Feb. 6, 1973 C. H. LITTLE 3,714,680

COUNTER-BALANCE SUPPORT

Filed Nov. 17, 1971 2 Sheets-Sheet 1

Fig.1

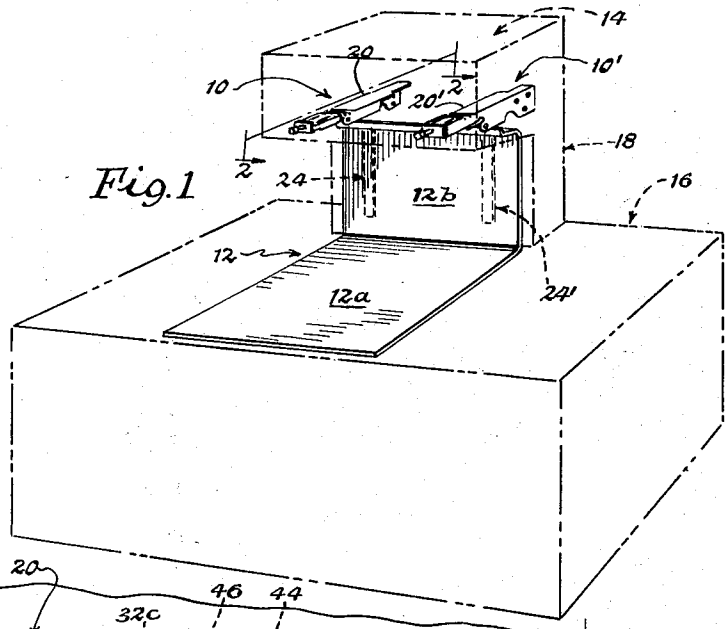


Fig.2.

