

Nov. 5, 1935.

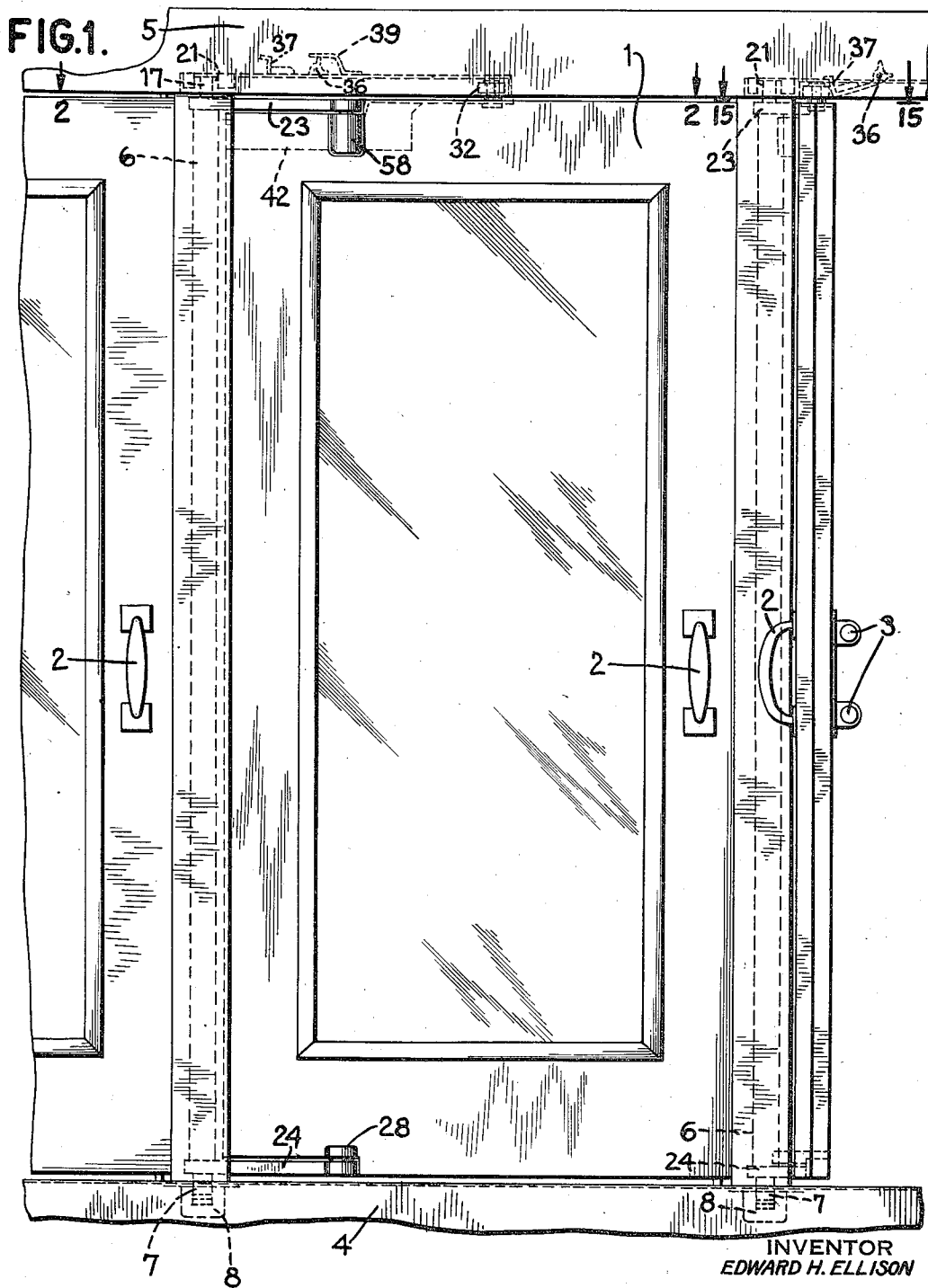
E. H. ELLISON

2,019,526

BALANCED DOOR

Filed April 27, 1931

6 Sheets-Sheet 1



BY THEIR ATTORNEYS

Bohlebe & Ledbetter

Nov. 5, 1935.

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BALANCED DOOR

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6 Sheets-Sheet 2

FIG. 2.

