Feb. 10, 1942. H. E. VAN VOORHEES 2,272,230

COUNTERBALANCED LID SUPPORT

Filed Jan. 23, 1939 3 Sheets-Sheet 1

Fig. 1

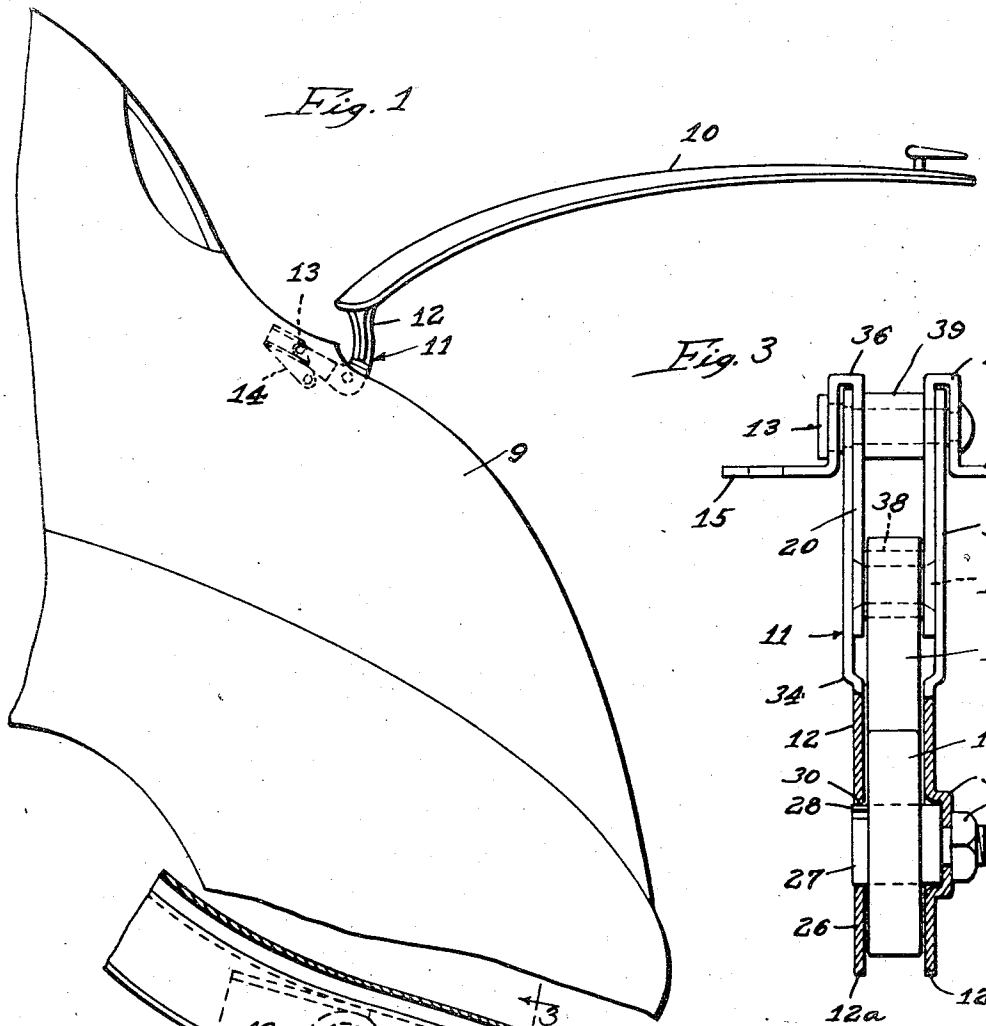
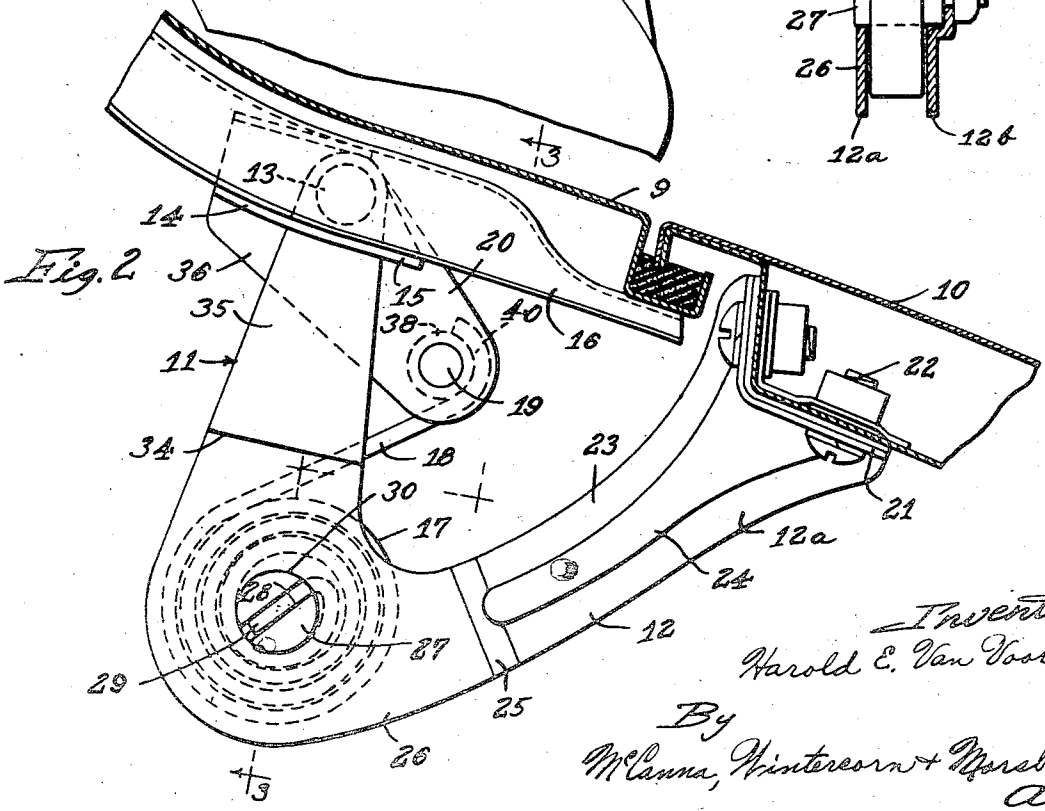