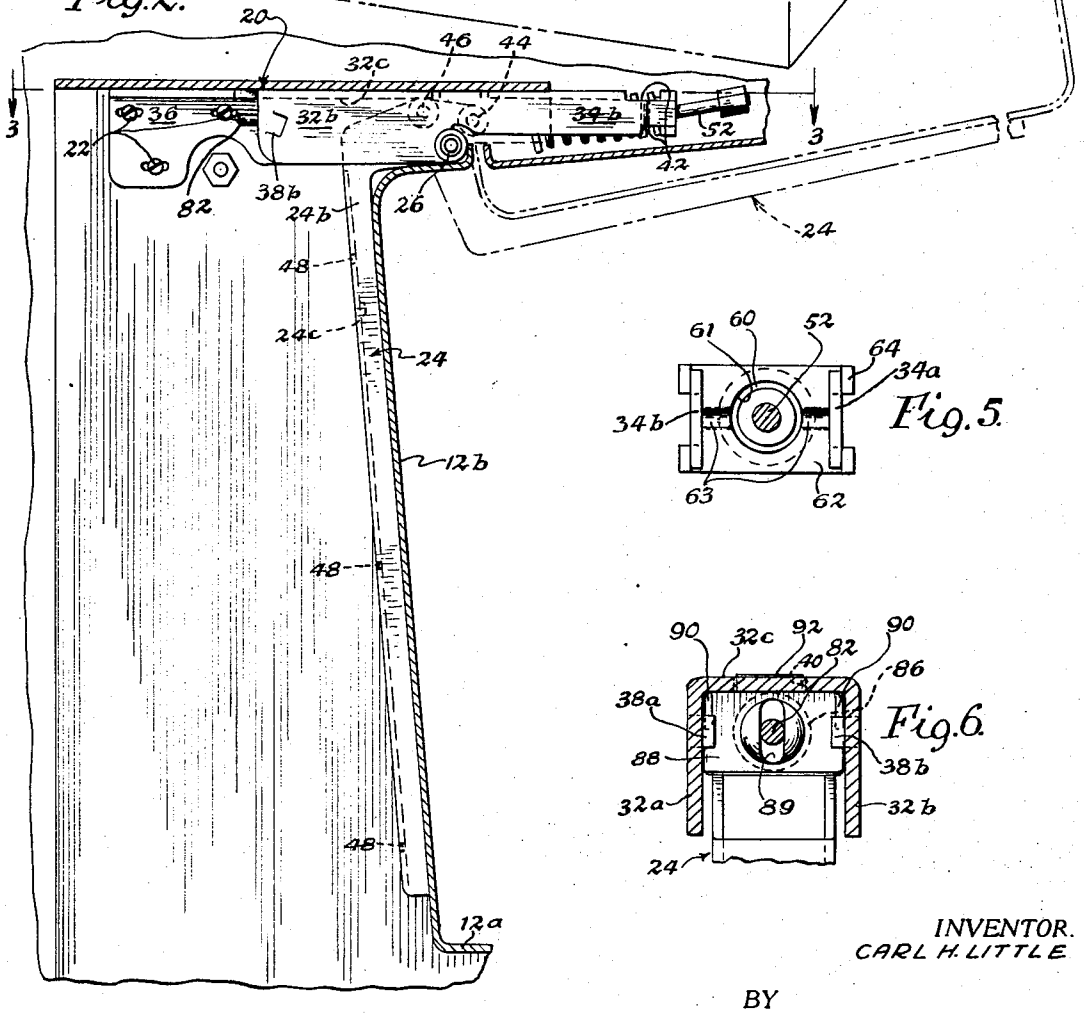


Fig.5

Fig.6

INVENTOR.
CARL H. LITTLE

BY

Bean & Bean
ATTORNEYS

Feb. 6, 1973 C. H. LITTLE 3,714,680

COUNTER-BALANCE SUPPORT

Filed Nov. 17, 1971 2 Sheets-Sheet 2

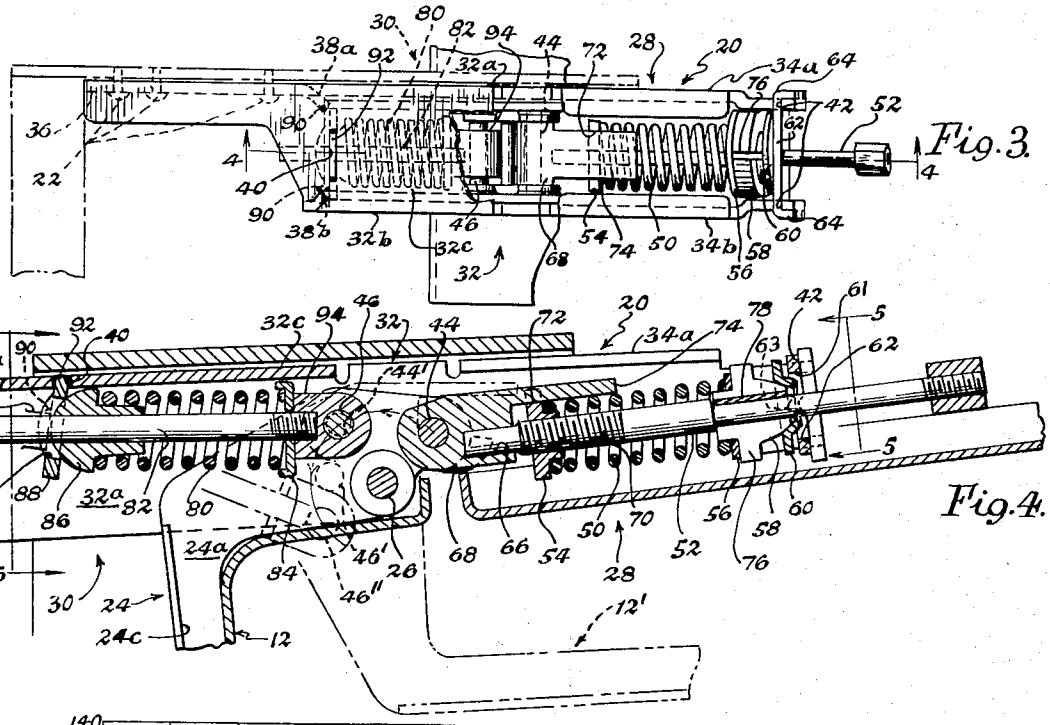


Fig. 3.

Fig. 4.

