June 19, 1962 T. W. MILTON ETAL 3,039,133

MOTION TRANSMITTING MECHANISM

Filed Oct. 24, 1958 3 Sheets-Sheet 1

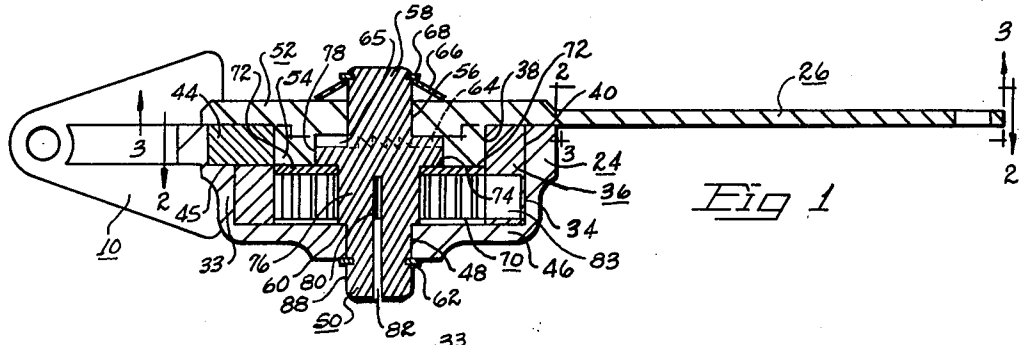


Fig 1

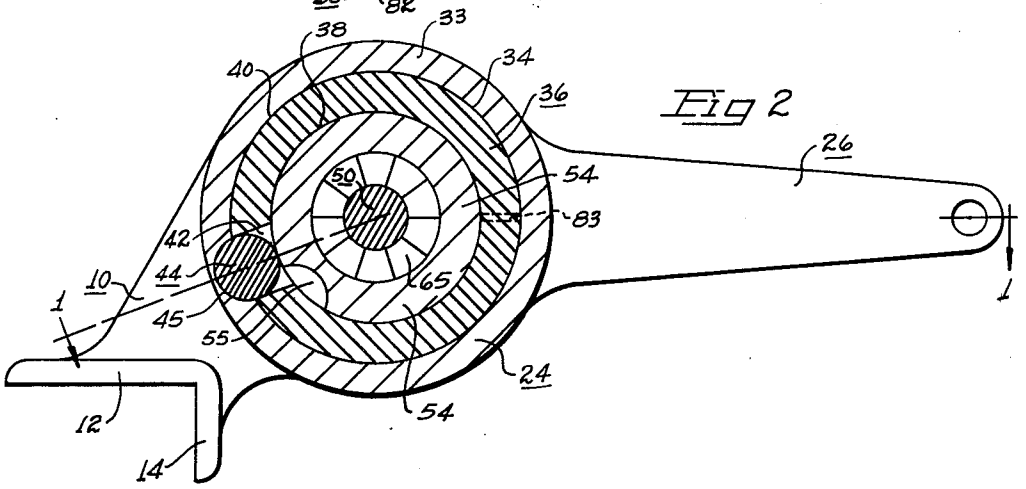


Fig 2

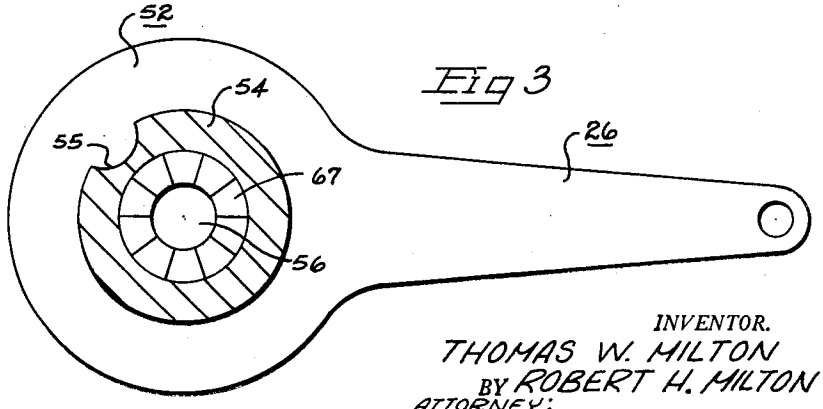


Fig 3

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MOTION TRANSMITTING MECHANISM

