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DIGESTER CAP ASSEMBLY WITH SLIDING CAP

Filed Nov. 27, 1961

2 Sheets-Sheet 1

FIG. 1

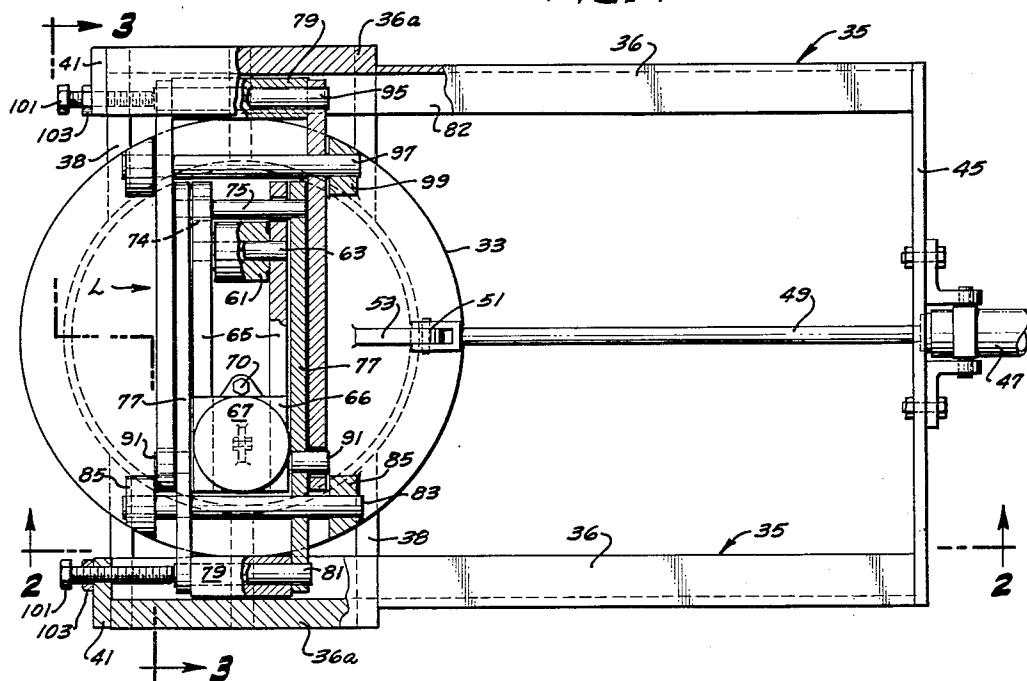
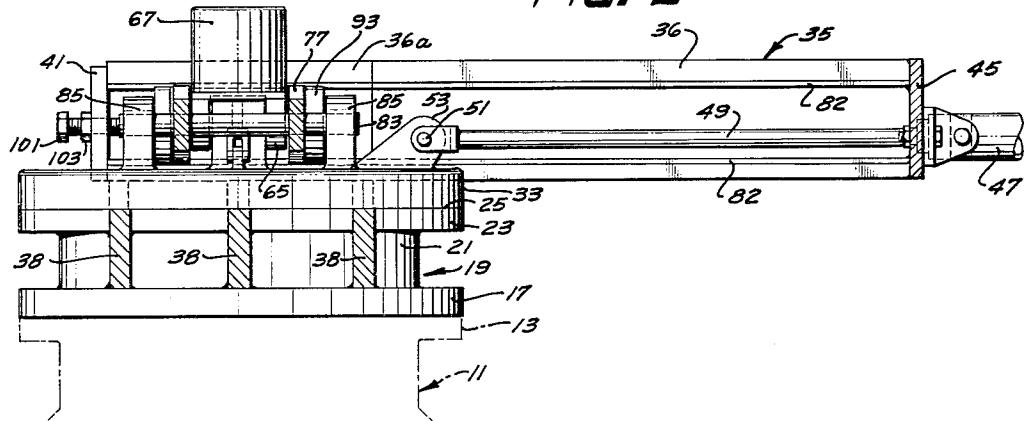


FIG. 2



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## DIGESTER CAP ASSEMBLY WITH SLIDING CAP

