 50 which is headed as shown at 52 at its lower end to be thereby anchored in an aperture 54 formed in a bottom plate 55 which bears upwardly against a centrally apertured bottom wall portion 56 of the bracket 18; cooperating nubs 57 and recesses 58 being formed on the bottom plate 55 and the bottom wall 56 respectively, to maintain the parts in proper position. The tie rod 50 at its upper end threads through a tapped aperture 60 (FIG. 9) in the cross bar 42, and thus the spring 30 is maintained in compressed relation between the bottom sill 38 and the cross bar 42; the degree of compression decreasing as the cover 12 moves towards its up-standing or "open" position to compensate for decreasing torque loads (due to gravity forces on the cover) as it swings upwardly.

The parts are so dimensioned and arranged that when the cover is down, as shown in FIGS. 1, 2, the stirrup 40 is pulled upon upwardly so as to compress the spring 30 into the range of its high-tensioned condition. Thus, the spring 30 is now exerting maximum pull downwardly through the stirrup and upon the pin 49; tending to rotate the hinge bracket 22 about the main hinge pin 16 so as to effectively counterbalance the torque load due to gravity effects upon the cover 12 when in its horizontal position. Hence, the cover may now be easily lifted for access to the cabinet interior by application of only slight manual pressures against the front edge of the cover.

As the cover is first moved upwardly, such as through the first 45 degrees of its opening arc, the stirrup hanger pin 49 swings in an arc behind the hinge pin 16 as from the position of FIG. 2 to the position of FIG. 5, thereby substantially reducing the distance between the pin 49 and the anchorage of the rod 50 at the bottom of the housing 18. This relaxes the spring and reduces the forces being applied by the spring for counterbalancing the gravity forces on the cover. Inasmuch as the cover is now swinging towards an upwardly standing position about the hinge pin 16, the torque forces thereon (due to gravity) are decreasing progressively as the cover approaches its fully upright position; and the parts are so proportioned and arranged that throughout the arc of cover motion the varying torque and spring forces are operable to generally compensate for and balance one another. When the cover reaches a truly vertical standing attitude as shown for example by broken lines in FIG. 5, the distance between the hanger pin 49 and the anchor point of the rod 50 is minimum; and the rod 59 is preferably so adjusted in the cross bar 42 so that under this condition the spring exerts minimum forces on the hanger pin 49. Furthermore, the construction is such that when the cover approaches the vertical attitude, an appreciable spring force over that required for cover counterbalance alone, is applied. This keeps the cover in its fully "open" position and prevents its unintended sagging forwardly therefrom, such as might otherwise occur in response to external jarring or vibration forces.

As shown in FIG. 2, the parts are so proportioned and arranged that as the cover swings down into its fully closed position, the hanger pin 49 moves towards a position above the hinge pin 16 so as to reduce the effective lever arm through which the spring is acting. Therefore, although the spring is now moving towards its condition of maximum compression, it is less effective in supporting the cover. This effect is augmented by the fact that the spring effect at this stage of the cover position, is arranged to be less than is required to support the cover at this point. Thus, the cover is now permitted to fall through the last few degrees of its travel arc with increasing force into firmly pressed relation against the cabinet; and the cover is now held down under gravity restraint. Furthermore, the friction-brake effect between the sleeve 34 and the tie rod 50 is now at its maximum (due to maximum compression of the spring 30) thereby contributing to the gravity effects hereinabove described. Thus, the cover is now held firmly down by both gravity and friction-brake effects, and is thereby prevented from noisily vibrating against the cabinet, such as might otherwise occur under the influence of cabinet vibrations induced by audio speakers, floor movements, or the like.

Screwdriver adjustments of the spring control tie rod 50 will of course adapt the mechanism to provide preferred cover actions, as well as to properly control the movements of covers of different weights and/or dimensions. Thus, when applied to heavier covers, for example, and/or to covers of greater depth dimensions, whereby gravity-induced torque loads thereon are heavier, the spring 30 will be more highly tensioned and will provide proportionately greater (and needed) cover balancing effects.

It is a particular feature of the mechanism of the present invention that the brake sleeve 34 is formed of a resiliently plastic material having variable contact-friction characteristics. Thus, for example as shown in FIG. 7, when the spring 30 is in its most relaxed condition (when the cover 12 is in full open and vertically standing position) the brake sleeve 34 fits with the least pressure on the rod 50 while the rounded bottom nose portion of the sleeve rests in the conical cup 36 in its least deformed condition. Hence, substantially no friction brake effects exist between the sleeve 34 and the rod 50.

