June 29, 1943. J. F. HARMON ET AL 2,322,933

AUTOMOBILE DOOR HINGE

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Fig. 1

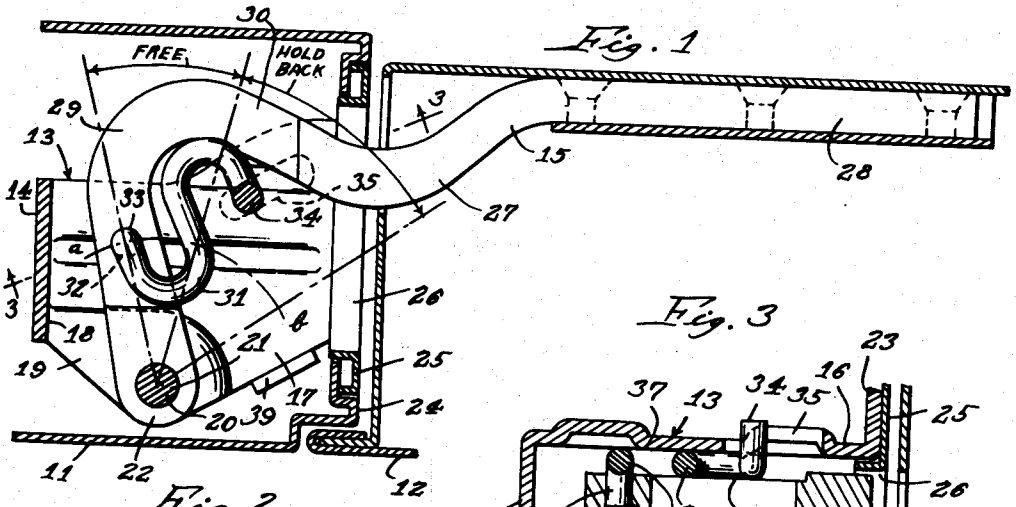


Fig. 3

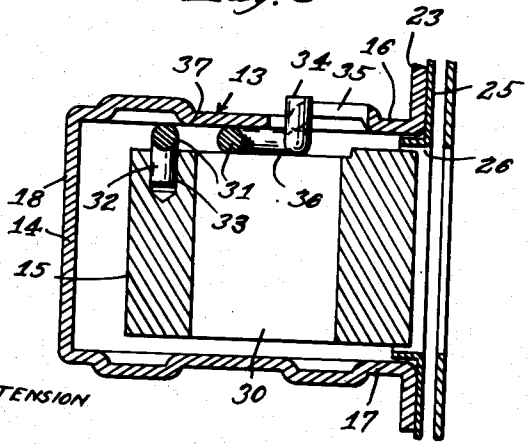


Fig. 2

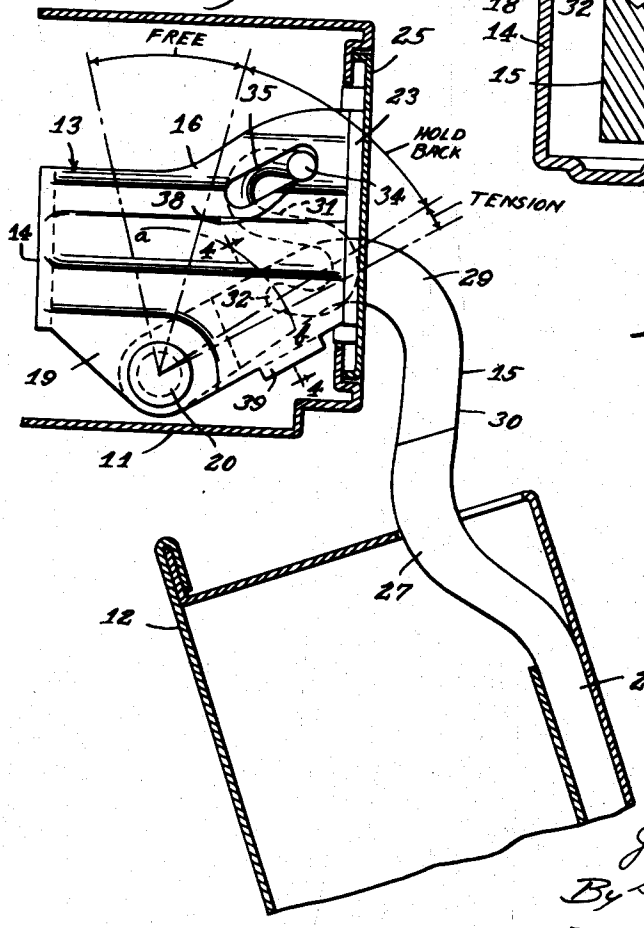
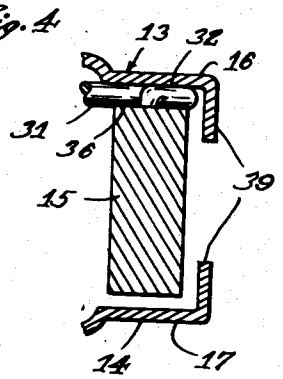