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2 Sheets-Sheet 2

FIG. 3

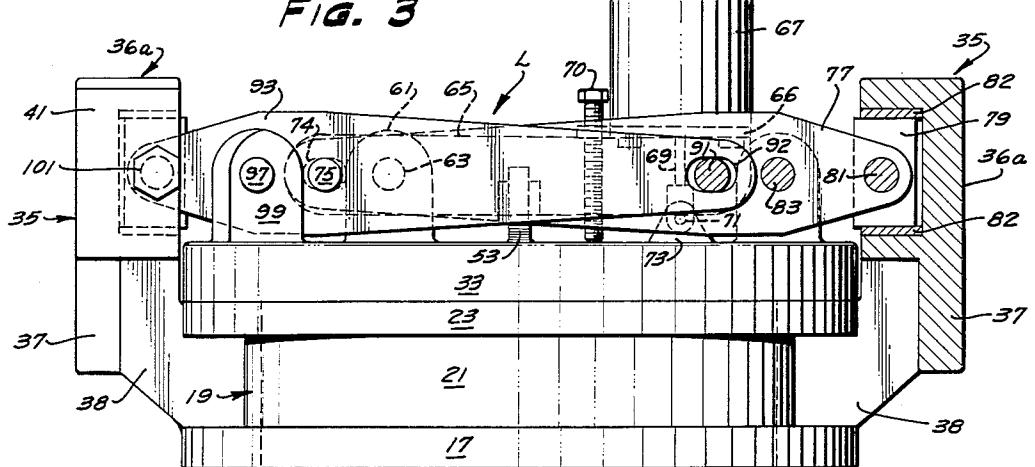
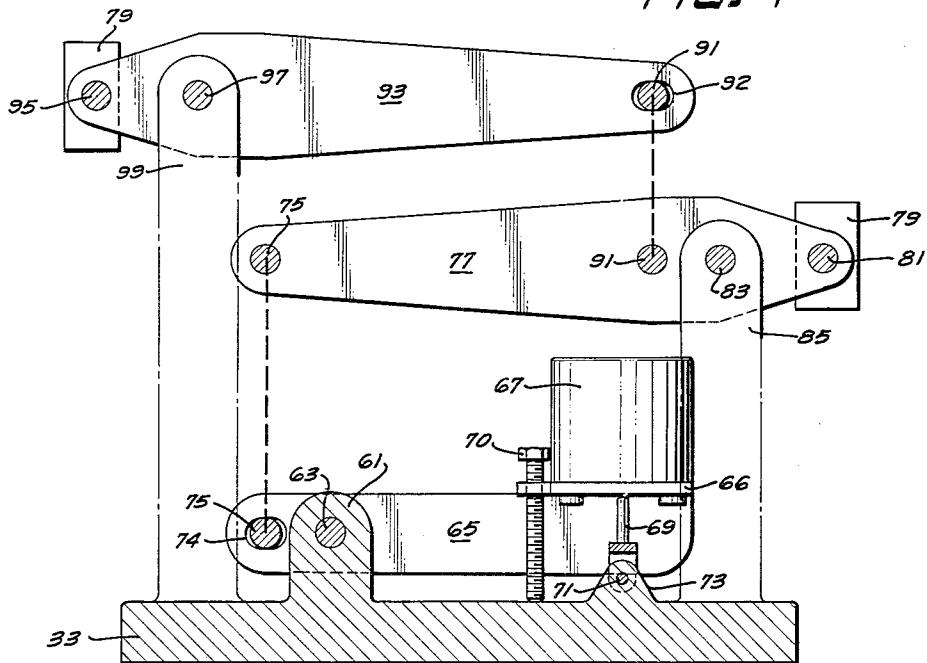


FIG. 4



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**DIGESTER CAP ASSEMBLY WITH SLIDING CAP**  
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10 Claims. (Cl. 268—50)

This invention relates to a digester cap assembly. Prior digester cap assemblies have been defective in several respects. The multiple swing bolt type is not only expensive but requires considerable time to open and close. The type having a simple latch to clamp a hinged cap closed has not proved satisfactory in high pressure installations because the clamping pressure is applied only at one, or at most, two places. Hence leakage sometimes occurs.

It is a main object of the present invention to provide a digester cap assembly overcoming the above objections, and particularly to provide a digester cap assembly in which an effective clamping force is distributed over the cap.

A more specific object of the invention is to provide a cap assembly in which a cap is slideable back and forth from its closed position, and in which there is a mechanism for forcing the cap against its seat in the closed position of the cap.

A further object of the invention is to provide an arrangement as just described having a novel relationship of the mechanism and the mounting arrangement for the cap.

Various other objects of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

FIG. 1 is a plan view of an assembly embodying the concepts of the present invention, parts being broken away for convenience in illustration;

FIG. 2 is a vertical section taken along line 2—2 of FIG. 1;

FIG. 3 is a view of the end of the assembly adjacent the arrows 3—3 of FIG. 1, parts being broken away for convenience in illustration; and

FIG. 4 is a diagrammatic side elevation view showing part of the lever system of the invention.

