March 10, 1953 M. MOSKOFF 2,630,595

SPRINGLESS SELF-CLOSING HINGE FOR DOORS

Filed July 21, 1949 5 Sheets-Sheet 1

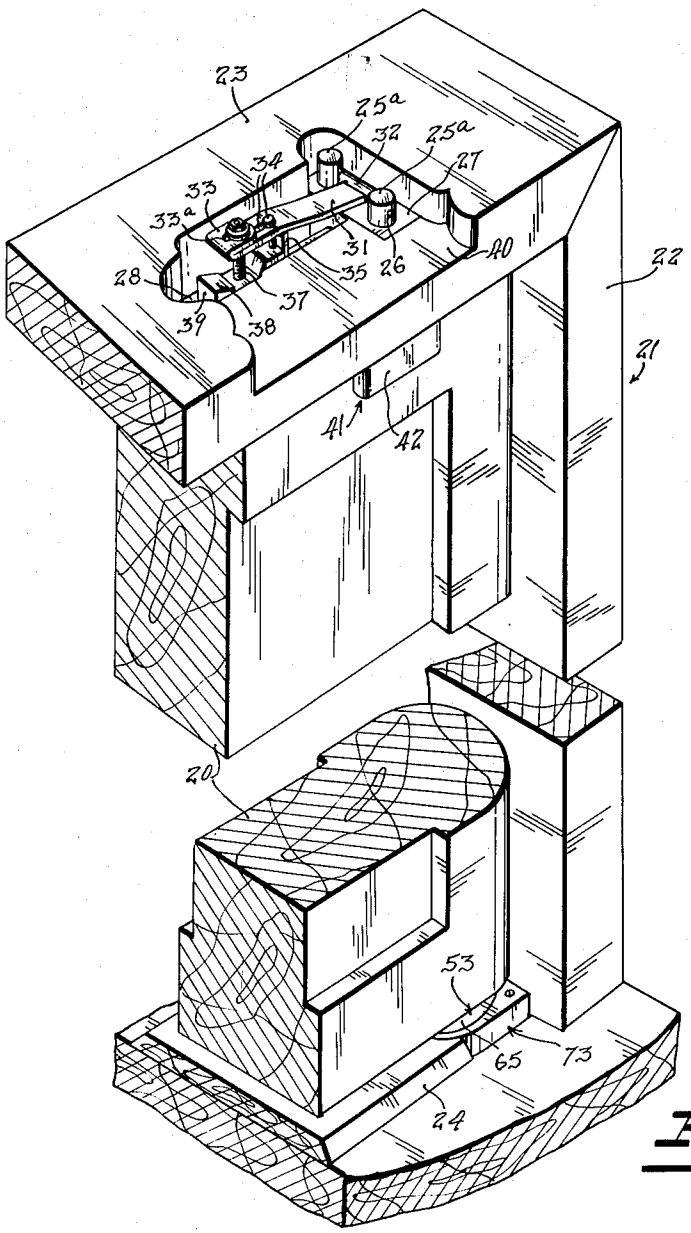


FIG. 1.

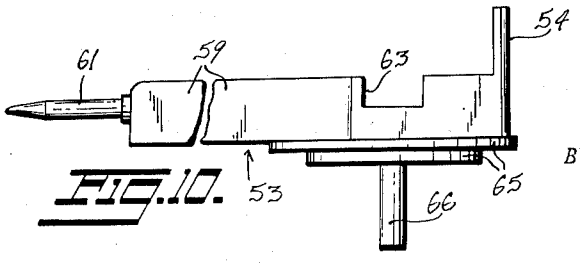


FIG. 10.

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SPRINGLESS SELF-CLOSING HINGE FOR DOORS