Fig. 4



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AUTOMOBILE DOOR HINGE

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Fig. 4a

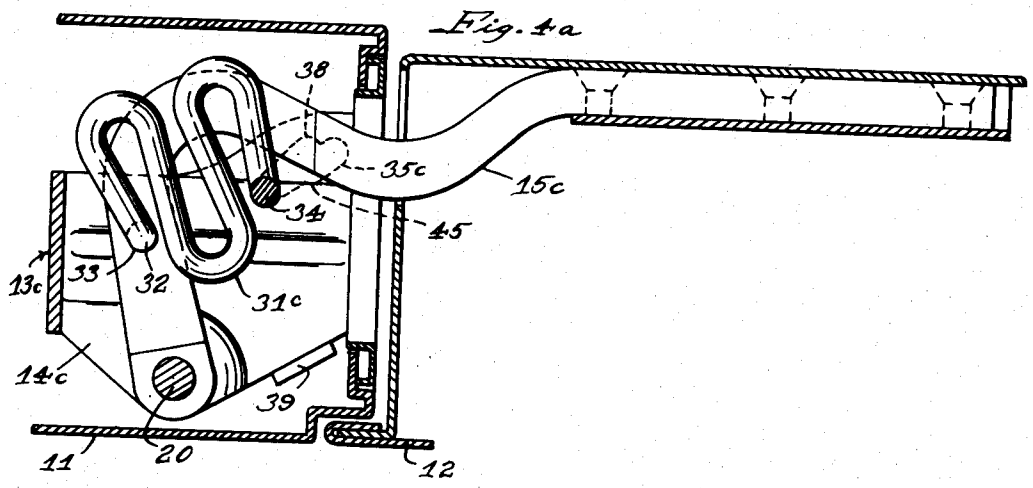
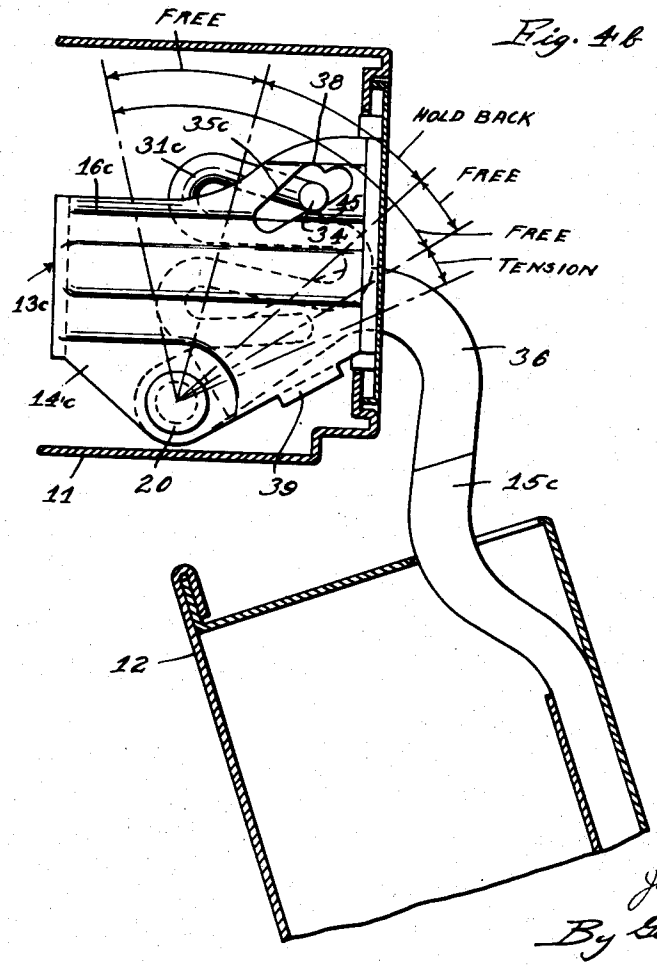