Fig. 3

Fig. 2



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Filed Jan. 23, 1939 3 Sheets-Sheet 2

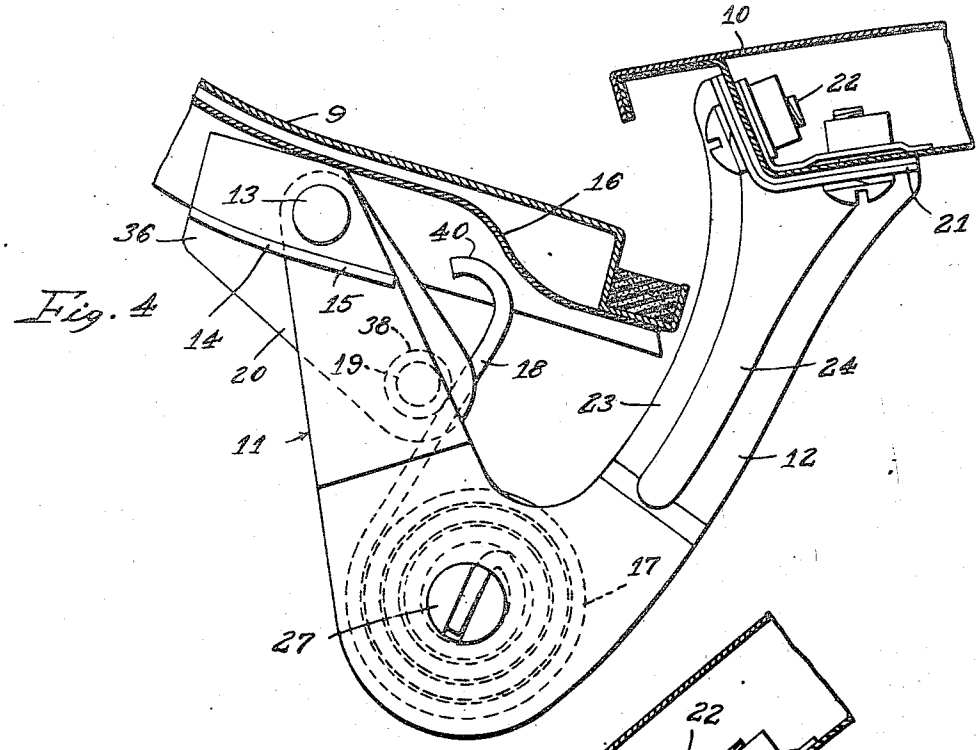


Fig. 4

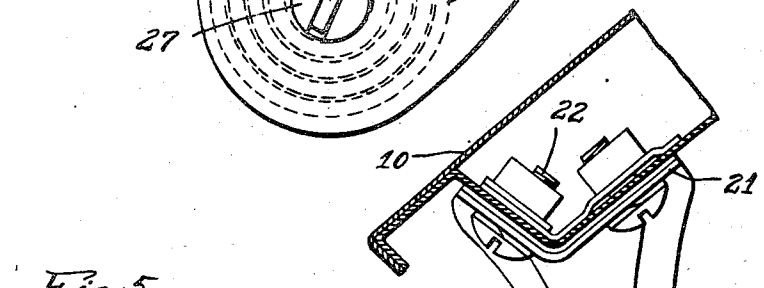
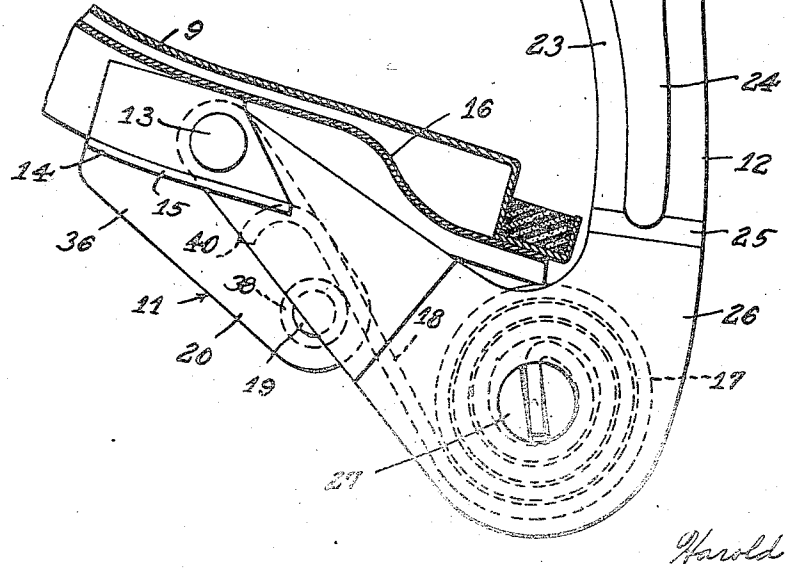


