Nov. 10, 1970 L. L. MILLER ETAL 3,538,641

TWO-WAY DRYER DOOR

Filed June 14, 1968 5 Sheets-Sheet 1

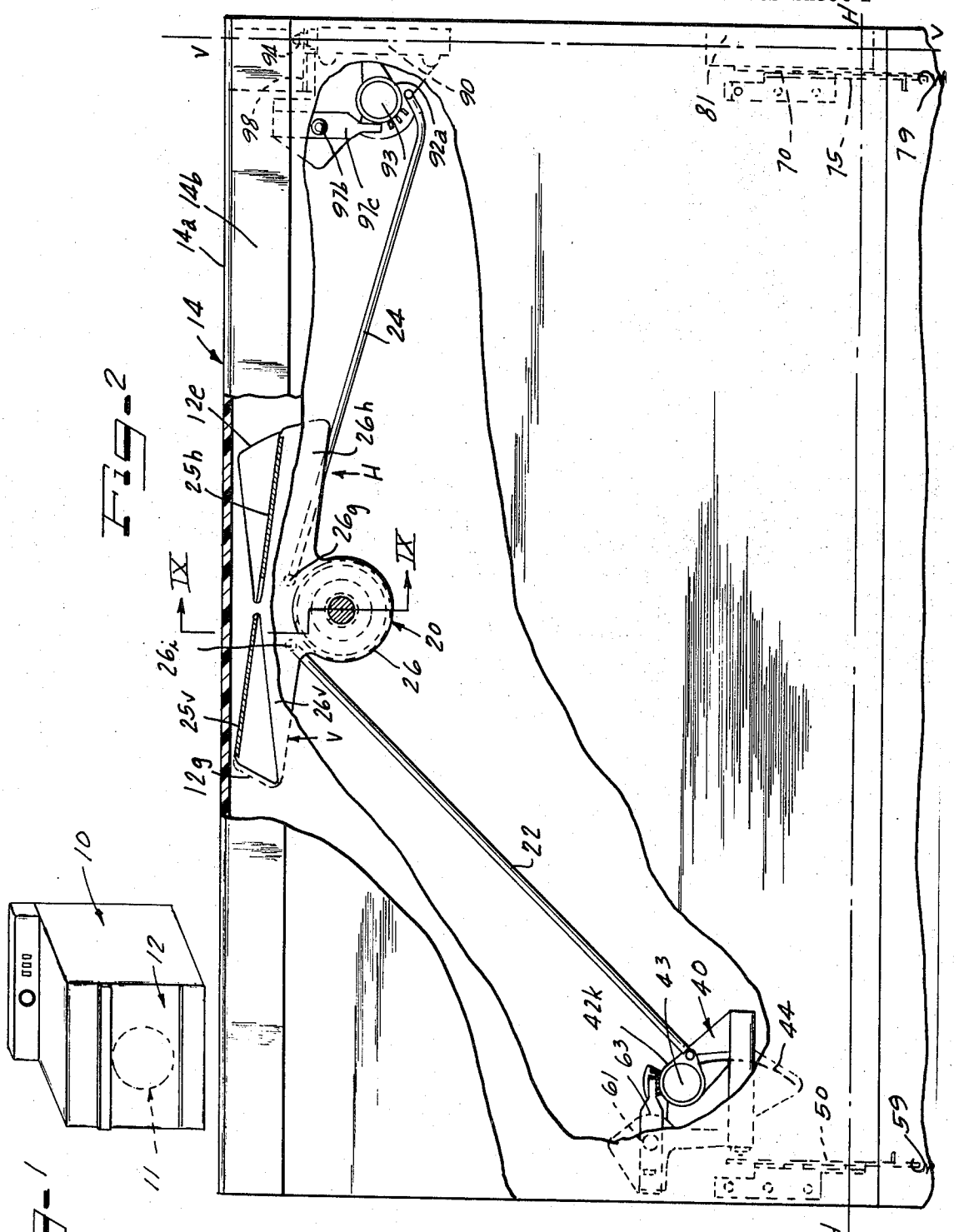

Fig. 2

Fig. 1

INVENTORS
LEWIS L. MILLER
JOSEPH P. LUX

BY Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

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Fig. 3

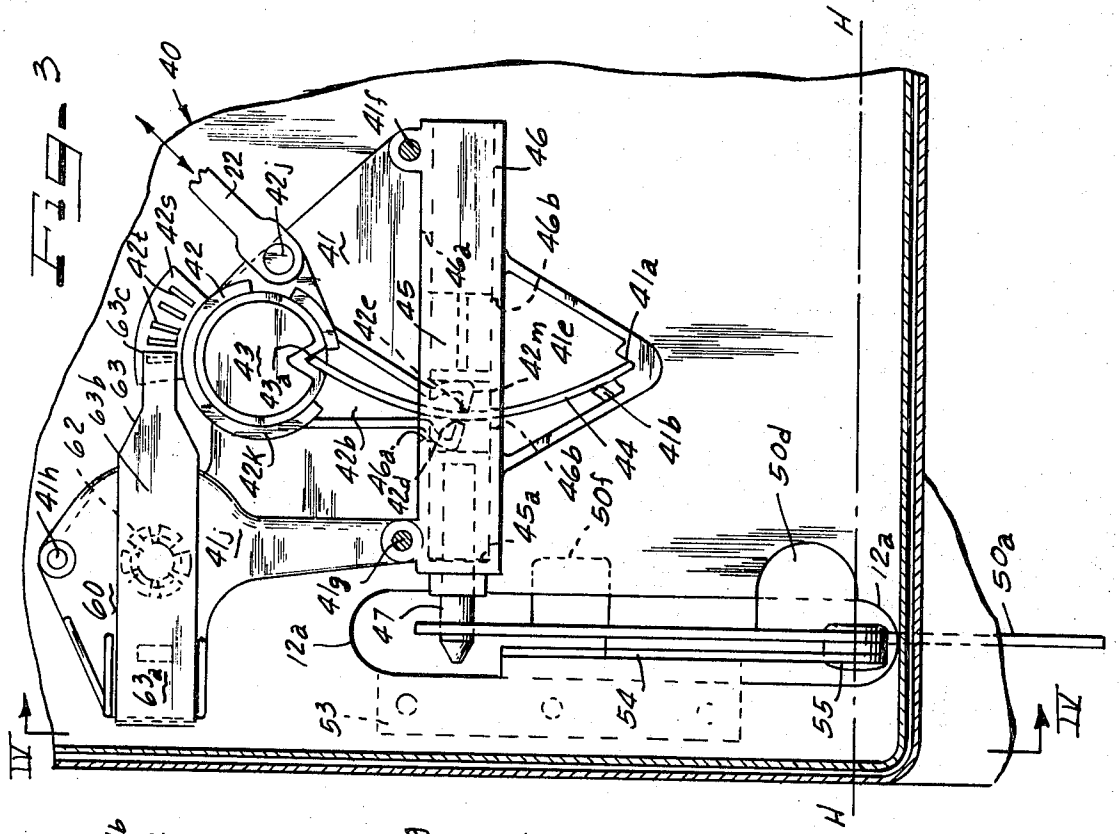
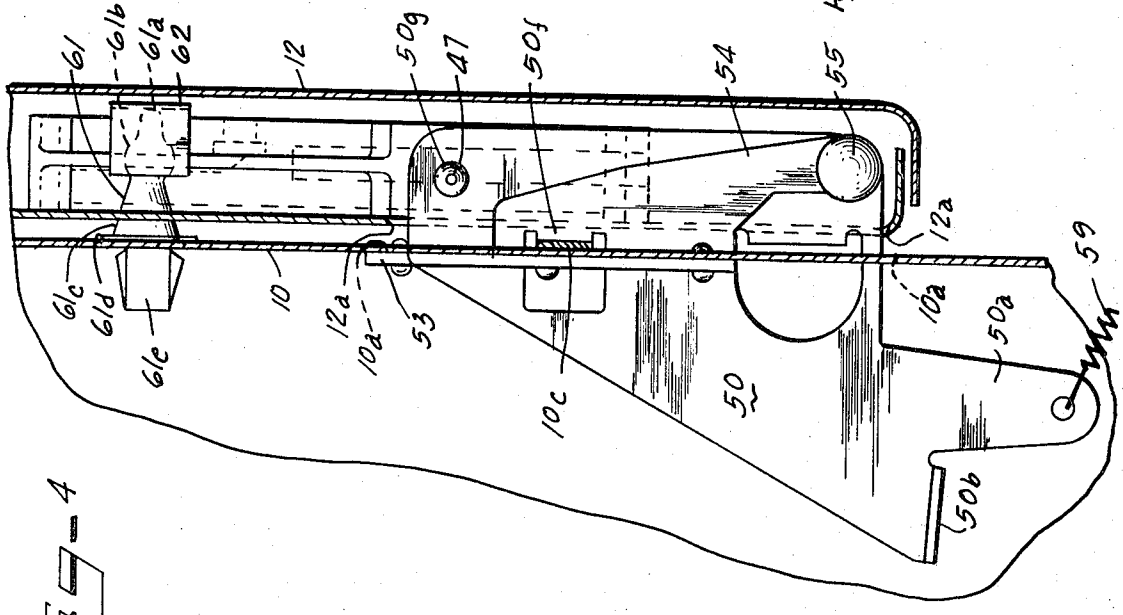