Fig. 4b



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AUTOMOBILE DOOR HINGE

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Fig. 5

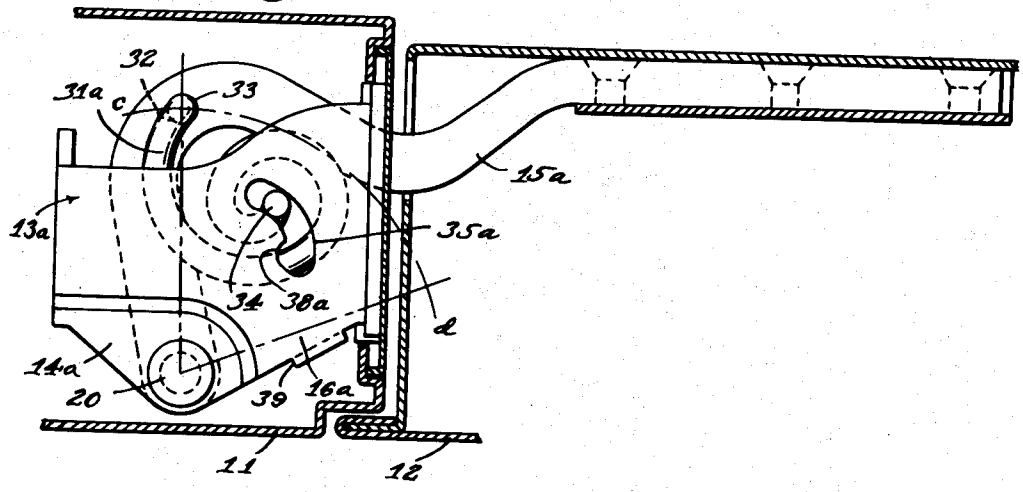


Fig. 6

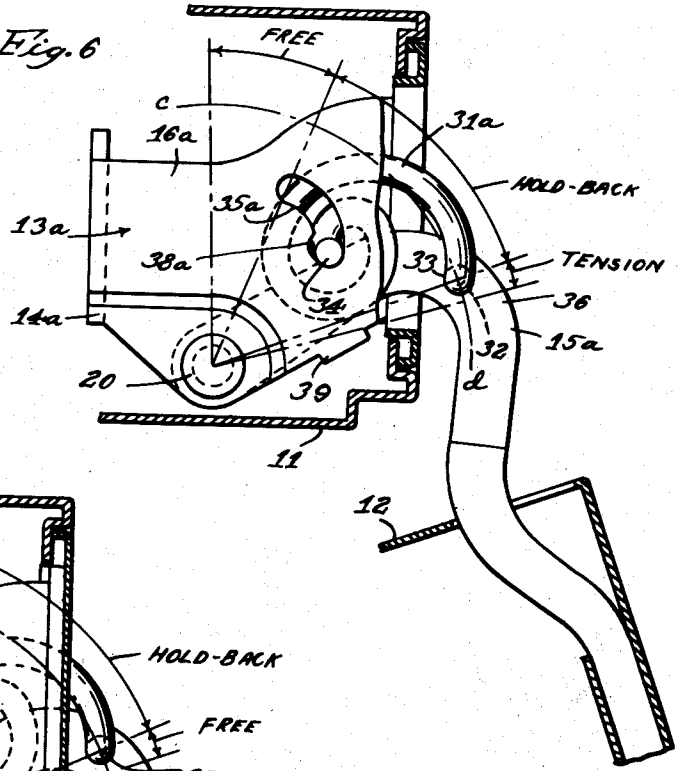
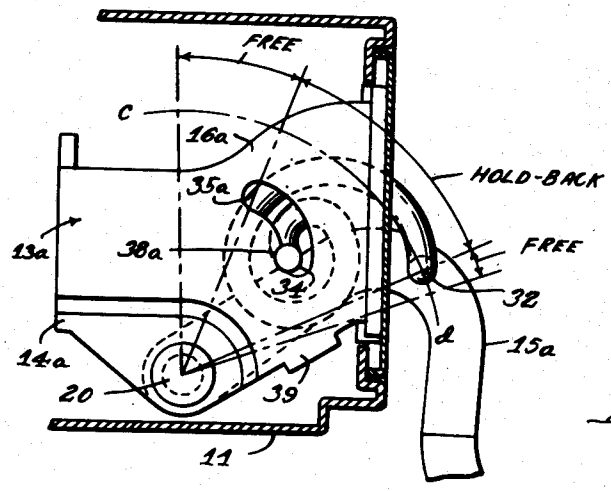


Fig. 7



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AUTOMOBILE DOOR HINGE

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Fig. 8

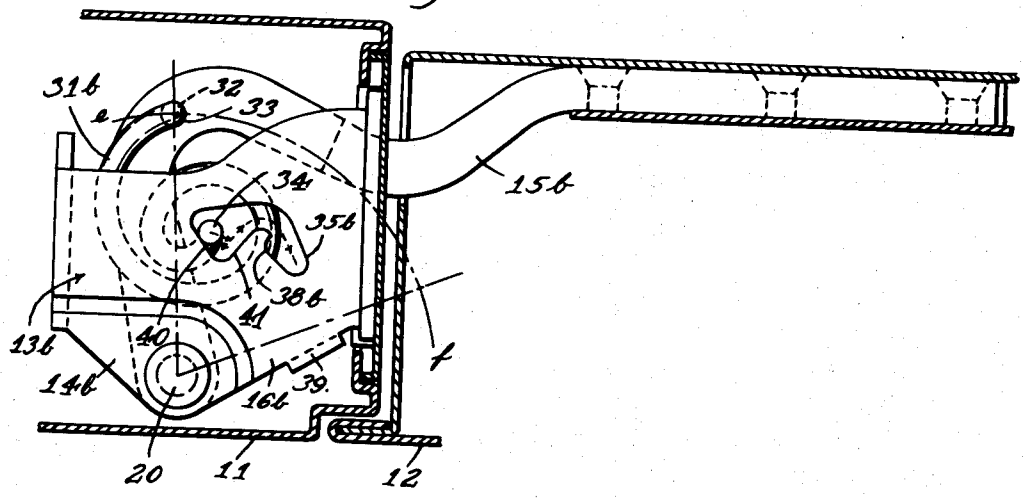


Fig. 9

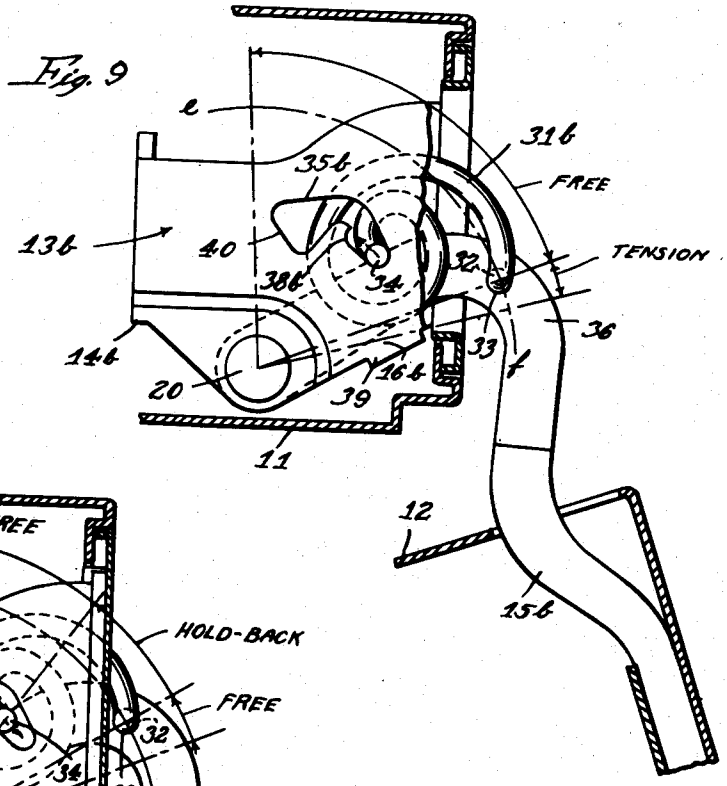
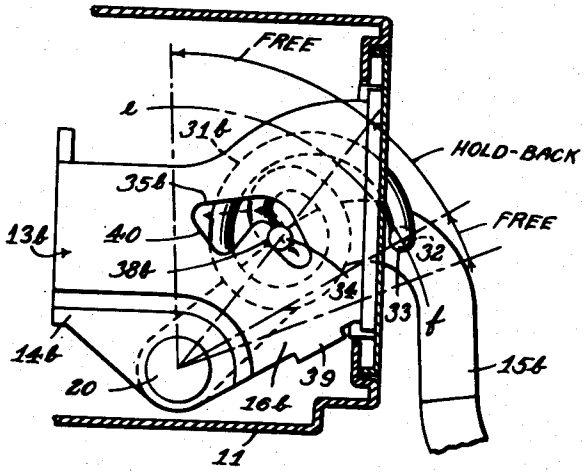