Fig. 5



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COUNTERBALANCED LID SUPPORT

Filed Jan. 23, 1939 3 Sheets-Sheet 3

Fig. 6

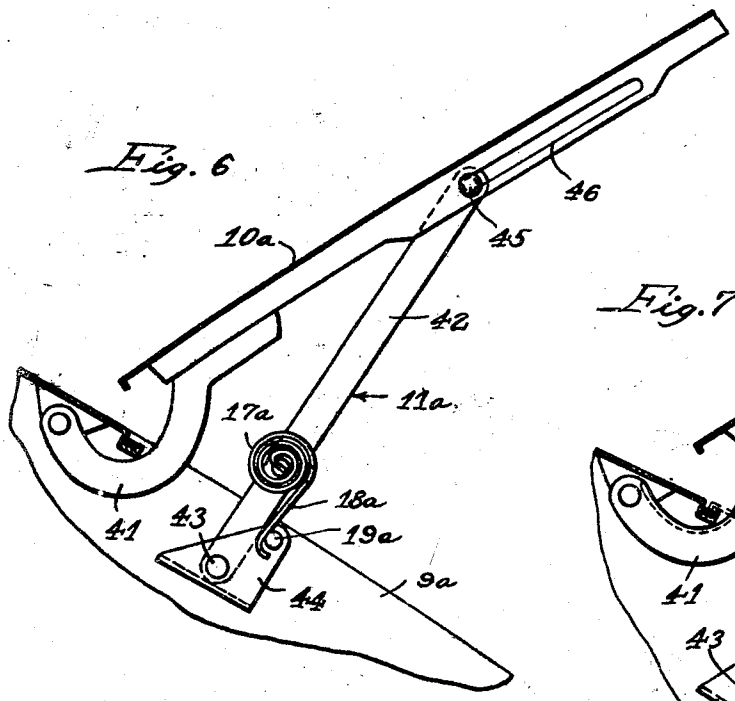


Fig. 7

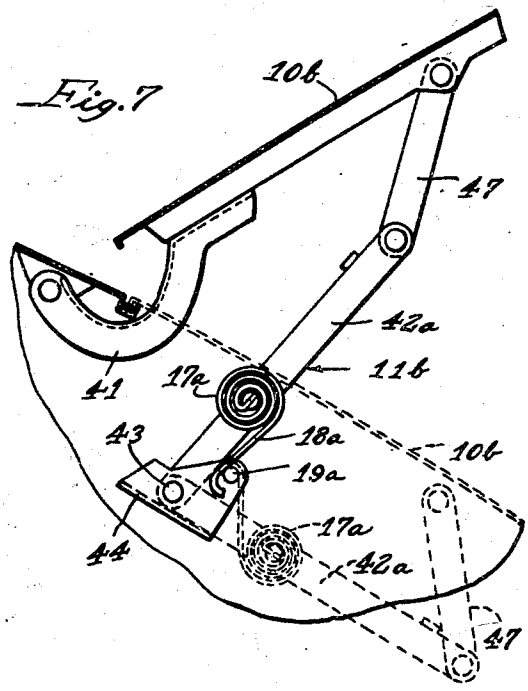
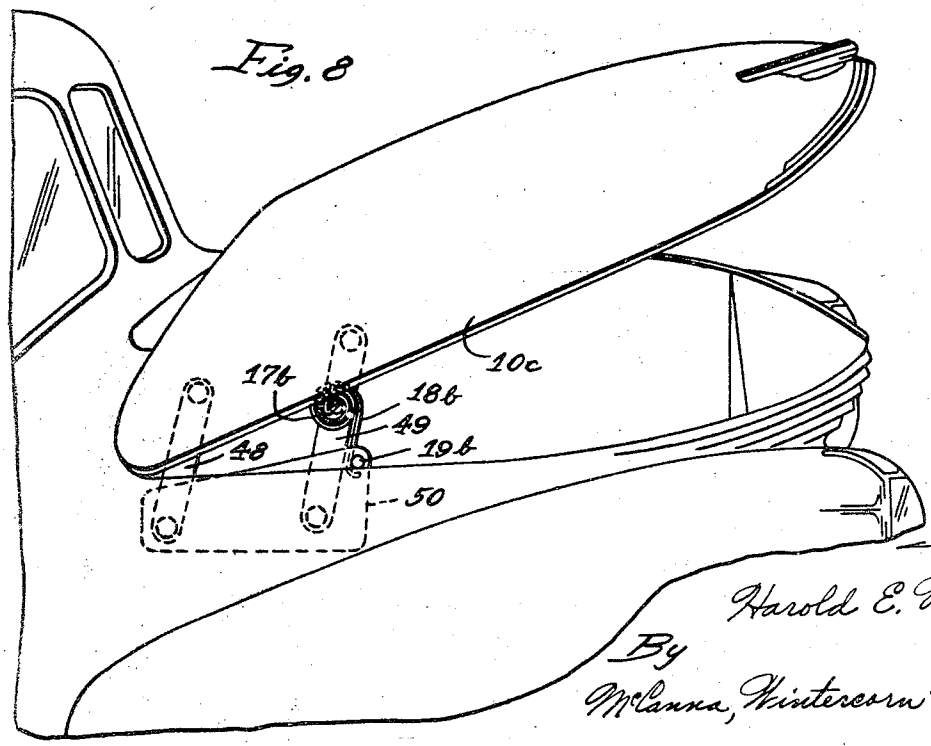


Fig. 8



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UNITED STATES PATENT OFFICE

2,272,230

COUNTERBALANCED LID SUPPORT

Harold E. Van Voorhees, Detroit, Mich.

Application January 23, 1939, Serial No. 252,363

23 Claims. (Cl. 16—180)

This invention relates to supports for liftable hinged closures, and has particular reference to a new and improved counterbalanced support for the lid of a luggage compartment on an automobile or other vehicle.

Various efforts have been made to provide counter-balancing spring means for lids and hoods on automobiles, but so far as I am aware, the constructions proposed have not been practical for one reason or another. They were invariably too complicated and expensive for practical purposes, and were usually objectionable from the standpoint that if the spring tension was great enough to hold the lid in raised position, it was invariably too heavy at lower positions of the lid, so that it was awkward and unhandy to close and open the lid. It is therefore the principal object of my invention to provide simpler and more practical counterbalancing spring means designed to counterbalance the lid in all positions, so that it will stand motionless in whatever position the operator places it, whereby to avoid the objectionable features present in the old constructions.

The salient feature of the counterbalancing means of my invention is the provision of a torsion spring having one end extended on a tangent to provide a lever arm slidable on a stationary abutment with relation to which the torsion spring moves in the opening and closing of the lid, said abutment being so arranged that the spring unwinds as the lid is raised and winds as the lid is lowered, but the arm slides on the abutment during such movement to vary the leverage of the spring with relation to said abutment, so that the spring has a predetermined desired counterbalancing effect at each lid position regardless of its degree of wind or unwind, the spring actually having the greatest counterbalancing effect at approximately a mid-position between the two extreme positions of the lid. Due to the fact that the point of application of the counterbalancing force shifts as the lid moves from one extreme position to the other, any desired effect may be obtained, even to the extent of having the spring exert a negative force at one extreme and a positive force at the other extreme position with respect to counterbalancing the lid in its different positions.