Filed Oct. 24, 1958 3 Sheets-Sheet 2

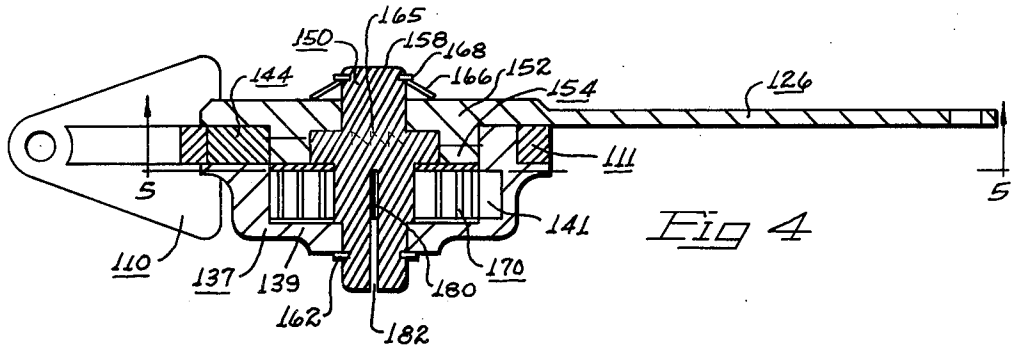


Fig 4

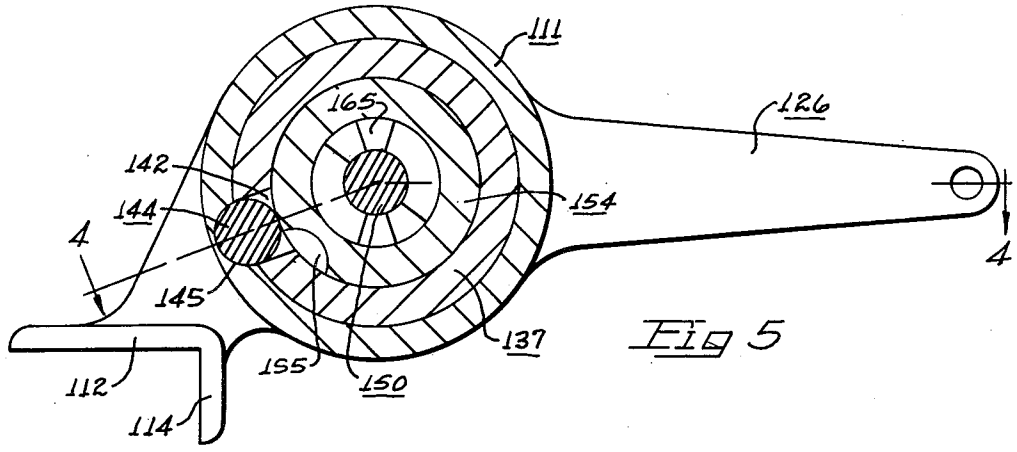


Fig 5

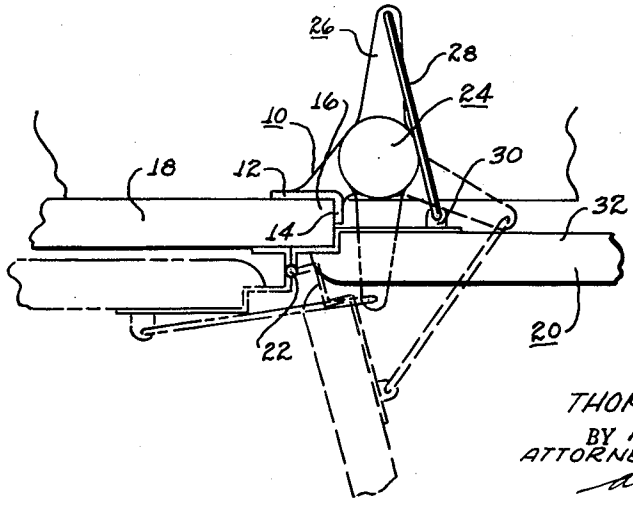


Fig 6

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MOTION TRANSMITTING MECHANISM

