Jan. 27, 1953 G. W. LYONS 2,626,421

HINGE STRUCTURE

Filed July 22, 1950

Fig. 2.

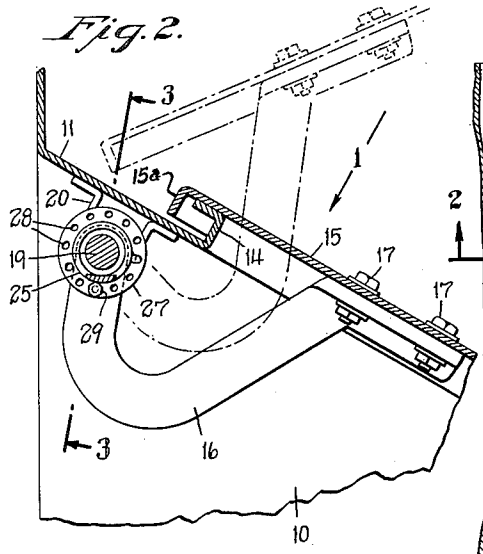


Fig. 1.

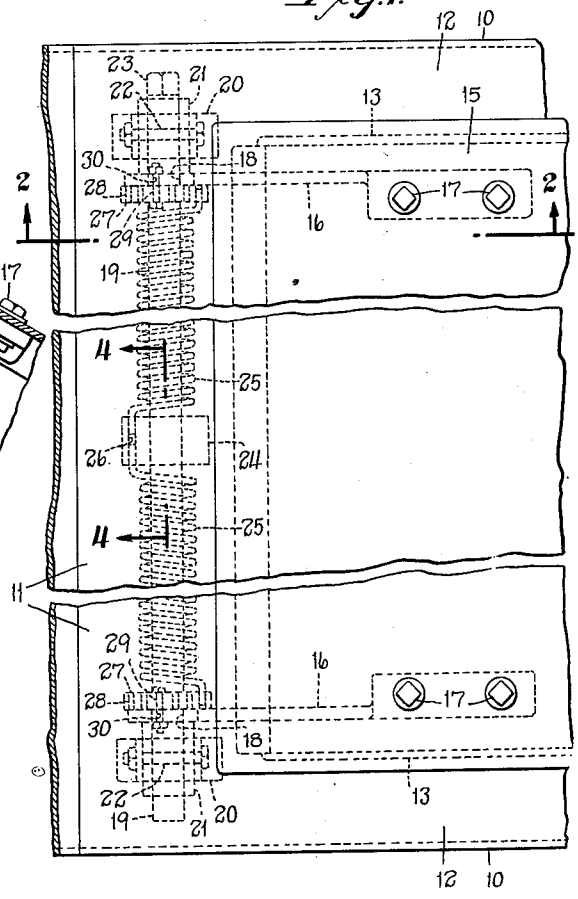


Fig. 3.

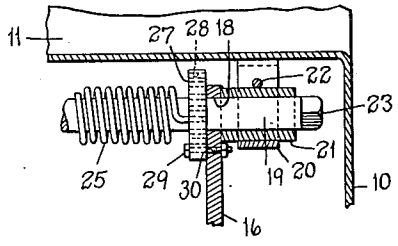


Fig. 4.

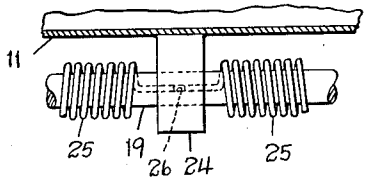
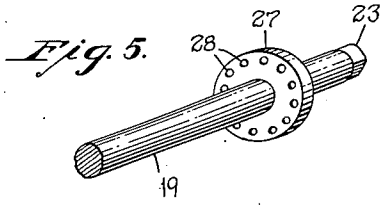


Fig. 5.



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HINGE STRUCTURE

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4 Claims. (Cl. 16—135)

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The present invention relates in general to a hinge structure and more especially to superior counterbalancing means for a hinged cover such as, for example, a hatch-cover, a bulkhead-cover, a box-cover, and the like.

It is a primary object of the invention to provide a hinged cover with adjustable counterbalancing means for holding the cover open and for assisting in raising the cover from its closed position.

A further object of the invention is to provide a hinged cover counterbalancing mechanism characterized by parts so made and arranged that they may be easily attached to the hinged cover, readily adjusted after attachment thereto without requiring the detachment thereof, and which will be protected from the weather when the cover is closed.