Fig. 4



INVENTORS
LEWIS L. MILLER
JOSEPH P. LUX

BY Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

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Fig. 5

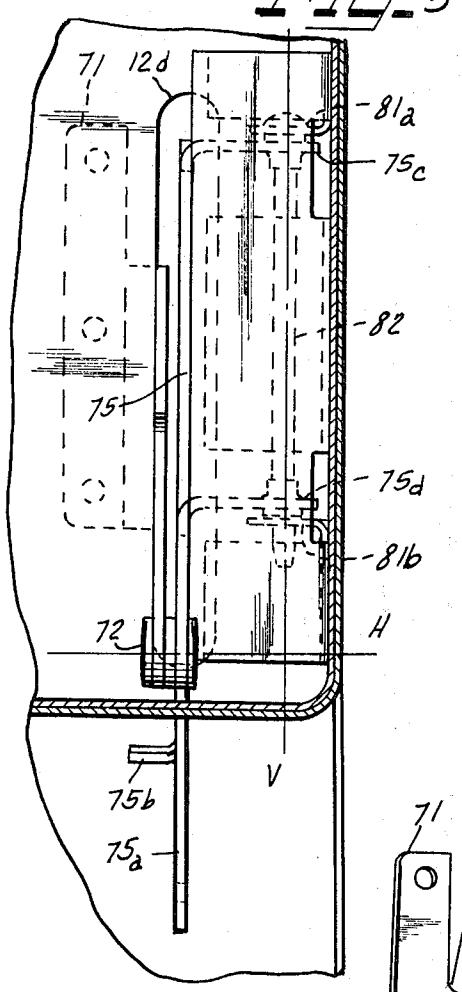


Fig. 6

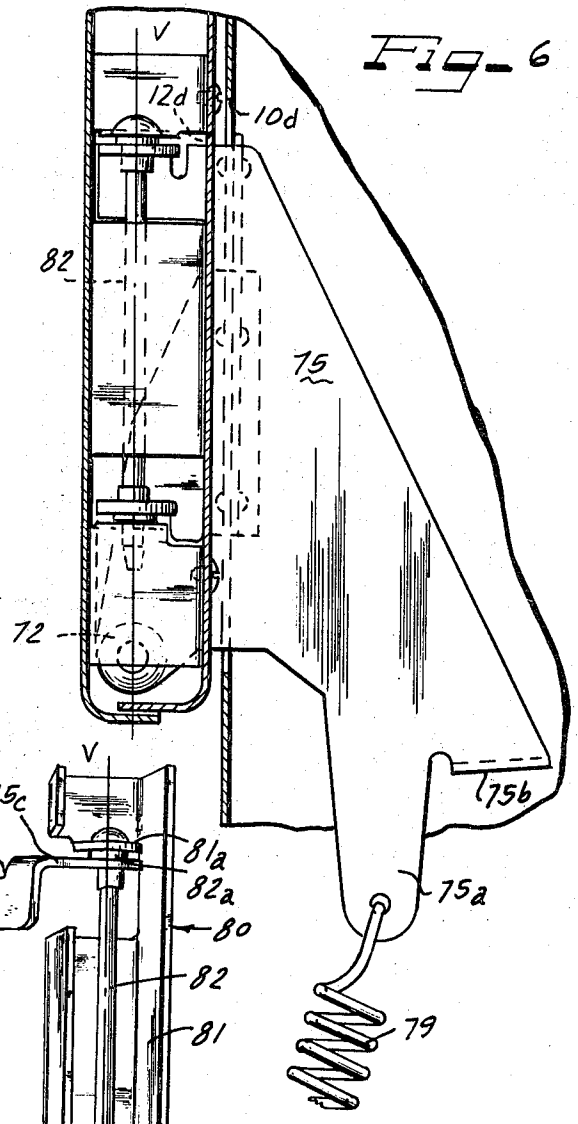
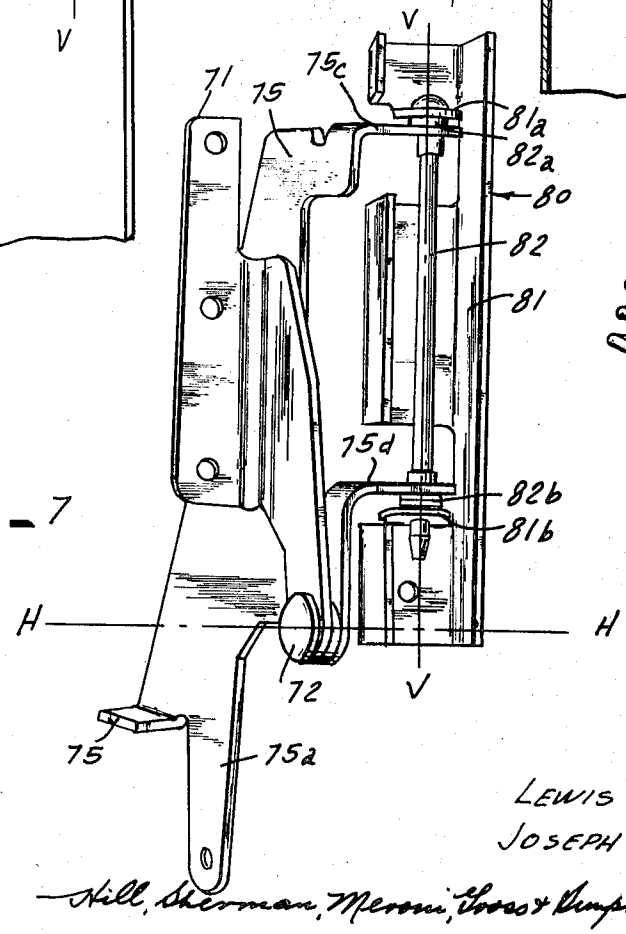


Fig. 7



INVENTORS
LEWIS L. MILLER
JOSEPH P. LUX

BY Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

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TWO-WAY DRYER DOOR

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Fig. 9

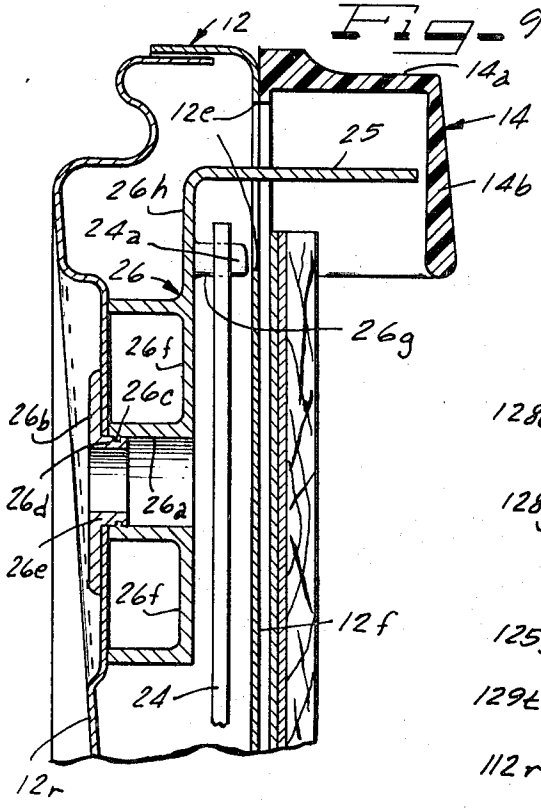
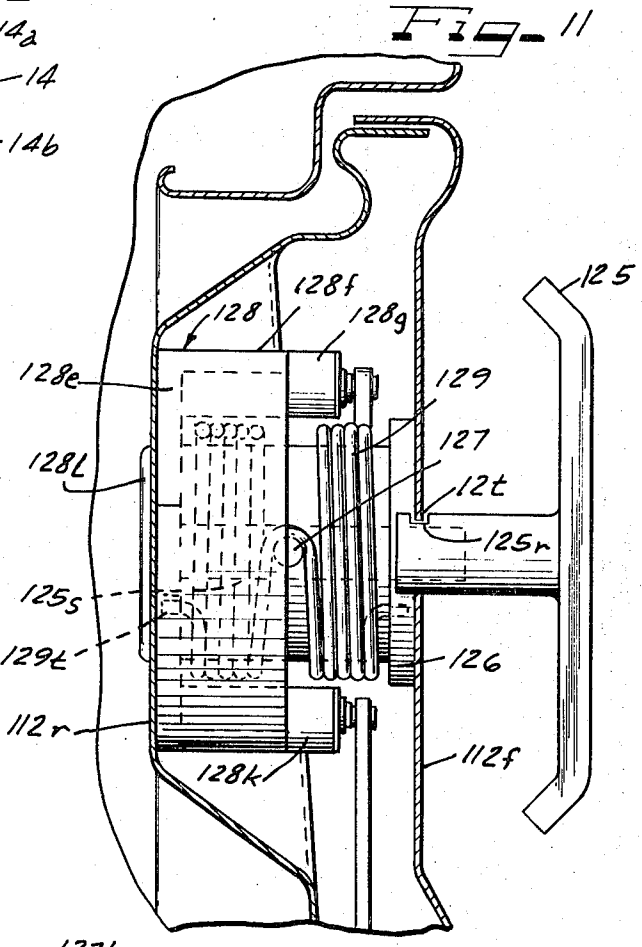