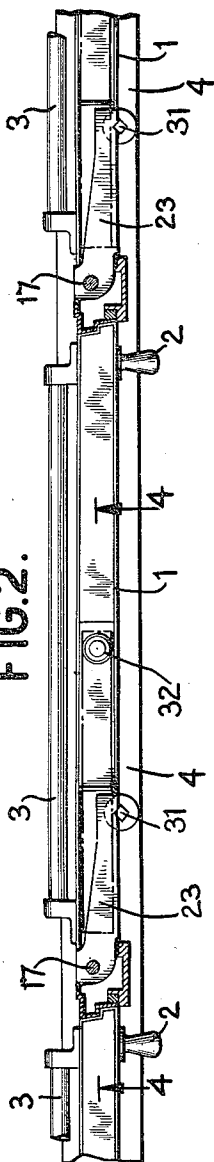
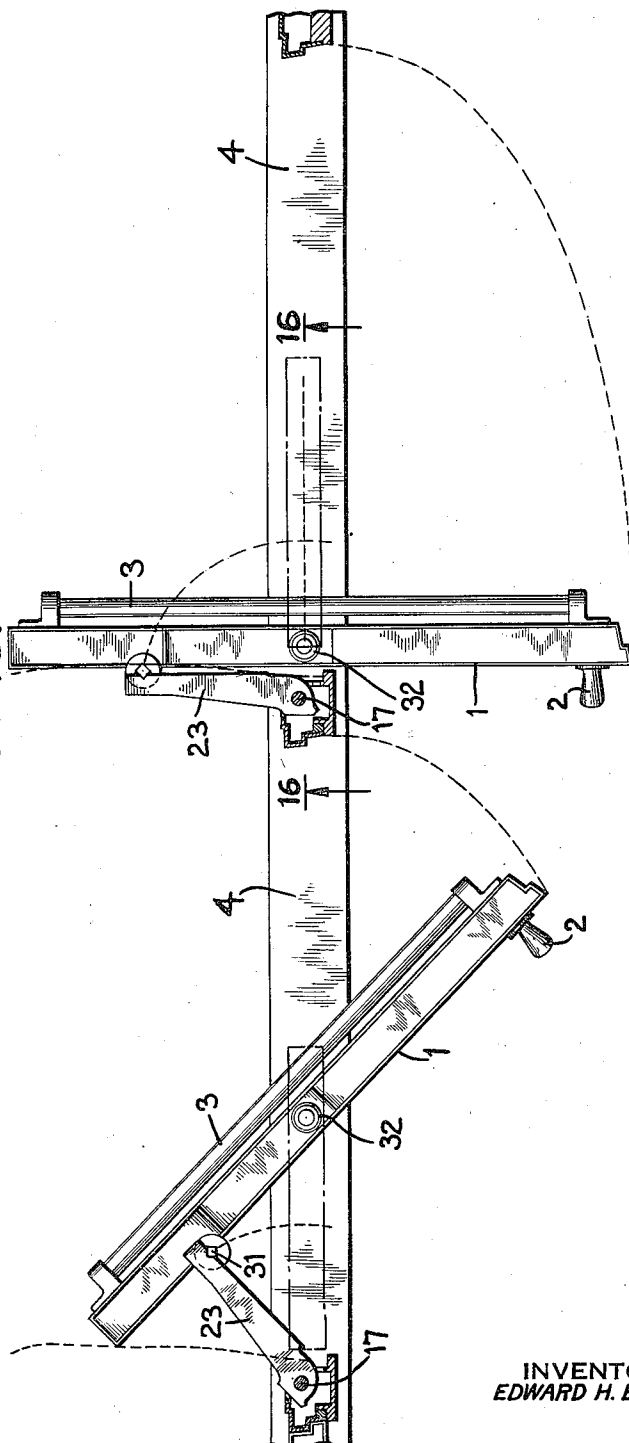


FIG. 3.



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6 Sheets-Sheet 3

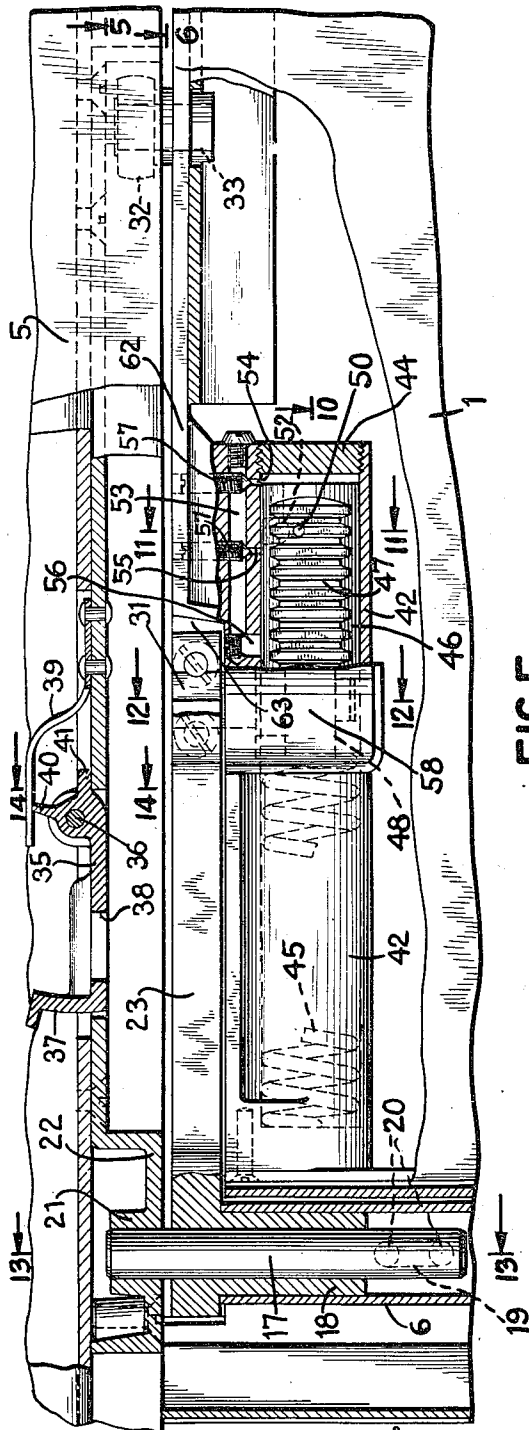


FIG. 4.

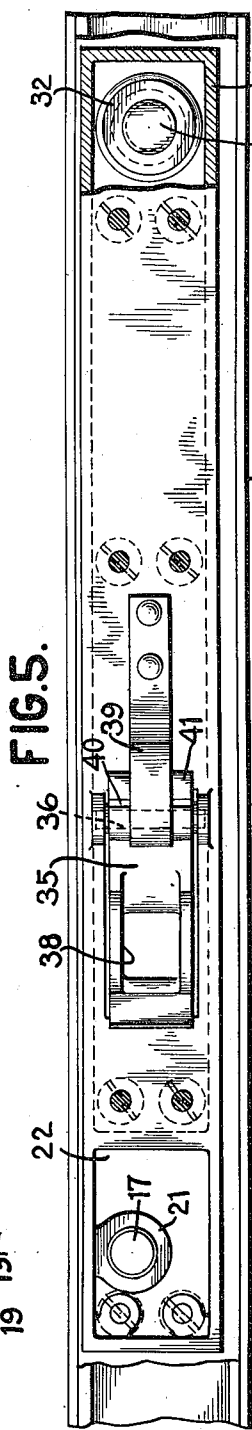


FIG. 5.