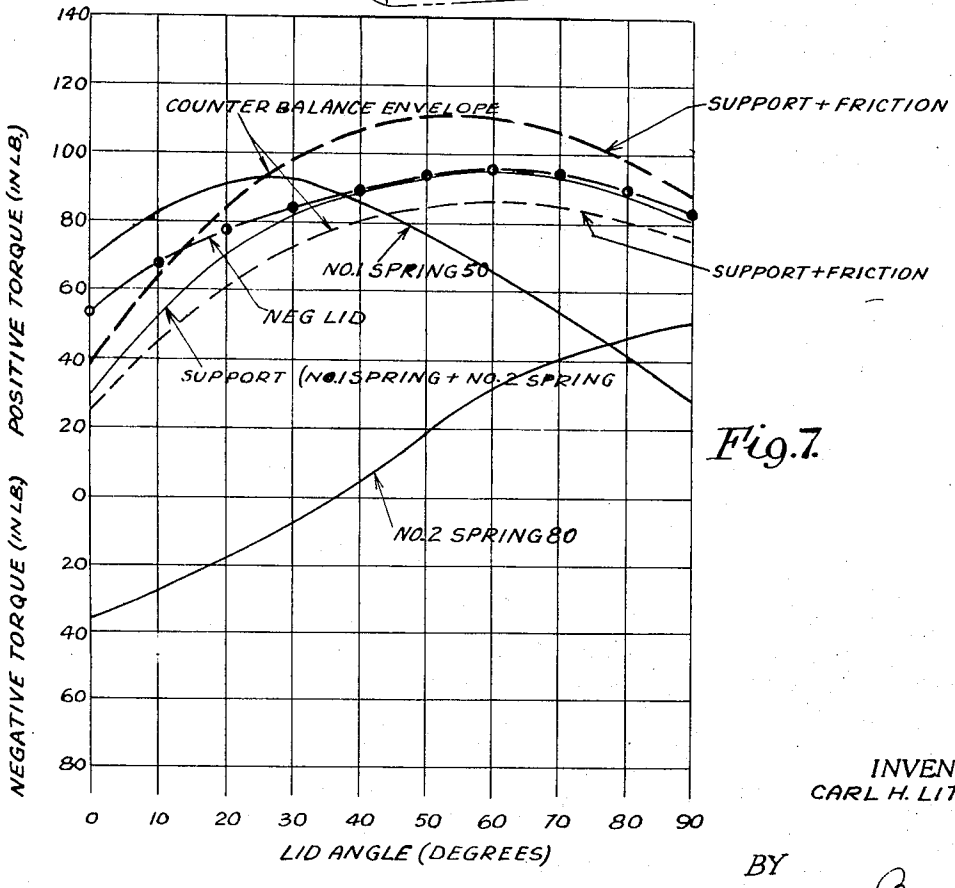


Fig. 7.

INVENTOR.
CARL H. LITTLE

BY

Bean & Bean
ATTORNEYS

United States Patent Office 3,714,680
Patented Feb. 6, 1973

3,714,680

COUNTER-BALANCE SUPPORT

Carl H. Little, Jamestown, N.Y., assignor to Weber-Knapp Company, Jamestown, N.Y.

Filed Nov. 17, 1971, Ser. No. 199,584
Int. Cl. E05f 1/12
U.S. Cl. 16—190 7 Claims

ABSTRACT OF THE DISCLOSURE

A counter-balance support for a suspended lid including a pair of compression springs acting alternatively together and in opposition for effectively counter-balancing the weight of the lid during vertical swinging movement thereof.

SUMMARY OF THE INVENTION

The present invention is directed towards a counter-balance support for suspending a lid or cover plate for opening movement in a direction upwardly towards an operator. More specifically, the present invention is directed towards an improved hinge mechanism which will effectively counter-balance the weight of a suspended lid at substantially all positions thereof throughout its operative arc of movement.

The present invention features the utilization of a pair of compression springs arranged to act alternately together and in opposition and a friction-brake mechanism associated with one of the springs; the springs and friction-brake mechanism co-operating to provide torque forces variable throughout the extent of vertical swinging movement of the lid as required to counter-balance the weight of the lid.

The nature and mode of the present invention will now be more fully described in the following detailed description as taken with the accompanying drawings wherein:

FIG. 1 is a perspective view partially in phantom illustrating the placement of the pair of hinge mechanisms forming the counter-balance support of the present invention;

FIG. 2 is a sectional view taken generally along line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken generally along line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken generally along line 4—4 of FIG. 3;

FIG. 5 is a sectional view taken generally along line 5—5 of FIG. 4;

FIG. 6 is a sectional view taken generally along line 6—6 of FIG. 4;

FIG. 7 is a graphic comparison of the torque effect curves of the lid and counter-balance support.