Fig. 10



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Patented June 29, 1943

2,322,933

UNITED STATES PATENT OFFICE

2,322,933

AUTOMOBILE DOOR HINGE

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Application March 10, 1941, Serial No. 382,480

20 Claims. (Cl. 16—135)

This invention relates to a new and improved automobile door hinge of the concealed type.

One of the principal objects of our invention is to provide a hinge embodying a hold-back spring working between the inner and outer hinge members to yieldingly resist movement of the door throughout a certain range of movement between the opened and closed positions, whereby to avoid accidental closing of the door once it is fully opened. In one embodiment the spring is flexed in the opening and closing movements, whereas in another embodiment the spring allows free opening movement and resists closing movement only through a certain range.

Another important object consists in the provision of a spring action hinge of the kind mentioned in which the hold-back spring serves also as a door check, the spring being subjected to compression throughout one range of movement to resist closing of the door and being subjected to tension through a small range at the limit of opening movement for door check action.

Still another object consists in the provision in a hinge of the kind last described of a stop for positively limiting the opening movement so as to avoid tensioning of the hold-back spring.

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

Fig. 1 is a horizontal section through an automobile door hinge embodying our invention, the door being shown closed;

Fig. 2 is a horizontal section similar to Fig. 1 but showing the door opened;

Fig. 3 is a vertical section on the line 3—3 of Fig. 1;

Fig. 4 is a vertical sectional detail on the line 4—4 of Fig. 2;

Figs. 4a and 4b are sections similar to Figs. 1 and 2, respectively, illustrating another hold-back structure;

Fig. 5 is a horizontal section similar to Fig. 1, showing still another hold-back structure.

Fig. 6 is a horizontal section like Fig. 5 but showing the door at the end of the opening movement;

Fig. 7 is another section like Fig. 6 but showing the parts in a different relationship to better illustrate the action of the hold-back spring, and

Figs. 8, 9 and 10 are views corresponding to Figs. 5, 6 and 7, respectively, but illustrating another construction.

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

Referring first to Figs. 1 to 4, 11 designates a portion of the body and 12 a portion of the door of an automobile hingedly mounted on the body by two or more hinges, one of which is shown at 13. The hinge shown comprises an outer member 14 and an inner member 15 mounted on the body and door, respectively. The outer member 14 is formed from sheet metal to a generally U-shaped cross-section so as to provide opposed substantially horizontal parallel walls 16 and 17 interconnected by a substantially vertical wall 18. The horizontal walls have embossed portions 19 forming supports for the pintle 20 received in a bearing hole 21 provided therefor in the enlarged end portion 22 of the inner hinge member 15. The walls 16 and 17 are also flanged outwardly as at 23 to provide attaching portions for bolting, riveting, or otherwise securing the outer hinge member 14 to the body pillar, a portion of which appears at 24. A sheet metal face plate 25 suitably welded to the attaching portions 23, is cut away as at 26 to provide operating clearance for the inner hinge member 15. The inner hinge member 15 has an offset portion 27 next to its attaching end portion 28 where it extends through the cut-out portion 26 of the plate 25, whereby to provide operating clearances for the gooseneck portion 29 when the door closes. The gooseneck portion 29 is next to the offset portion 27, and its radius is long enough so that the portion 30 clears the body pillar in the opening of the door, as appears in Fig. 2. The pintle end portion 22 provided on the other half of the gooseneck portion 29 is approximately at right angles to the attaching end portion 28, and the door 12 is accordingly free to swing through approximately 90° from closed to open position.

In accordance with our invention, an S-shaped "zigzag," flat, bow spring 31, which is preferably, but not necessarily, of cylindrical spring wire, is provided in a horizontal plane between the outer and inner hinge members 14 and 15 of the hinge 13, the spring having one end 32 bent vertically downwardly for pivotal engagement in a hole 33 provided therefor in the inner hinge member 15, while the other end 34 is bent vertically upwardly for sliding and pivotal engagement in a slot 35 provided in the upper wall 16 of the outer hinge member 14. The spring 31 as a whole is slidable freely between the upper edge 36 of the inner hinge member 15 and the bottom surface 37 of the upper wall 16 of the outer hinge member 14. There is a small shoulder 38 provided on one side of the slot 35 at the end remote from the pintle 20 on which the end 34 of the spring 31 is arranged to engage when the door is nearly fully

opened, as illustrated in Fig. 2, whereby to support the end 34 during the slight stretching to which the spring may be subjected when it acts as a door check. Lugs 39 are shown projecting inwardly toward one another from the edges of the top and bottom walls 16 and 17 of the outer hinge member 14 to serve as limit stops to be engaged by the inner hinge member 15 at the limit of the door opening movement, whereby to avoid excessive stretching of the spring 31 in the door check action thereof.

