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Little

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[54] **COUNTER BALANCE SUPPORT**

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[52] **U.S. Cl.** ..... **16/190,** 16/1 C, 16/49

[51] **Int. Cl.** **E05f 1/12**

[58] **Field of Search** ..... 16/190, 185 H, 142, 16/145, 85, 82, 80

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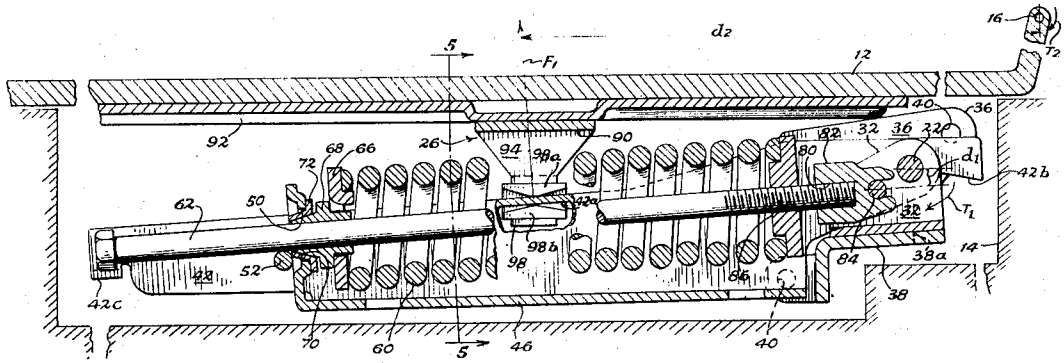
[57] **ABSTRACT**

A mechanism for counterbalancing a cabinet lid for swinging movements about an independent, relatively spaced hinge support; the mechanism being characterized as producing substantially no frictional binding forces on the lid hinge support or forces tending to disconnect the mechanism from the lid, while the lid is in its normal closed position.

7 Claims, 5 Drawing Figures



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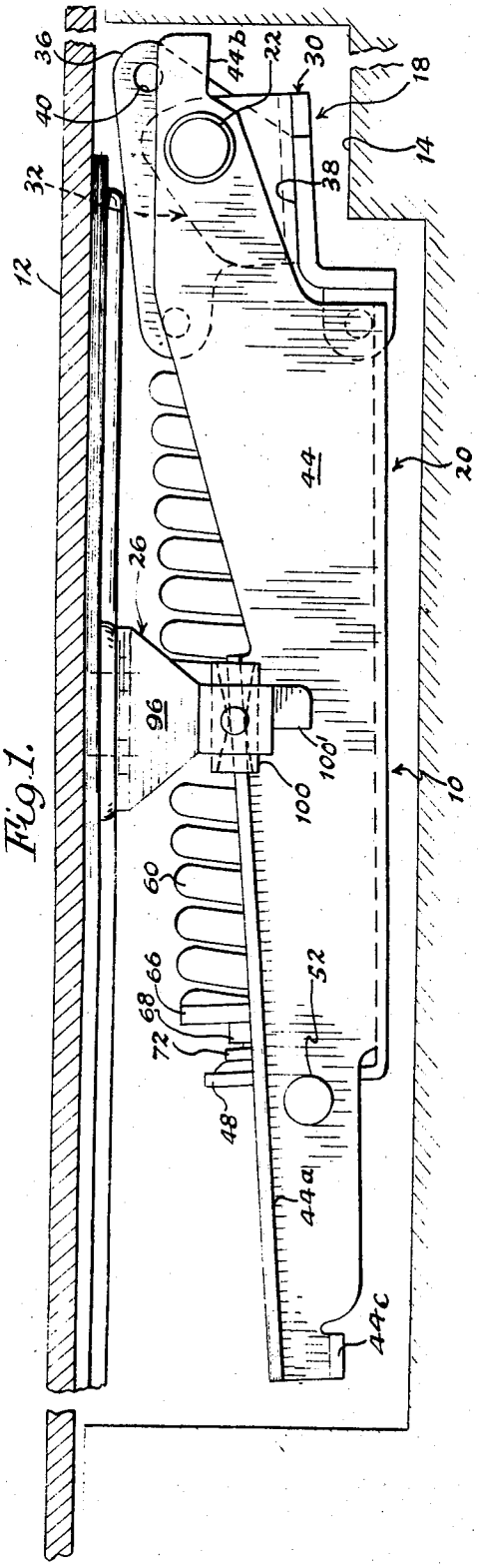

Fig. 1.