The invention is illustrated in the accompanying drawings, in which—

Fig. 1 is a side view of the rear portion of an automobile, showing a counterbalanced lid support made in accordance with my invention;

Fig. 2 is a sectional view on a larger scale with the lid support appearing in side elevation and with the lid shown closed;

Fig. 3 is a view partly in rear elevation and partly in section of the lid support taken on the broken line 3—3 of Fig. 2;

Figs. 4 and 5 are views similar to Fig. 2, but showing the lid in an intermediate position and in fully raised position;

Figs. 6 and 7 are side views of two other lid supports embodying counterbalancing spring means made in accordance with my invention, and

Fig. 8 is a perspective view of the front portion of an automobile, showing a hood support equipped with counterbalancing spring means similarly as in Figs. 6 and 7.

Similar reference numerals are applied to corresponding parts throughout the views.

Referring first to Figs. 1 to 5, the reference numeral 9 designates the luggage compartment of an automobile, and 10 its lid or door supported for hinging movement on a pair of my improved lid supports 11 to permit raising and lowering the lid. Each lid support comprises a bell-crank arm 12 pivoted at 13 on a bracket 14 bolted or otherwise suitably secured by its attaching portions 15 to the sheet metal frame member 16 of the body, the arm 12 carrying a counterbalancing torsion spring 17 arranged to be wound and unwound in the closing and opening movements of the lid by reason of the engagement of the tangentially extending end 18 thereof on an abutment 19 carried on the downward extension 20 of the bracket 14. The arm 12 has attaching flanges 21 formed on the other end thereof for bolting the same to the edge portion of the lid, as at 22. The arm 12 is formed from two sheet metal stampings 12*a* and 12*b* welded or otherwise suitably secured together at the end portion 23, the pieces being ribbed longitudinally, as at 24, in this portion for added strength and rigidity. The pieces diverge at 25 to provide the spaced middle portions 26 between which the torsion spring 17 is mounted on a fixed stud 27. The stud 27 is slotted, as indicated at 28, to receive the inner end 29 of the spring 17, and bears in an opening 30 in the arm piece 12*a* and is anchored in the other arm piece 12*b* in an embossed portion 31, there being a reduced threaded end portion 32 on the stud projecting through a hole in the embossed portion 31 and having a nut 33 threaded thereon to fasten the same securely in place and without freedom to rotate. If desired, the opening 30 may be formed with diametrically opposed lugs projecting into the slot 28 to further aid in pre-

venting rotation of the stud 27. The two pieces forming the arm 12 diverge further at 34 to provide a wider forked end portion 35 for pivotal connection with the bracket 14. The latter is formed by two sheet metal pieces 36 and 37, as clearly appears in Fig. 3. The abutment 19 is formed by a rivet entered through the downwardly projecting portions 20 and through a spacer collet 38 therebetween. The forked end portion 35 of the arm 12 receives the downwardly projecting portion 20 of the bracket 14, so that the projecting end 18 of the torsion spring 17 rides on the collet 38. A spacer 39 is provided between the pieces 36 and 37 forming the bracket 14 and has the pivot pin 13 entered therethrough and through the forked end portion 35 of the arm 12, making a unitary assembly. A hook 40 is preferably formed on the end of the arm 18 to limit sliding movement of the arm relative to the collet 38.

In operation, the spring 17 is wound as the lid 10 is lowered and is unwound as the lid is raised. However, it will be seen from a comparison of Figs. 2, 4 and 5 that, due to the location of the abutment 19 relative to the pivot 13 and spring support 27, the arm 18 slides relative to the abutment 19 to vary the effective reaction of the spring for different positions of the lid to give a predetermined desired counterbalancing effect in each position, so that the lid will stand motionless in whatever position the operator happens to leave it. There is therefore no difficulty or unhandiness in closing and opening the lid and no tendency for the lid to drop when it is raised as far as it will go. In other counterbalancing structures where the lid movement resulted in a proportionate winding up of the counterbalancing spring, the spring pressure was invariably too heavy at the lower positions of the lid and too light at the upper positions. With the present construction, however, I avoid that objection by decreasing the effectiveness of the spring as the spring is wound, by shifting the point of application of the spring pressure farther and farther out on the arm 18. Then as the lid is raised and the spring is unwound, the point of application of the spring pressure shifts inwardly on the arm 18 to such an extent that in one instance the counterbalancing effect of the spring 17 was equivalent to twenty-one pounds in the closed position (Fig. 2), twenty-five and one-half pounds in the mid-position (Fig. 4), and nineteen and one-half pounds in the raised position (Fig. 5). With that amount of counterbalancing force exerted on the lid in those three positions, it was found that the lid would stay wherever it was placed. In still another installation the device of the present invention affords approximately fifteen pounds counterbalancing force in the lower or slightly open position of the lid, whereas a force of approximately twenty pounds is obtained at a mid-position and about seventeen pounds in the full open position. It is clear, therefore, that almost any operating characteristics can be obtained by proper selection of the torsion spring and selecting the proper location of the abutment 19 in radially spaced relation to the pivot 13. The counterbalancing force at the lower or slightly open position of the lid can be decreased to a point where there is little or no positive counterbalancing force obtained or even to the point where a negative counterbalancing results while still having the desired positive counterbalancing forces at a mid-position and a full open position.