Filed Oct. 24, 1958 3 Sheets-Sheet 3

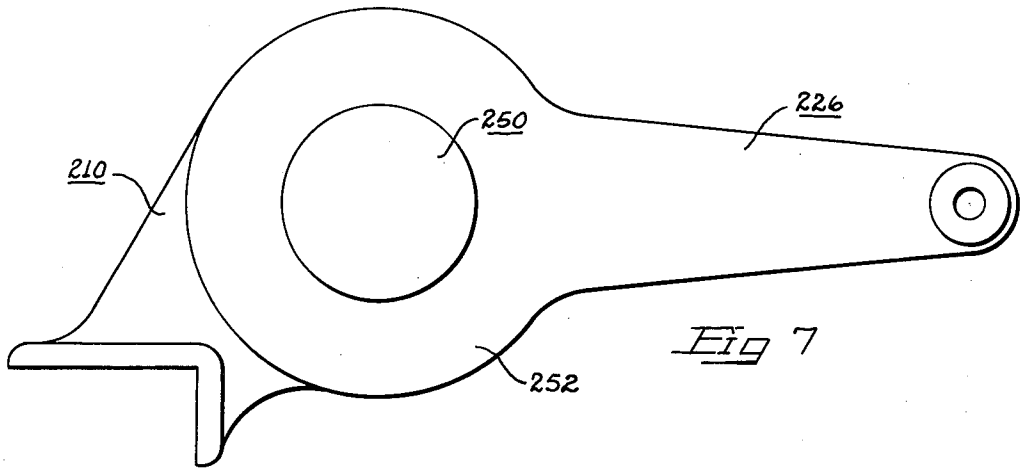


Fig 7

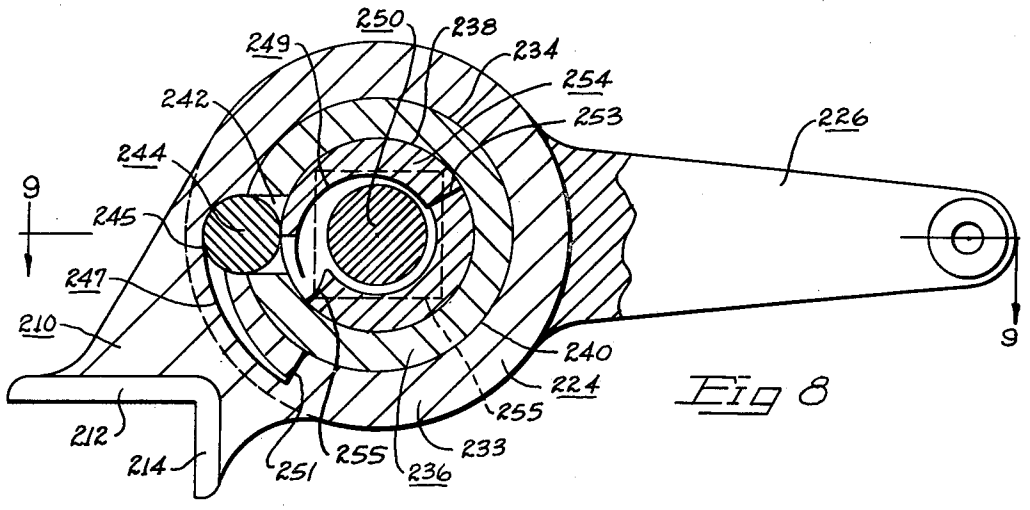
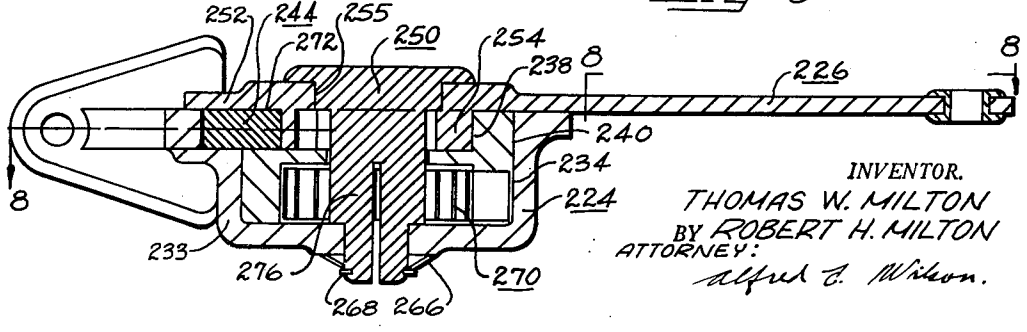