In operation, it should be clear that as the door 12 is opened, the end 34 of the spring moves outwardly in the slot 35 and the spring also turns relative to the inner hinge member 15 on its end 32 as a pivot. The door opens freely through approximately 30°, as indicated by the word "free" in Fig. 1, and in this movement the end 34 of the spring reaches the outer end of the slot 35. During the next approximately 45° of door opening movement, the spring 31 is subjected first to compression during the first half of this range and then expansion back to normal shape during the other half of this range, the compression and expansion being due to the fact that the end 32 moves along the arc *a*—*b* when the other end 34 pivots in the outer end of the slot 35, the distance from that point to the arc *a*—*b* being less than the distance between the ends 32 and 34 of the spring in its undistorted condition. This 45° range has been labeled "hold-back," inasmuch as in the closing of the door the spring is subjected to compression during the first half of this 45° range and the spring 31 by that resistance to door closing movement serves as a hold-back. In the final approximately 5° range of door opening movement the spring 31 is subjected to tensioning as indicated by the word "tension" in Fig. 2, the end 34 of the spring resting on the shoulder 38 for support during this stretching. In that way the spring serves as a door check in addition to a hold-back. The spring is not usually kept under tension but the door will ordinarily return enough to relieve it of any appreciable tension. The door is held open by the resistance of the spring 31 which, as previously stated, must be compressed thereto approximately half of the 45° hold-back range indicated in Figs. 1 and 2. This resistance is easily enough to prevent accidental closing of the door either by gravity or ordinary wind pressure, or both. The spring 31 is safe-guarded against excessive stretching in its door check action by the positive stop afforded by the lugs 39 which engage the side of the inner hinge member 15 in the limit of the door opening movement. In the closing of the door once the hold-back range is passed the door swings freely through the last approximately 30° to closed position. The end 34 of the spring in this final movement slides freely in the slot 35 back to the position shown in Fig. 1.

The construction disclosed in Figs. 4*a* and 4*b* is similar to that just described. The hinge 13*c* has its outer and inner hinge members numbered accordingly 14*c* and 15*c* respectively. The hold-back spring 31*c* is of flat, "zig-zag" or generally W-shape. Its radially inner end 32 is pivoted in a hole 33 in the inner hinge member, whereas the radially outer end 34 is slidably and pivotally engaged in a slot 35*c* provided in the upper wall 16*c* of the outer hinge member 14*c*, the spring 31*c* like the spring 31 is preferably, although not necessarily, made from round spring wire, and the main body portion of the spring is all in substantially the same horizontal plane so as to fit in the space left between the upper edge 36 of the inner hinge member and the bottom surface of the upper wall. The slot 35*c* is of uniform width but has a small shoulder 38 provided on one side thereof near the end remote from the pintle 20 on which the end 34 of the spring is arranged to engage when the door is given its initial closing movement, whereby to resist closing thereof. Opposite the shoulder 38 there is another shoulder 45 on which the pivot 34 engages at the limit of door opening movement, as indicated in Fig. 4*b*, thus insuring engagement of the pivot 34 with the shoulder 38 in the initial closing movement. The lugs 39 provided on the top and bottom walls of the outer hinge member serve as limit stops to be engaged by the inner hinge member at the limit of the door opening movement, whereby to avoid excessive stretching or spreading of the spring 31*c* in the door check action thereof.

In operation the door swings open freely, as shown by the approximately 90° "free" movement indicated in Fig. 4*b*, the end 34 of the spring being movable freely outwardly in the slot 35*c* in the opening of the door. The spring 31*c* at the limit of opening movement is stretched, as indicated by the word "tension" in Fig. 4*b*, to serve as a door check, the stretching of the spring being positively limited by the engagement of the inner hinge member with the lugs 39. In the initial closing movement, the end 34 engages the shoulder 38 and the spring 31*c* is therefore subjected to compression through approximately 45° of the closing movement and expands again in the remainder of the closing movement, the end 34 finally becoming disengaged from the shoulder 38 and moving toward the inner end of the slot 35*c* as shown in Fig. 4*a*.

Referring now to Figs. 5–7, the hinge 13*a* shown in these views is generally the same as the hinge 13 of Figs. 1–4 and its outer and inner hinge members have accordingly been numbered 14*a* and 15*a*, respectively. The hold-back spring 31*a*, however, is of a flat generally spiral form. The radially outer end 32 of the spring is pivoted in a hole 33 in the inner hinge member 15*a*, whereas the inner end 34 of the spring is slidably and pivotally engaged in an arcuate slot 35*a* provided in the upper wall 16*a* of the outer hinge member 14*a*. The spring 31*a*, like the spring 31, is preferably, although not necessarily, made from round spring wire. The spiral main body portion of the spring is all in substantially the same horizontal plane to fit in the small space left between the upper edge 36 of the inner hinge member 15*a* and the bottom surface of the upper wall 16*a*. The slot 35*a* is of uniform width except at one end where it is enlarged to provide the shoulder 38*a*. The end 32 of the spring travels along the arc *c*—*d* in the door opening and closing movements.