The lid support 11*a* shown in Fig. 6 in connection with the lid 10*a* is provided in addition to the lid's hinges 41 hingedly supporting the same on the luggage compartment 9*a*. The lid support comprises an arm 42 pivoted at 43 on a bracket 44 for swinging movement past a stud 19*a* projecting laterally from the other side of the bracket. The stud slidably engages the end 18*a* of the counterbalancing torsion spring 17*a* mounted on the arm 42. The arm 42 has a pin and slot connection 45—46 with the lid 10*a*, and it should be evident that as the lid closes, the spring 17*a* is wound and the arm 18*a* of the spring slides on the abutment 19*a* to change the spring's operating ratio similarly as in the case of the lid support 11, previously described, whereby to counterbalance the lid so that it will remain motionless in any position in which it may be placed.

The lid support shown at 11*b* in Fig. 7 in connection with the lid 10*b* is similar to the one just described, but in this case the arm 42*a* has a link connection 47 with the lid. The spring 17*a* has its end 18*a* cooperating with the abutment 19*a* in the same manner as above described.

In Fig. 8, I have shown a hood 10*c* supported on links 48 and 49 at the opposite sides thereof, each such pair of links being supported on a bracket 50 carried on the body, and the link 49 being in spaced relation to the bracket so as to clear the stud 19*b* which projects from the bracket and serves as an abutment for the end 18*b* of the counterbalancing spring 17*b* carried on the link 49. Here again it is clear that as the hood is lowered, the two springs 17*b* at opposite sides of the hood are wound, and the ends 18*b* thereof slide with respect to the abutments 19*b* to change the operating ratio of the springs with respect to the hood so as to counterbalance the hood and support the same motionless in any position in which it may be placed.

It is believed that the foregoing description conveys a good understanding of the objects and advantages of my invention. The appended claims have been drawn with a view to covering all legitimate modifications and adaptations.

I claim:

1. The combination with a stationary part and a part pivoted for swinging movement with respect thereto by gravity, of counterbalancing means for supporting the pivoted part in equilibrium in raised positions, comprising a torsion spring mounted on the pivoted part in spaced relation to the pivot point and adapted to counterbalance the pivoted part by spring pressure against the stationary part, said spring having a pressure applying end extension, and an abutment for said extension on the stationary part which in the lowered position of said pivoted part is between but out of alignment with the pivot and spring mounting in a counterclockwise direction relative to the pivot as the parts are viewed from one side thereof, the spring in the raising of the pivoted part being movable in an arc past said abutment with the pivot as a center and causing movement of its end extension relative to said abutment to automatically vary the counterbalancing effect of said spring, the abutment for said extension in the raised position of said pivoted part being between but out of alignment with the pivot and spring mounting in a clockwise direction relative to the pivot as the parts are viewed from the same side thereof.

2. The combination with a stationary part and a part pivoted with respect thereto for move-

ment by gravity, of counterbalancing means for supporting the pivoted part in equilibrium in raised positions, comprising a torsion spring carried on one of said parts and adapted by its spring pressure against the other of said parts to counterbalance the pivoted part, said spring having a pressure applying end extension, and an abutment for said extension on the other of said parts which in the lowered position of the pivoted part is between but out of alignment with the pivot and the spring mounting but which in the raising of the pivoted part approaches alignment with the pivot and spring mounting, whereby to cause relative movement between the end extension of said spring and said abutment to automatically vary the counterbalancing effect of said spring.

3. The combination with a stationary part and a part pivoted for swinging movement with respect thereto by gravity, of counterbalancing means for supporting the pivoted part in equilibrium in raised positions, comprising a torsion spring mounted on the pivoted part in spaced relation to the pivot point and adapted to counterbalance the pivoted part by spring pressure against the stationary part, said spring having a pressure applying end extension, and an abutment for said extension on the stationary part which in the lowered position of said pivoted part is between but out of alignment with the pivot and spring mounting, the spring in the raising of the pivoted part being movable toward alignment with said pivot and abutment and causing movement of its end extension relative to said abutment to automatically vary the counterbalancing force of said spring, the end extension of said spring having a hook formation to limit relative movement between said extension and said abutment in one direction.