Fig 8

Fig 9



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United States Patent Office

3,039,133

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MOTION TRANSMITTING MECHANISM

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21 Claims. (Cl. 16—65)

This invention relates to a door controlling mechanism, and more particularly to a novel motion transmitting mechanism for urging the door toward the closed position when it is positioned between a predetermined angular open position and the closed position, and to permit the door to stand open when it is positioned in any angular position between said predetermined position and the fully opened position.

In door closing mechanisms, particularly as applied to closet doors, it is desirable that, when moved in the opening direction beyond a predetermined angular position the door stand open in any angular position to which it is moved. When the door is moved in the closing direction beyond the predetermined angular position it is desirable that the door be automatically moved to the fully closed position.

An object of our invention is to provide an improved door controller wherein when the door is moved beyond a predetermined angular position in the door opening direction, the door remains open, and when moved in the closing direction beyond said predetermined angular position the force of a spring is applied through a linkage to urge the door to the fully closed position.

Another object of our invention resides in the development of a novel motion transmitting mechanism through with the force exerted by a spring may be exerted on a device to be actuated through a range of angular movement, and wherein the force exerted by the spring may be isolated from the device being actuated in another range of angular movement.

Our invention has desirable application as a cupboard door controller wherein air trapped within the cupboard induces a cushioning effect to slow down the closing of the door as it approaches the fully closed position, the air escaping around the edge of the door slowing down the closing movement to provide a substantially silent door closing action.

Yet a still further object of our invention resides in the development of a novel motion transmitting mechanism wherein a circumferentially directed force will be exerted on a circumferentially movable member to move it rotationally relative to another member through a predetermined range of circumferential movement, and wherein the circumferentially directed force will be isolated from the movable member when moved beyond a predetermined circumferential position relative to the other member.

A further object of our invention resides in the provision of a novel motion transmitting mechanism whereby force may be exerted between two members when they are disposed relative to each other in a predetermined range of angular movement, and whereby the transmission of the force between the members may be rendered inoperative when the members are moved angularly relative to each other beyond said predetermined angular range of movement.

Still another object of our invention is to provide an improved motion transmitting mechanism operable in a predetermined range of angular movement to provide a drive, and operable when moved beyond said predetermined range to render the drive inoperative.

Still another object of our invention is to provide an improved angular guiding mechanism which will provide a drive in one direction when operable in a predetermined range of angular movement and which will be operable to provide angular guidance when moved beyond said predetermined angular range, the one way drive being rendered inoperable in the angular range of movement beyond the predetermined angular position.

Other objects and advantages of our invention will be apparent from the following detailed description, considered in conjunction with accompanying drawings submitted for purposes of illustration only and not intended to define the scope of the invention, reference being had for that purpose to the subjoined claims.

In the drawings wherein similar reference characters refer to similar parts throughout the several views:

FIGURE 1 is a sectional view taken substantially on line 1—1 of FIG. 2 looking in the direction of the arrows and showing a motion transmitting device embodying our invention;

FIG. 2 is a sectional view taken substantially on line 2—2 of FIG. 1 looking in the direction of the arrows;

FIG. 3 is a sectional view on line 3—3 of FIG. 1 looking in the direction of the arrows;

FIG. 4 is a view similar to FIG. 1 illustrating a modified form of our invention;

FIG. 5 is a sectional view taken substantially on line 5—5 of FIG. 4 looking in the direction of the arrows;

FIG. 6 is an elevational view illustrating our improved motion transmitting device as applied to a door closing mechanism shown in three positions, a fully closed position shown in full lines, a fully opened position shown in dash-dot lines and in an intermediate position shown in dotted lines;

FIG. 7 is a plan view illustrating a still further modified form of our invention;

FIG. 8 is a sectional view taken substantially on line 8—8 of FIG. 9 looking in the direction of the arrows; and

FIG. 9 is a sectional view taken substantially on line 9—9 of FIG. 8 looking in the direction of the arrows.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

FIGS. 1 to 3 and 6 show one embodiment of our improved motion transmitting mechanism illustrated as applied to a door controlling device. As more clearly shown in FIG. 6, it will be noted that a mounting bracket 10 is provided with angularly related surfaces 12 and 14 adapted to be secured to an inner corner 16 of a wall 18 on which a door 20 is mounted as by hinges 22.