Other objects and advantages will appear to those skilled in the art from the following, considered in conjunction with the accompanying drawings.

In the accompanying drawings, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a fragmentary plan view looking in the direction of the arrow 1 of Fig. 2 of a bulkhead having a cover hinged at its upper end thereto and including the improved cover-supporting means of this invention;

Fig. 2 is a fragmentary transverse sectional view of the bulkhead and cover on line 2—2 of Fig. 1;

Fig. 3 is an elevation in section of a fragmentary portion of the resilient cover-supporting means on line 3—3 of Fig. 2;

Fig. 4 is a fragmentary sectional view on line 4—4 of Fig. 1; and

Fig. 5 is a broken detached perspective view of one end of the shaft.

The exemplary embodiment of the invention illustrated herein is used in conjunction with a frame structure such as, for example, a bulkhead, which, in the main, comprises a pair of substantially-vertical triangular-shaped side panels, indicated generally at 10—10, and joined at their upper ends in substantially spaced-parallel relationship by means of a head-plate 11. Each side panel 10 may be provided along its upper edge with a flange 12 which projects inwardly substantially perpendicularly to the vertical plane of its respective side panel and is provided along its inner edge with an upstanding lip 13. A similar lip 14 is provided along the forward edge of the head-plate 11, the upstanding lips of the side

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panels and the lip of the head-plate being adapted to form substantially-watertight joints with downwardly-bent flanges 15a which extend along the edges and ends respectively of the cover 15 of the bulkhead.

As shown in Fig. 2, the cover 15 is adapted to be hinged at its upper edge to the head-plate 11 of the bulkhead by hinge-means comprising, in part, a pair of substantially V-shaped hinge-arms 16—16, each arm being securely fastened at its forward end to the underside of the cover by suitable fastening-means 17, such as, for example, bolts and nuts, or the equivalent. The opposite or rearwardly-and-upwardly-extending end of each hinge-arm is provided with a transverse shaft-receiving aperture 18 for rotatably mounting the corresponding end of the hinge-arm on one end of a shaft 19. The latter is rotatably supported beneath the head-plate 11 of the bulkhead in vertically-spaced substantially-parallel relationship thereto and longitudinally thereof by shaft-supporting brackets 20—20 which are secured to the underside of the head-plate 11 and project downwardly therefrom at opposite ends thereof respectively. In the embodiment of the invention shown herein, each shaft-supporting bracket constitutes a substantially U-shaped strap, the arms of each strap being provided at their upper ends respectively with outwardly-bent flanges which are welded or otherwise fixedly secured to the underside of the head-plate 11 of the bulkhead. Supported within each U-shaped bracket is a bushing 21 which is secured therein against both vertical and transverse movements by means of a fastening-pin 22 or the like, the internal diameter of each bushing being such as to rotatably support the corresponding end of the shaft 19 therein. As shown in Fig. 3, each end of the shaft projects laterally beyond its respective bushing, and one end is milled or otherwise formed to provide a portion of non-circular cross-section, in this instance a squared head 23 for applying a wrench thereto and rotating the shaft in the bushed brackets 20—20, as and for the purpose hereinafter described.

Referring again to Fig. 3, the length of each bushing 21 exceeds the width of its corresponding bracket 20, the inner end of each bushing being adapted thus to form a fixed abutment against which the outer face of the apertured end of the corresponding hinge-arm engages to preclude transverse movement of the cover relative to the shaft. A third bracket 24 is similarly secured beneath the head-plate 11 of the bulk-

head substantially intermediate the bushed brackets **20—20**, the intermediate bracket **24** being adapted to rotatably support the intermediate portion of the shaft.

The resilient portion of the cover-supporting means of this invention for holding the cover open and assisting in raising the cover from its closed position, comprises the following associated elements.