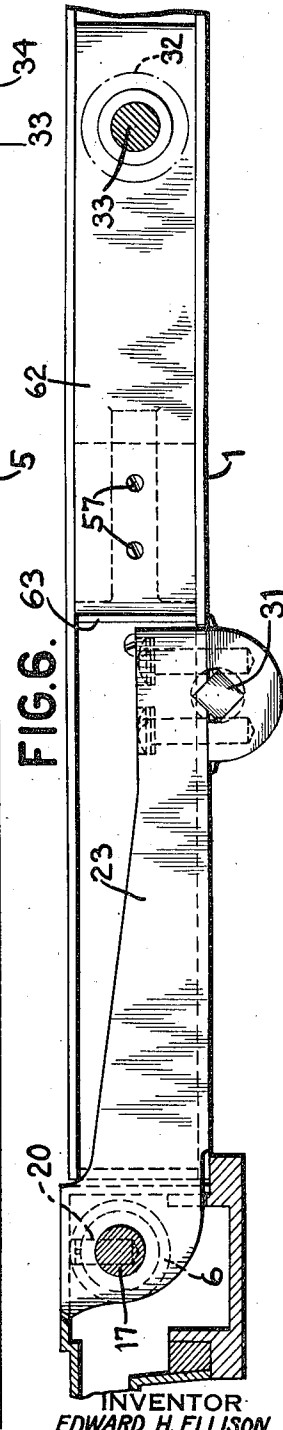


FIG. 6.

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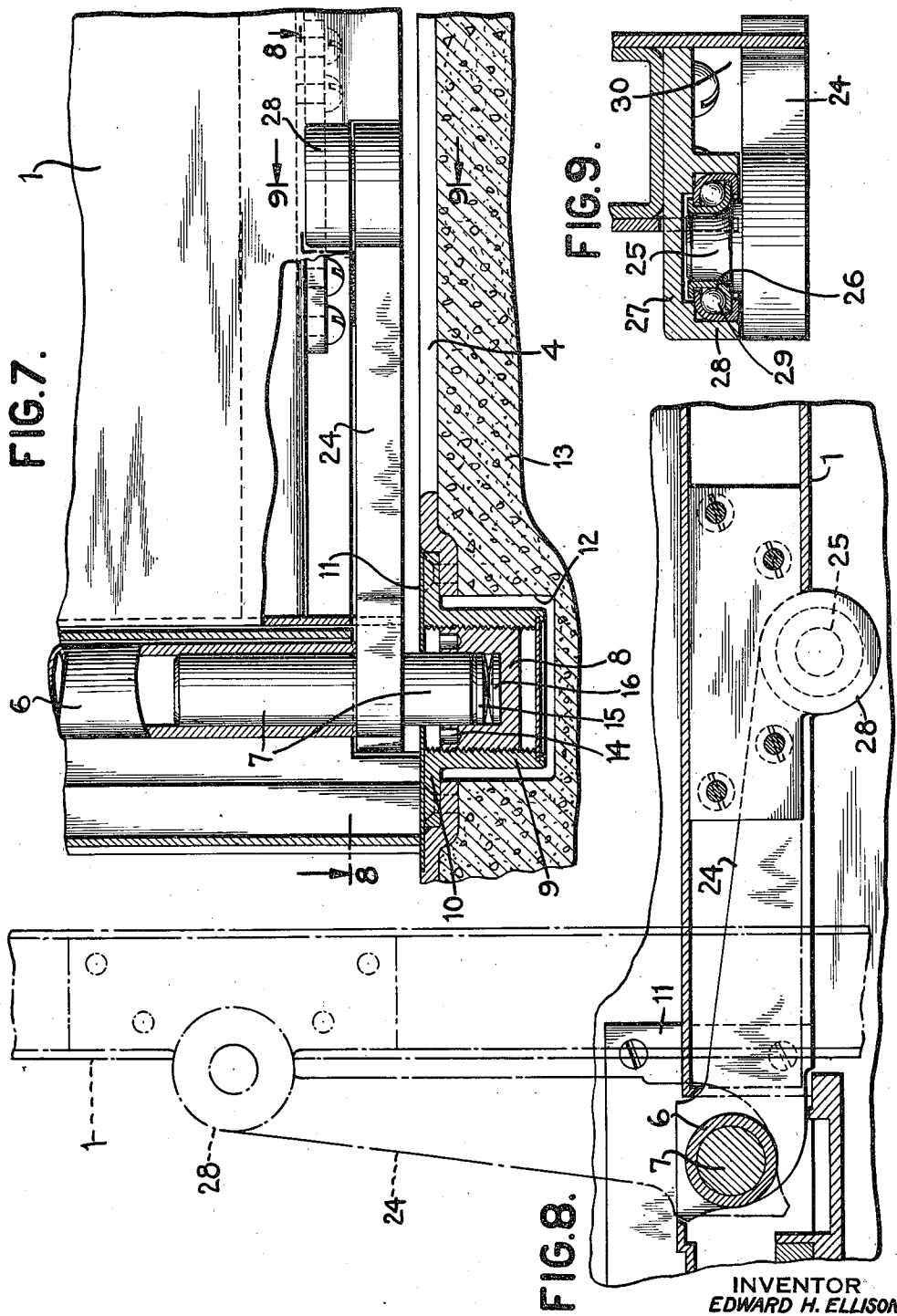
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6 Sheets-Sheet 4



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FIG.13.