Fig. 11



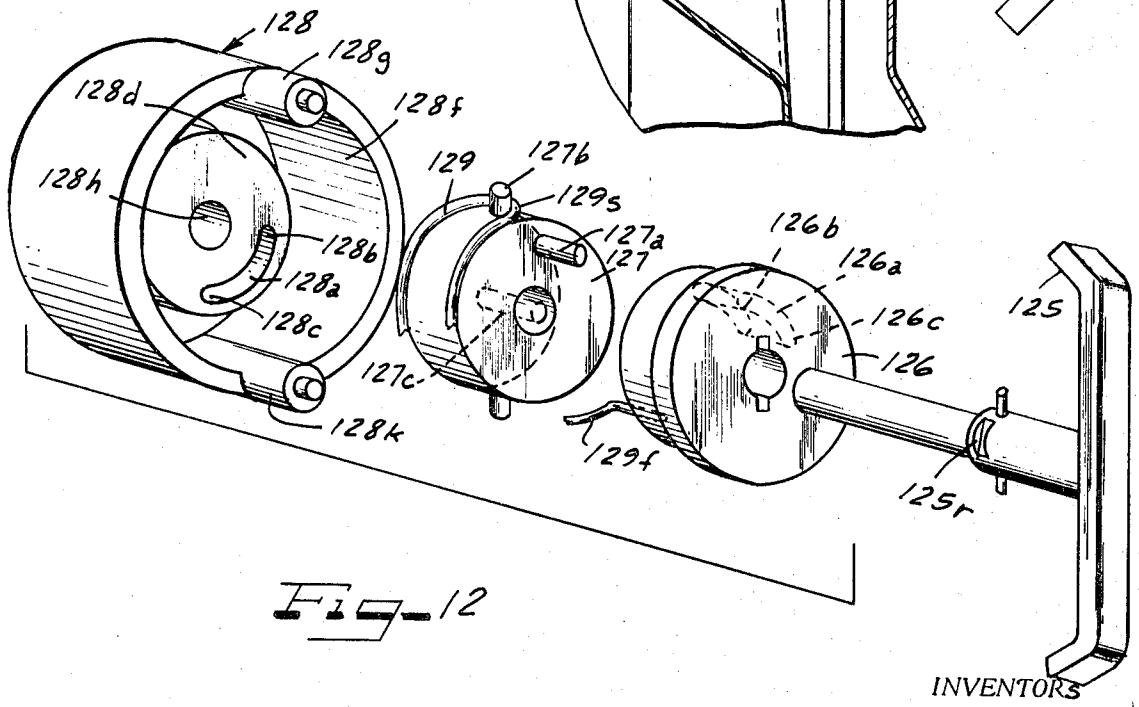


Fig. 12

INVENTORS
LEWIS L. MILLER
JOSEPH P. LUX

BY Hill, Sherman, Meroni, Gross & Simpson
ATTORNEYS

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Fig. 10

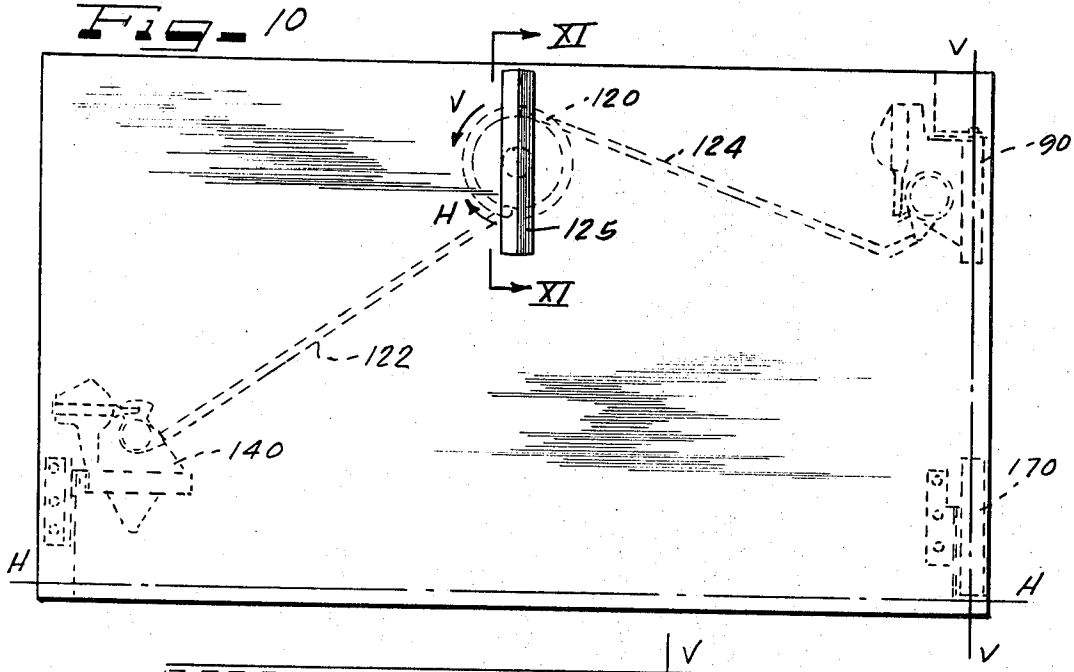
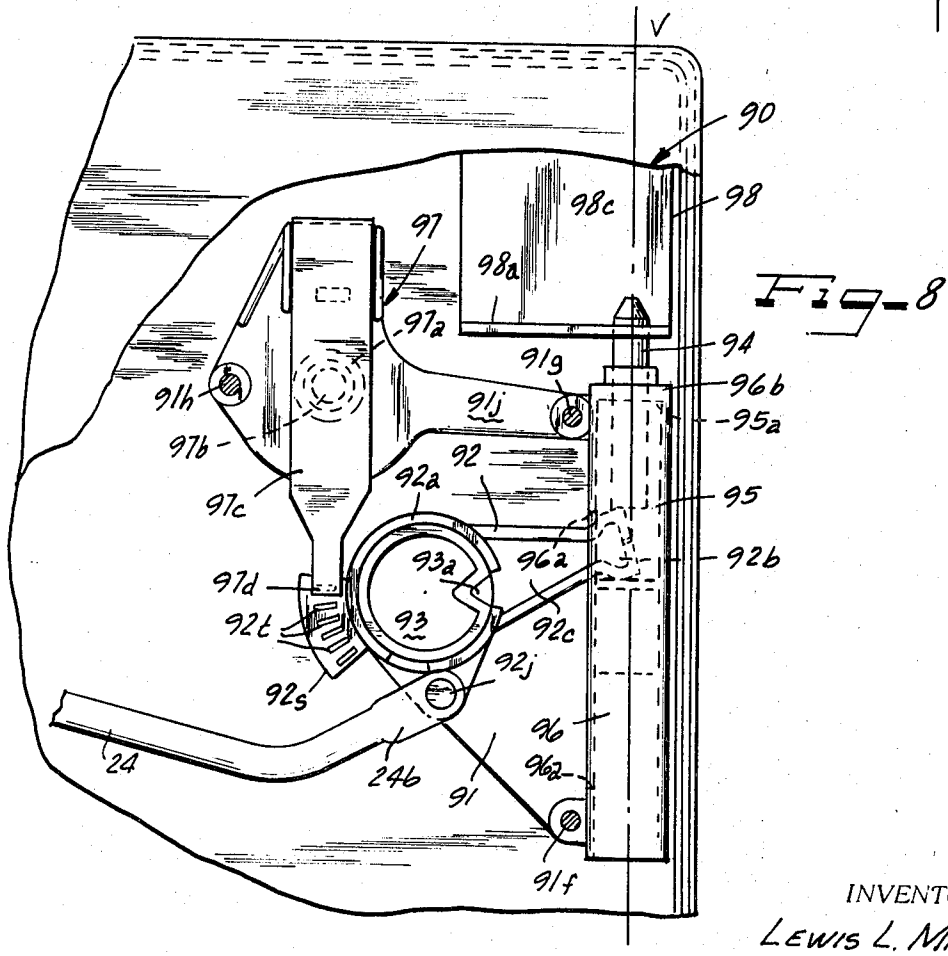


Fig. 8



INVENTORS
LEWIS L. MILLER
JOSEPH P. LUX

BY Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

United States Patent Office 3,538,641 Patented Nov. 10, 1970

3,538,641

TWO-WAY DRYER DOOR

Lewis L. Miller, Benton Harbor, Mich., and Joseph P. Lux, Marion, Ohio, assignors to Whirlpool Corporation, a corporation of Delaware

Filed June 14, 1968, Ser. No. 737,106
Int. Cl. E05d 15/52
U.S. Cl. 49—192 17 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for effecting a multiaxis closure hinging arrangement are provided which comprises a first, second and third hinge means spaced about the closure periphery, an axis selector, a safety lock and a snap action mechanism. The selector is linked to the first and third hinge means whereby on operation by the user the closure may be swung alternately about either a horizontal axis passing through the first and second hinge means or a vertical axis passing through the second and third hinge means. A leaf spring actuates the snap-action mechanism to assure that the linkage will always travel completely and instantaneously to one or the other of the two linkage positions. The safety lock cooperates with first and third hinge means to allow shifting of the axes only while the door is fully closed and additionally serves a dual function as a door catch. In one embodiment the axis selector includes a finger-tip operated pivotal lever concealed behind a closure traversing handle, while in another embodiment the selector includes a centrally-positioned T-shaped handle attached to a spring-block structure which limits the torque that may be transmitted through the selector and hinge means.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates generally to domestic appliances and more specifically to a clothes dryer apparatus having a multiaxis closure hinging arrangement whereby the door may be selectively swung about one of several different axes.

In particular, the invention lends itself to use on other appliances such as washers, dishwashers, etc., since it offers a simple, convenient, inexpensive, and compact means of providing a multi-hinge arrangement whereby selection of the hinging axis of the door may be easily made and will remain set until a future change is desired.

Description of the prior art

U.S. Pat. No. 2,212,114 is an early version of a closure having multiple swinging axes with independently removable hinge pins. The possibility of accidental removal of the hinge pins is made very probable by the exposure of the hinge pins to dislocating hands or forces.