The bracket 10 has integrally formed or otherwise secured thereon a casing 24 on which the hub of an arm 26 is journaled. The outer end of the arm 26 is pivotally connected through a link 28 to a bracket 30 secured to the inner face 32 of the door 20. It will be apparent that where the inner face 32 of the door 20 is aligned with the inner face of the wall 18 the angularly related surface 14 of the mounting bracket 10 may be dispensed with or it may be embedded to lie flush with the end of the wall 18.

The casing 24 has a cylindrical wall 33 defining a chamber 34 illustrated in FIGS. 1 and 2 to receive an angularly movable spring case 36. The spring case 36 is a hollow cylindrical ring having inner and outer diameters 38 and 40, and in its upper portion it is provided with a radial slot 42 as shown in FIGS. 1 and 2 adapted to receive a radially movable torque transmitting member 44, preferably in the form of a short cylinder. The casing 24

has an integral closure 46 provided with a centrally disposed aperture 48 in which a post 50 is journaled.

The arm 26 is provided with an enlarged circular hub portion providing a top closure 52 for the casing 24. A circular axially extending ridge 54 carried by the closure 52 is proportioned to be rotatably journaled within the inner diameter 38 of the spring casing 36.

The top closure member 52 at the upper end of the casing 24 is provided with a central aperture 56 through which the upper end 58 of the post 50 is journaled. It will be noted that the lower end of the post 50 is provided with a shoulder 60 to engage the inner surface of the bottom closure 46 of the casing 24, and that the post 50 is maintained in assembled relation in the casing 24 as by a snap ring 62 projecting into a groove in the post 50.

The upper portion of the post 50 is formed with a shoulder 64 having serrations or saw-tooth configurations 65 against which bear the inner oppositely serrated surfaces or saw-tooth configurations 67 of the circular closure member 52 carried by the arm 26 and defining the upper closure of the casing 24.

The closure member 52 is yieldingly maintained in assembled relation on the casing 24 by a spring such for example, as a Belleville type spring washer 66, held in place as by a snap ring 68 engaging in a groove formed in the upper end 58 of the central post 50.

A helical or clock-type spring 70 is positioned within the spring casing 36 and extends axially between the bottom closure 46 and a plate 72 extending radially between the post 50 and the spring case 36. The plate 72 may if desired be dispensed with, but if it is employed it engages a shoulder 74 formed on the post 50 between a section 76 of intermediate diameter and a section 78 of larger diameter thereof. The inner end 80 of the spring 70 projects into a slot 82 formed in the lower end of the post 50, and the outer end of the spring 70 is anchored in a slot 83 in the lower portion of the spring casing 36.

The central post 50 carries the saw-tooth configurations 65 on the upper surface of the shoulder 64 of the section of large diameter of the post. The reversely disposed saw-tooth configurations 67 shown in FIGS. 1 and 3 carried by the closure 52 of the arm 26 are adapted to engage the teeth 65 carried by the post 50 illustrated in FIG. 2 to permit winding up the clock-type spring 70 to vary the torsion exerted through the post 50, teeth 65 and 67, closure 52, arm 26, link 28 and bracket 30 to urge the door 20 toward the closed position. The slot 82 in the post 50 serves to receive the blade of a screw driver for the purpose of adjusting the tension of the spring 70 to increase or decrease the torsion urging the door toward the closed position.