Referring to FIG. 2, the numeral 11 indicates diagrammatically a conventional digester vessel having a flange 13 defining a mouth through which material is dumped into the vessel. This flange is most frequently formed with peripheral slots to receive swing bolts of a cap. In the present construction, the slots receive bolts (not shown) which secure a lower flange 17 of an adapter, generally entitled 19, to the flange 13 in register therewith. The adapter includes a riser or tubular member 21 having the flange 17 at its lower end and having at its upper end an upper flange 23 machined to form a seat 25 for a circular cap 33. The cap may also be considered as a cover or closure member.

The cap 33 is connected to a linkage system L (FIG. 1) which is to be described in detail presently and which is slidably supported by a pair of guides 35 (FIGS. 1 and 3) in the form of channel members. The channel members 35 include channel pieces 36 permanently secured to pieces 36a of F shape (FIG. 3) in cross section. The pieces 36a provide extensions of the grooves of the pieces 36 and in addition have depending portions 37 secured to bracket arms 38 which fit between and are secured to the flanges 17 and 23. End pieces 41 (FIG. 3) close one set of ends of the channel members 35 and will be mentioned further hereinafter.

The outboard ends of the channel members 35 are connected by a cross-piece 45 (FIG. 1) which pivotally supports a double acting hydraulic piston and cylinder actuator 47. The actuator has a piston rod 49 pivotally con-

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nected at 51 to a lug 53 which is fixedly secured to, or formed integrally with, the cap 33 near an edge of the cap.

When the actuator 47 is energized one way, the cap 33 will be pulled out of register with the digester vessel, and when energized the opposite way, the cap will be moved back to a position in register with the digester vessel.

The relationship of the various parts of the linkage system L is best shown diagrammatically in FIG. 4, but reference to the other figures will be made to illustrate the actual, as contrasted to diagrammatic, form of the parts. Referring to FIG. 1, the cap 33 has an eye 61 pivotally receiving a fulcrum shaft 63 the ends of which extend through and are pinned to a pair of spaced inner levers 65 at places intermediate the ends of the inner levers. The ends of the levers 65 most remote from the fulcrum shaft 63 are fixedly joined by a base plate 66 to which the cylinder of a piston and cylinder type actuator 67 is secured. The actuator has a piston rod 69 (FIG. 3) pivotally connected at 71 to a lug 73 on the cap 33. A safety stop bolt 70 (FIG. 3) threadedly extends through the plate 66 to limit the movement of the actuator toward the cap. The opposite ends of the levers 65 have horizontally oversize slots 74 (FIGS. 1 and 4) receiving a pivot shaft 75 which extends through and is pinned to the adjacent ends of a pair of intermediate levers 77 straddling the inner levers 65. The other ends of the levers 77 embrace a slide 79 and receive the ends of a fulcrum shaft 81 (FIG. 3) which projects through the slide and levers and is pinned to the latter. Wear strips 82 (FIG. 3) are preferably secured to the inner horizontal faces of the channel members 35 in positions next to the upper and lower inner faces of the slide 79.

A pivot shaft 83 (FIG. 1) extends through and is pinned to the levers 77 at a place between the actuator 67 and the shaft 81. The ends of the shaft 83 are pivotally received by a pair of standards 85 which are fixedly secured to or integrally formed with the cap 33.

Inwardly of the shaft 83, that is inwardly toward the axis of the cap, there is a pair of pivot shafts 91 pinned to the levers 77 and received by horizontally oversize slots 92 formed in one set of ends of a pair of outer levers 93 which straddle the intermediate levers 77. The opposite ends of the levers 93 receive and are pinned to a fulcrum shaft 95 which is pivotally received by a second slide, also numbered 79, disposed in the associated guide 35. Just inwardly of the fulcrum shaft 95 is a pivot shaft 97 which extends through and is pinned to the levers 93 and is pivotally received by a pair of standards 99 disposed in flanking relation to the levers 93 and fixedly secured or integrally formed with the cap 33.

Referring again to FIG. 1, a pair of stop bolts 101, threadedly pass through the end pieces 41 and act as adjustable stops to ensure register of the cap 33 when it is returned from its inoperative position to its operative position. Jam nuts 103 on the bolts hold them in desired positions of adjustment.