In U.S. Pat. No. 3,030,656, the changing of the axis, which is possible when the door is opened, will be inconvenient and may cause damage to the door. Moreover, the prior art in general fails to show adequate latch means and swing stop means in a simple and economical construction. Further, the prior art does not show an attractive pull means whereby the changing means need not be touched during operation of the closure about a previously selected axis.

SUMMARY OF THE INVENTION

The problems in the prior art of accidental disengagement during operation and particularly while the door is open, are overcome by the instant invention through the provision of lock means associated with the shifting

mechanism which prevents the actuator from moving while the closure is open and allow movement only when the closure engages the catch. Snap action means is provided which moves the shifting mechanism quickly and completely between one or the other of the two linkage positions, thereby allowing no intermediate position of the shifting mechanisms. A catch means serves first as a means for retaining the door in a closed position and secondly as a means for disengaging the locking means whereby the shifting mechanism may be moved. In one form of the invention, the catch is situated adjacent each actuator means, thereby providing a double safeguard against the possibility of the door falling off as is shown in the prior art.

The spring biased two-way hinge means is also novel in this construction in that it provides a counter-balancing means and stop means limiting movement of the closure about a horizontal axis.

The present invention is conveniently embodied in a clothes dryer cabinet having an opening in one supporting surface thereof. This clothes dryer may have a rotatable tumbling drum mounted in the cabinet and communicating with the opening so that the articles to be dried may be deposited therein. A motor means rotates said drum and an air translation means introduces air into said cabinet, moves it into contact with a conveniently located air heating means and exhausts the air with its absorbed moisture from the cabinet. Control means coordinate the operation of the tumbler, heating means and translation means.

The apparatus for effecting the multiaxis dryer door hinging arrangement generally comprises a door or closure mounted on said clothes dryer cabinet supporting surface with first, second and third hinge means spaced about and adjacent to the periphery of said door. In the illustrated embodiment a first axis passes through said first and second hinge means and a second axis passes through said second and third hinge means whereby said door may be selectively alternately swung about either said first or second axis. In the embodiment of our invention on the clothes dryer the first axis may be a horizontal axis usually located adjacent the clothes dryer supporting surface below the opening. Similarly, the second axis may be vertical and may be positioned on either side of the opening. Since the clothes dryer cabinet supporting surface will usually be planar, the axes of rotation may lie in a plane that is substantially parallel to the supporting surface. It is envisioned that the door will be of greater extent than the opening to provide areas about the periphery of the opening where the door will be of substantially parallel abutting relationship with the supporting surface when it is closed. In the open position, or when the door is not abutting the cabinet supporting surface, it is understood that the door may be swung downwardly as much as 90° or more and sidewardly as much as 100° or more. Although the hinge means may be placed adjacent and about the periphery of the door it is to be understood that they may be placed in whatever position and arrangement is preferable in carrying out our invention.

By selecting the proper length of the hinge pins, the operation of the shafter mechanism is such that one set of hinges engages before the other set disengages, thereby insuring that at least one hinging axis is always established. Inasmuch as the various hinge means serve to mount the door on the cabinet supporting surface, each such hinge means will have a portion mounted on said cabinet supporting surface and a portion mounted on said door. An axis changing mechanism will generally be mounted on or in said door, however portions thereof may be mounted on said cabinet. Generally, the axis changing mechanism includes a shifter mechanism which

is part of said first and third hinge means, a two-way hinge which is part of said second hinge means, a selector usually located on said door connected to said first and third hinge means and cooperating therewith to alternately engage either said first or third hinge means, and a safety lock means cooperating with the shifter mechanism and the selector means to prevent their operation when said door is not abutting said cabinet supporting surface.

The first hinge means includes a hinge mounted on said cabinet supporting surface, pivotal about the first or horizontal axis and having a portion thereof projecting outwardly from the cabinet support surface. A shifter mechanism portion of the first hinge means is usually mounted on the door and includes a body member having means for mounting on said door and a hub. An actuator arm having an upper circular end is rotatably mounted on the hub. The remainder of the actuator arm includes an intermediate portion and a lower end. The lower end of the actuator arm projects through an opening in the tubular slide channel and engages a slide slidably mounted in the channel. One end of the slide channel has a hole therethrough and the slide has an elongated hinge connector which projects through said hole into engagement with said hinge when said actuator arm is rotated. Thus the hinge becomes fixed to the door so that it may be rotated about the first, or horizontal axis.

The hinge has a first stop member which butts against the inside of the cabinet supporting surface while the door is swung downwardly about the horizontal axis into a horizontal position. In this position the open door provides a horizontal work area below the dryer opening. A second stop on the hinge engages the supporting surface of the cabinet to position the hinge to align with the elongated hinge connector for engagement or disengagement. A resilient means such as a coil tension spring may be attached at one end to an extension of the hinge inside the cabinet and at the other end suitably fixed mounted to the inside cabinet. This resilient means operating alone or in cooperation with a similar resilient means on the second hinge means serves to counterbalance the dryer door when it is swung about the first or horizontal axis.

The second hinge means comprises a first and second pivotal hinge. The first hinge will usually be horizontally mounted on the cabinet supporting surface, pivotal about the first axis and having a portion thereof projecting outwardly from the support surface. This first horizontally pivotal hinge may be similar in construction to the hinge of the first hinge means. Thus it may include a first stop limiting the downward swing of the door about the first axis so that when fully open the door serves as a horizontal work area. It may also have a resilient means biasing said door to a closed position and thereby serving as a counterbalance. The second hinge means also includes a second usually vertically pivotal hinge which is fixedly attached to the door and pivotal about the second or vertical axis on a hinge pin that is coaxial with the second axis and mounted on said first pivotal hinge through two vertically spaced tabs 90° out of the plane of the first pivoted hinge. In substance the second hinge means is what may be termed a two-way hinge.

The third hinge means comprises a mounting member mounted on said cabinet supporting surface, projecting outwardly therefrom and having a hinge pin receiving hole therein which is coaxial with the second or vertical axis. The portion mounted on said door comprises a shifter mechanism of a construction which may be similar to that of the first hinge means. Thus it may have an actuator arm rotatably mounted on one end and having a lower end projecting through an opening in a tubular slide channel where it engages a slide. The slide includes a hinge pin which, when moved in response to the rotation of the actuator arm, slides into and out of engagement with the mounting member to effect swinging of the door about the second and first axes respectively.

A selector means coordinates the operation of the first and third hinge means so that when said first hinge means is engaged said third hinge means will be disengaged to allow the door to swing about the first axis. Conversely the selector mechanism assures that when the third hinge means is engaged the first hinge means is disengaged to allow the door to swing about the second axis. Several embodiments of the selector means are disclosed. In one embodiment a handle bar rigidly fixed to the door has a skirt depending therefrom. A rotatable handle is mounted below and behind said handle bar and may be rotated through pressure applied thereto by the fingers extended under the skirt. Links or other means directly connect the selector to the actuator arms of the shifter mechanisms so that movement of the selector handle is directly transmitted to the shifter mechanisms.

In a second embodiment of the selector means an energy absorbing torque limiting means is interposed between the handle and the portion of the selector means connected to the shifter mechanisms. Through this torque limiting means excess torque is prevented from being transmitted to the shifter mechanisms and hinge means.

To assure that the change from one axis to the other is substantially complete and instantaneous, a snap action means is provided in the axis changing mechanisms. The snap action means may be located on the first hinge means and comprises a bowed leaf spring having its upper end seated on the hub and its lower end seated in a fixed support below the slide channel. The bowed spring extends through a portion of the actuator arm and through the slide and slide channel. Snap action of the leaf spring is initiated through movement of the actuator arm so that the snapping of the leaf spring over center from one bowed position to an alternate bowed position snaps the actuator arm and hinge engaging means into and out of engagement with the hinge on the first hinge means. Through the linkage of the selector means this force is transmitted to the third hinge means and that too snaps into and out of engagement with the mounting member.

The problem in the prior art of accidental disengagement during operation is absolutely prevented by the safety lock means. This safety lock means usually comprises a locking surface on the actuator arm, a spring lock mounted on the shifter mechanism and resiliently biased against the locking surface to prevent rotation of the actuator arm when the spring is in engagement with the locking surface and a door catch mounted on and extending from the supporting surface which is adapted to move the spring lock out of engagement with the locking surface when the door is in the closed position adjacent to the cabinet supporting surface. Thus changing of the axes of rotation is possible only when the door is in abutment with the supporting surface. In addition, the door catch is frictionally gripped by means on the door to hold the door in the closed position during the changing of the axes.

Other and further objects of this invention will be apparent to those skilled in this art from the following detailed description of the annexed sheets of drawings which, by way of a preferred embodiment of the invention, illustrate one example of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an appliance embodying the principles of the invention.

FIG. 2 is a front view of the closure of the invention.

FIG. 3 is an enlarged front view showing additional details of the first hinge means and associated mounting means as seen in the lower left-hand corner of FIG. 2.

FIG. 4 is a side view of the structure of FIG. 3 taken on the plane of line IV—IV.

FIG. 5 is an enlarged front view of the two-way hinge seen in FIG. 2.

FIG. 6 is a side view of the hinge of FIG. 5.

FIG. 7 is a further enlarged perspective view of the double hinge as it would appear when the closure is opened about the vertical axis.

FIG. 8 is a front view of the third hinge means and associated mounting means as is shown in the upper right-hand corner of FIG. 2.

FIG. 9 is a cross-section of the selector means as viewed along the lines IX—IX in FIG. 2.

FIG. 10 is a front view of a closure showing another embodiment of the selector means.

FIG. 11 is a cross-sectional view along the lines XI—XI in FIG. 10.