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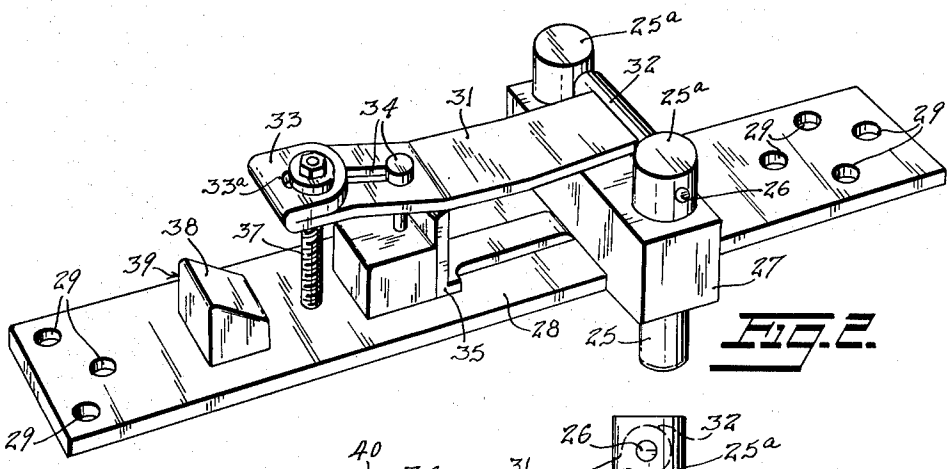


FIG. 2.

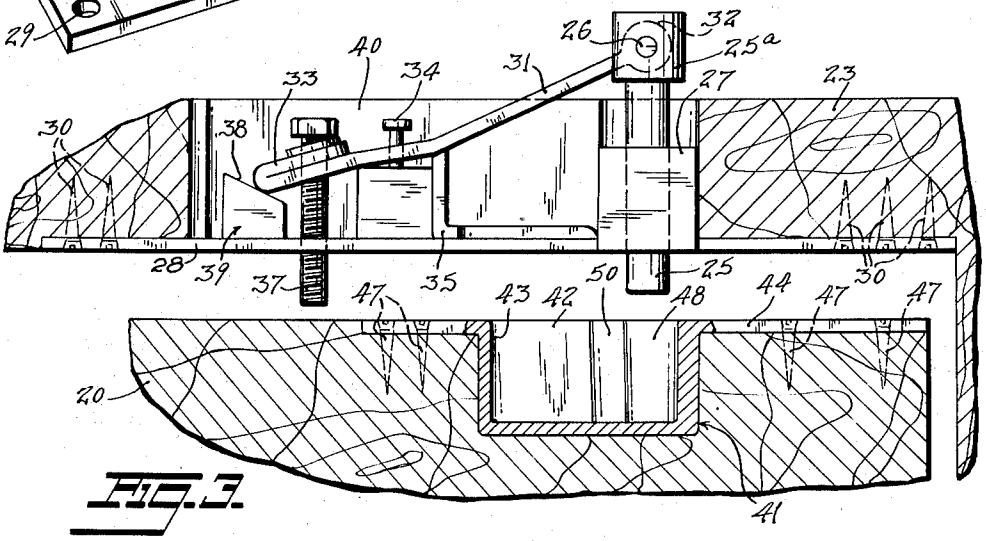


FIG. 3.

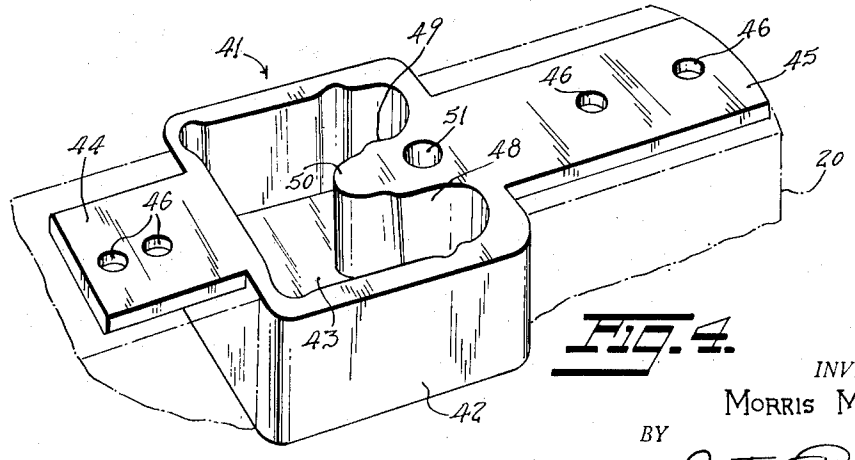


FIG. 4.

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SPRINGLESS SELF-CLOSING HINGE FOR DOORS

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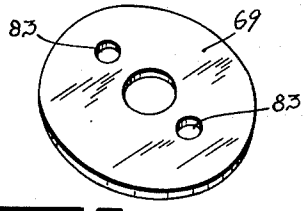


FIG. 6.

FIG. 5.