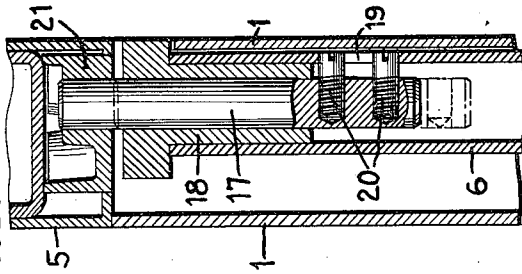


FIG.14.

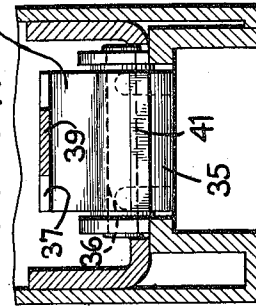


FIG.10.

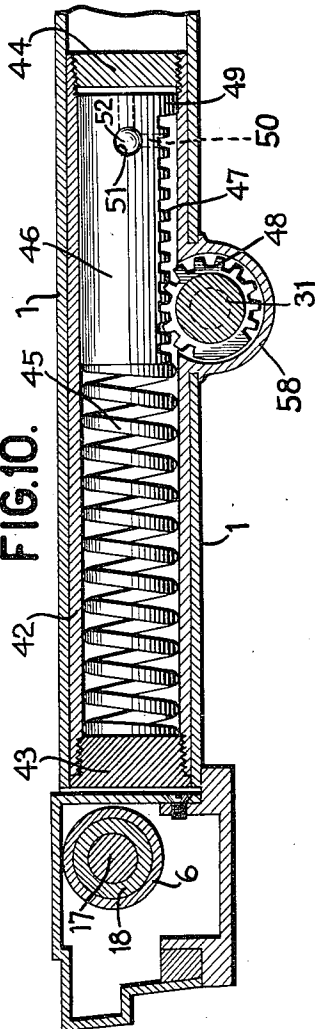


FIG.12.

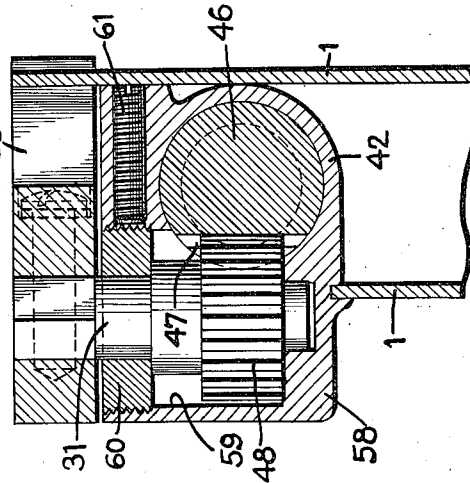
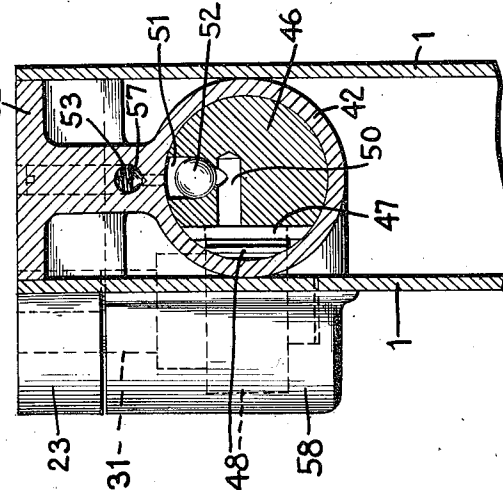


FIG.11.



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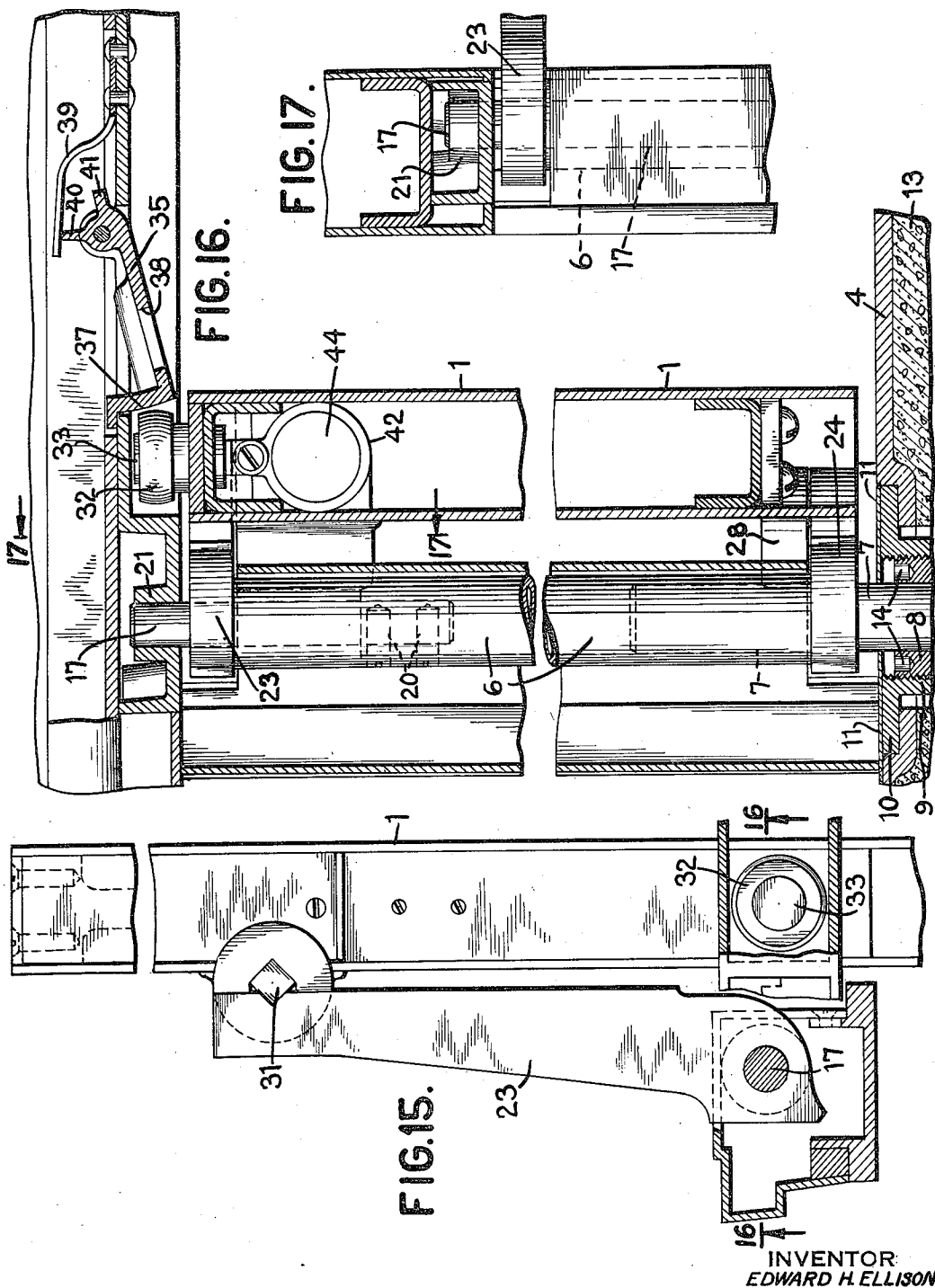
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BALANCED DOOR