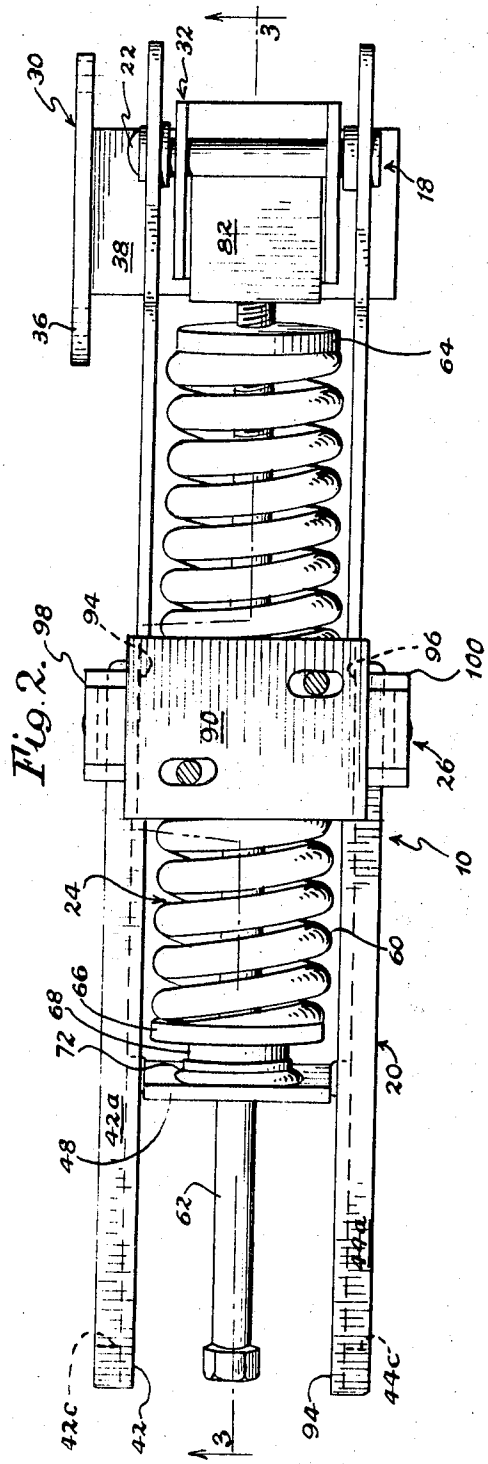

Fig. 2.

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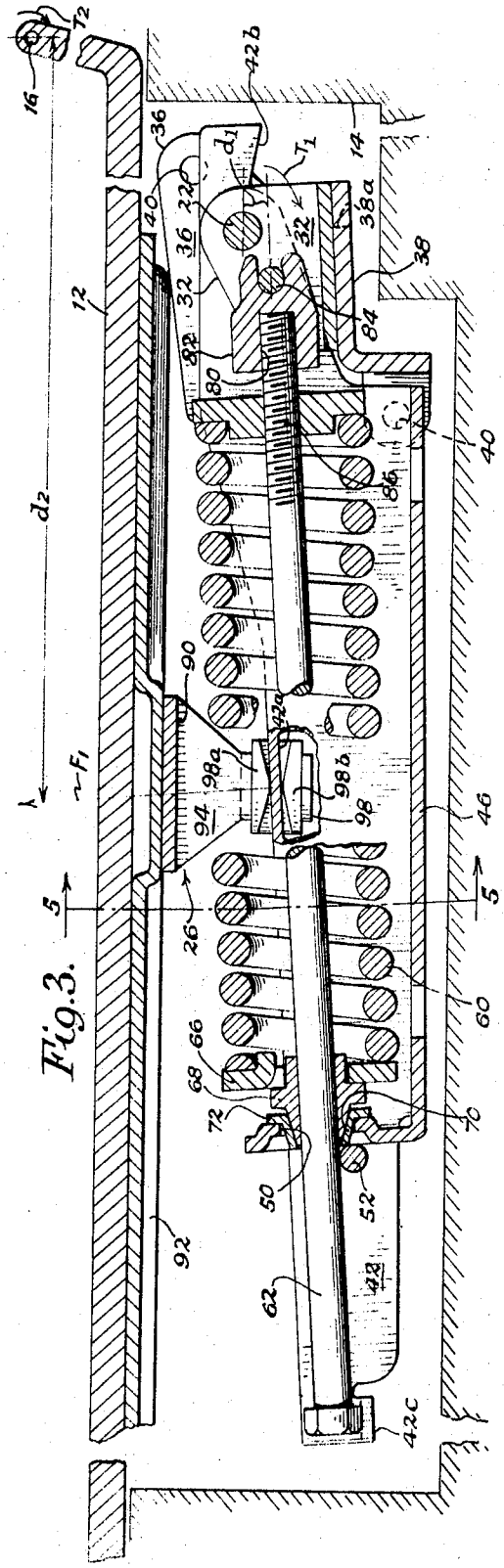