4. The combination set forth in claim 2, wherein the end extension of said spring has a hook formation to limit relative movement between said extension and said abutment in one direction.

5. A counterbalanced support for hinged raisable lids, hoods and the like, comprising a pair of relatively pivoted brackets, one of which is carried on the hinged part and the other on the support therefor, one of said brackets being of bell-crank form with the pivot at the end of one arm thereof and the same being attached to one of said relatively hinged parts at the end of the other arm, a spiral torsion spring carried on said bell-crank bracket at the junction of the two arms thereof and having the inner end thereof fixed with respect to said bracket, said spring having the outer end extended tangentially for pressure application, and the other of said brackets having an abutment thereon for engagement with the outer tangential end of said spring in radially spaced relation to the point of pivotal connection between said brackets.

6. A counterbalanced support as set forth in claim 5, including a hook on the extremity of the tangential outer end of said spring for limiting relative movement between the abutment and the spring in one direction.

7. A counterbalanced support as set forth in claim 5, wherein both of said brackets are bifurcated, said spring being supported in the bifurcated portion of the bell-crank bracket, and said abutment comprising a cross-member carried in the bifurcated portion of the other bracket and having the tangential outer end of the spring slidably engaging the same.

8. A counterbalanced support as set forth in claim 5, wherein both of said brackets are bifurcated, said spring being supported in the bifurcated portion of the bell-crank bracket, and said abutment comprising a cross-member carried in the bifurcated portion of the other bracket and having the tangential outer end of the spring slidably engaging the same, the extremity of said tangential end portion being formed to provide a hook for limiting relative sliding movement between said cross-member and said spring in one direction.

9. A spring-hinge comprising hinge members pivoted together, a torsion spring on one of said members adapted by its spring pressure against the other of said members to resist relative movement in one direction, said spring having a pressure applying end extension, and an abutment for said extension on the other of said members, which in an extreme position of said members is between but out of alignment with their pivotal connection and the spring mounting, but which in the relative movement of said members toward the opposite extreme position approaches alignment with the pivot and spring mounting whereby to cause relative movement between the end extension of said spring and said abutment to automatically vary the counteracting effect of said spring.

10. A spring-hinge as set forth in claim 9, wherein the end extension of said spring has a hook formation to limit relative movement between said extension and said abutment in one direction.

11. A spring-hinge comprising hinge members pivoted together, one of said members being of bell-crank form with the pivot at the end of one arm thereof, a spiral torsion spring carried on said bell-crank hinge member at the junction of the two arms thereof and having the inner end thereof fixed with respect to said member, said spring having the outer end extending tangentially for pressure application, and the other of said hinge members having an abutment thereon for engagement with the outer tangential end of said spring in radially spaced relation to the point of pivotal connection between said hinge members.

12. A spring-hinge as set forth in claim 11, including a hook on the extremity of the tangential outer end of said spring for limiting relative movement between the abutment and the spring in one direction.

13. A spring-hinge as set forth in claim 11, wherein both of the hinge members are bifurcated, said spring being supported in the bifurcated portion of the bell-crank hinge member, and said abutment comprising a cross-member carried in the bifurcated portion of the other hinge member and having the tangential outer end of the spring slidably engaging the same.

14. A spring-hinge as set forth in claim 11, wherein both of the hinge members are bifurcated, said spring being supported in the bifurcated portion of the bell-crank hinge member, and said abutment comprising a cross-member carried in the bifurcated portion of the other hinge member and having the tangential outer end of the spring slidably engaging the same, the extremity of said tangential end portion being formed to provide a hook for limiting relative sliding movement between said cross-member and said spring in one direction.

15. A spring-hinge comprising hinge members pivoted together, a spring supported on one of

said hinge members and arranged to be subjected to loading upon relative movement between said hinge members in one direction and a pressure application lever arm for transmitting pressure from the spring to the other hinge member, said arm extending from the spring and having a movable fulcrum engagement with said other hinge member so as to vary the counteracting effect of said spring differentially in the relative movement between the hinge members, the fulcrum being located in radially spaced relation to the pivot and spaced on one side of a line from the spring to the pivot when the hinge members are in one extreme position of relative pivotal movement and being spaced on the opposite side of said line when the hinge members are in the other extreme position of relative pivotal movement.