In operation, when the door is closed the spring 31*a* is disposed as shown in Fig. 5. When the door is opened the first 30° range of movement is free, as indicated in Fig. 6, as the end 34 slides freely in the slot 35*a*, but in the next 45° range of movement the spring is subjected first to compression as the end 32 moves toward dead center alignment with the pintle 20 and end 34, the spring thereafter expanding again until the door reaches the fully opened position in which it is illustrated in Fig. 6. The end 34

of the spring is movable freely in the enlarged end of the slot and this approximately 5° range of free movement is indicated in Fig. 7 where the end 34 is shown moved over into abutment with the shoulder 38a defined in the enlarged end of the slot. This shoulder prevents the end 34 from returning freely to the other end of the slot when the door closes. The spring is, therefore, supported for compression again through the first half of the approximately 45° of the hold-back range indicated in Figs. 6 and 7. After the end 32 passes the dead center position relative to the pintle 20 and end 34, the end 34 will slide away from the shoulder 38a toward the adjacent end of the slot 35a and thereafter as the door continues on the closing movement the end 34 will slide freely along the slot 35a back to the position shown in Fig. 5 ready for the next cycle. It is obvious from inspection of Fig. 6 that when the door in opening reaches the position shown, the spring will be subject to some stretching for a door check action similar to what was previously described in regard to the spring 31 in Fig. 2. The range for the door check action is labeled "tension" similarly as in Fig. 2. The lugs 39 limit the stretching of the spring 31a similarly as in the case of the spring 31 by engagement with the inner hinge member 15a and, of course, immediately after the engagement of the hinge member with the lugs 39 the hinge member will return slightly, thus relieving the spring of tension.

Figs. 8, 9 and 10 illustrate another flat spiral spring 31b in connection with a hinge 13b that is similar to the hinges previously described, the outer and inner hinge members being accordingly numbered 14b and 15b, respectively. The slot 35b in the upper wall 16b of the outer hinge member in this case is of a different form from either the slots 35 and 35a previously described, this one being substantially V-shaped and enlarged at both ends to provide a shoulder 38b at one end similar to the shoulders 38 and 38a of the other constructions. The other half of the slot 35b is flared outwardly to the substantially triangular form indicated at 40. Now, the end 32 of the spring fitting in the hole 33 in the inner hinge member 15b moves along the arc e—f while the other end 34 of the spring works in the slot 35b. Of course, it is understood that the spring 31b like the other springs 31 and 31a is preferably, although not necessarily, of round spring wire with the main spiral body portion thereof all substantially in the same horizontal plane to work in the small space between the upper edge 36 of the inner hinge member and the bottom surface of the upper wall 16b.

In operation, the spring 31b offers no resistance throughout any portion of the opening movement of the door due to the fact that there is no compression of the spring in the opening movement. The end 34 in the initial opening movement moves along an arc with the pintle 20 as a center into engagement with the side 41 of the flared end 40 of the slot 35b as indicated by the dotted lines and arrows in Fig. 8. Then, as the door continues in the opening movement the end 34 first moves inwardly toward the pintle 20 as the end 32 comes toward a dead center line through the pintle 20 and end 34 after which the further opening movement of the door the end 34 moves outwardly along the side 41 of the slot as indicated by the dotted lines and arrows in Fig. 8. Finally, when the door reaches the fully open position the end 34 of the spring has reached the other end of the slot 35b as shown in Fig. 9. Here again, it is obvious that the spring 31b is adapted to serve as a door check, the spring being subjected to stretching through the small range of movement indicated by the caption "tension" in Fig. 9. The door check action is positively limited by the engagement of the inner hinge member 15b with the lugs 39 as in the other constructions. In the initial closing movement of the door the end 34 of the spring slides away from the end of the slot from the position shown in Fig. 9 to that shown in Fig. 10, where the end 34 engages the shoulder 38b. This free movement range is approximately 10° as indicated in Fig. 10. In the further closing movement of the door as the end 32 of the spring moves along the arc e—f the spring is compressed as the end 32 approaches the dead center line through the end 34 and pintle 20. This resistance to closing movement is for hold-back and is sufficient as in the other springs previously described to prevent the door from closing accidentally. After the end 32 passes the dead center line the spring expands again, thus assisting in the final closing movement. The end 34 immediately after the end 32 passes the dead center line returns to the adjacent end of the slot 35b and thereafter, when the door has closed far enough for the spring to return to its normal shape, the end 34 travels along an arc with the pintle 20 as a center and moves past the shoulder 38b into the other half of the slot 35b as indicated by the dotted lines and arrows in Fig. 10. When the door reaches closed position the end 34 of the spring is in the position shown in Fig. 8, ready for the next cycle of movements.

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

We claim:

1. In combination, a hinge comprising a generally U-shaped outer member, and an inner member pivoted on a pintle disposed in approximately 90° relation to and supported on the arms of the U-shaped outer member, there being a space left between the one edge of the inner hinge member and an adjacent arm of the outer hinge member, said hinge members being movable relative to one another through approximately 90°, and a bow spring for yieldingly restraining pivotal movement of one hinge member relative to the other, said spring being disposed in said space in a plane approximately parallel to the edge of the inner hinge member and adjacent arm of the outer hinge member, the opposite ends of said spring having integral pivot portions provided thereon projecting substantially at right angles to the plane of the spring, the one pivot portion being pivotally received in a bearing provided therefor in the edge portion of the inner hinge member and the other pivot portion projecting in the opposite direction from the spring and being slidably and pivotally engaged in a slot provided in the adjacent arm of the outer hinge member.