DETAILED DESCRIPTION

Reference is now made specifically to FIG. 1 wherein a pair of hinges **10** and **10'**, which are formed in accordance with the present invention, are shown as being employed to suspend a generally L-shaped lid or cover **12** beneath a console or other machine control enclosure **14**; the altter being supported on a machine case cabinet or stand **16** by means of a pedestal **18**. It will be understood, that lid **12** is shown as being in its normally closed position, wherein horizontally disposed lid part **12***a* is arranged to cover an opening, not shown, in the top surface of machine base cabinet **16** and lid part **12***b* is arranged in facing engagement with pedestal **18**. Of course, lid portion **12***b* may be employed to close any opening present in the pedestal, as required. Alternatively, lid portion **12***a* may be dispensed with and lid portion

12*b* employed to cover an opening in a vertically disposed wall or cabinet side.

In that hinges **10** and **10'** are of similar construction, only hinge **10** will be discussed in detail and similar parts of hinge **10'**, where shown, will be designated by primed numbers.

Now making particular reference to FIGS. 2, 3 and 4, it will be seen that hinge **10** generally includes a housing member **20**, which is suitably fixed, as by machine screws **22** to the framework of console **14**; a pivot nose piece member **24**, which is mounted by a pin shaft **26** in housing member **20** and serves to support lid **12** for vertical swinging movement; and first and second spring mechanisms **28** and **30**.

Housing member **20** is formed from sheet metal to define an inverted generally U-shaped intermediate portion **32** having side flanges **32***a*, **32***b* and a top flange **32***c*; a pair of parallel spring mechanism mounting flange portions **34***a* and **34***b*, which extend from side flanges **32***a* and **32***b*; and a single side mounting flange portion **36**, which extends from side flange **32***a* and is formed with apertures to receive housing member mounting screws **22**. Further, side flanges **32***a* and **32***b* are formed with aligned openings to receive pin shaft **26** and are punched out to define inwardly converging stops **38***a* and **38***b*; top flange **32***c* is punched out to define a slot opening **40**; and the ends of mounting flange portion **32***a* and **32***b* are formed with notches, as at **42**.

Nose piece member **24** is of generally U-shaped cross-sectional configuration, wherein legs **24***a* and **24***b* are formed with three pairs of aligned apertures to receive pin shaft **26**, and pin shafts or rivets **44** and **46** for supporting ends of first and second spring mechanisms **28** and **30**, respectively. The base portion **24***c* of member **24** is formed with apertures **48** for receiving suitable fastener devices, not shown, by which cover part **12***b* is secured against the free edge surfaces of legs **24***a* and **24***b*.

First spring mechanism **28** includes a coil type compression spring **50**, which is arranged concentrically of a bolt **52** to bear adjacent its opposite ends of an adjustment nut **54** and a washer **56**. Washer **56** is carried on one end of a resiliently deformable, plastic brake shoe **58**, which is arranged concentrically of and in frictional engagement with bolt **52**. The other end of shoe **58** is preferably rounded and arranged in engagement with the converging inner or bearing walls of a through bored, cup shaped member **60**, which is in turn movably received within an opening **61** formed in a generally H-shaped mounting plate **62**. As best shown in FIGS. 3, 4 and 5, legs **64** of mounting plate **62** are arranged to lie within mounting flange notches **42**, whereby to positionally anchor or constrain one end of spring mechanism **28** relative to housing member **20**. As will be apparent from viewing the drawings, bolt **52** freely passes through member **60** and mounting plate **62**, such that it is freed for reciprocating and/or rotary adjustment movements relative to housing member **20**. Vertical pivotal movements of bolt **52** relative to housing member **20** is facilitated by arranging a flat rim portion of member **60** in engagement with a pair of dimples **63**, which project rearwardly of mounting plate **62** in opposite directions from adjacent opening **61**.

The opposite end of spring mechanism **28** is positionally fixed to nose piece **24** by freely fitting a reduced diameter end portion of bolt **52** within a bore opening **66** formed in an adjustment connector **68**; the latter being pivotally mounted on the nose piece member by pin shaft **44**, which is arranged essentially parallel to pin shaft **26**.