When the door is closed, and until it reaches a predetermined degree of opening, the cylindrical torque transmitting member 44 is in the position shown in FIGS. 1 and 2, wherein more than half of the member 44 is positioned in the slot 42 formed in the spring case 36, and less than half of the torque transmitting member 44 is positioned in a pocket 45 formed in the upper portion of the wall 33 of the cylinder 34. The torque transmitting member 44 is maintained in this position by the outer periphery of the ridge 54. When the parts are in this relative position the spring case 36 is locked to the outer member or the outer wall 33 of the casing 24 and is thus secured against rotation. The outer end of the spring 70 is thus anchored and the spring exerts torsional force through the post 50, saw-tooth configurations 65 and 67, closure 52, arm 26 and the associated linkage to urge the door toward the closed position. When the arm 26 is rotated in the door-opening direction, torsional energy is imparted to or built up in the spring 70.

When the arm 26 reaches a predetermined position such, for example, as the position shown in dotted lines in FIG. 6, a pocket 55 formed in the outer periphery of the ridge 54 as shown in FIGS. 2 and 3 moves into registry with the slot 42 in the spring case 36 and since less than one-half of the diameter of the torque transmitting member 44 is positioned in the pocket 45 of the outer member, the torque transmitting member 44 is self-energized and moves radially inwardly toward the pocket 55 formed in the inner member or ridge 54.

As the rotation of arm 26 continues toward the fully open position as shown in dash-dot lines in FIG. 6, the torque transmitting member 44 is urged radially inwardly into the pocket 55 of the inner member. In this position the outer periphery of the spring case 36 is released from the outer wall 33 of the casing 24, and it is clamped at its inner periphery 38 by the torque transmitting member 44 to rotate with the ridge 54 and closure 52 and arm 26. Since both ends of the clock-type spring 70 are connected to the arm 26, no energy is transmitted by the spring as the arm 26 oscillates because the spring moves with the arm. The door 20 is therefore permitted to stand open in any position to which it is moved beyond the predetermined angular position shown in dotted lines in FIG. 6 as previously described.

When the arm 26 is moved in the door-closing direction this action is again reversed, because here again less than one-half of the diameter of the torque transmitting member 44 is positioned in the pocket 55 of the ridge 54 carried by the closure 52 and arm 26. Consequently, the torque transmitting member 44 is again self-energized, and when pocket 55 and slot 42 move into register with the pocket 45 in the outer member 33, the torque transmitting member 44 moves radially outwardly and is forced into the pocket 45 by the outer periphery of the ridge 54 as the arm 26 continues to rotate in the door-closing direction. When the member 44 is again partially positioned in the pocket 45 of the outer member, the spring case 36 is locked against rotation and energy which was built up in the spring 70 during the door-opening cycle is released and forces the door to close.

The alternative construction illustrated in FIGS. 4 and 5 is silimar in many respects to that disclosed in FIGS. 1 and 2. Corresponding parts have therefore been given corresponding reference numerals with the addition of 100. It will be noted that in this embodiment of our invention the casing of the embodiment illustrated in FIGS. 1 to 3 has been eliminated and that a ring 111 is secured to the angularly related surfaces 112 and 114 adapted to be secured to the member to which our improved device is secured to control the door. In this embodiment of our invention a spring case 137 having a bottom closure 139 engaging the pin 150 has a slot 141 to receive the end of the spring 170 to yieldingly urge the central post 150 and the arm 126 to oscillate to move the door to the closed position when the cylindrical force transmitting member 144 is shifted radially outwardly to project into the pocket 145 formed in the ring 111, thereby locking the spring case 137 to the stationary ring 111 secured to the framework of the door when the door is in the range between the full and dotted line positions shown in FIG. 6. In this embodiment, as in the FIGS. 1 to 3 embodiment, when the door moves in the range beyond the dotted line position of FIG. 6, and up to the fully opened position shown in the dash-dot position, the cylindrical force transmitting member 144 shifts radially inwardly out of the pocket 145 in the ring 111 and into the pocket 155 in the ridge 154 carried by the closure 152 secured to the arm 126. The spring case 137 then moves with the ridge 154 of the closure 152 thereby isolating the force of the spring 150 from the door, thereby permitting the door to stand in any angular open position to which it is moved between the dotted line position and the fully open dash-dot line position of FIG. 6.

When the door is moved in the closing direction beyond the dotted line position, the reverse action takes place, the cylindrical force transmitting member 144 shifting radially outwardly to disengage the pocket 155 in the ridge 154 of the closure 152 and moving into the pocket

145 in the ring 111, thereby anchoring the outer end of the spring 170 and enabling it to exert its torsional force through the post 150 to urge the door toward the closed position shown in full lines in FIG. 6.