2. In combination, a hinge comprising a pair of hinge members pivoted relative to one another for relative pivotal movement through approximately 90°, and a bow spring having one end pivoted to one of said hinge members radially

from the hinge axis, the other end of said spring having a sliding and pivotal connection with the other hinge member at different radial distances from the hinge axis, said sliding and pivotal connection including means for limiting sliding movement of the slidable end of the bow spring radially with respect to the hinge axis so that unconstrained pivotal movement of said hinge members is permitted only through a portion of the 90° pivotal movement, said bow spring being subjected upon stoppage of the slidable end thereof by the aforesaid means to compression in the movement of one hinge member relative to the other through a portion of the remainder of the 90° pivotal movement, said spring expanding again in at least a portion of the balance of the 90° pivotal movement.

3. The combination set forth in claim 2, wherein the sliding pivotal connection also includes means cooperating with the slidable end of the bow spring near the end of the opening movement of the hinge members releasably to hold said slidable end against sliding whereby said spring is adapted to be spread when the hinge members approach the end of the opening movement yieldingly to resist said movement.

4. The combination set forth in claim 2, wherein the sliding pivotal connection also includes means cooperating with the slidable end of the bow spring near the end of the opening movement of the hinge members releasably to hold said slidable end against sliding whereby said spring is adapted to be spread when the hinge members approach the end of the opening movement yieldingly to resist said movement, the combination including a stop for positively limiting the opening movement of said hinge members when the spring is spread to a predetermined extent.

5. In combination, a hinge comprising a pair of hinge members pivoted relative to one another for relative pivotal movement through approximately 90°, and a bow spring having one end pivoted to one of said hinge members radially from the hinge axis, the other hinge member having a slot provided therein, and said spring having the other end thereof provided with a protruding end portion engaging slidably and pivotally in said slot at different radial distances from the hinge axis, said slot permitting limited sliding movement of said protruding end portion of said bow spring in a radial direction relative to the hinge axis less than that required for unconstrained pivotal movement of said hinge members through 90°, whereby unconstrained pivotal movement of one hinge member relative to the other is permitted only through a portion of the 90° movement, said bow spring being subjected upon stoppage of said protruding end portion thereof at one end of said slot to compression in the movement of one hinge member relative to the other through a portion of the remainder of the 90° pivotal movement, and said spring expanding again in at least a portion of the balance of the movement.

6. The combination set forth in claim 5 wherein the slot has an offset provided therein defining a shoulder on one side of the slot in one end portion thereof on which said protruding end portion of said spring is arranged to engage when the hinge members are opened to a point near the end of the opening movement of the hinge members, whereby said spring is adapted to be spread when the hinge members approach the end of the opening movement yieldingly to resist said movement.

7. The combination set forth in claim 5 wherein the slot has an offset provided therein defining a shoulder on one side of the slot in one end portion thereof on which said protruding end portion of said spring is arranged to engage when the hinge members are opened to a point near the end of the opening movement of the hinge members, whereby said spring is adapted to be spread when the hinge members approach the end of the opening movement yieldingly to resist said movement, the combination including a stop for positively limiting the opening movement of said hinge members when the spring is spread to a predetermined extent.

8. In combination a hinge comprising a pair of hinge members pivoted relative to one another for relative pivotal movement through approximately 90°, and a bow spring having one end pivoted to one of said hinge members radially from the hinge axis, the other end of said spring having a sliding and pivotal connection with the other hinge member at different radial distances from the hinge axis, said sliding and pivotal connection permitting free movement of the slidable end of the bow spring in one direction with respect to the hinge axis in the opening hinge movement through 90°, said sliding and pivotal connection including means cooperating with the slidable end of the bow spring at the end of the opening movement of the hinge members to stop sliding movement of said slidable end, said sliding and pivotal connection further including means arranged to cooperate with the slidable end of the bow spring in the first portion of the closing movement of the hinge members relative to one another to stop sliding movement of the slidable end of said spring, whereby said spring is subjected to compression during a portion of the closing movement, said spring expanding again in at least a portion of the balance of the closing movement.

9. The combination set forth in claim 8 wherein the sliding and pivotal connection comprises a slot provided in one of the hinge members, and wherein the first and second means cooperating with the slidable end of the bow spring comprise offset portions defining shoulders on opposite sides of said slot intermediate the ends of the slot for engagement with the slidable end of the spring as limiting stops.

10. In combination, a hinge comprising a pair of hinge members pivoted relative to one another for relative pivotal movement through approximately 90°, and a bow spring having one end pivoted to one of said hinge members radially from the hinge axis, the other end of said spring having a sliding and pivotal connection with the other hinge member at different radial distances from the hinge axis, said sliding and pivotal connection permitting free movement of the slidable end of the bow spring in one direction with respect to the hinge axis in the opening hinge movement through 90°, said sliding and pivotal connection including means cooperating with the slidable end of the bow spring near the end of the opening movement of the hinge members to stop sliding movement of said slidable end, said spring while stopped by said means being adapted to be spread in any additional opening movement of the hinge members, so that the spring yieldingly resists such further opening movement, said sliding and pivotal connection further including means arranged to cooperate

with the slidable end of the bow spring in the first portion of the closing movement of the hinge members relative to one another to stop sliding movement of the slidable end of said spring, whereby said spring is subjected to compression during a portion of the closing movement, said spring expanding again in at least a portion of the balance of the cloesing movement.

11. The combination set forth in claim 10 including a stop for positively limiting said additional opening movement of the hinge when the spring has been spread to a predetermined extent.