Filed April 27, 1931

6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE

2,019,526

BALANCED DOOR

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Ellison Bronze Company, Inc., Jamestown,
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Application April 27, 1931, Serial No. 533,147

26 Claims. (Cl. 20—16)

The present invention relates to doors and em-
bodies, more specifically, an improved door and
door mounting construction by means of which
ease of operation and simplicity of construction
and assembly are accomplished.

More specifically, the invention comprises a
door and door mounting construction of the
above character, wherein an effective balance of
a door is obtained to render the same easy to
open and to maintain closed against high wind
pressures and other disturbing influences. In
this connection, where doors are used for serv-
ice in entrances and vestibules of office and pub-
lic buildings, the doors are required to swing out-
wardly and the wind pressure thereagainst has
made such doors extremely difficult to operate.
In doors of this character, door closers must be
used which exert pressures upon the doors to
maintain them closed against wind pressure
from the inside, as for example, due to a cur-
rent of air into the vestibule through one or more
doors which are opened from the outside. The
pressure required in these door closers adds to
the difficulty of opening the doors and thus fre-
quently becomes objectionable.

The present invention proposes to balance
doors of this character by mounting them in such
fashion that part of the door swings inwardly
while the other part swings outwardly. In this
fashion, the pressures exerted upon one side of
the door are in substantial equilibrium in view
of the fact that part of such pressure tends to
open the door and part tends to maintain the
same closed. This construction obviously re-
quires less normal pressure to maintain the door
closed and hence permits a door closer construc-
tion to be employed having a comparatively slight
spring pressure.

Furthermore, the construction is such that all
of the parts may be conveniently contained with-
in the door, thus avoiding unsightly projections
and irregular contours. The construction thus
permits free application of architectural design.
The door construction is further adapted to re-
ceive all modern improvements which it is de-
sired to apply thereto and is of adequate strength
to withstand the severe stresses and strains im-
pressed thereon in service of this character.

On object of the invention, accordingly, is to
provide an improved door mounting means
whereby wind pressures upon the sides of a door
may be equalized and the resistance heretofore
produced thereby eliminated.

A further object of the invention is to provide
a door mounting mechanism of the above char-

acter wherein a door closer may be utilized hav-
ing a comparatively slight spring pressure serv-
ing to maintain a door normally closed.

A further object of the invention is to pro-
vide a construction of the above character, where-
in the mounting and auxiliary elements are
maintained within the door in order that the
architectural design and beauty of the door may
be preserved.

A further object of the invention is to pro-
vide an improved door mounting mechanism by
means of which the adjustable spacing of the
door vertically may be effected.

A further object of the invention is to pro-
vide an improved door closing mechanism.

A further object of the invention is to pro-
vide a closing mechanism for doors, wherein the
mechanism is contained within the door struc-
ture.

A further object of the invention is to provide
an improved door mounting and closing mech-
anism, wherein the wind pressure upon the door
may be equalized in such fashion that no re-
sistance to opening or closing thereof results, at
the same time providing a door closing mech-
anism which offers a comparatively slight re-
sistance to such movement.

A further object of the invention is to provide
an improved holding mechanism for holding a
balanced door in its open position.

A further object of the invention is to provide
a mounting mechanism for balancing doors
against wind pressures, such mechanism includ-
ing mounting arms in combination with a
straightening out or door closing mechanism, as
well as a door check.

A further object of the invention is to pro-
vide a mounting mechanism for doors of the
above character by means of which the same
may be readily installed and dismantled, the
mechanism further being adapted for use in con-
nection with jambs of varying height.

Further objects, not specifically enumerated
above, will be apparent as the invention is de-
scribed in greater detail in connection with the
accompanying drawings, wherein:

Figure 1 is a view in front elevation, showing
a door and door mounting mechanism construct-
ed in accordance with the present invention.

Figure 2 is a view in section, taken on line 2—2
of Figure 1, and looking in the direction of the
arrows, this figure showing the door mounting
mechanism in plan.