Fig. 3.

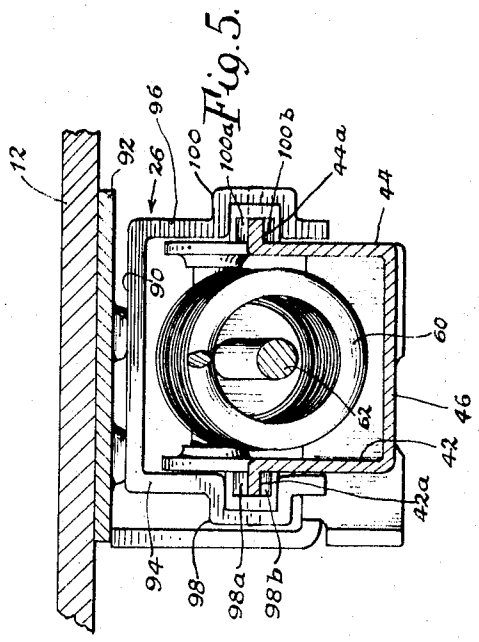

Fig. 5.

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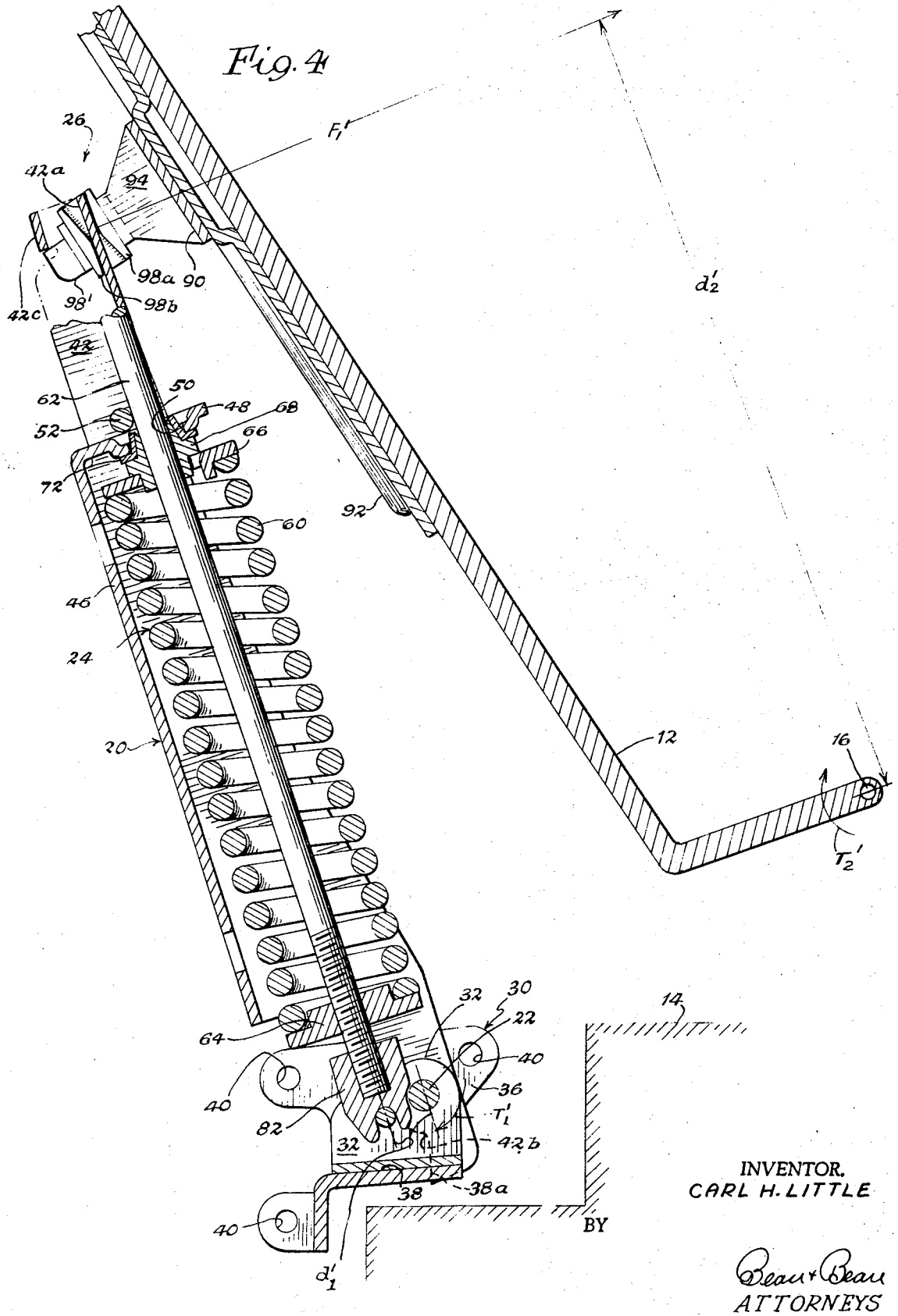
Fig. 4