Mounted on the shaft **19** are two torsion coil springs **25—25**, each spring being engaged between the center bracket **24** of the shaft and one of the hinge-arms **16** of the cover, the inner end of each spring, that is to say, the end thereof which is adjacent the center bracket **24**, being anchored thereto by engagement in a transverse aperture **26** thereof. The opposite or outer end of each spring is adapted to be anchored to the shaft **19** for rotation therewith. To this end, spring-anchoring means comprising, in the instance shown, substantially disk-shaped plates **27—27**, are mounted on opposite ends respectively of the shaft substantially concentrically thereto and in juxtaposition to the inner faces respectively of the corresponding hinge-arms of the cover, each spring-anchoring disk being fixedly secured on the shaft by a welded joint or equivalent fastening-means. Extending through each spring-anchoring disk is a plurality of adjusting-apertures **28** arranged circumferentially and in substantially equally-spaced relationship therearound, the axes of the adjusting-apertures **28** being substantially parallel to the longitudinal axis of the shaft **19**. One of these adjusting-apertures of each spring-anchoring disk is adapted to receive the other end of the corresponding torsion coil spring **25**, thereby to anchor the spring thereto so that the torsion spring will be tightened and loosened respectively upon rotation of the shaft, as and for the purpose hereinafter described.

The circumferentially-arranged adjusting-apertures **28** of the spring-anchoring disks **27—27** are adapted also to accommodate a locking-pin or -bolt **29** which is adapted to extend through a selected one of the adjusting-apertures **28** and to engage in an axially aligned aperture **30** provided in the adjacent end of the juxtaposed hinge-arm of the cover to lock the hinge-arm to the spring-anchoring plate for rotation therewith about the shaft **19**. The aforesaid adjusting apertures in discs **27** and the cooperating aperture in hinge-arms **16** also serve to permit a pre-load to be applied to the torsion coil springs when an installation is made in order that there shall always be at least some force acting upon the door or cover tending to swing it towards an open position. This point will be discussed in further detail hereinafter.

Pursuant to the objects of the invention, the two torsion coil springs **25—25** are wound in opposite directions so that upon rotation of the shaft both springs will be simultaneously wound or unwound, respectively, depending upon the direction of rotation of the shaft. Moreover, by way of example, the torsion springs are formed of substantially $\frac{3}{16}$-inch wire, the outside diameter of each torsion spring being substantially 1½ inches and its inside diameter substantially 1⅛ inches, whereby each spring may be mounted on the shaft **17** which, in the embodiment shown herein, is preferably substantially ⅞ inch in diameter. It will be understood, however, that these specific dimensions are given merely by way of illustrating a satisfactory embodiment of the invention and that the spring specifications may vary depending upon the composition of material of the springs and the weight of the cover.

As set forth at the outset, the resilient portion of the supporting-means of the cover is adapted to hold the cover in its open position and for this purpose such means is assembled to the cover under a pre-load. That is, the torsion springs **25—25** are under some load even when the cover is in its open position. Furthermore, the torsion springs **25—25** are adapted to be wound-up or tightened to a maximum degree when the bulkhead cover is in its normal or closed position, and in a direction such that the torque forces of the torsion springs will act to swing the cover upwardly, and thus assist in raising the cover from its closed position. However, the moment force created by the weight of the cover in its closed position, times its effective distance from the shaft **19**, is greater than the combined torque forces of the torsion springs **25—25** and acts in a direction opposed thereto, and hence holds the cover in its closed position. The difference between these respective forces is, however, small enough so that only relatively little manual effort is required to swing the cover upwardly from its closed position.

Then as the cover is swung upwardly manually, the counterclockwise rotation of the hinge-arms **16—16** causes the shaft **19** and the spring-anchoring disks **27—27** to rotate in a similar direction, thereby unwinding the torsion springs and lessening the torque forces tending to raise the cover. However, since the force-moment of weight of the cover times its effective distance to the shaft decreases as the cover is swung upwardly, a point will be reached at which the sum of the torque forces of the torsion springs which tends to raise the cover, will exceed the force-moment tending to close the cover, and hence the partially-unwound torsion springs will hold the cover in its open position.

To close the cover, it is only necessary to grasp the forward edge thereof and pull the cover down initially with sufficient force to overcome the torque forces of the springs, after which the force-moment of the weight of the cover exceeds the combined torque forces of the springs, even though these torque forces increase as the cover is closed, whereupon the cover is positively held in its closed position.