However, as the cover 12 is moved downwardly toward its horizontal or cabinet-closing position, the stirrup 40 is thereby pulled upwardly relative to the bracket 18 and this increasingly compresses the spring 30. This progressively increasing compression of the spring 30 is reflected in correspondingly increasing pressures being applied by the spring against the shoulder portion 35 of the brake sleeve 34, tending to further drive the rounded bottom nose portion of the sleeve into the conical cup 36, thereby squeezing the material of the sleeve radially inwardly into progressively increasing friction-bearing contact with rod 50.

Thus, it will be appreciated that as the torque loads on the cover (due to gravity effects thereon) increase as the cover moves from an upright standing position toward a horizontal extending position, the motion "snubbing" or friction brake effects generated by the nose portion of the brake sleeve 34 against the rod 50 increase proportionately. Conversely, as the cover moves from a horizontal attitude towards an upwardly standing position the brake action progressively decreases; and therefore, by virtue of this arrangement the braking effect tending to snub any cover movement automatically varies in intensity in accordance with the torque loads on the cover, which are functions of the angular attitudes of the cover as it swings about its hinge axis.

As shown more clearly in FIGS. 8 and 9, the brake sleeve 34 is preferably slotted as indicated at 60, 60 longitudinally of the sleeve and through diametrically opposed wall positions thereof, to facilitate the variable clamping action of the shoe parts against the control

rod 50. However, a small web portion 62 (FIG. 8) is preferably left at one side when slotting the sleeve to maintain the two halves of the sleeve in integral relation, thereby facilitating manufacture and easier handling of the parts.

Hence, it will be appreciated that the relatively simple mechanism of the present invention is adapted to hingedly mount a cover as explained hereinabove and to at the same time provide an automatically varying counterbalancing spring effect (as a function of cover position), compensating for coincidental variations in the torque loads on the cover due to gravity effects. Also, at the same time the cover motion snubbing action of the friction sleeve 34 is automatically adjusted to provide appropriately varying degrees of brake action to compensate for the varying inertia forces of the cover. Thus the cover is easily put manually into motion from a standstill position at any point within the arc of its permissive hinge movement; and yet whenever manual displacement forces are removed the snubbing action of the sleeve 34 will operate to smoothly and quickly cushion and then halt the cover movement. Thus, for example, the cover may be given a motion impetus, and whenever the manually applied force is removed the cover will immediately decelerate and come to a smooth stop, regardless of the position thereof within the range of permissive movement. This is true whether the cover is being moved upwardly, or downwardly toward cabinet closing position, and at any stage throughout its arc of movement, and also operates to damp out any tendency of the cover to oscillate when standing still.

FIG. 10 illustrates graphically the torque effect curves involved in the operation of a typical mechanism of the invention when the lid is moving towards its closed position. Curve A depicts the lid torque due to gravity effects acting on the lid throughout the range of its hinging movements in either direction. Curve B depicts the torque output of the mechanism as the lid moves from its "open" position towards its "closed" position; being a combination of the spring and friction outputs operating to counterbalance the lid and to damp any movements thereof. Curves C and D depict respectively the spring and friction torque components of curve B. From this graph it will be evident that the mechanism of the invention will operate to counterbalance and snub any coasting tendency of the lid until it approaches its closed position whereupon the gravity torque exceeds the spring and friction torque, and the lid falls into firmly closed position.

FIG. 11 corresponds to FIG. 10 but compares the operative torque effects as the lid moves from its closed position towards its open position. Note that whereas in FIG. 10 the spring and friction effects both operate against gravity effects, FIG. 11 shows how the gravity and friction effects both oppose the spring effect. When the lid reaches a substantially elevated position the spring and friction effect begins to exceed the gravity effect, and assures firm holding of the lid when in its "open" position. The mechanism may be designed to provide any preferred ratio of the friction effect to the combined spring and friction effect, by altering the angle of coning of the cup 36. Thus, the friction brake effect may be increased for example to accommodate heavier lids, by closing the cone angle of the cup; and conversely, lighter lids are accommodated by widening the cone angle. Also, in any case if it is preferred to give the lid greater freedom of movement, this can be achieved by reducing the ratio of the friction effect to combined friction and spring effect.