The embodiment of our invention illustrated in FIGS. 7 to 9 is also similar in many respects to that illustrated in FIGS. 1 to 3. Corresponding parts have therefore been given corresponding reference numerals with the addition of 200.

The pockets 245 and 255 formed respectively in the outer wall 233 of the casing 224, and in the ridge 254 of the closure 252 carried by the arm 226 extend to greater depths than in the embodiment of FIGS. 1 to 3. The force transmitting member 244 projects more than half of its diameter into the outer or inner pockets 245 or 255, thereby providing a stabilized construction where the member 244 will tend to remain in either position to which it is moved. The force transmitting member 244 will therefore not of its own volition spring out of the position to which it is urged when the other pocket aligns with it to permit radial movement of the member 244.

In this embodiment of our invention auxiliary leaf springs 247 and 249 have one of their ends 251 and 253 respectively extending radially into slots formed in the outer wall 233 and into the ridge 254 to anchor the springs thereby providing a fulcrum against which the springs 247 and 249 exert radially inward and outward forces on the force transmitting member 244 urging it in the opposite direction to which it is positioned. The member 244 thus reverses its position whenever the casing and closure members move to a predetermined position relative to each other. The spring casing 236 may thus be connected to the casing 224 to lock it against oscillation, thereby exerting the force of the spring 270 through the central post 250 to exert a yielding force on a member to be actuated. When the member 244 is engaged in the pocket 255 in the ridge 254 the spring case 236 is locked to rotate with the ridge 254, closure 252 and arm 226 whereupon no work is done by the spring 270 and therefore in that operative range no force will be exerted by the spring 270 on the arm 226.

As shown in dotted lines 255 in FIG. 8 and in full lines in FIG. 9, the central post 250 has a non-round configuration which fits into a correspondingly apertured configuration in the arm 226 to secure the post 250 to the arm 226. It will be noted that the opposite end of the post 250 is provided with a Belleville spring washer to permit axial shifting of the post to effect the adjustment of the tension of the spring 270.

We claim:

1. A motion transmitting device comprising three concentrically disposed inner, intermediate and outer members, the intermediate member being radially slotted and the inner and outer members having confronting radially extending restricted pockets, a spring interposed between the intermediate and inner members and adapted to be tensioned by relative rotation thereof, and a radially movable member having a rounded configuration positioned in the intermediate member and selectively movable radially relative to the common axis of said concentrically disposed members to selectively project into the pocket of one of the inner and outer members to selectively connect the intermediate member to one of the inner and outer members.

2. The invention defined in claim 1 wherein the radially movable member is positioned in the slot formed in the intermediate member and extends longitudinally relative to the axis of the concentrically disposed members and is selectively movable radially in opposite directions into the pockets formed in the outer member and in the inner member.

3. The invention defined in claim 2 wherein one of the inner and outer members is adapted to be connected to a device to be actuated and the other of said members is non-rotatably supported.

4. The invention defined in claim 3 wherein the device to be actuated is connected to the inner member and the outer member is non-rotatably supported.

5. The invention defined in claim 4 wherein the device to be actuated is a hinged door and linkage means connecting the door to the inner member.

6. In a motion transmitting device, the combination of three concentrically disposed inner, intermediate and outer relatively movable members, the intermediate member and the inner and outer members being contoured to provide contoured pockets, a spring interposed between two of said members and adapted to be tensioned by relative rotation thereof, means to non-rotatably support one of said members, and a radially movable member positioned in the pocket of said intermediate member and selectively movable radially relative to the common axis of said concentrically disposed members to engage one of the other pockets and connect the intermediate member to the inner member and to the outer member.

7. The invention defined in claim 6 wherein the pocket of the intermediate member wherein the radially movable member is positioned constitutes a slot formed in the intermediate member, the slot extending radially relative to the axis of the concentrically disposed members, said radially movable member being selectively movable radially in opposite directions into the pockets formed in the outer member and in the inner member.

8. The invention defined in claim 7 wherein the device to be actuated is a hinged door, and linkage means connecting the door to the inner member.