Flexible conduits (not shown) are provided to allow the cap and its actuator to move back and forth relative to a stationary control valve (not shown). Referring to FIG. 4, after the cap is returned to its operative position over the flange 23, the actuator 67 is energized in a manner to extend the same. Extension of the actuator 67 tends to lower the left hand ends of the inner levers as the parts are shown in FIG. 4, the fulcrum shaft 63 under this condition acts as the fulcrum of a first class lever system. Lowering of the left hand end of the levers 65 tends to lower the left hand ends of the intermediate lever 77. Since the fulcrum shaft 81 is bodily stationary, this means that a downward force is exerted by means of the pivot shaft 83 on the standards 85 and a downward force is exerted on the right hand ends of the levers 93 through

the medium of the pivot shafts 91. A downward force exerted on the right hand ends of the levers 93 will exert a downward force on the standards 99 through the medium of the pivot shaft 97, with the levers 93 acting and the levers 77 acting as second class levers. There is thus created downward forces on the standards 99, the standards 85, and the hydraulic actuator 67, and because of the resistance of upward movement of the left hand ends of the lever 77, downward pressure is created on the eye 61. With the specific spacing of the standards on the cap shown, there are provided seven spaced points of downward pressure distributed over the upper surface of the cap 33.

To release the cap from its tight position against the flange 23, the control valve is actuated to contract the actuator 67. This tends to raise the left hand ends of the inner lever 65, this action tending to raise the left hand ends of the intermediate lever 77. This creates an upward force on the standards 85 and also an upward force on the right hand ends of the levers 93 through the medium of the pivot pins 91. Upward forces on the right hand ends of the outer levers 93 create an upward force on the standards 99. The total result is that the cap is lifted sufficiently to allow it to be slid or moved to an inoperative position.

The particular seal to be employed between the cap 33 and the flange 23 has not been as yet described, and as a matter of fact, it could be of any particular form. For instance, it could be an O ring recessed in the surface of the cap, or even an O ring recessed in the upper surface of the flange 23. Or, it could be a gasket strip carried by either flange or cap or merely disposed between the two. In any event, when reference in the claims is made to the cap seating on its seat, the seat is to be considered as the fixed structure against which the cap is pressed. If a gasket happens to be secured against the upper surface of the flange, the seat would be the flange and its gasket. If the flange does not have a gasket, the surface of the flange is considered as the seat. If the flange has one or more O rings, the flange surface and the O rings are considered as a seat.

While it has not been mentioned that there are wear strips for the other slide 79, the associated guide does have wear strips.

Having described the invention in what is considered to be the preferred embodiment thereof, it is desired that it be understood that the invention is not to be limited other than by the provisions of the following claims.

I claim:

1. A closure assembly for the mouth of a pressure vessel, comprising
  - a pair of parallel spaced straight guides located one on either side of said mouth with the axis of said mouth being located within the longitudinal confines of said guides and perpendicular to the plane of said guides,
  - a pair of slides, one for each of said guides and slideable along said guides,
  - a cover for said seat,
  - means mounting said cover on said slides with the axis of said cover parallel to the axis of said vessel mouth,
  - said mounting means supporting said cover for movement in a direction parallel to its axis to effect seating of said cover on said mouth,
  - said mounting means including a pair of levers, one for each slide,
  - each lever being connected to its slide for pivotal movement about an axis parallel to said guides,
  - said levers also being pivotally connected to said cover, and means interconnecting said levers to effect movement of said levers relative to one another to cause seating and unseating of said cover.
2. A closure assembly for the mouth of a pressure vessel, comprising
  - a pair of parallel spaced straight guides located one

on either side of said mouth with the axis of said mouth being located within the longitudinal confines of said guides and perpendicular to the plane of said guides,

a pair of slides, one for each of said guides and slideable along said guides,

a cover for said seat,

means mounting said cover on said slides with the axis of said cover parallel to the axis of said vessel mouth, said mounting means supporting said cover for movement in a direction parallel to its axis to effect seating of said cover on said mouth,

said mounting means including a pair of levers, one for each slide,

each lever being connected at one end to its slide for pivotal movement about an axis parallel to said guides,

said levers also being pivotally connected at places intermediate the ends thereof to said cover,

and means interconnecting the remaining ends of said levers and said cover to effect movement of said levers relative to one another to cause seating and unseating of said cover.

3. A pressure vessel closure assembly for a seat of a pressure vessel, comprising

a closure member for seating on said seat, closure member moving means for moving said closure member toward and away from said seat, said means comprising

a pair of levers pivotally mounted at certain ends thereof,

means pivotally connecting said levers to said cover at places intermediate the lengths of said levers, and means connecting the remaining end of one lever

to an intermediate portion of the other lever and connecting the remaining end of said other lever to said cover to actuate said levers to move said closure member toward and away from said seat.