FIG. 12 is an exploded perspective view of the embodiment of the selector means shown in FIGS. 10 and 11.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In its broadest sense, the invention encompasses a closure swingable about more than one axis and a mounting or supporting means therefor. For purposes of illustration an exemplary construction of the invention is indicated at **12** in FIG. 1 on a clothes dryer cabinet **10**. In this embodiment the cabinet provides the mounting or support means for the closure **12** which, in this case, can swing about both a vertical and a horizontal axis. The pivotal axes may be along any two sides, however, in a clothes dryer one of the axes provided will usually be horizontal since this has the advantage that the open door may serve as a working shelf.

The combination of the operative elements for the door **12** is shown in FIG. 2 where an axis selector means **20** simultaneously controls a first hinge means **40** and a third hinge means **90** for movement of the door **12** about either the vertical axis V—V or the horizontal axis H—H, both of which pass through a two-way or second hinge means **70**. In position as shown, the door is set to swing about the vertical axis V—V.

Movement of the door-mounted axis selector means **20**, possible only when the door is closed, will move, through a rigid linkage system, a hinge pin **94** in the door-mounted third hinge means **90** into engagement with a mounting means **98** on the cabinet while simultaneously disengaging a locking pin **47** in the cabinet-mounted first hinge means **40** from engagement with a cabinet-mounted hinge **50** so that the door will pivot about the vertical axis. This operation is reversed when it is desired to have the door pivot about the horizontal axis.

A cutaway view of the elements interior of the closure are seen generally in FIG. 2 and specifically shown in enlarged detail as follows: the first hinge means **40** is set out in FIGS. 3 and 4; the two-way second hinge means **60** is seen in FIGS. 5–7; the third hinge means **80** is shown in FIG. 8 and selector means **20** and **120** may be viewed in FIGS. 9–12.

First hinge means

As shown in FIGS. 3 and 4, the first hinge means **40** comprises a shifter mechanism **41–47** and a safety lock means **61–63** in the interior of the closure with a hinge and hinge-mounting means **53**, **54** mounted inside the cabinet and projecting outwardly therefrom. The shifter means **41–46** functions to slide a hinge connector **47** into and out of engagement with a hinge **50** in response to movement of the axis selector means shown in FIG. 2 at **20** and in FIG. 10 at **120**.

Thus, a link **22** has one end attached to the selector means and the other end attached to the actuator arm **42**, which has one end **42***k* journalled on hub **43** for rotation thereabout and an other end **42***m* snugly received in a slide **45** with a portion **42***b* rigidly connecting these opposite ends. Movement of the link **22** is thereby converted into rotational motion that is transmitted through the actuator arm end **42***m* to move the slide **45** and the attached hinge connector **47** into and out of engagement with the hinge **50**.

A bowed leaf spring **44** promotes complete and quick movement of the hinge connector **47** between positions in and out of engagement with the hinge **50**. Having its upper end restrained by the notch **43***a* in the hub **43**, the leaf spring **44** extends through the end **42***m* of the actuator arm **42**, through an opening **46***b* in the bottom of the slide channel **46** and has its other end restrained by the notch **41***a* on the shifter body. The length of the spring is greater than the distance between the notches **43***a* and **41***a*, causing it to bow. Thus when the actuator arm **42** is pivoted about the hub **43**, edges **42***d* and **42***e* in the end **42***m* serve to transmit the force applied to arm **42** to a central portion of spring **44** to snap the leaf spring **44** from a position where it is bowed in one direction over center to a position where it is bowed in the other direction. At the same time the slide **45** will be moved in the slide channel **46** by actuator arm end **42***m*. Movement of the slide and the attached hinge connector **47** towards the hinge **50** is limited by the slide shoulders **45***a*. The spring stop means **41***b* on the actuator body limits movement of the spring **44**.

Slide channel **46** preferably is square or rectangular in cross-section as is the slide **45** so that the slide will always be properly oriented for the receipt of the actuator arm therein. An opening **46***a* in the side of the channel **46** nearest the actuator arm is long enough so that the actuator may swing completely in and out of the channel thereby facilitating assembly and disassembly of the apparatus. An opening **46***b* in the side opposite the opening **46***a* allows the snap spring to pass through the slide and have its lower end seat at **41***a* on the shifter body. Whereas the shifter body will preferably be made of a self-lubricating material, the connector pin **47** may be made of metal and is securely mounted in the slide **45**.

The hinge **50** pivots about a pivot **55** through which horizontal axis H—H passes. A mounting means **53**, **54** supporting the pivot includes a cabinet attachment flange **53** secured to the inside of the cabinet **10** by suitable means and a projecting wing **54** which supports the pivot **55** at its lower end. When the door **12** is in its closed position the wing **54** and the hinge **50** project through corresponding slots **10***a* in the cabinet and **12***a* in the door into the interior of the door a distance limited by a door stop **50***d* (FIG. 4). Thus, the door stop **50***d* may, as shown, be a portion struck out from the hinge and extending at right angles thereto. The hinge **50** in turn is biased by a spring **59** so that a struck-out portion **50***f* bears against a shock absorbing pad **10***c* thereby limiting movement of the hinge into the cabinet.

A spring means **59** has one end fixed to the cabinet and the other end attached to the lowermost portion **50***a* of the hinge thereby serving to keep the hinge in its closed position when no load is applied and to act as a counter balance when the door is opened about the horizontal axis. The opening of the door **12** about the horizontal axis is limited to approximately 90° by a stop **50***b* which comprises a bent-over portion of the hinge **50**. With the door in its opened position, the stop **50***b* bears against the mounting means **53** so that the door is horizontal and cantilevered out from the cabinet below the opening **11** to provide a convenient work area.

Changing the axes of rotation to the horizontal axis H—H whereby the door **12** pivots about the pivot **55** and the pivot of the second hinge means **70**, is thus accomplished by operating the selector means **20** to exert a clockwise rotation to the actuator arm **42** which snaps the leaf spring **44** over-center, simultaneously moving the slide **45** toward the hinge and driving the tapered hinge connector **47** through the mating opening **50***g* in the hinge **50**. With the door now engaging an upper portion of the hinge at **50***g* and bearing against a central portion of the hinge at a door stop **50***d*, the door **12** and the hinge **50** are effectively connected and move as one.

If the door were swung out from the cabinet so that either the connector pin of the first hinge means or the hinge pin of the third hinge means could not engage the mounting means when the selector means were moved, the other connector or hinge pin might be withdrawn leaving the door supported solely by the second hinge means. This might cause inconvenience to the user and/or damage to the second hinge means. To prevent this situation from occurring, a safety lock means **60** is provided which insures that when the dryer door **12** is in the opened position, the actuator arm **42** cannot be rotated.

Basically, the first hinge safety means **60** comprises a door catch knob **61** mounted on the cabinet **10** and projecting therefrom so that when the door is closed it extends into the door and pushes against a leaf spring **63** thereby disengaging the leaf spring from a toothed structure **42***s* integrally mounted on the actuator arm **42**. Only when the leaf spring is disengaged will the arm **42** be free to rotate in response to movement of the axis selector means.

Referring to the details of the catch knob **61**, shown in FIG. 4, it can be seen to comprise a protrusion **61***a*, a spherical portion **61***b*, a base portion **61***c*, and a fastening means **61***d* and **61***e*. When the protrusion **61***a* is holding the leaf spring **63** out of engagement with the teeth on the actuator arm the bulbous spherical portion **61***b* is resiliently held in the socket **62** to effect a catch holding the door closed. Thus, the catch knob **61** serves a dual function of retaining the door closed while moving the leaf spring **63**, **63***c* away from the teeth **42***t* so that the actuator arm **42** may be moved. Since this can occur only when the door is closed, any accidental disengagement of both the first and the third hinge means is prevented.

The leaf spring **63** comprises a long body portion **63***b* of resilient spring steel that is attached near one end **63***a* to the actuator body **41** and has a bent portion **63***c* at one end extending at right angles to the body portion **63***b* which moves into and out of the spaces between the teeth **42***t*. The number of teeth and their spacing is dependent upon the arc through which the arm **42** moves since it is clear that they will be positioned over the full extent of the arc.

In the embodiment as illustrated, the shifter body **41** is of a unitary construction that includes the hub **43**, the tubular slide channel **46**, the leaf spring supporting portion **41***e* that extends below the slide channel structure, the safety lock support **41***j*, the resilient socket **62** and the three means **41***f*, **41***g*, **41***h* for attachment of the body to the closure **12**. It will be understood of course that these features may be separate or in a different combination. In practice, we have found the self-lubricating plastic material ACETAL to be an excellent material for this part, although any suitable material may be used.

Second hinge means

Referring to the second hinge means which is shown generally at **70** in the lower right hand corner of FIG. 2 and in detail in FIGS. 5–7, there is provided a structure similar in several respects to the hinge **50** of the first hinge means. Thus, a mounting means **71** is similar in placement, function and construction to the mounting means **54**. It is attached to the inside of the cabinet **10**, extends through a corresponding opening **12***d* in the door and **10***d* in the cabinet, and supports the pivot **72** about which a hinge **75** pivots when the door **10** is opened about the horizontal axis H—H. The hinge **75** is likewise similar to the hinge **50** insofar as the stop **75***b* and the depending portion **75***a* are concerned. Again, a stop **75***b* strikes the rear portion of the mounting means **71** to stop the downwardly pivoting motion of the hinge **75** and cooperates with a stop **50***b* on the first hinge means to provide a support for the door in its horizontally cantilevered position. A spring **79**, like its counterpart spring **59**, is anchored to the cabinet structure at one end and engages the depending portion **75***a* at its other end, thereby serving as a counter balance for the door when it is pivoted about the horizontal axis H—H.