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COUNTER BALANCE SUPPORT

BACKGROUND OF THE INVENTION

Heretofore, it has been common practice to employ spring biased, scissor type mechanisms to counter balance the weight of vertically swinging lids, particularly where it is desired to support the lid by conventional barrel or like hinges, which do not comprise a part of the counter balance mechanism. These mechanisms have the advantage of being mounted within the cabinet in order to preserve its aesthetic appearance. However, these mechanisms usually suffer from the disadvantage that when the lid is in its normal closed position, a significant portion of the counter balancing spring force acts to produce friction binding of the lid hinge pin and tends to loosen screws or other fasteners employed to connect the lid to the counter balance mechanism and/or the lid hinge to the cabinet.

SUMMARY OF THE INVENTION

The present invention is directed towards an improved mechanism for counter balancing the weight of vertically swinging cabinet lids of the type wherein the lid hinge is separate and spaced from the mechanism. More specifically, the present invention features the provision of a "tiltable" glide for interconnecting the counter balance mechanism with the lid, such that substantially all counter balance spring forces act perpendicular to the lid when in closed position, thereby essentially no spring force acts through the lid hinge pin or applies shear forces on the fasteners connecting the lid to the mechanism.

DRAWINGS

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

FIG. 1 is a side elevational view of the counter balance mechanism of the present invention showing it in association with a cabinet lid;

FIG. 2 is a top plan view of the mechanism;

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

FIG. 4 is a view similar to FIG. 3, but showing the lid in open position; and

FIG. 5 is a sectional view taken generally along line 5—5 in FIG. 3.

DETAILED DESCRIPTION

Now referring particularly to the drawings, it will be understood that the counter balance mechanism of the present invention is generally designated as **10.** Mechanism **10** is employed to counter balance the weight of a lid **12,** which is supported on a cabinet **14** for vertically swinging movement upwardly from an essentially horizontal, cabinet opening closed position shown in FIGS. **1** and **3** by an independent lid hinge mechanism including a horizontally disposed hinge pin **16,** shown only in FIGS. **3** and **4.**

Mechanism **10** generally includes a stationary hinge part **18,** which is suitably fixed to cabinet **14;** a movable hinge part **20,** which is supported for vertical swinging movement relative to hinge part **18** and thus cabinet **14** by a hinge pin **22** arranged essentially parallel to lid hinge pin **16;** a counter balance spring mechanism **24,** which is carried adjacent its opposite ends on hinge parts **18** and **20;** and a guide device **26** for connecting lid **12** to hinge part **20** for conjunctive vertical swinging movement. Guide device **26** is fixedly mounted on lid **12** and movably mounted on or coupled to hinge part **20** in the manner to be described. In this connection, it will be understood that, since the lid and hinge part **20** swing about different axes, it is necessary for guide device **26** and hinge part **20** to undergo relative movement incident to or as such hinge part and the lid undergo conjunctive vertical swinging movement.