4. A closure assembly for a mouth to be closed comprising,

guide means including a pair of parallel spaced straight guides located one on either side of said mouth with the axis of said mouth being located within the longitudinal confines of said guides and perpendicular to the plane of said guides,

a pair of slides, one for each of said guides and slideable along said guides,

a closure member for said seat,

means mounting said closure member on said slides with the axis of said closure member parallel to the axis of said vessel mouth,

said mounting means supporting said closure member for movement in a direction parallel to its axis to effect seating of said closure member on said mouth, said mounting means including a first pair of spaced parallel levers pivotally connected at one set of ends to one slide and a second pair of spaced parallel levers pivotally connected at one set of ends to said other slide,

said second pair of levers being disposed between the levers of said first pair,

all the above named levers extending at right angles to said guide means,

said closure member having a first pair of spaced fixed elements directly pivotally connected to said first levers at places intermediate the length of said first levers,

said closure member having a second pair of spaced fixed elements directly pivotally connected to said second levers at places intermediate the length of said second levers,

means pivotally connecting the free ends of one pair of levers to the other pair of levers at a place which is intermediate the length of the latter and which

is spaced from the fixed elements associated with such other pair of levers, and actuating means connecting the free ends of said other pair of levers to said closure member for effecting movement of the just named free ends toward said closure member to effect bodily movement of said closure member one way, and for effecting movement of said just named free ends away from said closure member to effect bodily movement of said closure member the opposite way.

5. A closure assembly for a mouth to be closed comprising, guide means including a pair of parallel spaced straight guides located one on either side of said mouth with the axis of said mouth being located within the longitudinal confines of said guides and perpendicular to the plane of said guides, a pair of slides, one for each of said guides and slidable along said guides, a closure member for said seat, means mounting said closure member on said slides with the axis of said closure member parallel to the axis of said vessel mouth, said mounting means supporting said closure member for movement in a direction parallel to its axis to effect seating of said closure member on said mouth, said mounting means including a first pair of spaced parallel levers pivotally connected at one set of ends to one slide and a second pair of spaced parallel levers pivotally connected at one set of ends to said other slide, said second pair of levers being disposed between the levers of said first pair, all the above named levers extending at right angles to said guide means, said closure member having a first pair of spaced fixed elements directly pivotally connected to said first levers at places intermediate the length of said first levers, said closure member having a second pair of spaced fixed elements directly pivotally connected to said second levers at places intermediate the length of said second levers, means pivotally connecting the free ends of one pair of levers to the other pair of levers at a place which is intermediate the length of the latter and which is spaced from the fixed elements associated with such other pair of levers, and actuating means connecting the free ends of said other pair of levers to said closure member for effecting movement of the just named free ends toward said closure member to effect bodily movement of said closure member one way, and for effecting movement of said just named free ends away from said closure member to effect bodily movement of said closure member the opposite way,

said actuating means comprising a third pair of levers disposed between the levers of said second pair, said third levers being pivotally mounted intermediate the end thereof on said closure member, one set of ends of said third levers being connected to the free ends of said other pair of levers, and operating means interconnecting the remaining ends of said third levers to said closure member to effect movement of such remaining ends toward and away from said closure member and thereby effect bodily movement in opposite ways of said closure member.

6. A closure structure for an opening comprising, a closure member, guide means for guiding said closure member to and from a position in register with said opening, said guide means including a pair of spaced slides, mounting means mounting said closure member on said slides for movement relative thereto,

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said mounting means including a first pair of spaced parallel levers pivotally connected at one set of ends to one slide and a second pair of spaced parallel levers pivotally connected at one set of ends to said other slide, said second pair of levers being disposed between the levers of said first pair, all the above named levers extending at right angles to said guide means, said closure member having a first pair of spaced fixed elements directly pivotally connected to said first levers at places intermediate the length of said first levers, said closure member having a second pair of spaced fixed elements directly pivotally connected to said second levers at places intermediate the length of said second levers, means pivotally connecting the free ends of one pair of levers to the other pair of levers at a place which is intermediate the length of the latter and which is spaced from the fixed elements associated with such other pair of levers, and actuating means connecting the free ends of said other pair of levers to said closure member for effecting movement of the just named free ends toward said closure member to effect bodily movement of said closure member one way, and for effecting movement of said just named free ends away from said closure member to effect bodily movement of said closure member the opposite way.