A hinge **80**, mounted on the hinge **75**, includes a bracket **81** to which the door **10** is attached, and a hinge pin **82** coaxial with the vertical axis V—V about which the bracket and door pivot when swung about the vertical axis. As shown in FIG. 7, the bracket is positioned as it would be when the door is opened about the vertical axis. Although the bracket **81** is shown having a U-shaped cross-section, any suitable configuration for mounting inside a door panel is contemplated. The bent-over bracket tabs **81***a* and **81***b* have a hole therein through which the hinge pin **82** extends. A pair of correspondingly spaced hinge tabs **75***c* and **75***d* comprise portions of the hinge bent outwardly approximately 90° from the hinge **75** to provide support for the hinge **81**. The hinge tabs are inside the bracket tabs, have a hole therein through which the hinge pin **81** extends and preferably separated from the bracket tabs by spacers **82***a* and **82***b*.

Third hinge means

The third hinge means **90** is shown generally in the upper right hand corner of FIGS. 2 and 10 and in enlarged detail in FIG. 8. Basically it comprises a shifter mechanism **91** and a safety lock means **97** similar to those of the first hinge means carried within the door **12** and a mounting means **98** on the cabinet **10**. The purpose of the third hinge means is to move a hinge pin **94** into and out of engagement with the mounting means **98** so that when the hinge pin **94** is disengaged the door will be free to rotate about the horizontal axis H—H and when the hinge pin **94** is engaged the door will be free to pivot about axis V—V.

Construction of the third hinge shifter mechanism **91–96** and safety lock means **97** is identical to that of the first hinge shifter mechanism and safety lock means with the exception that the snap action means of the first hinge means, including the leaf spring **44** and the depending shifter body portion **41***e*, is not duplicated because their effect is transmitted through the selector means **20**, **22**, **24** to the third hinge means.

Thus, the third hinge means, functioning similarly to the first hinge means, is connected to the selector means through a rigid link **24** that has one end **24***a* pivotally connected to the selector means and the other end **24***b* pivotally connected to the actuator arm **92** at **92***j*. An arm **92** has an enlarged circular portion **92***a* in one end that is journalled in, and rotates about, hub **93** in response to movement of the axis selector means. An enlarged end **92***b* at the other end of the arm **92** extends through an opening **96***a* in the slide channel **96** and is seated in the slide **95**. Connecting the circular portion **92***a* and the end **92***b* is a tapered portion **92***c*.

When movement of the link **24** causes the arm **92** to rotate about the hub **93**, the force is transmitted through portion **92***c* to end **92***b* which in turn moves a slide **95** in a channel **96** whereby a hinge pin **94** will be moved in and out of engagement with a hole in a flange **98***a* of a mounting means **98**. The movement of the slide **95** is limited as hinge pin **94** is moved into engagtment with means **98** by a shoulder means **95***a* that butts against an end **96***b* of the slide channel. When the pin **94** is moved out of engagement with the mounting means **98** the movement is limited by the selector means on the snap action means **44** of the first hinge means.

Whereas the above-noted limits are effective when the door is closed, the safety lock on the third hinge means **90**, similar in construction to the safety lock means of the first hinge means **40**, operates to prevent movement of the axis-changing mechanism when the door is opened or not fully engaging the catch means of either the first or third hinge means. This insures that the diagonally related corners of the closure, in which areas the catch means will usually be positioned, are both in a fully closed position before an axis change may be made.

As with the safety lock means **60** of the first hinge means, the safety lock means **97** comprises a door catch knob **97***b*, of exactly the same construction as a catch knob **61**, hidden in FIG. 8, mounted on the cabinet and projecting therefrom so that when the door **12** is closed it extends into the door and lifts angularly bent portion **97***d* of leaf spring **97***c* out of engagement with the toothed structure **92***t* mounted on the portion **92***s* projecting from the actuator arm **92**. In the illustrated embodiment, the teeth **92***t* have parallel sides substantially normal to the portion **92***s* and lie on radii of the hub **93**. The elongated leaf spring **97***c* has its major axis on a line tangent to the actuator arm portion **92***a* and hub **93** thus disposing the tooth engaging portion **97***d* substantially normal to the teeth **92***t*. Although the number of teeth **92***t* is dependent upon the arc through which the actuator arm **92** pivots, their spacing at the narrowest point must be such to allow easy entry of portion **97***d* and yet allow minimal movement of the hub when the portion **97***d* is in engagement with the teeth. The interrelation of the two safety lock means will be more fully set out in the discussion of the operation of the apparatus.

The hinge means **90** is constructed similarly to the first hinge means except for the fact that it does not have a portion equivalent to the portion **41***e*. Thus, the body **91**, arm **92**, hub **93**, hinge means **94**, slide **95**, channel **96** and lock means **97** may be of identical construction with the equivalent elements on the first hinge means. Similar means **91***f*, **91***g*, and **91***h* allow attachment to the interior of the door.

The mounting means **98** comprises a right angularly bent member having a flange **98***c* mounted inside of the cabinet and the other flange **98***a* projecting through a slot in the front of the cabinet. It will be understood, however, that the flange **98***a* may be otherwise attached.

Selector means

There is shown in FIGS. 2 and 9 an axis selector means **20** positioned under the door opening bar **14**. When the axis has been selected and no change is desired, the bar may be grasped at any point to open the door **12**. When a change is desired, however, the door may be grasped and the finger tips slid under the bar either at the area indicated by V in FIG. 2 to effect a swinging of the door about the vertical axis or at the area indicated by H, to effect a swinging of the door about the horizontal axis. With the area of grasp for the vertical axis furthest removed from that axis it can be seen that greater leverage is afforded in opening the door. It is important to note that the door may be grasped at any point without changing the axis and that it is not until the fingers are specifically slid under the bar that the change in axis will be effected.

As seen in cross-section in FIG. 9, the handle bar portion **14***a* projects outwardly from an area on the front of the door adjacent the upper edge of the door. A skirt **14***b* depends from the outer edge of the portion **14***a* to conceal the selector means from a normal viewpoint.

The selector handle means **25** comprises two elongated flanges **25***v* and **25***h* projecting through a corresponding pair of triangularly shaped openings **12***g* and **12***e* in the front panel **12***f* of door **12**. The lengthened position of the flanges reduces the force necessary to operate the door mechanism. At a point inside the door the flanges are attached to portions **26***v* and **26***h* respectively of the body member **26**. In addition to the portions **26***v* and **26***h*, the body member has a circular central member **26***f*. The hole **26***a* in the body member has an annular projection **26***c* therein that engages an annular groove **26***d* in a portion **26***e* of the handle retaining member **26***b* which projects through the rear panel **12***r* of door **12** and which is received into the opening **26***a*. The portion **26***e* thus provides a hub about which the handle **25** may rotate.

The projections **26***c* and **26***g* are located on the handle and have links **22** and **24** respectively attached thereto so that the links are in a generally tangential relation to the circular body portion **26**. One projection is located on each of the portions **26***v* and **26***h*. With the selector means directly connected between the first and third actuator means it is subject to the snap action means of the first hinge means so that it will move instantaneously into and out of position.

It will be appreciated that other configurations of the selector means could be provided for location in the upper left-hand corner of door **12**. In such position, the flange **25***v* would be moved 90° counterclockwise to roughly parallel the left edge of the door with the flange **25***h* in its same attitude. The handle bar **14** would extend vertically down the left side from the upper left-hand edge to cover the flange **25***v*. Such configuration would allow swinging about the vertical axis while grasping the vertical handle bar portion whereas grasping the horizontal handle portion would result in the door swinging about the horizontal axis. In other words, the portions grasped would parallel the axis of rotation.

Selector means with torque-limiting feature

In FIGS. 10, 11 and 12 a second embodiment of the selector means is shown which has an additional torque-limiting feature. Whereas the handle **25** of FIGS. 2 and 9 could only be pushed through the use of finger tips, it is obvious that the handle **125** may be grasped with the entire hand and have considerable torque applied thereto. If the shifting mechanism within the door were to somehow become jammed, the torque could bend the links **122** and **124** or otherwise damage the mechanism. It is to prevent this possibility that the torque-limiting structure is provided.

As may be viewed through a section of the door in FIG. 11 and in exploded perspective in FIG. 12, the torque-limiting selector mechanism comprises a handle **125** fixedly secured to a first rotating block member **126**, a second rotating block **127**, a third rotating block member **128** and a coil spring **129**. The second block member **127** has a first pin **127***a* and a second pin **127***c* thereon. A coil spring **129** surrounds portions of all of the rotating blocks and is fixed at one end to the first block and at the other end to the third block. A handle **125** has a shaft portion **125***a* that extends through holes in the centers of the three blocks and is journalled in the third block. Handle **125** has an arcuate slot **125R** in the shaft portion **125***a* which guides a tab portion **12T** of door **12**. This arrangement limits the angle through which handle **125** may be turned since tab **12T** will come to rest against one end of slot **125R**.

The first block **126** has an arcuate slot **126***a* in what will normally be the upper right-hand quadrant thereof. The slot **126***a* receives the first pin **127***a* therein. Spring **129**, being retained at **129***s* by a protrusion **127***b* and anchored to the first block **126** at **129***f*, exerts a counterclockwise force on a pin **127***a* to bias it against an end **126***b* of the slot **126***a*. Likewise the third block means **128** has an arcuate slot **128***a* therein, here shown in the lower right-hand quadrant, which slot similarly receives the second pin **127***c* that projects from the second block. The spring **129** has its end **129***t* fixedly secured to the third block means and is restrained on the second block at **129***s* by a projection **127***b* to exert a counterclockwise force on a pin **127***c* so that it is biased against an end **128***b* of the slot **128***a*. Spring **129** therefore produces a bias on both pins **127***a* and **127***c*.