As will be apparent from viewing FIGS. 3 and 4, adjustment nut **54** is threaded onto a relatively short threaded portion **70** of bolt **52** and formed with a top edge

opening slot **72**, which is dimensioned to slideably receive a guide extension or finger **74** formed integrally with adjustment connector **68**. As will be apparent, nut **54** may be moved lengthwise of threaded portion **70** upon rotations of bolt **52** in order to adjustably vary the extent to which spring **50** is initially compressed.

By again referring to FIG. 4, it will be appreciated that spring **50** serves to drive the round nose portion of shoe **58** into engagement with the converging inner walls of member **60**, thereby squeezing the inner wall surfaces of the shoe radially inwardly into friction-bearing contact with bolt **52**. The "snubbing" or friction braking effect generated by friction between the shoe and the bolt will be a function of the degree of compression of spring **50** and tend to oppose movement of the lid during both openings and closures thereof. Deformation of shoe **58** may be facilitated by slotting diametrically opposed wall portions of shoe **58**, as at **76**, except for a small web portion **78**, which serves to maintain the two halves of the shoe in an integral relationship. It will be understood that the construction of shoe **58** per se forms no part of the present invention; the structure and mode of operation of such shoe having been disclosed in commonly assigned U.S. Pat. 3,187,374.

Second spring mechanism **30** includes a compression spring **80**, which is arranged concentrically of a bolt **82** and bears adjacent its opposite ends on a bearing washer **84** and an enlarged shoulder portion of a sleeve **86**. Sleeve **86** is bored to slideably receive bolt **82** and formed with a rounded end portion moveably seated within a cup-shaped recess formed in a mounting plate **88**; the mounting plate additionally being formed with a vertically disposed slot opening **89** for freely receiving bolt **82**. As best shown in FIGS. 3, 4 and 6, spring mechanism **30** is positionally anchored to housing member **20** by forming mounting plate **88** with a pair of edge notches **90**, which are arranged to bear against stops **38***a* and **38***b*; and an upper tab portion **92**, which is received within slot **40**. It will be apparent that with this construction, bolt **82** is supported for both reciprocation and relative vertical pivotal movement relative to housing member **20**.

The opposite end of spring mechanism **30** is pivotally affixed to nose piece member **24** by threading bolt **82** into connector **94**, the latter being engaged by bearing plate **84** and pivotally mounted on the nose piece member by pin shaft **46** arranged essentially parallel pin shaft **26**.

When lid **12** is in its closed position, spring mechanisms **28** and **30** occupy the full line positions illustrated in FIG. 4, wherein each of springs **50** and **80** is compressed; spring **50** tending to pivot the lid towards its open position illustrated in phantom and designated as **12'**, and spring **80** opposing spring **50** and cooperating with the weight of the lid to maintain same in fully closed position. As the lid is moved towards its open position, spring **50** is permitted to expand in a continuous manner until its associated pin shaft **44** moves into the phantom line position designated as **44'** when the lid is in its open position. However, spring **80** is progressively compressed during opening movement of the lid from its closed into an intermediate position, which is determined when pin shaft **46** moves into a "centered" or aligned relationship relative to pin shaft **26**, as indicated at **46'**. As pin shaft **46** is moved "over center" relative to pin shaft **26** into a lid open position designated in phantom line at **46''** during continued door opening movements, spring **80** is permitted to progressively expand.

In FIG. 7, the torque curves for spring **50**, spring **80**, lid **12** and the support (both of springs **50** and **80**) are plotted in full line, whereas curves representing the "snubbing" effects of shoe **58** on the support curve are indicated by dashed lines. In practice, the support curve is designed to approximately match the lid curve with a view to substantially counterbalance the weight of the lid and preferably to positively bias the lid towards open position during a wide range of opening movements, and the "snubbing" action of shoe **58**, which opposes all movement of the lid, is employed in conjunction with the support to define a counter balance envelope to enclose the lid curve for only that portion of lid movement during which it is desired to counter balance the lid and prevent coasting thereof towards either closed or open positions. When the lid curve falls outside of the counter balance envelope, the lid is not "balanced" and will either fall under the influence of gravity or be propelled upwardly by the support towards open position depending upon whether the lid curve lies above or below the counter balance envelope, respectively. In the illustrated construction, the design is such that the lid curve lies above the counter balance envelope for about the last 15° of lid closing movement in order to permit the lid to fall with progressively increasing force into firmly closed position. Of course, adjustment of the initial composition of spring **50** will produce adjustments of the counter balance envelope and thus the relative ease with which the lid is opened and closed.