7. A closure structure for an opening comprising, a closure member, guide means for guiding said closure member to and from a position in register with said opening, said guide means including a pair of spaced slides, mounting means mounting said closure member on said slides for movement relative thereto, said mounting means including a first pair of spaced parallel levers pivotally connected at one set of ends to one slide and a second pair of spaced parallel levers pivotally connected at one set of ends to said other slide, said second pair of levers being disposed between the levers of said first pair, all the above named levers extending at right angles to said guide means, said closure member having a first pair of spaced fixed elements directly pivotally connected to said first levers at places intermediate the length of said first levers, said closure member having a second pair of spaced fixed elements directly pivotally connected to said second levers at places intermediate the length of said second levers, means pivotally connecting the free ends of one pair of levers to the other pair of levers at a place which is intermediate the length of the latter and which is spaced from the fixed elements associated with such other pair of levers, and actuating means connecting the free ends of said other pair of levers to said closure member for effecting movement of the just named free ends toward said closure member to effect bodily movement of said closure member one way, and for effecting movement of said just named free ends away from said closure member to effect bodily movement of said closure member the opposite way,

said actuating means comprising a third pair of levers disposed between the levers of said second pair, said third levers being pivotally mounted intermediate the end thereof on said closure member, one set of ends of said third levers being connected to the free ends of said other pair of levers, and operating means interconnecting the remaining ends of said third levers to said closure member to effect movement of such remaining ends toward and away from said closure member and thereby effect bodily movement in opposite ways of said closure member.

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effect movement of such remaining ends toward and away from said closure member and thereby effect bodily movement in opposite ways of said closure member.

8. A closure structure for an opening comprising, a closure member, means for moving said closure member toward and away from said opening, said means including a first pair of spaced parallel levers pivotally mounted at one set of ends and a second pair of levers pivotally mounted at one set of ends at a place spaced from the place of mounting of said first levers, said second levers being disposed between said first levers, said closure member having a first pair of spaced fixed elements directly pivotally connected to said first levers at places intermediate the length of said first levers, said closure member having a second pair of spaced fixed elements directly pivotally connected to said second levers at places intermediate the length of said second levers, means pivotally connecting the free ends of one pair of levers to the other pair of levers at a place which is intermediate the length of the latter and which is spaced from the fixed elements associated with such other pair of levers, and actuating means connecting the free ends of said other pair of levers to said closure member for effecting movement of the just named free ends toward said closure member to effect bodily movement of said closure member one way, and for effecting movement of said just named free ends away from said closure member to effect bodily movement of said closure member the opposite way.

9. A closure structure for an opening comprising, a closure member, means for moving said closure member toward and away from said opening, said means including a first pair of spaced parallel levers pivotally mounted at one set of ends and a second pair of levers pivotally mounted at one set of ends at a place spaced from the place of mounting of said first levers, said second levers being disposed between said first levers, said closure member having a first pair of spaced fixed elements directly pivotally connected to said first levers at places intermediate the length of said first levers, said closure member having a second pair of spaced fixed elements directly pivotally connected to said second levers at places intermediate the length of said second levers,

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means pivotally connecting the free ends of one pair of levers to the other pair of levers at a place which is intermediate the length of the latter and which is spaced from the fixed elements associated with such other pair of levers, and actuating means connecting the free ends of said other pair of levers to said closure member for effecting movement of the just named free ends toward said closure member to effect bodily movement of said closure member one way, and for effecting movement of said just named free ends away from said closure member to effect bodily movement of said closure member the opposite way, said actuating means comprising, a third pair of levers disposed between the levers of said second pair, said third levers being pivotally mounted intermediate the end thereof on said closure member, one set of ends of said third levers being connected to the free ends of said other pair of levers, and operating means interconnecting the remaining ends of said third levers to said closure member to effect movement of such remaining ends toward and away from said closure member and thereby effect bodily movement in opposite ways of said closure member.

10. A closure structure for an opening comprising, a closure member, guide means for guiding said closure member to and from a position in register with said opening, said guide means including a pair of spaced slides, mounting means mounting said closure member on said slides for movement relative thereto, said mounting means including a lever for each slide, each lever being directly pivotally connected at one end to its slide, each lever being pivotally connected intermediate its ends directly to said closure member, and actuating means connecting the free end of one lever to an intermediate portion of the other lever and connecting the free end of said other lever to said closure member for effecting movement of the last named lever toward and away from said closure member to effect bodily movement of the latter.

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