12. In combination, a hinge comprising a pair of hinge members pivoted relative to one another for relative pivotal movement through approximately 90°, and a bow spring having one end pivoted to one of said hinge members radially from the hinge axis, the other end of said spring having a sliding and pivotal connection with the other hinge member at different radial distances from the hinge axis, said sliding and pivotal connection permitting limited free sliding movement of the slidable end of the bow spring substantially arcuately with respect to the hinge axis so as to permit free pivotal movement of the hinge members with respect to one another through certain angularities at opposite ends of the 90° pivotal movement, said sliding and pivotal connection including means cooperating with the slidable end of the bow spring when the hinge members are closed to an intermediate extent, whereby to permit only pivotal movement of the slidable end of the bow spring in the intermediate range of pivotal movement of the hinge members so that said bow spring is subjected to compression in the relative movement of the hinge members through a portion of the closing movement in said intermediate range, said spring expanding again in the balance of the closing movement in said intermediate range.

13. The combination set forth in claim 12 wherein the sliding and pivotal connection comprises a slot provided in one of said hinge members to receive the slidable end of the bow spring, said slot being extended eccentrically with respect to the hinge axis, one end portion of the slot being enlarged so as to define a shoulder therein on one side thereof for engagement by the slidable end of the bow spring to stop sliding movement thereof but permit pivotal movement thereof.

14. In combination, a hinge comprising a pair of hinge members pivoted relative to one another for relative pivotal movement through approximately 90°, and a bow spring having one end pivoted to one of said hinge members radially from the hinge axis, the other end of said spring having a sliding and pivotal connection with the other hinge member at different radial distances from the hinge axis, said sliding and pivotal connection permitting limited free sliding movement of the slidable end of the bow spring substantially arcuately with respect to the hinge axis so as to permit free pivotal movement of the hinge members with respect to one another through certain angularities at opposite ends of the 90° pivotal movement, the slidable end of said spring cooperating with abutment means to limit the free opening movement of the hinge members, said spring being adaped to be spread in any additional opening movement of the hinge members, so that said spring yieldingly resists such further opening movement, said sliding and pivotal connection including means cooperating with the slidable end of the bow spring when the hinge members are closed to an intermediate extent, whereby to permit only pivotal movement of the slidable end of the bow spring in the intermediate range of pivotal movement of the hinge members so that said bow spring is subjected to compression in the relative movement of the hinge members through a portion of the closing movement in said intermediate range, said spring expanding again in the balance of the closing movement in said intermediate range.

15. The combination set forth in claim 14, including a stop for positively limiting the said additional opening movement of the hinge members when the spring has been spread a predetermined extent.

16. In combination, a hinge comprising a pair of hinge members pivoted relative to one another for relative pivotal movement through approximately 90°, and a bow spring having one end pivoted to one of said hinge members radially from the hinge axis, the other end of said spring having a sliding and pivotal connection with the other hinge member at different radial distances from the hinge axis, said sliding and pivotal connection permitting free sliding movement of the slidable end of the bow spring in the opening movement of the hinge through substantially all of the said 90° pivotal movement, said sliding and pivotal connection including means cooperating with the slidable end of the bow spring in the closing of the hinge to allow sliding movement of the slidable end of the bow spring and permit unconstrained pivotal movement of one hinge member relative to the other in the closing thereof through a certain angularity at the opposite ends of said 90° pivotal movement, and said slidable and pivotal connection further including means cooperating with the slidable end of said bow spring to permit only pivotal movement of the slidable end of the bow spring in the pivotal movement of one hinge member relative to the other through an intermediate portion of said 90° pivotal movement, whereby said bow spring is subjected to compression in the closing movement of one hinge member relative to the other through a portion of said intermediate range, said spring expanding again in the balance of the closing movement in said intermediate range.

17. The combination set forth in claim 16 wherein the sliding and pivotal connection comprises a slot provided in one of said hinge members receiving the slidable end of the bow spring, said slot being generally V-shaped, one portion being of tapered form flaring from the crotch of the V, and the other portion being of tapered form flaring from the outer end toward the crotch and defining a shoulder on the inner side of the slot with respect to the crotch, said shoulder constituting the last-mentioned means, for engagement by the slidable end of the bow spring to stop sliding movement thereof but permit pivotal movement thereof.

18. In combination, a hinge comprising two members pivotally connected for hinging movement through approximately 90° relative to one another, one of said hinge members having a portion in spaced substantially parallel relation to one edge portion of the other hinge member, and a bow spring for yieldingly restraining pivotal movement of one hinge member relative to the other, said spring being disposed in the space

between said hinge members in a plane approximately parallel to said edge portion of the one hinge member and said spaced portion of the other hinge member, the opposite ends of said spring having integral pivot portions provided thereon projecting substantially at right angles to the plane of the spring, the one pivot portion being pivotally received in a bearing provided therefor in one of said hinge members and the other pivot portion projecting in the opposite direction from the spring and being slidably and pivotally engaged in a slot provided in the other of said hinge members.

19. The combination set forth in claim 18, wherein the slot is provided with means cooperating with the pivot portion of said bow spring projecting into said slot near the end of the opening movement of the hinge members relative to one another whereby said bow spring is adapted to be spread when the hinge members approach the end of the opening movement yieldingly to resist further pivotal movement of said hinge members.

20. The combination set forth in claim 18, wherein the slot is provided with means cooperating with the pivot portion of said bow spring projecting into said slot near the end of the opening movement of the hinge members relative to one another whereby said bow spring is adapted to be spread when the hinge members approach the end of the opening movement yieldingly to resist further pivotal movement of said hinge members, the combination including a stop for positively limiting the pivotal movement when the spring is spread to a predetermined extent.

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