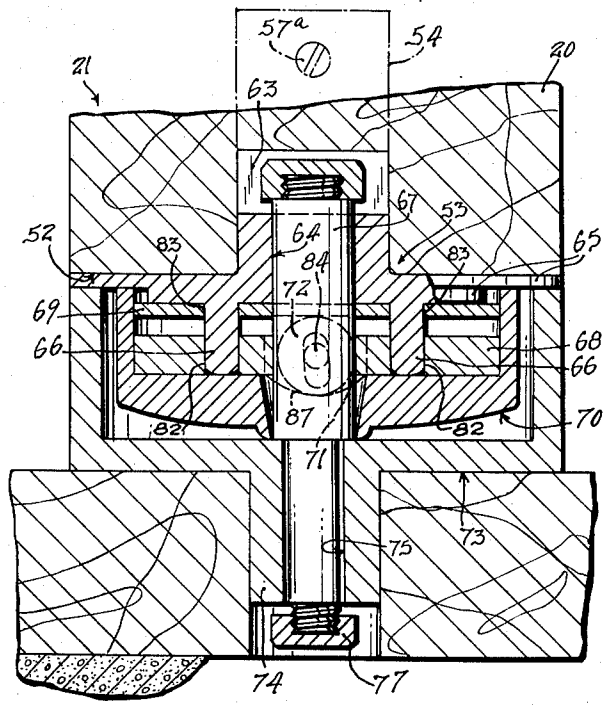


FIG. 8.

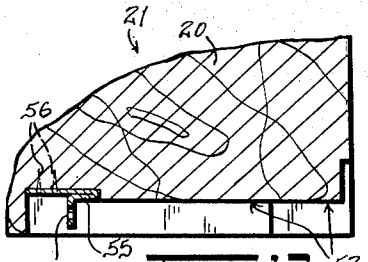


FIG. 12.

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SPRINGLESS SELF-CLOSING HINGE FOR DOORS

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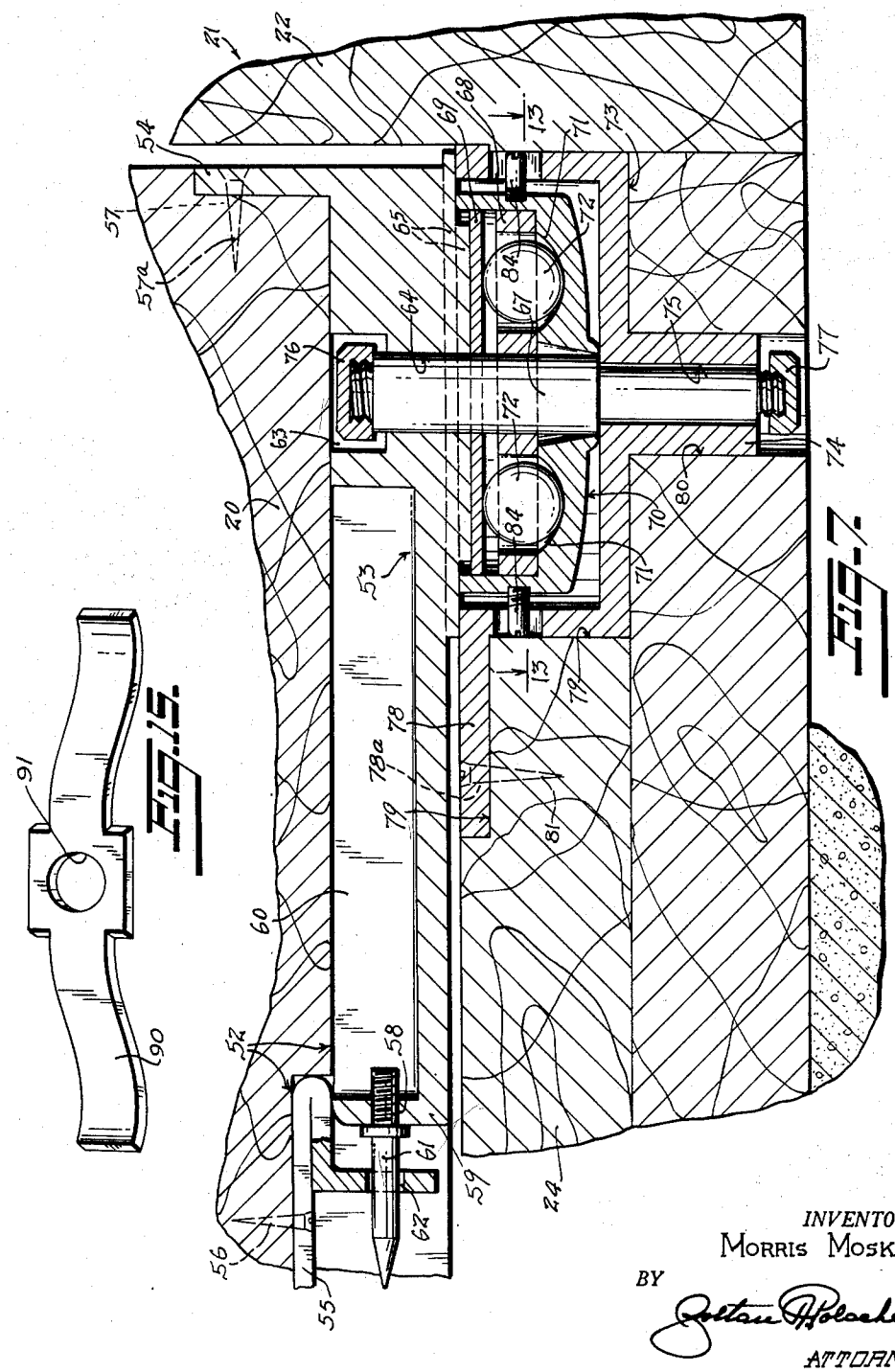