More specifically, by reference to FIGS. **1, 2** and **3,** it will be seen that hinge part **18** is of plural part construction including a generally L-shaped mounting flange **30** and a generally U-shaped hinge flange **32** for mounting opposite ends of hinge pin **22.** Flange **30** is shown as having vertically and horizontally disposed flange portions **36** and **38;** flange portion **36** being formed with apertures **40** to receive cabinet mounting fasteners, not shown, and flange portion **38** being weld or otherwise fixed to hinge flange **32.**

Movable hinge part **20** is shown in the drawings as being of elongated, generally U-shaped construction including a pair of parallel leg portions **42** and **44,** which are formed adjacent one end thereof with aligned apertures to receive hinge pin **22** and adjacent an opposite end thereof with outturned, aligned guide rails **42a** and **44a;** and a connecting portion **46,** which is formed with an upstanding mounting flange portion **48** having a through opening **50.** A retaining pin **52,** which is carried adjacent its opposite ends by leg portions **42** and **44** is arranged to engage flange portion **48** in order to prevent deformation thereof, as a result of the spring force present in spring mechanism **24.**

Spring mechanism **24** is shown as including a coil type compression spring **60,** which is arranged concentrically of a bolt **62** and bears adjacent its opposite ends on an adjustment nut **64** and a washer **66.** Washer **66** in turn bears on one end of a resiliently deformable, plastic brake shoe or sleeve **68,** which is arranged concentrically of and in frictional engagement with bolt **62.** The other end of shoe **68** is preferably rounded or conically shaped and arranged in engagement with the converging inner or bearing walls **70** of a through bored, cup shaped member **72,** which is in turn movably received within mounting flange portion opening **50** thereby to positionally anchor or constrain one end of spring mechanism **24.** As will be apparent from viewing FIG. **3,** bolt **62** freely passes through member **72** and opening **50,** such that it is freed for reciprocating and/or rotary adjustment movements relative to movable hinge part **20.** Slight vertical pivotal movement of bolt **62** relative to movable hinge part **20,** as required to permit movements of the spring mechanism as the lid is moved between closed and open positions illustrated respectively in FIGS. **3** and **4,** is permitted by tilting movement of member **72** within opening **50.**

The opposite end of spring mechanism **24** is positionally fixed to hinge flange **32** by freely or loosely fitting an end of bolt **62** within a bore opening **80** formed in a connector **82;** the latter being pivotally mounted on hinge flange **32** by a pin shaft **84** arranged essentially parallel to hinge pin **22.**

As will be apparent, adjustment nut **64** is threaded onto a relatively short thread portion **86** of bolt **62.** Thus, adjustment nut **64,** when constrained against rotational movement, may be moved lengthwise of threaded portion **86** upon rotation of bolt **62** in order

to adjustably vary the extent to which spring **50** is initially compressed. Adjustment nut **64** may be so constrained by a manually manipulated tool, not shown, or by a guide means, also not shown, carried by connector **82** to extend parallel to and slideably engage bolt **62.**

By referring to FIGS. **3** and **4,** it will be appreciated that spring **60** serves to continuously drive the rounded nose portion of shoe **68** into engagement with the converging inner walls of member **72** with the result that the inner wall surfaces of shoe **68** are squeezed radially inwardly into friction bearing contact with bolt **62.** The "snubbing" or friction braking effect generated by friction between the shoe and bolt will be a function of the degree of compression of spring **60** and tend to oppose movement of the lid during both opening and closing movements thereof. A more detailed discussion of shoe **68** and its manner of operation may be had by referring to U.S. Pat. No. 3,187,374.