Figure 3 is a view similar to Figure 2, showing
one door moved to a fully open position and

another door moved to a partially opened position.

Figure 4 is a view in section, taken on a plane indicated by the line 4—4 of Figure 2, and looking in the direction of the arrows, this figure showing the straightening out device for a door constructed in accordance with the present invention, also the door check device, adjustable hinge pin, and holding device for holding the door in an open position.

Figure 5 is a view in section, taken on line 5—5 of Figure 4, looking in the direction of the arrows and showing the device for holding the door in an open position.

Figure 6 is a view in section, taken on line 6—6 of Figure 4, and looking in the direction of the arrows, this view showing the upper door mounting arm.

Figure 7 is a view in section, showing the lower bearing for the door mounting mechanism, this bearing being adjustable vertically to vary the height of the door and its spacing thereof from the floor.

Figure 8 is a view in section, taken on line 8—8 of Figure 7 and looking in the direction of the arrows.

Figure 9 is a view in section, taken on line 9—9 of Figure 7, and looking in the direction of the arrows.

Figure 10 is a view in section, taken on line 10—10 of Figure 4, and looking in the direction of the arrows.

Figure 11 is a view in section, taken on line 11—11 of Figure 4, and looking in the direction of the arrows.

Figure 12 is a view in section, taken on line 12—12 of Figure 4, and looking in the direction of the arrows.

Figure 13 is a view in section, taken on line 13—13 of Figure 4, and looking in the direction of the arrows.

Figure 14 is a view in section, taken on line 14—14 of Figure 4, and looking in the direction of the arrows.

Figure 15 is a view in section, taken on line 15—15 of Figure 1, and looking in the direction of the arrows.

Figure 16 is a view in section, taken on line 16—16 of Figures 3 and 15 and looking in the direction of the arrows.

Figure 17 is a view in section, taken on line 17—17 of Figure 16, and looking in the direction of the arrows.

Referring to the above drawings, a door is shown at 1 and may be of any desired shape or design. Handle 2 and push bars 3 are mounted thereon in the usual fashion and the door is adapted to be mounted in a suitable doorway formed by a floor 4 and cornice 5 for suitably hanging the door, a tubular shaft 6 is provided within the lower end of which a pin 7 is welded or brazed. This pin is received within a bearing cup 8 which is threaded within a recessed member 9 having a flange 10 which is adapted to be secured to the floor 4 and preferably lies flush therewith, as shown in Figure 7. A flush plate 11 is provided to close the recess formed by the member 9 and prevent the accumulation of foreign matter therein. The foregoing mechanism is thus received within a recess 12 within the foundation 13 and vertical adjustment of the bearing cup 8 may be effected by engagement of a suitable wrench with recesses 14 within the cup 8. To provide a suitable step bearing, the pin 7 is mounted upon a button 15 which has a lower curved bear-

ing surface and which is adapted to engage with a cooperating similarly formed opposed button 16, also having a curved bearing face. The construction thus facilitates the easy operation of the door.

The upper end of the tube 6 carries an axially movable pin 17 which is received within a bushing 18. The bushing is rigidly secured to the tube and a slot 19, formed in the tube, receives set screws 20 which are secured to the pin 17. By removing the lower set screw, see Figure 13, the pin may be dropped to the position indicated in dot and dash lines and the door thus easily removed. In the position shown in solid lines the pin engages a bearing 21 in a bracket 22, mounted within the cornice 5 and thus hangs the door in a suitable fashion.

Extending horizontally from the bushing 18 and pin 7 are upper and lower arms 23 and 24, respectively. The extremity of the lower arm is formed with a stud 25 which is adapted to receive a ball race 26 and thus journal the arm 24 upon a bracket 27 which has a downwardly extending cup-shaped extremity 28 within which a bearing 29 is received. The bracket 27 is secured to the bottom of the door in a recess 30, formed therein in order that the arm may not constitute an objectionable protrusion to interrupt the profile and contour of the door. The foregoing construction is well illustrated in Figures 7, 8, and 9.

Upper arm 23 engages a squared shaft 31 for operating a door closer and check in a manner which will be described hereinafter, the axis of such squared shaft being aligned with the axis of the stud 25 in order that the door may be journaled upon a single vertical axis which lies between the edges thereof. Movement of the door is guided by means of a roller 32 which is journaled upon a stub shaft 33 mounted upon the door. This roller engages a track 34 which is mounted within the soffit of the cornice. This groove or guide track 34 is preferably formed in the bracket 22 which is so formed as to be of sufficient length to accommodate a groove of this character and lie within the soffit of the cornice. The roller 32 thus imparts a sliding movement to the door while the arms 23 impart a swinging or hinging movement thereto. Arms 23, in combination with the portion of the door between the axis of the shaft 31 and roller 33, constitute a toggle which is utilized, in a manner described hereinafter, to facilitate the closing and opening of the door.

Within the bracket 22 and in the upper wall of the groove 34, a door holder or detent 35 is mounted, this detent being hinged at 36 and having a stop face 37 for engaging the roller 32, as illustrated in Figure 16. A finger hole 38 is formed in the detent to facilitate its adjustment in the position shown in Figure 16, and a leaf spring 39 is provided for engaging a cam 40 which is formed on the detent adjacent the pivot thereof. Spring 39 thus normally urges the detent into its retracted position as shown in Figure 4 and stop 41, formed on the detent, limits the movement thereof into this normal position. When the stop is moved to the position shown in Figure 16, the direction of pressure of the spring 39 upon cam 40 passes upon the other side of the axis 35, thus yieldingly maintaining the stop in its extended or "stop" position, as shown in Figure 16.