FIG. 7

FIG. 15

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SPRINGLESS SELF-CLOSING HINGE FOR DOORS

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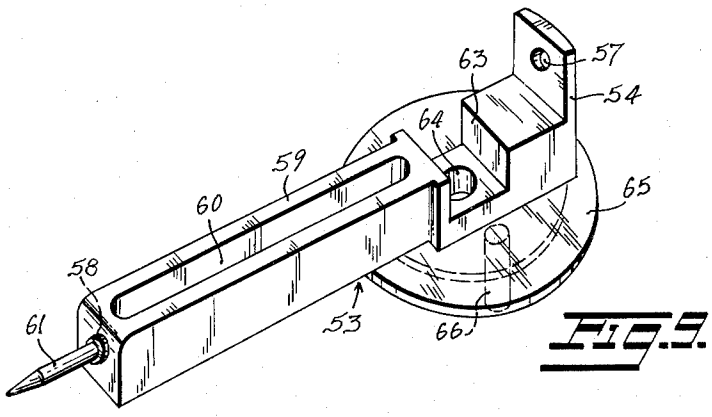


FIG. 9.

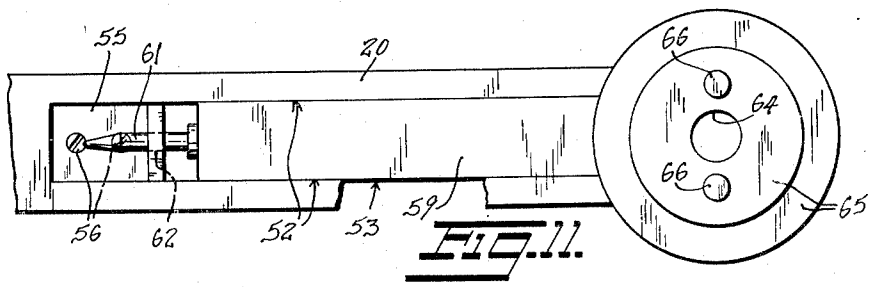


FIG. 11.

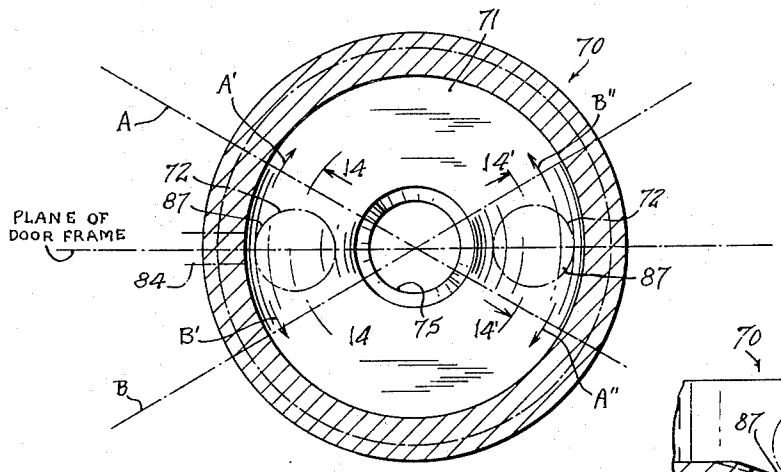


FIG. 13.