Glide device **26** is best shown in FIG. **5** as being of inverted U-shaped construction, including a connecting flange portion **90,** which is suitably fixed via a mounting plate **92** to the under surface of lid **12;** and a pair of leg flange portions **94** and **96,** which carry facing U-shaped guide flanges **98** and **100,** respectively, adjacent their free or lower ends. In the illustrated construction, guide flanges **98** and **100** serve to carry facing upper and lower convex or arcuate plastic guide blocks **98***a*, **98***b* and **100***a*, *100b*, respectively. Guide blocks **98***a* and **100***a* are arranged for sliding engagement with the upper surfaces of guide rails **42***a* and **44***a*, respectively, and guide blocks **98***b* and **100***b* are arranged in close proximity with the lower surfaces of guide rails **42***a* and **44***a*, respectively. The spacing between the central or rounded apex portions of guide blocks **98***a*, **98***b* and **100***a*, **100***b* is such as to permit tilting of guide device **26** relative to guide rails **42***a* and **44***a*, as the guide device is moved lengthwise of the guide rails between the lid closed and lid open positions illustrated in FIGS. **3** and **4,** respectively. If desired, guide blocks **98***a* and **100***a* may be replaced by roller members.

The open and closed positions of the lid and mechanism **10** may be variously defined, depending on installation requirement. However, for purposes of illustration, the closed position of both is shown in FIG. **3** as being defined by engagement of the lid with the cabinet. The open position of mechanism **10** is shown in FIG. **4** as being defined by engagement of leg portion end surfaces **42***b* and **44***b* with a stop or rear edge portion **38***a*. The open position of lid **12** may be defined by forming guide rails **42***a* and **44***b* with tabs **42***c* and **44***c*, which are arranged to engage tabs **98'** and **100'** of guide flanges **98** and **100,** at the same time that or immediately after leg portion end surfaces **42***b* and **44***b* engage stop portion **38***a*. Engagement of guide blocks **98***b* and **100***b* With the under surfaces of rails **42***a* and **44***a* prevent separation of the lid from the mechanism.

By again referring to FIG. **3,** it will be understood that the force of spring **60** always acts along its longitudinal axis, which essentially corresponds to the longitudinal axis of bolt **62,** and that the frictional force caused by the "snubbing" effects of shoe **68** acts along these axes, but always in opposition to the direction of lid and mechanism movement. Therefore, the frictional force either adds to or substracts from the variable spring force. The sum of the spring and frictional forces act through the moment arm d_1 to produce initial torque T_1 when the lid is closed (FIG. 3), and through moment arm d_1' to produce a final torque T_1' when the lid is open (FIG. 4). T_1 and T_1' bound opposite ends of a moment tending to swing hinge part **20** upwardly about hinge pin **22.**

The tendency of hinge part **20** to move upwardly produces on glide device **26** a continuous, but variable force bounded by an initial force F_1 in FIG. **3** and a final force F_1' in FIG. **4,** which are always perpendicular to rails **42***a* and **44***a* and act through the radius center of guide blocks **98***a* and **100***a*. Force F_1 acting through initial moment arm d_2 and force F_1' acting through final moment arm d_2' define initial and final torques T_2 and T_2', respectively, which act about lid hinge pin **16** in opposition to the gravity induced lid torque.

As will be apparent the moment bounded by T_1 and T_1' as well as the moment bounded by T_2 and T_2' will have different valves during opening and closing movements of lid **12,** due to the "snubbing" action of shoe **68,** such that there is defined a counter balance envelope. When the lid torque curve falls within the envelope, the lid is "balanced" and prevented from coasting toward either of its open or closed positions. For most installations, it is preferable to pattern the counter balance envelope such that the lid torque curve is disposed relatively above the envelope during the last 10° to 15° of lid closing movement in order to permit gravity to maintain the lid in tightly closed position.