When the weight and/or configuration of the lid is such as to permit more accurate matching of the support and lid curves and/or lid coasting movements are not deemed undesirable, the friction shoe may be dispensed with. Moreover, in installations where uniform "snubbing" action is not required and/or not desired, the friction shoe may be associated with the second spring mechanism.

I claim:

1. A cover mounting combination hinge and counterbalance and motion snubbing mechanism for suspending a cover relative to a cabinet for opening movement vertically upwardly towards an operator and for closing movement vertically downwardly away from such operator, which comprises in combination:

a pair of hinge parts fixed one to each of said cover and cabinet;

hinge pin means for joining said hinge parts for relative vertical pivotal movement about an essentially horizontal hinge axis between cover open and closed positions;

first and second compression springs;

first means coupling opposite ends of said first spring one to each of said hinge parts for establishing a moment tending to continuously bias said cover upwardly towards said open position;

second means coupling opposite ends of said second spring one to each of said hinge parts for establishing first and second moments tending to alternately bias said cover towards said closed and opened positions during movements of said cover between about said closed position and an intermediate position and between about said intermediate position and said open position, respectively; and

friction means carried in operative association with one of said springs by an associated one of said first and second means for dampening movements of said cover as a function of spring compression variations of said one spring incident to cover positional changes, said moments of said first and second springs cooperating with said friction means to counter balance the torque effects of gravity on said cover throughout substantially the whole of the opening and closing movements.

2. A mechanism according to claim **1**, wherein said friction means is in operative association with said first spring, said first means includes a connector having a bore opening, pin means extending essentially transversely of said bore opening for coupling said connector to one of said hinge parts for pivotal movement about an axis essentially parallel to said hinge axis, an aprtured member defining a converging bearing surface, means for positionally mounting said apertured member relative to the other of said hinge parts, a bolt having one end extending freely

through said apertured member and having another end rotatably supported within said bore opening, and a plate threadably carried by said bolt adjacent said other end thereof whereby to permit adjustments of said plate lengthwise of said bolt towards and away from said connector; said friction means is resiliently deformable and arranged in frictional engagement with said bolt intermediate said apertured member and said plate; and said first spring is arranged essentially concentrically of said bolt to bear adjacent opposte ends thereof on said plate and said friction means whereby adjustments of said plate varies compression of said first spring and said friction means is biased by said first spring into engagement with said converging bearing surface and thereby into frictional engagement wtih said rod.

3. A mechanism according to claim **2**, wherein said second means includes a second connector, second pin means for connecting said second connector to said one hinge part for pivotal movement about a second axis essentially parallel to said hinge axis, a second bolt fixed adjacent one end thereof to said second connector, a sleeve having an opening therethrough to slideably support another end of said second bolt, and means for positionally mounting said sleeve relative to said other hinge part; and said second spring is arranged essentially concentrically of said second rod to bear adjacent opposite ends thereof on said second connector and said sleeve.

4. A cover mounting combination hinge and counterbalnce and motion snubbing mechanism for suspending a cover relative to a cabinet for opening movement vertically upwardly towards an operator and for closing movement vertically downwardly away from such operator, said cover being characterized as being of generally L-shaped configuration having base and upstanding portions disposed essentially horizontal and vertical, respectively, when said cover is in its closed position, said mechanism comprising in combination:

a generally horizontally extending first hinge part fixed to said cabinet;

a generally vertically extending second hinge part fixed to said upstanding portion of said cover;

hinge pin means for joining an upper end of said second hinge part to said first hinge part for vertical pivotal movement about an essentially horizontally disposed hinge axis between cover open and closed positions, said axis extending transversely of said first hinge part intermediate front and rear ends thereof;