The aforesaid locking-pin **29** of each spring-anchoring plate constitutes adjusting-means for adjusting the torque forces of the springs. Thus, on installing the cover in a bulkhead, the spring-anchoring disks are disconnected from the hinge-arms by removing the locking-pins **29** therefrom, whereupon a wrench or other lever is temporarily applied to the head **23** of the shaft to rotate the latter in a direction to tighten the coil springs and to impart the aforesaid pre-load thereto. As the shaft rotates, the spring-anchoring disks fastened thereto are similarly rotated, whereby the circumferential apertures thereof are successively moved into register with the locking-pin aperture in the adjacent end of the corresponding hinge-arm. After the shaft has been rotated sufficiently to develop the required pre-load torque in each of the torsion springs, the locking-pins are engaged in the axially-aligned adjusting-apertures and locking-pin apertures of the spring-anchoring disks and the hinge-arms respectively, to lock the disks thereto for transmitting the torque forces of the springs to the

hinge-arms of the cover. In like manner, adjustments may be made in the springs to compensate for variations in spring structure and cover weights and to insure that the cover will be held open by the torque forces of the torsion springs against inadvertently closing when struck by a gust of wind or the like.

The construction taught by this invention by which adjustment of the torsion springs is effected is thus characterized by its simplicity and durability, as well as by the ease of compensating for variations in spring structure and cover weights.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respect as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. A hinge structure to a door or other cover adapted to be swung between open and closed positions, which structure comprises: a shaft; a pair of supporting brackets; journal means carried by said brackets for rotatably supporting said shaft; a circumferential flange fast with said shaft and having its plane disposed substantially perpendicularly to the axis of the shaft, said flange being provided with a plurality of holes extending in an axial direction therethrough and spaced circumferentially about said shaft, a spring helically coiled about said shaft, one end of said spring being adapted to be secured to a stationary member to prevent unrestrained rotation of said spring with said shaft, the other end of said spring being secured to said flange to effect the winding and unwinding of said spring with rotation of said shaft; a hinge arm having an aperture at one of its ends within which said shaft is rotatably received, said arm having means at its opposite end for engaging a cover whereby as the latter is swung between its open and closed positions said arm is pivoted about the axis of said shaft; said arm being positioned on said shaft adjacent said flange and having an aperture adapted and arranged to move into register with successive holes in said flange upon relative rotational movement between said arm and flange; and a locking pin passing through the aperture in said arm and into a registering hole in said flange to prevent such relative rotational movement, whereby said torsion spring is arranged normally to exert a relatively large force on said cover in a direction tending to raise the latter when in its closed position and to exert a lesser force thereon tending to hold it open once said cover has been moved to its open position.

2. A hinge structure as defined in claim 1, wherein said shaft is provided with a portion of non-circular cross section adapted and arranged to receive in interlocking engagement a lever which may be temporarily attached thereto to effect rotation of said shaft and flange whereby, when said locking pin is removed, said shaft and flange may be rotated by said lever independently of said hinge arm to impose a desired preload upon said spring so that when said locking pin is reinserted to interlock said flange and arm against relative rotational movement, said spring normally exerts a force on said cover in a direction tending to raise the latter when it is in its closed position and to exert a lesser force thereon tending to hold it open once it has been moved to this latter position.

3. A hinge structure as defined in claim 2, wherein said portion of non-circular cross section of said shaft projects axially beyond one of said supporting brackets and is formed to provide a squared head.

4. A hinge structure for a door or other cover adapted to be swung between open and closed positions, which structure comprises: a shaft; a pair of supporting brackets located adjacent the ends of said shaft and a third bracket interposed between said pair; journal means carried by said brackets for rotatably supporting said shaft; a pair of circumferential flanges fast with said shaft and in axially spaced apart relation thereon on opposite sides of said third bracket, the planes of the respective flanges being disposed substantially perpendicular to the axis of said shaft, and being provided with a plurality of holes extending in an axial direction therethrough and spaced circumferentially about said shaft; a pair of torsion springs helically coiled in opposite directions about said shaft, one end of each of said coils being secured to said third supporting bracket, the opposite end of each coil being secured to its respective flange whereby each of said springs is wound and unwound simultaneously with rotation of said shaft; a pair of hinge arms mounted on said shaft, one adjacent each flange, said arms adapted to be connected at their opposite ends, respectively, to a cover for supporting the latter and for imparting thereto a counter-balancing force exerted by said torsion springs upon said shaft; each of said arms having an aperture adapted and arranged to move into register with the successive holes in its respective flange upon relative rotational movement between them; and locking pins passing through the respective apertures in said arms and into a registering hole in said flanges, respectively, to prevent such relative rotational movement.

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