Within the door and preferably at the top thereof adjacent the shaft 31 is a cylinder 42 provided with heads 43 and 44. Against head 43

a coil spring 45 is seated, this spring being of sufficient diameter to permit the compression thereof by axial movement of piston 46 within the cylinder. The piston is formed with rack teeth 47 which engage a pinion 48 mounted upon the squared shaft 31 and thus relative rotation of the door about the shaft 31 causes the piston 46 to be moved axially within the cylinder 42. The piston is formed with a head 49 which snugly engages the cylinder and thus forms, with the closed end of the cylinder, a chamber within which fluid may be compressed.

Piston 46 is drilled at 50 and 51 to form ducts communicating between the space in the cylinder back of the piston head 49 and ducts to be described hereinafter. Duct 51 communicates with the compression chamber between the piston head 49 and cylinder head 46 and a ball check 52 permits fluid flow from the region back of the piston head to the above described space and prevents fluid flow in the reverse direction.

To afford the desired gradual checking effect, a duct 53 is formed in the cylinder wall 42 and provided with a plurality of ports 54, 55, and 56. Port 56 communicates with the region back of the piston head and set screws 57 are provided for the ports 54 and 55 to provide a desired degree of restriction of the ports. In this fashion, movement of the piston may be progressively checked to any desired degree and the door thus brought to a closed position in a suitable fashion.

From Figure 12, it will be seen that the piston 42 is preferably formed of a casting including an offset portion 58 within which a recess 59 is formed. A bushing 60 is threaded into the top of this recess and serves as a bearing for the squared shaft 31 which is also journaled in the offset portion in its lower extremity. A set screw 61 is provided to lock the bushing 60 in a desired position and the cylinder casting is also preferably formed with an upper flanged surface 62 which forms the top of the door, extending a sufficient distance thereacross to serve as a support for the pivot shaft 33 of the guide roller 32. This structure is clearly shown in Figure 4. Adjacent the squared shaft 31, and the edge of the door adjacent the tubular support 6, the casting is cut away at 63 to permit the nesting of arm 23 therein when the door is in a closed position.

From the foregoing, it will be seen that a door mounting structure has been provided which is simple of construction and of great strength. The elements are few in number and are readily assembled and afford an effective means for hanging a door at a desired height. Provision is made for swinging the door in doorways of slightly varying dimensions without requiring a material change in the structure, thus adding to the convenience of the device and the ability to standardize the parts thereof. Movement of the door to and from open and closed positions is effected with facility in view of the fact that a portion of the door swings in while another portion swings out, thus balancing the effective pressures upon the sides thereof to prevent wind pressure, etc., from resisting such movement. The toggle effect of the mounting mechanism including the arms 23 and pivot connections of the door thereto, in addition to a portion of the door between such pivot connections and the guide rollers 32, facilitate a checking of the movement of the door as it approaches a closed position. The means for straightening out the toggle elements and thus closing the door is simple in construction and contained within the door itself, thus im-

proving the appearance thereof and permitting doors of any design to be used. Combined with the straightening out elements is the door check described above, these two devices being formed as a unit and thus adding to the simplicity of the structure.

While the invention has been described with specific reference to the accompanying drawings, it is not to be limited, save as defined in the appended claims.

I claim as my invention:

1. A door mounting means comprising a hollow tubular shaft extending parallel to the door at one side thereof, parallel arms rigidly secured to the shaft adjacent the ends thereof, a pin rigidly secured in the shaft at one end thereof, a pin slidably mounted in the shaft at the other end thereof, means to secure the last named pin to the shaft in a plurality of positions, and means to journal a door on the parallel arms.

2. Means to support a door comprising a vertical door carrying member, a recessed member, a step bearing in the recessed member to receive the door carrying member, and means to vary the position of the bearing in the recessed member.

3. Means to support a door comprising a vertical door carrying member, a flanged recessed member, means to secure the flange of the member to a floor, said recessed member being threaded internally, a step bearing threaded in the recessed member to receive the door carrying member, and means to move the bearing in the threaded member.

4. Means to support a door comprising a vertical door carrying member, a flanged recessed member, means to secure the flange of the member to a floor, said recessed member being threaded internally, a cup bearing threaded in the recessed member, means to vary the position of the cup in the member, a curved bearing member in the cup, and a curved bearing member between the last named member and the door carrying member.

5. Means to support a door comprising a vertical door carrying member, a flanged recessed member, means to secure the flange of the member to a floor, said recessed member being threaded internally, a cup threaded in the recessed member, means to vary the position of the cup in the member, and a plurality of buttons in the cup for supporting the door carrying member, said buttons having opposed curved bearing surfaces.

6. In combination with a vertical door supporting member having an arm for carrying the weight of a door, a recessed portion on a door to receive the arm, a bracket secured to the bottom of the door in the recess and formed with a downwardly extending cup, said bracket being spaced from the edge of the door adjacent the supporting member, an upwardly extending stud on the extremity of the arm and received by the cup, and a bearing device between the cup and the arm.

7. A door mounting means disposed in the plane of the door when the door is closed, means hingeably supporting the door on the mounting means, means actuated by the hinging means to urge the door to a normal position, and means actuated by the last named means to check movement of the door.

8. A door mounting means disposed in the plane of the door when the door is closed, means hingeably supporting the door on the mounting means,

means mounted within the door and actuated by the hinging means to urge the door to a normal position, and means actuated by the last named means to check movement of the door.

9. A door mounting means disposed in the plane of the door when the door is closed comprising a door supporting arm, means to hinge the door on the arm, and means on the door actuated by relative movement of the arm and door to urge the door to a normal position.

10. A door mounting means disposed in the plane of the door when the door is closed comprising a door supporting arm, means to hinge the door on the arm, and means on the door actuated by the hinge upon relative movement of the arm and door to urge the door to a normal position.