The third block means **128** comprises a central block portion **128***d* having an arcuate slot **128***a* and a hole **128***h* therein. The block portion **128***d* is fixed to an end wall **128***e* which serves as an end wall of the cylindrical portion **128***f*. A connector means **128***g* and **128***k* are shown here as rods extending from the end wall **128***e* to a point beyond the cylindrical portion **128***f* where they

serve as means by which the shifting links **122** and **124** may be connected to the selector means **120**.

In. FIG. 11, the location of the torque-limiting means between the front panel **112***f* and rear panel **112***r* of door **112** is readily apparent. The handle **125**, passing through the front panel **112***f*, serves to mount the limiting means on the front panel, while a retaining member **128***r*, similar in construction to the retaining member **26***b*, functions to rotatably mount the limiting means on the rear panel **112***r*.

Except for the torque-limiting means **120** and the slightly different orientation of the links **122**, **124**, the construction of closure **112** and the first, second and third hinge means thereon is exactly the same as that as previously set out for the closure **12**.

From the above detailed description of the various parts, it may be seen that the torque-limiting mechanism functions as follows: upon clockwise movement of the handle **125** to effectuate swinging of the closure **112** about the horizontal axis H—H, the first block **126** moves the second block **127** through the direct bearing of slot end **126***b* against pin **127***a*. The portion of spring **129** between **129***f* and **129***s* is bypassed, so to speak, by the direct connection of the blocks **126** and **127**. Between such portions of the spring **129***s* and **129***t* however, there is no direct bearing since the pin **127***c* may slide in the slot **128***a* through an arc of about 90° until it abuts the slot end **128***c*. Forces are transmitted between the second and third blocks by the portion of spring **129** that extends between **129***s* and **129***t*. At point **129***s* the pin **127***b* exerts a clockwise force on the spring that is transferred to the third block **128** only through the spring **129**. Handle **125**, blocks **126**, **127** and **128** and spring **129** will therefore move together unless the restraining torque on block **128** exceeds the spring bias torque.

Before pin **127***c* comes into direct contact with end **128***c* of slot **128***a*, the tab **12T** will come into contact with the end of slot **125R**. This provides a positive stop for handle **125** thereby preventing it from turning any faster. The amount of torque therefore which is actually transmitted to the links and shifting means from the selector means is effectively limited by the portion of the spring **129** between **129***s* and **129***t*.

Operation of the handle and torque-limiting means in a counter-clockwise direction to effect a swinging of the closure about the vertical axis V—V will be just the reverse with the portion of spring **129** between **129***f* and **129***s* limiting the torque transmitted. In this case the counter-clockwise force will be transmitted from spring end **129***f* to the spring portion **129***s* which bears against projection **127***b* of the second block. With the pin **127***c* butting against end **128***b*, any force applied to the second block **127** is directly transmitted to the third block. The force in the spring between end **129***f* and the portion **129***s* increases as the pin **127***a* slides in the slot **126***a* toward the slot end **126***c* until it reaches a point just before the contact of **127***a* and **126***c* where tab **12T** comes into contact with the end of slot **125R**. This effectively limits the force which may be transmitted to the rest of the system. Ordinarily enough force will be transmitted by the spring so that operation of the shifting mechanism would take place long before the high torque was attained and it is contemplated that only where the system somehow jams that this limiting function would come into full use.

Operation

For purposes of illustration it will be assumed that the user wishes to change from the vertical hinging arrangement shown in FIG. 2 to a horizontal hinging axis whereby the door swings down. To allow this change the door **12** must be fully closed so that door catch knobs **61** and **97***b* have disengaged leaf springs **63** and **97***c* from tooth structures **42***s* and **92***s* on the actuator arms **42** and **92** respectively.

With the door closed the operator grasps the handle bar **14** in the area generally indicated at H on FIG. 2 and slides his fingertips under the bar so they press upwardly on the flange **25***h* and thereby begin to rotate the body member **26**, which is attached to the flange **25***h*, counter-clockwise about the hub **26***e*. This rotary movement simultaneously transmits the force through the links **22** and **24** from a generally tangent point on the circular portion **26***k* of the selector body member **26** to generally tangent points on the respective circular arm ends **42***k*, **92***a* of the shifter mechanisms **40** and **90**.

Thus, the link **22** exerts force on the actuator arm **42** urging it to rotate clockwise about the hub **43** while the link **24** exerts a force on the actuator arm **92** urging it into clockwise rotation about the hub **93**.

Movement of the selector means **20** however, is initially resisted and the force stored as potential energy by the bowed leaf spring **44** of the shifter mechanism **40** until the force is sufficient to move the leaf spring **44** from a position as seen in FIG. 2 over a center position whereupon the spring snaps into an oppositely bowed position as is shown in FIG. 3, thereby releasing the potential energy of the spring to move the entire shifter mechanism, including the selector means **20** and shifting means **40** and **90**, simultaneously into a position where the axis of rotation is about the horizontal axis.

During the movement of the shifter means, the arm **42** rotates clockwise to slide the member **45** in the slide channel **46**, thereby pushing the hinge connector **47** through a hole **50***g* into engagement with the hinge **50**. Simultaneous with this action in the first hinge means, the actuator arm **92** of the third hinge means is rotating clockwise thereby sliding the member **95** in the channel **96** and pulling the hinge pin **94** out of engagement with the mounting means **98**. A reversal of the above operation takes place when the user changes from the horizontal to the vertical axis.

With the hinge **50** engaged and the hinge mounting **98** disengaged the door may be swung downwardly. The friction catch knobs **61** and **97***b* more than adequately hold the door itself firmly closed but may be overcome by slight force of the user. As the door swings downwardly on the hinges **50** and **75** about the pivot points **55** and **72** respectively, both of which are located on axis H—H, the depending portions **50***a* and **75***a* of each spring cause the springs **59** and **79** respectively to elongate and counter-balance the weight of the door **12**. Having counter-balance means on both hinges has been found to provide ease of operation free from possible racking or bending of the door.

In the case where the axis has been shifted to the vertical, the door swings open about the hinge pin **94** (shown in detail in FIG. 8) and the hinge **81** (shown in FIGS. 5–7). If the cabinet is level, no counter-balance is necessary, however, a conventional counter-balance and/or stop feature may be easily added.

Operation of the selector means **120** on the door **112** as set out in the description of FIGS. 10–12 produces the same type movements of links **122** and **124** so that operation of the hinge means **140**, **170** and **190** of door **112** is exactly the same as that of their counterparts on door **12**.

From the foregoing description of the construction and operation of our invention, it may be seen that we have produced a safe, convenient, attractive, sturdy and economical axis-shifting mechanism for multiple-axis doors.

Although minor modifications might be suggested by those versed in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of our contribution to the art.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A two way closure means for an opening in an adjacent supporting surface comprising a supporting surface, a door mounted on said support surface selectively

changeable to swing about multiple axes of rotation between a closed position in abutment with said support surface covering said opening and an open position wherein said opening is not covered, an axis changing mechanism on said door,

a safety lock means on said door including,

(1) a safety lock positioned to prevent operation of said axis changing mechanism when engaged therewith or to allow operation of said axis changing mechanism when disengaged therefrom,

(2) a catch knob mounted on and projecting from said cabinet, said catch knob disengaging said safety lock when said door is in said closed position and allowing said safety lock to engage said axis changing mechanism when said door is not in abutment with said cabinet,

said door being mounted on said supporting surface with first, second and third hinge means spaced about said door,

a first axis passing through said first and second hinge means whereby said door may be selectively swung about said first axis,

a second axis passing through said second and third hinge means whereby said door may be selectively swung about said second axis,

said axis changing mechanism including,

(A) a shifter mechanism on said first and third hinge means,

(B) a two-way hinge on said second hinge means,

(C) a selector cooperating with said first and third hinge means to alternately engage either said first or third hinge means for rotation of said door about the first or second axis respectively,

(D) said safety lock means being positioned adjacent each shifter mechanism and cooperating with the selector means so that both safety lock catch knobs must engage their respective safety locks to allow operation of said axis changing mechanism.

2. A closure means according to claim **1**, wherein each of said safety lock means additionally includes,

(A) a frictionally gripping socket member on said door adapted to receive and hold said catch knob when said door is in said closed position thereby holding said door on said cabinet during changing of the axis of rotation.

3. In a closure means according to claim **1** wherein said first hinge means includes,

(A) a hinge mounted on said cabinet pivotal about the first axis and having a portion thereof projecting outwardly from said cabinet,

(B) said shifter mechanisms of said first and third hinge means comprising,

(1) an actuator arm pivotally mounted at one end,

(2) a slide channel,

(3) a slide in said slide channel,

(4) said actuator arm having its other end engaging said slide so that movement of said axis selector will move said slide into and out of engagement with said hinge and thereby change the axis of rotation of said door.

4. A closure means according to claim **3** wherein said axis changing mechanism additionally includes

a snap action means on said first hinge means comprising,

a leaf spring bowed between its ends and engaging the actuator arm so that when the spring snaps over center between oppositely bowed positions the shifter mechanism on both the first and third hinge means is operated to change the axis of rotation.

5. A closure means according to claim **3** wherein said actuator arm, slide and slide channel of said first and third hinge means are of substantially identical design.