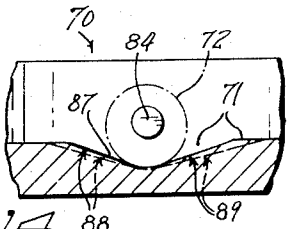


FIG. 14.

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UNITED STATES PATENT OFFICE

2,630,595

SPRINGLESS SELF-CLOSING HINGE FOR DOORS

Morris Moskoff, Bronx, N. Y.

Application July 21, 1949, Serial No. 106,019

4 Claims. (Cl. 16—154)

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This invention relates to new and useful improvements in door hanging mechanisms. The invention particularly relates to a mechanism for hanging a swing door.

The fundamental principle availed of is that well-known principle of physics that when a somehow supported body is disposed relative to its support in such manner that it is in unstable equilibrium the body will always, friction allowing, seek a condition of stable equilibrium, and will perform by itself automatically a movement in space to assume a condition of stable equilibrium.

According to the present invention, this principle is as above utilized, but said principle is carried further, in that the door is swingably mounted relative to each of a pair of vertically spaced points; and in this connection a mechanism is provided which so functions that, in view of the fact that included in said mechanism is a means movable on a door-opening swing to effect a temporary horizontal offsetting of said points, the door, whenever the same is pushed to swing out of the plane of the door frame and then released from the pushing pressure thereon, immediately responds to its own inherent urge to seek a position of stable equilibrium, that is, to lower its center of gravity, thereby to return the door to its normal extension in said plane.

It is therefore an object to provide a novel door hanging mechanism which is a new article of manufacture.

It is another object of this invention to provide a mechanism for hanging a swing door which insures positive self closing of the door.

It is a further object of the invention to provide a door hanging mechanism applicable to a door installed for being swung open in only one direction with respect to the door frame.

It is a further object to provide a door hanging mechanism applicable to a door installed for being swung open in two opposite directions with respect to the door frame.

It is a further object of the invention to provide a door hanging mechanism which is non-inclusive of a spring means for restoring the door to a closed position after it has been manually pushed open and released from the pushing pressure thereon.

It is a further object of the invention to provide a springless hanging mechanism for a swing door.

Various other objects, features and advantages of the invention, among these a special arrangement for reducing friction to a minimum

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if not substantially excluding friction except to a negligible extent, will become apparent or be specifically referred to hereinafter.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

Fig. 1 is a perspective view, partially broken away and partially in section, showing a now favored embodiment of the new mechanism, and in a form adapted to permit hanging of the door to allow the same to be opened from either side thereof by swing of the door in the appropriate direction relative to the door frame.

Fig. 2 is a similar view, on an enlarged scale, for showing more clearly that part of the door hanging mechanism seen near the top of Fig. 1.

Fig. 3, drawn to a further enlarged scale, side elevationally shows the mechanism of Fig. 2 said mechanism being shown in this view as temporarily rearranged to have its pair of depending pins raised, as preparatory to hingedly mounting the door or to removing the door from its frame; this view also showing, in central vertical section, a cooperant subdivision of said mechanism which, fixed on the top of the door, swings with the latter.

Fig. 4, drawn to still a further enlarged scale, shows the cooperant subdivision of Fig. 3 in top perspective.

Fig. 5 is a perspective view showing a portion of that part of the door hanging mechanism interposed between the bottom of the door and the sill or equivalent across the bottom of the door frame; said portion of said mechanism part including a cup-like housing fixedly set in said sill or equivalently fixedly secured.

Fig. 6 is a perspective view showing, by itself, a triply apertured washer to be added to the mechanism of Fig. 5 to constitute the top member of the incomplete assembly seen in Fig. 5.

Fig. 7, drawn to an enlarged scale is a vertical section showing the arrangement of a complete assembly of parts on and adjacent to the bottom of the door when the door plane is parallelly arranged relative to the door-frame opening. Fig. 7 also shows in part the mechanism taken on the lines 7—7 of Fig. 5.

Fig. 8 is a view similar to Fig. 7, but showing the changed relationship of the parts at the conclusion of a swing of the door in either direction

for then lying in a plane at a full 90° angle relative to said door-frame opening.