Thus, the mechanism of the invention provides highly desirable operational features; and it will of course be appreciated that although only one specific form of the invention has been illustrated and described in detail herein, various changes may be made in the mechanism shown and described by way of example, without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. A cover mounting combination hinge and counterbalance and motion snubbing mechanism for hingedly mounting a cover upon an open top cabinet whereby said cover may be easily swung between horizontal and vertically standing attitudes, said mechanism, including first and second brackets adapted to be fixed to said cover and said cabinet respectively, a hinge pin pivotally interconnecting said brackets, a stirrup member of U-shaped form including opposed leg portions pivotally connected at their upper ends to a hanger pin carried by said first bracket at a position radially offset from the axis of said hinge pin, said stirrup member including a bottom sill portion apertured and carrying therein a cup with a conical bore, a resilient friction-material sleeve having a rounded bottom end portion resting in the bore of said cup, a compression spring bearing downwardly at its bottom end upon said sleeve and bearing at its upper end against a cross arm having its opposite end portions riding in slide guide means formed on said stirrup leg portions, a tie rod fixed at its bottom end to the second of said brackets and slidably extending vertically through said sill portion and said cup and said spring and fixed at its upper end to said cross arm whereby to hold the latter in constant distance relation with said second bracket, said spring being adjusted to exert forces acting through said stirrup member counterbalancing the torque effects of gravity on said cover throughout the range of its positional movements, the internal wall surfaces of said sleeve bearing in frictional engagement with said tie rod and thereby operating to snub movements of said stirrup member relative to said tie rod thereby damping hinging movements of said cover, the friction bearing pressures between said sleeve and said tie rod varying according to the thrust pressure variations of said spring against said sleeve as a function of spring compression variations incident to cover positional changes.

2. A cover mounting combination hinge and counterbalance and motion snubbing mechanism for hingedly mounting a cover upon an open top cabinet whereby said cover may be easily swung between horizontal and vertically standing attitudes, said mechanism including first and second brackets adapted to be fixed to said cover and said cabinet respectively, a hinge pin pivotally interconnecting said brackets, a hanger pin carried by said first bracket at a position radially offset from the axis of said hinge pin and moving in an arc therearound upon hinging movements of the mounted cover between positions above and to one side of the hinge axis, a stirrup member of U-shaped form including opposed leg portions pivotally connected at their upper ends to said hanger pin, said stirrup member including a bottom sill portion apertured and carrying therein a conically bored cup, a resilient friction-material sleeve having a rounded bottom end portion resting in said cup, a compression spring bearing downwardly at its bottom end upon said sleeve and bearing at its upper end against a cross arm having its opposite end portions riding in slide guide means formed on said stirrup leg portions, a tie rod fixed at its bottom end to the second of said brackets and slidably extending vertically through said sill portion and said cup and said spring and fixed at its upper end to said cross arm whereby to hold the latter in constant distance relation from said second bracket, said spring being adjusted to exert forces acting through said stirrup member counterbalancing the torque effects of gravity on said cover throughout the range of its positional movements and said stirrup being rocked alternately between near and far off center attitudes relative to the hinge axis as the cover swings between closed and open positions thereby varying the effective lever arm through which the spring forces act upon said cover, the internal wall surfaces of said sleeve bearing in frictional engagement with said

tie rod and thereby operating to snub movements of said stirrup member relative to said tie rod thereby damping hinging movements of said cover, the friction bearing pressure between said sleeve and said tie rod varying according to the thrust pressure variations of said spring against said sleeve as a function of spring compression variations incident to cover positional changes.

3. A cover mounting combination hinge and counterbalance and motion snubbing mechanism for hingedly mounting a cover upon an open top cabinet whereby said cover may be easily swung between horizontal and vertically standing attitudes, said mechanism including first and second brackets adapted to be fixed to said cover and said cabinet respectively, a hinge pin pivotally interconnecting said brackets, a stirrup member of U-shaped form including opposed leg portions pivotally connected at their upper ends to a hanger pin carried by said first bracket at a position radially offset from the axis of said hinge pin, said stirrup member including a bottom sill portion of conically bored cup form, a resilient friction-material sleeve having a rounded bottom end portion resting in said cup form, a compression spring bearing downwardly at its bottom end upon said sleeve, a tie rod fixed at its bottom end to the second of said brackets and slidably extending vertically through said sill portion and said spring and fixed at its upper end to the upper end of said spring whereby to hold the latter in constant distance relation from said second bracket, said spring being adjusted to exert forces acting through said stirrup member counterbalancing the torque effects of gravity on said cover throughout the range of its positional movements, the internal wall surfaces of said sleeve bearing in frictional engagement with said tie rod and thereby operating to snub movements of said stirrup member relative to said tie rod thereby damping hinging movements of said cover, the friction bearing pressure between said sleeve and said spring against said sleeve as a function of spring compression variations incident to cover positional changes.