a first spring device including a bolt, a connector having a guide projection and means to support one end of said bolt for free rotational movement about an axis extending co-directionally with said guide projection, connector pin means extending essentially transversely of said bolt rotational axis for connecting said connector to said second hinge part for pivotal movement about an axis essentially parallel to said hinge axis, an apertured plate defining a converging bearing surface, a mounting plate carried by said front end of said first hinge part and supporting said apertured member for vertical tilting movement, said apertured member and said mounting plate freely receiving an opposite end of said bolt, an adjustment plate threadably carried by said bolt adjacent said one end thereof and slideably engaging said guide projection whereby upon rotation of said bolt said adjustment plate is caused to reciprocate lengthwise of said bolt towards and away from said connector, a resiliently deformable friction sleeve arranged in frictional engagement with said bolt intermediate said apertured member and said adjustment plate, and a first coil compression spring arranged concentrically of said bolt to bear adjacent opposite ends thereof on said adjustment plate and said friction sleeve whereby said friction sleeve is biased by said spring into engagement with said converging bearing surface and thereby into frictional engagement with said bolt, said connector pin means being arranged to move from a position in front of and above said hinge axis when said cover is in closed position over said hinge axis and into a position in back of and above said hinge axis when said cover is in open position whereby to permit said spring to establish a moment tending to continuously bias said cover upwardly towards said open position; and

a second spring device including a second connector, second pin means for connecting said second connector to said second hinge part for pivotal movement about a second axis essentially parallel to said hinge axis, a second bolt fixed adjacent one end thereof to said second connector, a sleeve device having an opening therethrough for slideably supporting another end of said second bolt, a second mounting plate means mounted on another of said rear end of said first hinge part for end supporting said sleeve device for vertical movement relative thereto, and a second coil compression spring arranged concentrically of said second bolt to bear adjacent opposite ends thereof on said second connector and said sleeve device, said second pin means being arranged to move from a position to the rear of and above said hinge axis when said cover is in closed position rearwardly of said hinge axis and into a position below said hinge axis when said cover is in closed position whereby to permit said second spring to establish first and second movements tending to alternately bias said cover towards closed and opened positions during movements of said cover between about said closed position and an intermediate position and between about said intermediate position and said open position, respectively, said moments established by said first and second springs cooperating to produce a support moment counterbalancing the torque effects of gravity on said cover throughout substantially the whole of the opening and closing movements thereof, and said support moment being opposed by friction between said sleeve and said bolt for dampening movements of said cover as a function of compression variations of said first spring incident to cover positional changes.

5. A cover mounting combination hinge and counterbalance mechanism for suspending a cover relative to a cabinet for opening movement vertically upwardly towards an operator and for closing movement vertically downwardly away from such operator, which comprises in combination:

a pair of hinge parts fixed one to each of said cover and cabinet;

hinge pin means for joining said hinge parts for relative vertical pivotal movement about an essentially horizontal hinge axis between cover open and closed positions;

first and second compression springs;

first means coupling opposite ends of said first spring one to each of said hinge parts for establishing a moment tending to continuously bias said cover upwardly towards said open position; and

second means coupling opposite ends of said second spring one to each of said hinge parts for establishing first and second moments tending to alternately bias said cover towards said closed and opened positions during movements of said cover between about said closed position and an intermediate position and between about said intermediate position and said open position, respectively, said moments of said first and second springs cooperating to produce a support moment counter balancing the torque effects of gravity on said cover throughout substantially the whole of the opening and closing movements.

6. A mechanism according to claim **5**, wherein said first means includes a connector having a bore opening, pin means extending essentially transversely of said bore

opening for coupling said connector to one of said hinge parts for pivotal movement about an axis essentially parallel to said hinge axis, constraining means tiltably mounted on the other of said hinge parts, a bolt having one end extending freely through said constraining means and having another end rotatably supported within said bore opening, and a plate threadably carried by said bolt adjacent said other end thereof whereby to permit adjustments of said plate lengthwise of said bolt towards and away from said connectors, said first spring is arranged essentially concentrically of said bolt to bear adjacent opposite ends thereof on said plate and said constraining means whereby adjustments of said plate vary compression of said first spring.

7. A mechanism according to claim 6, wherein said connector includes a guide projection extending codirectionally with said bore opening thereof, and said plate is arranged for sliding engagement with said guide projection,

whereby upon rotation of said bolt said plate is caused to reciprocate lengthwise of said bolt.

References Cited

UNITED STATES PATENTS

2,686,340	8/1954	Shepard et al.	49—386
1,467,124	9/1923	Sunde et al.	16—190
3,457,584	7/1969	Phelps	16—190
2,713,737	7/1955	Hawkins	49—386 X

FOREIGN PATENTS

209,109	3/1925	Great Britain	16—180

BOBBY R. GAY, Primary Examiner

P. A. ASCHENBRENNER, Assistant Examiner

U.S. Cl. X.R.

16—85; 49—386