11. A door mounting means comprising an arm hinged at one end to a support and at the other end to a door between the vertical edges thereof, a guide engaging the support and disposed between the hinge connection of the arm to the door and the edge of the door distant from the arm, and means actuated by the hinge connection to urge the door to a normal position wherein the arm and door are each substantially in alignment.

12. A door mounting means comprising an arm hinged at one end to a support and at the other end to a door between the vertical edges thereof, a guide engaging the support and disposed between the hinge connection of the arm to the door and the edge of the door distant from the arm, means actuated by the hinge connection to urge the door to a normal position wherein the arm and door are substantially in alignment, and means actuated by the hinge connection to check movement of the door.

13. A door mounting means comprising an arm hinged at one end to a support and at the other end to a door between the vertical edges thereof, a guide engaging the support and disposed between the hinge connection of the arm to the door and the edge of the door distant from the arm, a rack carried by the door, a pinion actuated by the hinge connection of the door and engaging the rack, and means to urge the rack to a normal position.

14. A door mounting means comprising an arm hinged at one end to a support and at the other end to a door between the vertical edges thereof, a guide engaging the support and disposed between the hinge connection of the arm to the door and the edge of the door distant from the arm, a rack carried by the door, a pinion actuated by the hinge connection of the door and engaging the rack, means to urge the rack to a normal position, and means to check movement of the rack.

15. A door mounting means comprising an arm hinged at one end to a support and at the other end to a door between the vertical edges thereof, a guide engaging the support and disposed between the hinge connection of the arm to the door and the edge of the door distant from the arm, a cylinder carried by the door, a piston in the cylinder, a spring urging the piston to a normal position, a rack carried by the piston, and a pinion actuated by the hinge connection of the door and engaging the rack.

16. A door mounting means comprising an arm hinged at one end to a support and at the other end to a door between the vertical edges thereof, a guide engaging the support and disposed between the hinge connection of the arm to the

door and the edge of the door distant from the arm, a cylinder carried by the door, a piston in the cylinder, a spring urging the piston to a normal position, a rack carried by the piston, a pinion actuated by the hinge connection of the door and engaging the rack, and passages and a check valve in the piston to prevent fluid flow from the cylinder in advance of the piston to the region back of the piston.

17. A door mounting means comprising an arm hinged at one end to a support and at the other end to a door between the vertical edges thereof, a guide engaging the support and disposed between the hinge connection of the arm to the door and the edge of the door distant from the arm, a cylinder carried by the door, a piston in the cylinder, a spring urging the piston to a normal position, a rack carried by the piston, a pinion actuated by the hinge connection of the door and engaging the rack, passages and a check valve in the piston to prevent fluid flow from the cylinder in advance of the piston to the region back of the piston, and passages and bleed valves in the cylinder to relieve compressed fluid in the cylinder in advance of the piston.

18. A door closing device comprising a fixture adapted to be mounted within a door and forming a portion of the top thereof, a cylinder formed in the fixture and carrying a piston, a spring normally urging the piston to a normal position, a rack on the piston, ducts in the piston and cylinder to afford a checking effect on the movement of the piston to a normal position, an extension on the fixture forming a housing, a shaft journaled in the housing and adapted to be secured to a door mounting means, and a pinion secured to the shaft and engaging the rack.

19. In combination with a door mounted for sliding and swinging movement, means for holding said door in a desired position, said means comprising a detent, means to mount the detent in the doorway and in the path of movement of the door, means to maintain the detent normally out of said path of movement of the door, and means to maintain the detent in door engaging position.

20. In combination with a door mounted for sliding and swinging movement, means for holding said door in a desired position, said means comprising a detent, means to mount the detent in the doorway and adjacent the path of the sliding movement of the door, and common means to maintain the detent out of the said path of movement of the door and in said path of movement upon actuation of the detent.

21. In combination with a door mounted for sliding and swinging movement, means for holding said door in a desired position, said means comprising a detent, means to mount the detent adjacent the path of the sliding movement of the door, a cam on the detent, and a spring engaging the cam and adapted either to hold the detent out of said path of movement of the door or in such path of movement upon actuation of the detent.

22. In combination with a door mounted for sliding and swinging movement, means for holding said door in a desired position, said means comprising a lever, means to pivot the lever adjacent the path of movement of the door, a detent on the lever to engage the door, said lever having a recess serving as a finger hole, and a spring engaging the lever to hold the same in a desired position.

23. In combination with a door mounted for

sliding and swinging movement, means for holding said door in a desired position, said means comprising a lever, means to pivot the lever adjacent the path of movement of the door, a detent on the lever to engage the door, said lever 5 having a recess serving as a finger hole, stops to limit movement of the lever in opposite directions, and a spring to maintain the lever yieldingly in any stopped position.

10 24. In combination with a door mounted for sliding and swinging movement, means for holding said door in a desired position, said means comprising a lever, means to pivot the lever adjacent the path of movement of the door, a detent on the lever to engage the door, said lever 15 having a recess serving as a finger hole, stops to limit movement of the lever in opposite directions, a cam on the lever, and a spring engaging

the cam and mounted to urge the cam in either direction past a dead center position.

25. In combination with a door mounted in a doorway for sliding and swinging movement, a door holder mounted in said doorway for engaging said door at a point intermediate the vertical edges thereof, and means for selectively maintaining said holder in door engaging position or out of door engaging position. 5

26. In combination with a door mounted in a doorway for sliding and swinging movement, a door holder mounted in said doorway for engaging said door at a point intermediate the vertical edges thereof, means for selectively maintaining said holder in door engaging position or out of door engaging position, and a finger hole in said holder to facilitate the manipulation thereof to 10 and from door engaging position. 15

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