4. A cover mounting combination hinge and counterbalance and motion snubbing mechanism for hingedly mounting a cover upon an open top cabinet whereby said cover may be easily swung between horizontal and vertically standing attitudes, said mechanism including first and second brackets adapted to be fixed to said cover and said cabinet respectively, a hinge pin pivotally interconnecting said brackets, a stirrup member of U-shaped form including opposed leg portions pivotally connected at their ends to a hanger pin carried by one of said brackets and including a conically apertured cross still portion, a resilient friction-material sleeve having a rounded end portion resting in said sill portion, a compression spring bearing at one end upon said sleeve, a tie rod fixed at one end to the second of said brackets and slidably extending vertically through said sill portion and said spring and fixed at its other end to said spring whereby to hold the latter in constant distance relation from said second bracket, said spring being adjusted to exert forces acting through said stirrup member counterbalancing the torque effects of gravity on said cover throughout the range of its positional movements, the internal wall surfaces of said sleeve bearing in frictional engagement with said tie rod and thereby operating to snub movements of said stirrup member relative to said tie rod thereby damping hinging movements of said cover, the friction bearing pressure between said sleeve and said tie rod varying according to the thrust pressure variations of said spring against said sleeve as a function of spring compression variations incident to cover positional changes.

5. A cover mounting combination hinge and counterbalance and motion snubbing mechanism for hingedly mounting a cover upon an open top cabinet whereby said cover may be easily swung between horizontal and vertically standing attitudes, said mechanism including first and second brackets adapted to be fixed to said cover and said cabinet respectively, a hinge pin pivotally interconnecting said brackets, a hanger pin carried by said first bracket at a position radially offset from the axis of said hinge pin and moving in an arc therearound between positions above and to one side of the hinge axis upon hinging movements of the mounted cover, spring control means comprising a stirrup member and a tie rod each pivotally connected to one of said brackets, said stirrup including a sill portion apertured and carrying therein a conically bored cup, a resilient friction-material sleeve having a rounded bottom end portion resting in said cup, a compression spring bearing at one end upon said sleeve and fixed at its other end to said tie rod, said tie rod being slidably extending vertically through said sill portion and said cup and said spring, said spring being adjusted to exert forces acting through said stirrup member counterbalancing the torque effects of gravity on said cover throughout the range of its positional movements and said stirrup being rocked alternately between near and far off center attitudes relative to the hinge axis as the cover swings between closed and open positions thereby varying the effective lever arm through which the spring forces act upon said cover, the internal wall surfaces of said sleeve bearing in frictional engagement with said tie rod and thereby operating to snub movements of said stirrup member relative to said tie rod thereby damping hinging movements of said cover, the friction bearing pressure between said sleeve and said tie rod varying according to the thrust pressure variations of said spring against said sleeve as a function of spring compression variations incident to cover positional changes.

6. A cover mounting combination hinge and counterbalance and motion snubbing mechanism for hingedly mounting a cover upon an open top cabinet whereby said cover may be easily swung between horizontal and vertically standing attitudes, said mechanism including first and second brackets adapted to be fixed to said cover and said cabinet respectively, a hinge pin pivotally interconnecting said brackets, a stirrup member of U-shaped form including opposed leg portions pivotally connected at their ends to a hanger pin carried by one of said brackets and including a tapered dwell portion, a resilient friction-material sleeve having an end portion resting in said dwell portion, a compression spring bearing at one end upon said sleeve, a tie rod fixed at one end to the second of said brackets and slidably extending through said dwell portion and said spring and fixed at its other end to said spring whereby to hold the latter in constant distance relation from said second bracket, said spring being adjusted to exert forces acting through said stirrup member counterbalancing the torque effects of gravity on said cover throughout the range of its positional movements, the internal wall surfaces of said sleeve bearing in frictional engagement with said tie rod and thereby operating to snub movements of said stirrup member relative to said tie rod thereby damping hinging movements of said cover.

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