Fig. 9 is a perspective view of a complementary component of the part of the mechanism shown in Fig. 5; said component, more specifically, being that portion of the last-named mechanism part which is fixedly mounted in a suitable accommodating recess in the door and extending upward from the bottom portion of the door.

Fig. 10 shows the mechanism of Fig. 9 elevationally.

Fig. 11, drawn to a scale somewhat enlarged over that of Fig. 9, is a bottom plan view of the mechanism part of Fig. 9 as assembled for hingedly mounting the bottom of the door in the door frame.

Fig. 12 fragmentarily shows a lower portion of the door, at its side opposite to its wide swinging side, showing a recess and a one-piece bracket bent to T-shape secured in said recess.

Fig. 13 is a horizontal section, as though taken on the line 13—13 of Fig. 7, for more clearly showing one of two like ball-race formations at opposite locations at the bottom of an annular groove in a cup-like housing containing a pair of steel balls (these indicated in this view in dot and dash lines).

Fig. 14 is a fragmentary sectional development taken on the line 14—14 of Fig. 13; which Fig. 14 may also be considered to represent a section taken on the line 14'—14' of Fig. 13.

Fig. 15 illustrates in perspective, and on a rather enlarged scale, a shaped steel plate for facilitating ready securement in fixed location of the lower end of a central bolt associated with the cup-like housing Fig. 5, where, as in the case of a cement floor, a wooden sill for the door frame is omitted, or, if a sill be present, it is monolithic with the cement floor.

Referring now to the drawings more in detail, and first to Fig. 1, a door 20 is illustrated as hingedly hung pursuant to the invention in a door frame 21; one of the two jambs of said frame being indicated at 22, and the top member of said frame being indicated at 23. The door sill is shown at 24.

The part of the mechanism installed above the door and carried by the top member 23 is shown in Figs. 1–4. Each of the two depending cylindrical pins 25, has at its upper end a cylindrical enlargement 25a; said pins being coupled into a single structure by a cross-rod 26. These pins, in an exact sense, are not pivot pins, but rather what may be called pivotee pins; as will be explained below. The pins 25 are raisable and lowerable relative to a saddle-bar 27 of inverted U-shape fixed to a mounting plate 28 provided at opposite ends with a suitable plurality of countersunk apertures 29 for attaching screws 30.

The means for raising and lowering the pins 25 comprises a lever 31 which at one end carries a collar 32 for rockably embracing the cross-rod 26 and at its other end is bent over on itself as indicated at 33. This lever, by virtue of a pin and slot mounting therefor as indicated at 34, and the presence of an L-bracket 35 secured to the plate 28, has a floating fulcrum. The bent over end portion 33 of said lever is slotted as at 33a, and downwardly extended through said slot 33a and the adjacent end of the first-named slot is the shank of a set-screw 37 which is threaded through an aperture in the plate 28. The rounding established by the bent over structure of said lever adjacent to the set-screw 37 is for coaction with the ramped face 38 of a shaped block 39 fixed on the plate 28.

The top member 23 of the door frame has a suitable upwardly recessed cut-out 40, for having nested therein the parts just described.

When the set-screw 37 is retracted as in Fig. 2, the pins 25 are fully lowered, for engagement with the portion of this part of the door hanging mechanism carried at the top of the door 20; and when said set-screw is turned until the adjacent end of the lever 31 is stopped by the block 39, said pins are precisely raised to the intended maximum extent, as shown in Fig. 3.

Now, the door may be hung at its top relative to the door frame 21, or removed from the latter. The rise of pins 25 as an accompaniment of a descent of the screw 37, and vice versa, is an important safety feature; since, in raising the door in the course of its installation to its predetermined path of swing (preferably about $\frac{3}{32}$'' below the bottom of the top door frame member 23), the pins 25, fully lowered, must be entered into a receptor 41 fixed in the top of the door, while the screw 37 is retracted upward. If the screw 37 is not retracted upward it will not be possible to raise the door under the top member 23 of the door frame 21. Consequently, a careless workman cannot ever leave the installation, thinking the door is properly hung, yet with the latter inadvertently disconnected from or insecurely connected to the top member 23 of the door frame.

The receptor 41 is clearly shown in Figs. 3 and 4. Said receptor 41 comprises a main portion 42 cavitated at 43 and having at its top a pair of aligned and oppositely offset plate extensions 44 and 45 with countersunk apertures 46 for attaching screws 47 for attaching the receptor to the door top as in a recess shaped as shown in Fig. 3.