Where installation space allowances permit, it is preferable to position rails **42***a* and **44***a* such that they are parallel to lid **12** in lid closed position in order to permit F_1 to normally act perpendicular to the lid, and therefore only produce a torque about the lid hinge axis. Slight divergence of rails **42***a* and **44***a* from a parallel relationship with the lid, as required by the cramped spacing illustrated in FIG. **3,** will result in there being produced only a small force vector parallel to the lid, which is negligible. While a force vector will be produced parallel to the lid during movements of the lid into open position, as will be apparent from viewing FIG. **4,** such force vector will still be relatively small when compared to the perpendicular force vector of F_1' and will not produce undesired binding of hinge pin **16** or produce excessive shear force, tending to weaken the connection between lid **12** and mounting plate **92.** Moreover, since for most installations the lid will normally be disposed in its closed position, the period of time during which the lid is subjected to higher than negligible forces will be relatively small, thereby extending the overall operational life of the unit.

As will be apparent, the above described mechanism may be modified, if desired, by fixedly mounting the guide device on the movable hinge part and mounting guide rails on the underside of the lid.

I claim:

1. A counter balance mechanism for use in combination with a lid supported on a cabinet for vertical swinging movement about an essentially horizontally disposed first hinge axis between closed and open positions, said mechanism including:

a pair of hinge parts, a first of said hinge parts being fixed to said cabinet;

hinge pin means for joining a second of said hinge parts to said first hinge part for vertical swinging movement relative thereto about a second hinge

axis disposed in a spaced essentially parallel relationship to said first hinge axis;

a guide device for connecting said lid to said second hinge part for conjunctive vertical swinging movement, said guide device being fixedly mounted on one of said second hinge part and said lid and being coupled to the other of said second hinge part and said lid for movement relative thereto incident to said conjunctive movement;

spring means;

coupling means fixing opposite ends of said spring means one relative to each of said first and second hinge parts thereby establishing a first moment tending to continuously bias said second hinge part in upwardly directed vertical swinging movement about said second hinge axis, said first moment establishing a force transmitted by said guide device from said second hinge part to said lid thereby establishing a second moment tending to continuously bias said lid in upwardly directed vertical swinging movement about said first hinge axis whereby to counter balance at least a substantial portion of the torque effects of gravity on said lid throughout substantially the whole of the swinging movement thereof, said force being directed relative to said lid when said lid is in closed position such that a component of said force normal to said lid is substantially in excess of any component of said force parallel to said lid.

2. A mechanism according to claim **1**, wherein said spring means includes a compression spring and friction means for dampening swinging movement of said second hinge part and thereby said lid as a function of spring compression variations of said spring incident to second hinge part positional changes, said friction means opposing said spring during vertical upward movements of said lid and cooperating with said spring during vertical downward movements of said lid to establish said first moment.

3. A mechanism according to claim **1**, wherein said spring means includes a compression spring and friction means; said coupling means includes a connector having a bore opening, pin means extending essentially transversely of said bore opening for coupling said connector to said first hinge part for pivotal movement about an axis essentially parallel to said first and second hinge axes, an apertured member defining a converging bearing surface, means for positionally mounting said apertured member relative to said second hinge part, 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 compression spring is arranged essentially concentrically of said bolt to bear adjacent opposite ends thereof on said plate and said friction means whereby adjustments of said plate varies compression of said compression spring and whereby said friction means is biased by said compression spring into engagement with said converging bearing surface and thereby into frictional engagement with said rod.

4. A mechanism according to claim **1**, wherein said other of said second hinge part and said lid defines rail means and said guide device is movable lengthwise of and tiltable relative to said rail means whereby permitting movements of said lid relative to said second hinge part.

5. A mechanism according to claim **4**, wherein said rail means is defined by said second hinge part, said guide device is fixed to said lid at a point remote from said first hinge axis, and said rail means is arranged essentially parallel to said lid at least adjacent said point when said lid is in closed position.

6. A mechanism according to claim **5**, wherein said second hinge part includes a pair of elongated essentially parallel leg portions, said leg portions having aligned openings adjacent first ends thereof for receiving said hinge pin means and defining adjacent second ends thereof a pair of relatively outturned and aligned rails, said guide device is of inverted generally U-shaped construction having a connecting portion fixed relative to said lid and a pair of depending legs, said legs being associated one with each of said rails, and each of said legs having a pair of upper and lower guide means arranged to engage relatively upper and lower surfaces of its associated rail.

7. A mechanism according to claim **6**, wherein each pair of said guide means has facing convex rail engaging surfaces.

* * * * *