6. A closure means alternately swingable about either a first or second axis comprising:

(A) a door,

(B) a supporting surface adjacent said door,

(C) a first hinge means adapted to selectively mount said door on said supporting surface,

(D) a second hinge means spaced from said first hinge means mounting said door on said supporting surface,

(E) a third hinge means spaced from said first and second hinge means adapted to selectively mount said door on said supporting surface,

(F) a first axis passing through said first and second hinge means whereby said door may be swung about said first axis between an open and a closed position,

(G) a second axis passing through said second and third hinge means whereby said door may be swung about said second axis between an open and a closed position,

(H) a selector cooperating with said first and third hinge means to change the axis of rotation from the first to the second axis by simultaneously engaging the third hinge means and disengaging the first hinge means, or to change the axis of rotation from the second to the first axis by simultaneously engaging the first hinge means and disengaging the third hinge means,

(I) a safety lock limiting the operation of the selector and the consequent changing of the axis to the period when the door is in the closed position adjacent the supporting surface, thereby assuring that the first and third hinge means are not simultaneously disengaged while the door is open or not adjacent to the supporting surface,

said first hinge means including,

(J) a hinge mounted on said supporting surface, pivotal about the first axis and having a portion thereof projecting outwardly from said support surface, and

(K) a shifter mechanism mounted on said door comprising,

(1) an actuator arm having, (a) an upper circular end rotatably mounted on a hub, said upper end connected to said selector whereby it moves in response to movement of the selector, (b) an intermediate portion, and (c) a lower end,

(2) a slide channel having a first end and a second end,

(3) a slide in said channel slidable in said channel engaging the lower end of said actuator arm and having a hinge connector engaging said outward projecting hinge portion so that movement of the selector will rotate said actuator arm which in turn will slide said slide and hinge connector into and out of engagement with the hinge to effect swinging of the door about the first and second axes respectively.

7. A closure means according to claim **6**, wherein said hinge has

(A) a first stop limiting the downward swing of said door about the first axis to approximately 90° so that the fully-opened door serves as a work area,

(B) a second stop limiting the closing of said door adjacent said support surface, and

(C) a resilient means attached thereto to serve as a counterbalance for said door when it is swung about the first axis.

8. A closure means according to claim **6**, including, a snap action means cooperating with said selector and said first and third hinge means to instantaneously and completely change the axis of rotation.

9. A closure means according to claim **8**, wherein said snap action means comprises,

(A) a fixed support positioned below said slide channel, and

(B) a bowed leaf spring having its upper end seated on said hub and its lower end seated in said fixed support below said slide channel, said fixed support being located at a distance from the spring seat on the hub less than the unbowed length of said spring whereby said spring is bowed and will snap over center from alternate bowed positions, said bowed leaf spring having its middle portion slidably passing through said actuator arm so that said leaf spring and said actuator arm move together to snap said hinge engaging means into and out of engagement with said hinge.

10. A closure means according to claim **9**, wherein,

(A) said slide channel is located between the ends of the leaf spring, is of a rectangular tubular cross-section and has top and bottom openings of a size to accommodate said snap action means,

(B) said lower end of said actuator arm passes through said upper opening to engage said slide,

(C) said leaf spring passes through both said upper and lower openings,

(D) said slide channel end has an opening of lesser extent than said slide, but of greater extent than said hinge-engaging means whereby movement of the hinge-engaging means past the first end is limited,

(E) said hub, slide channel and lower support point being part of a unitary shifter body.

11. A closure means according to claim **6**, wherein

(A) the safety lock means comprises,

(1) a locking surface on said actuator arm,

(2) a spring lock mounted on said shifter mechanism and resiliently biased against said locking surface so as to prevent rotation of said actuator arm when the spring is in engagement with said locking surface,

(3) a door catch mounted on and extending from said supporting surface and adapted to move said spring lock out of engagement with said locking surface when said door is in the closed position adjacent said supporting surface thereby allowing the changing of the axis of rotation.

12. A closure means according to claim **6**, wherein said third hinge means comprises,

(A) a mounting member mounted on said supporting surface projecting outwardly therefrom having a hinge pin receiving hole therein coaxial with the second axis,

(B) a shifter mechanism mounted on said door comprising,

(1) an actuator arm having,

(a) an upper circular end rotatably mounted,

(b) said upper end connected to said selector whereby it moves in response to movement of the selector, (c) an intermediate portion, and

(d) a lower end,

(2) a slide channel having a first end and a second end,

(3) a slide in said channel slidable in said channel, engaging the lower end of said actuator arm and having a hinge pin for engaging said hole in the mounting means so that movement of the selector will rotate the actuator arm which in turn will slide said hinge pin into and out of engagement with the mounting member to effect swinging of the door about the second and first axes respectively.

13. A closure means according to claim **6** wherein said selector comprises,

(A) a handle bar having, an outwardly projecting portion with one edge attached to said door and the other edge having a skirt depending therefrom in parallel relation to said door,

(B) a concealed only slightly rotable handle mounted on said door below and behind said handle bar comprising

(1) a rotatable body member,

(2) elongated flanges extending from generally diametrically opposed sides of said body member and situated completely below said outwardly projecting portion of said bar so as to be completely concealed at all times whereby fingers of a user must be extended under the skirt to press against alternate ones of said flanges to effect slight rotary movement thereof said body member having means to attach the the links connecting the selector and the shifter mechanism so that movement of the selector are directly transmitted to the shifter mechanisms.

14. A closure means according to claim **11**, wherein said third hinge means comprises,

(A) a mounting means mounted on said supporting surface, projecting outwardly therefrom and having a hinge pin receiving hole therein coaxial with the second axis,

(B) a shifter mechanism mounted on said door comprising,

(1) an actuator arm having, (a) an upper circular end rotably mounted, (b) said upper end connected to said selector whereby it moves in response to movement of the selector, (c) an intermediate portion, and (d) a lower end,

(2) a slide channel having a first end and a second end,

(3) a slide in said channel slidable in said channel, engaging the lower end of said actuator arm and having a hinge pin for engaging said hole in the mounting means so that movement of the selector will rotate the actuator arm which in turn will slide said hinge pin into and out of engagement with the mounting means to effect swinging of the door of about the first and second axes respectively.

15. A closure means according to claim **14**, wherein said snap action means comprises,

(A) a fixed support positioned below said slide channel, and

(B) a bowed leaf spring having its upper end seated on said hub and its lower end seated in a fixed support below said slide channel, said fixed support being located at a distance from the spring seat on the hub less than the unbowed length of said spring whereby said spring is bowed and will snap over center from alternate bowed positions, said bowed leaf spring having its middle portion slidably passing through said actuator arm so that said leaf spring and said actuator arm move together to snap said hinge engaging means into and out of engagement with said hinge.

16. A closure means according to claim **14**, wherein said second hinge means comprises,

(A) a horizontally pivotal hinge mounted on said supporting surface pivotal about the first axis and having,

(1) a portion thereof projecting outwardly from said support surface, said first axis being horizontal and passing through said outwardly projecting portion,

(2) a first stop limiting the downward swing of said door about the first axis to approximately 90° so that when fully opened the door serves as a horizontal work area,

(3) a resilient means attached thereto and adapted to serve as a counterbalance for said door when it is swung about the horizontal axis,

(B) a vertically pivotal hinge fixedly attached to the

door and pivotal about the vertical axis on a hinge pin that is coaxial with the vertical axis and mounted on said horizontally pivotal hinge through two vertically spaced tabs bent 90° out of the plane of said horizontally pivoted hinge.

17. A closure means alternately swingable about either a first or second axis comprising,

(A) a door,

(B) a supporting surface adjacent said door,

(C) a first hinge means adapted to selectively mount said door on said supporting surface,

(D) a second hinge means spaced from said first hinge means mounting said door on said supporting surface,

(E) a third hinge means spaced from said first and second hinge means adapted to selectively mount said door on said supporting surface,

(F) a first axis passing through said first and second hinge means whereby said door may be swung about said first axis between an open and a closed position,

(G) a second axis passing through said second and third hinge means whereby said door may be swung about said second axis between an open and a closed position,

(H) a selector cooperating with said first and third hinge means to change the axis of rotation from the first to the second axis by simultaneously engaging the third hinge means and disengaging the first hinge means, or to change the axis of rotation from the second to the first axis by simultaneously engaging the first hinge means and disengaging the third hinge means, said selector coordinating the operation of said first and third hinge means comprising,

(I) a first rotatable block means located at a point on said door remote from said first and third hinge means having the form of a cylinder with one end closed by an end wall having an arcuate slot with first and second ends,

(J) a first rigid linkage means connecting said first block and the shifter mechanism of said first hinge means,

(K) a second rigid linkage means' connecting said first block and the shifter mechanism of said third hinge means so that rotation of the block in either direction actuates both shifter mechanisms to change the axis of rotation,

(L) torque-limiting handle means for rotating said block means comprising,

(1) a handle means having an arcuate slot therein with first and second ends,

(2) a projection on said door projecting into the slot in said handle,

(3) a third rotatable block having an arcuate slot with first and second ends in a portion of said third block facing said first block,

(4) a second rotatable block within the cylindrical portion of said first block having a first pin projecting toward said first block end wall and into the arcuate slot of said end wall and a second pin projecting into the arcuate slot in the third rotating block,

(5) a spiral spring means having a first portion with one end attached to said first block and the other end portion connected with the second block and having a second portion with one end portion connected with said second block and the other end attached to said third block biasing said first pin against said first end of said arcuate slot in said first block and biasing said second pin against said first end of said arcuate slot in the third block so that as said handle means is rotated clockwise said second pin bears against the first end of said slot in the third block to transmit the torque from the handle means directly to said second block whereas the torque is transmitted from the second block to the first block through the spring until the rotational resistance of the drum overcomes the force of the spring whereas the first pin will move in the arcuate slot of said first block until the projection on the door reaches the end of the slot in the handle thereby limiting the torque transmitted to the block means and preventing change to the system.

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KENNETH DOWNEY, Primary Examiner

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