The cavitation 43 has two horn-like extensions 48 and 49 on opposite sides of a tongue 50, near the root end of which is a cylindrical lightening recess 51.

The inner ends of the specially shaped recesses established by the horn-like extensions 48 and 49 are preferably rounded in conformity with the rotundity of the pins 25; and, with the door 20 hung by a mechanism pursuant to the invention, each of said pins while in the cavitation 43 is spaced outward from the inner ends of the last-named recesses when the door is closed.

Hence, assuming the door when thus hung to be suitably pivotally mounted adjacent to its bottom, and there adapted also to be minutely rockable about a point vertically below a midpoint between the axes of the two pins 25—as the door actually is thus pivotally and rockably mounted at its bottom, by means shortly to be described—on swinging the door in either direction out of the door frame the receptor 41 revolves in the same direction relative to said pins 25 and about said midpoint.

Consequently, whether the door is swung in one direction or the other, the inner end of the recess adjacent the extension 48 or 49 moves away from one of the pins 25 while the inner end of the other of said recesses moves toward the other of said pins thus throwing the center of gravity of the mass of the door to one side or the other of a vertical line including the center of rockability of the bottom pivotal mounting of the door.

When such a door swing is a full 90° one, the inner end of the last-named one of the recesses

adjacent the extensions 48 and 49 moves into engagement with the last-named one of said pins.

The function of the mechanism for the bottom of the door as shown in Figs. 1, 5–14 will now be explained. The door 20, has at its bottom and adjacent to its hingedly mounted side a recess 52, said recess in horizontal section shaped for snugly accommodating a structure 53, and said recess shaped in vertical section to receive an upstanding blade portion 54 of said structure 53 and also to receive the horizontal partially two-ply limb of a T-bent strip bracket 55.

The screws for attaching said bracket 55 are shown at 56; and the structure 53 is fully anchored in the recess 52 by means including an aperture 57 through the upstanding blade portion 54, for taking a screw 57a, with said means further including a tapped aperture 58 through the outer end of the main part or swing arm 59 hollowed out as at 60 and integral with the structure 53, a tapered-point adjustment screw 61, and an aperture 62 through the vertical limb of the bracket 55 for taking the outer end of said screw.

Said structure 53 at its top has a transverse cut-out 63, and said structure is vertically bored at 64 through said cut-out. Integral also with the structure 53 is a circularly stepped bottom circular plate portion 65, carrying rigidly a pair of depending cylindrical studs 66, one diametrically opposite the other relative to a rotary path traversed along by a circular line on the circular plate portion 65 when the latter with the door 20 is turned in one direction or the other about an up and down extending axis. Journalled in and extending through the bore 64 is the upper enlarged end of a vertical shaft or bolt 67, which enlarged bolt end also passes through a central opening in apertured plate 68 and also through a central opening in a triply-apertured washer 69.

Said upper enlarged end of the bolt 67 is also journaled in and passes through a central opening in a rocker and camming member 70, provided at its upper side with an annular groove 71 in which are placed a pair of steel balls 72.

The lower reduced end of the bolt 67 has fixedly connected thereto a cup-shaped housing 73; these parts 66, 69 and 70, together with the balls 72, being contained in said housing.

Housing 73, and plate 69, are desirably made, in accordance with established engineering principles aimed at diminution of frictional wear, of bronze or the like. Housing 73 integrally includes a depending sleeve portion, having a bore 75 therethrough concentric with the bore 64. The bolt 67 at its top is threaded for taking a nut 76, and a nut 77, applied to the lower threaded end of said bolt, clamps the housing 73 fast to the bolt.

As shown in Fig. 5, the housing 73 has a squared end for placement adjacent to the jamb 21, and extended from the opposite side of the casing is an integral plate-like portion 78 having holes 78a for the passage of attaching screws 81. In a recess 79 cut in the sill 24 the housing 73 is seated, while seated in a recess 80 cut in the floor below the sill is the sleeve portion 74 of said housing. One of the attaching screws 81 for the housing 73 is indicated at 81 in Fig. 7 and two others are shown in Fig. 5.

The pins 66 rigidly dependent from the bottom disk-like portion 65 of the structure 53 made fast to the door bottom, extend through the two apertures 82 of the plate 68 and also through two matching apertures 83 in the washer 69; so that

these elements 53, 68 and 69 rotate as one unit on the occurrence of a door swing. The two larger acentric pockets 87 in the plate 68 serve to keep the two balls 72 180° apart at all times, even when said balls during rolling thereof travel around the annular groove 71 incidental to door opening in one direction or the other.