16. The combination with a stationary part and a part swingable on a substantially horizontal axis relative thereto by gravity from a raised position in a substantially horizontal plane to a lowered position at an acute angle to the horizontal, of means for supporting the movable part in equilibrium in the raised position and a range of intermediate positions relative to the stationary part, comprising spring means adapted to counterbalance the weight of said movable part differentially so as to exert the greatest counterbalancing force at approximately the mid-position of the movable part, said spring having a force transmitting lever arm, and an abutment relative to which said arm is slidable in the swinging of the movable part disposed in radially spaced relation to the pivotal axis, said abutment in one extreme position of the movable part being spaced on one side of a line from the spring means to the pivotal axis, and in the other extreme position of the movable part being disposed spaced on the opposite side of said line.

17. The combination with a stationary part and a part pivoted with respect thereto for movement biased in a downward direction by gravity, of counterbalancing means for supporting the pivoted part in substantial equilibrium in a range of raised positions, comprising a torsion spring carried on one of said parts and adapted by its spring pressure against the other of said parts to counterbalance the pivoted part, said spring having an active end portion moved in the movement of the pivoted part so that the spring winds in downward movement and unwinds in upward movement of said pivoted part, and an abutment fixed in relation to the stationary part relative to which the active end portion of said torsion spring is movably fulcrumed and moves in the movement of the pivoted part, said abutment being disposed in radially spaced relation to the pivotal axis, said abutment in one extreme position of the movable part being spaced on one side of a line from the center of the torsion spring to the pivotal axis, and in the other extreme position of the movable part being spaced on the opposite side of said line.

18. A spring-hinge comprising hinge members pivoted together, a torsion spring on one of said members adapted by its spring pressure against the other of said members to resist relative movement in one direction, said spring having a pressure applying end extension, and an abutment for said extension on the other of said members, which in one extreme position of said members is between the spring mounting and the point of pivotal connection of said members but spaced on one side of a line from the spring mounting to the pivot point, but which in the opposite extreme position of said members is spaced on the opposite side of a line drawn from the pivot point to the spring mounting, whereby as said spring is wound its end extension is given greater leverage, and vice versa in the unwinding of said spring.

19. A spring-hinge comprising hinge members pivoted together, a torsion spring on one of said members adapted by its spring pressure against the other of said members to resist relative movement in one direction, said spring having a pressure applying end extension, and an abutment for said extension on the other of said members, which in one extreme position of said members is between the spring mounting and the point of pivotal connection of said members but spaced on one side of a line from the spring mounting to the pivot point, but which in the opposite extreme position of said members is spaced on the opposide side of a line drawn from the pivot point to the spring mounting, whereby said spring exerts a greater counteracting effect at a certain intermediate position than at least at one of the two extreme positions.

20. A spring-hinge comprising hinge members pivoted together, a spring on one of said members arranged to be loaded in the relative movement of said members in one direction and unloaded in the relative movement of said members in the opposite direction, a force transmitting lever arm for said spring acting against the other of said members, and an abutment fixed with respect to said other member relative to which said lever arm is movably fulcrumed, said abutment in one extreme position of the hinge members being between the pivot point and the spring mounting spaced on one side of a line from the pivot point to the spring mounting, but in the other extreme position of said members being located spaced on the opposite side of said line, whereby as said spring is loaded its force transmitting lever arm is given greater leverage, and vice versa in the unloading of said spring.

21. A spring-hinge comprising hinge members pivoted together, a spring on one of said members arranged to be loaded in the relative movement of said members in one direction and unloaded in the relative movement of said members in the opposite direction, a force transmitting lever arm for said spring acting against the other of said members, and an abutment fixed with respect to said other member relative to which said lever arm is movably fulcrumed, said abutment in one extreme position of the hinge members being between the pivot point and the spring mounting spaced on one side of a line from the pivot point to the spring mounting, but in the other extreme position of said members being located spaced on the opposite side of said line, whereby said spring has a greater counteracting effect at a certain intermediate position of the hinge members than at least at one of the two extreme positions.

22. The combination with a stationary part and a part swingable on a substantially horizontal axis relative thereto by gravity from a raised position in a substantially horizontal plane to a lowered position at an acute angle to the horizontal, of means for supporting the movable part in equilibrium in its raised position and intermediate positions comprising a torsion spring mounted on one of said parts having a pressure applying end extending substantially tangentially therefrom, and an abutment on the other of

said parts on which said pressure applying end is slidable in the swinging movement of the movable part, the abutment being so disposed in radially spaced relation to the pivotal axis and in relation to the stationary and movable parts that in one extreme position of the movable part the abutment is spaced on one side of a line from the center of the torsion spring to the pivotal axis and in the other extreme position of the movable part the abutment is spaced on the opposite side of said line.

23. The combination set forth in claim 22, wherein the pressure applying end of said torsion spring has a hook formation for engagement with the abutment to limit relative movement between said pressure applying end and said abutment in one direction.

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