9. A motion transmitting mechanism comprising three concentrically disposed inner, intermediate and outer members, bracket means to non-rotatably support the outer of said members against rotation relative to the inner member, a movable connecting member associated with the intermediate member and adapted upon radial movement relative to the common axis of said concentric members to selectively connect the intermediate member with the inner member and with the outer member, a device to be actuated, connecting means between the device to be actuated and the inner member, and a spring interposed between the inner and the intermediate members whereby the spring is tensioned when the connecting member interconnects the intermediate and the outer members and the force exerted by the spring is isolated from the device to be actuated when the connecting member interconnects the intermediate and the inner members.

10. The invention defined in claim 9 wherein the device to be actuated is a hinged door, and linkage means connecting the door to the inner member.

11. A motion transmitting member comprising three concentrically disposed inner, intermediate and outer members, means to non-rotatably support the outer member relative to the inner member, a spring interposed between the inner and the intermediate members and adapted to be tensioned by relative rotation thereof, ratchet means between said inner and intermediate members to control the force exerted by the spring between said members, a movable member carried by the intermediate member and operable upon movement radially outwardly from a neutral position to engage the intermediate member with the outer member to lock the intermediate member against rotation with the outer member thereby exerting the torsional force of the spring on the inner member, the movable member carried by the intermediate member being operable upon movement radially inwardly from the neutral position to lock the intermediate member with the inner member to isolate the force of the spring from the inner member, and an arm connected to the inner member.

12. The invention defined in claim 11 wherein more than half of the radially movable member is at all times positioned in the intermediate member to provide a self-energizing action of the force transmitting member.

13. The invention defined in claim 11 wherein a portion of the radially movable member is positioned in the

intermediate member to exert a force urging the radially movable member toward the neutral position, and spring means carried by the inner and outer members yieldingly urging the radially movable member toward the neutral position.

14. A motion transmitting device comprising three concentrically disposed inner, intermediate and outer members, means to non-rotatably support the outer member relative to the inner member, a spring interposed between the intermediate and inner members and adapted to be tensioned by relative rotation thereof, and a radially movable member carried by the intermediate member and selectively projectable into the outer member to secure the intermediate member against rotation, and projectable into the inner member to induce the intermediate member to rotate with the inner member.

15. The invention defined in claim 14 wherein a radially extending groove is formed in the intermediate member and spaced pockets formed in the inner periphery of the outer member and in the outer periphery of the inner member align with the radially extending groove when said members are moved to a predetermined angular relation relative to each other for the reception of the radially movable member.

16. The invention defined in claim 15 wherein less than one-half of the radially movable member is positioned in the pocket formed in the outer member to exert a self-energizing force on the radially movable member when the inner, intermediate and outer members are relatively moved in one direction to a predetermined angular relation relative to each other.

17. The invention defined in claim 16 wherein less than one-half of the radially movable member is positioned in the pocket formed in the inner member to exert a self-energizing force on the radially movable member when the inner, intermediate and outer members are relatively moved in an opposite direction to a predetermined angular relation relative to each other.

18. A motion transmitting device comprising three concentrically disposed inner, intermediate and outer members, means to non-rotatably support one of said members, a spring interposed between the intermediate and the inner member and adapted to be tensioned by the relative movement thereof, and a radially movable member positioned in the intermediate member and selectively projectable into the non-rotatably supported member to secure the intermediate member against rotation, and projectable into the other of said members to induce the intermediate member to rotate with said member.

19. The invention defined in claim 18 wherein a radially extending groove is formed in the intermediate member and spaced pockets formed in the inner periphery of the outer member and in the outer periphery of the inner member align with the radially extending groove when said members are relatively moved to a predetermined angular relation relative to each other.

20. The invention defined in claim 19 wherein less than one-half of the radially movable member is positioned in the pocket formed in one of the outer and inner members to exert a self-energizing force on the radially movable member when the inner, intermediate and outer members are relatively moved in one direction to a predetermined angular relation relative to each other.

21. The invention defined in claim 20 wherein less than one-half of the radially movable member is positioned in the pockets formed in the outer and inner members to exert a self-energizing force on the radially movable member when the inner, intermediate and outer members are relatively moved in opposite directions to a predetermined angular relation relative to each other.

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