A pair of oppositely located screw-studs 84 (Fig. 7) connect the housing 73 (which it will be recalled is fixed at the bottom of the door frame opening) and the rocker or camming member 70. The studs 84 are secured to the rocker member 70. The member 70 is curved at its lower end as shown in Fig. 7 and is spaced from the bottom of housing 73. The housing 73 loosely engages the studs 84 in holes slightly larger than the studs 84. The member 70 is thus universally minutely rockable in the housing 73.

In Figs. 13 and 14, at each of two properly diametrically oppositely located points in groove 71 are shown detent pockets 87. The pockets 87 receive balls 72 when the door 20 is precisely closed. In this connection note the legend "Plane of Door Frame" as applied in Fig. 13, and note that the dot and dash line A represents the limit of a door swing through 30° in one direction and that the dot and dash line B represents the limit of a door swing through 30° in the opposite direction. Accordingly, each of the pockets 87 is, as shown most clearly in Figs. 13 and 14, oppositely attended, by ramp surfaces as shown and respectively marked 88 and 89 in Fig. 14, with the rise of these surfaces extended in the direction of curvilinear extension of the groove 71.

Thus, referring to Fig. 13, when the door 20 is swung toward but insufficiently for arrival at the line A, the balls 72 are both forced uphill, in the direction of the arrows A'; and also, when the door is swung toward but insufficiently for arrival at the line B, the balls 72 are both forced uphill, in the direction of the arrows B'. Consequently, on releasing a manual swing-effecting push on the door, after the door has been swung in either direction even merely a fraction of 1°, the door is returned to normal extension in the door frame. In usual operation of the mechanism as the door is swung open a few degrees or more the entire door rides upward as the balls 72 are forced out of pockets 87 into groove 71. Simultaneously the center of gravity of the mass of the door is thrown to one side of a vertical line including the center of rockability of the mass of the bottom pivotal mounting of the door as explained previously. The door is thus suspended in a state of unstable equilibrium and upon release, at once swings back. The balls ride in groove 71 until they descend into pockets 87 at which point the door is parallel with the door sill and in closed position.

In regard to the plate portion 54 of the structure 53, note as shown in Fig. 9 the lateral rounding of the outer side of said plate portion, to avoid any rubbing against the adjacent jamb 22.

A simplified embodiment of the invention could, of course be provided, for hanging a door to be swung open in merely one direction; although, as will be understood, the embodiment of the invention herein described and illustrated in the drawings could be used even in that case, as by attaching properly located stops on one or both jambs of the door frame.

Where a cement, a terrazzo or other like floor is encountered, affording difficulty in chipping out recesses corresponding to the recesses 79 and

80, merely a round hole need be bored down into the floor, at its monolithic sill or if no sill is present into the main body of the floor, as by use of the well-known star drill; such hole accommodating the sleeve portion 74 of the housing 73. Then, such an additional element 90, as illustrated in Fig. 15, of a leaf-spring type having a central aperture 91 for embracing the upper end portion of the sleeve portion 74 could be employed.

While I have illustrated and described the preferred embodiment of my invention, it is to be understood that I do not limit myself to the precise construction herein disclosed and the right is reserved to all changes and modifications coming within the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent is:

1. A mechanism for hanging a swing door comprising a cup-like structure having a ball race, a pair of balls in said race, said race underlying said balls and having a pair of recesses therein 180° apart, a circular plate having apertures 180° apart in which said balls fit, said circular plate having a cam bottom plate, a flat plate above and resting on the balls, a disk-like structure resting on said flat plate and having a pair of pins projecting through apertures in said plates, and means for attaching said door to the said disk-like structure.

2. The combination of claim 1 wherein said cam bottom tapers upwardly towards the periphery of the circular plate.

3. The combination of claim 1 wherein said attaching means comprises a securing plate including an attaching blade portion and strip bracket for connection to a door and a vertical pin extending through said securing plate and cuplike structure to retain the device for rotational movement with a door.

4. The combination of claim 3 wherein said strip bracket includes a depending flange, said securing plate includes a swing arm, aligned apertures in said flange and swing arm, and an adjustment pin retained in said swing arm aperture and extending through the flange aperture.

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