

Oct. 12, 1965

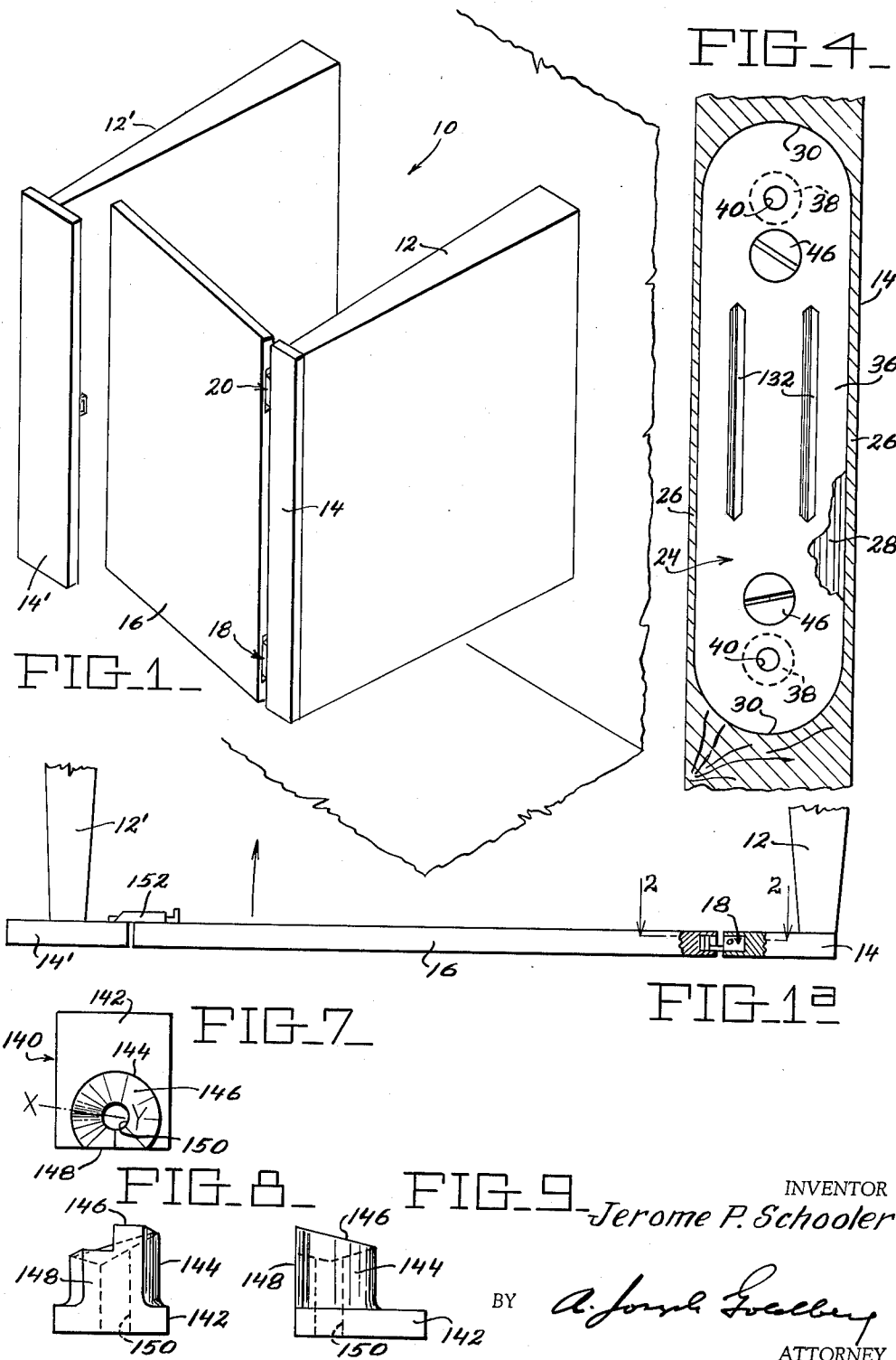
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3,210,799

CONCEALED GRAVITY HINGE AND CONCEALED COMPANION HINGE ASSEMBLIES

Filed Jan. 2, 1964

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

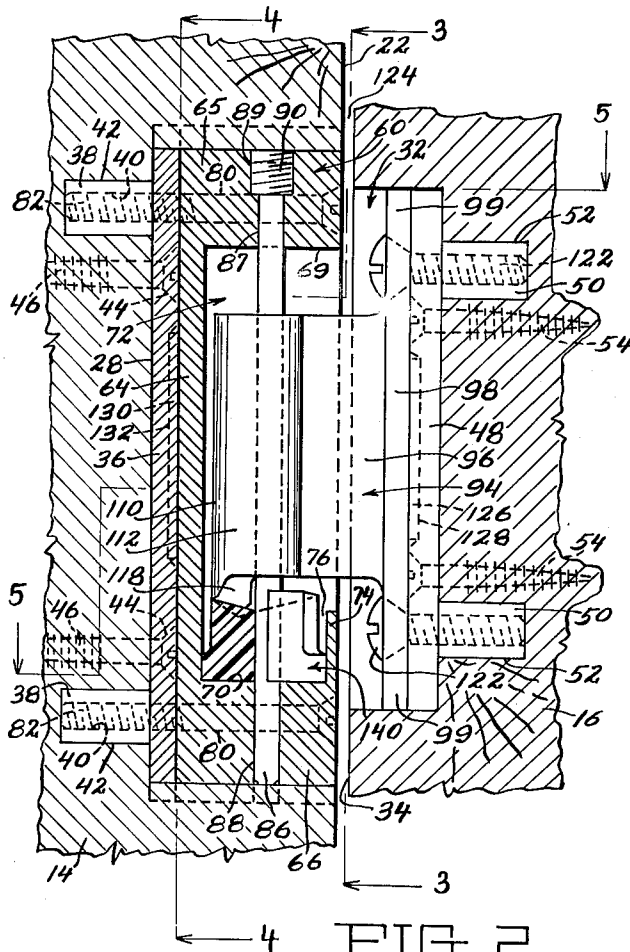


FIG. 2

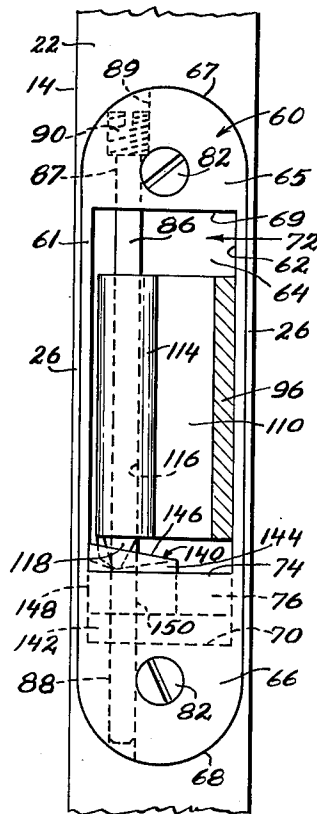


FIG. 3

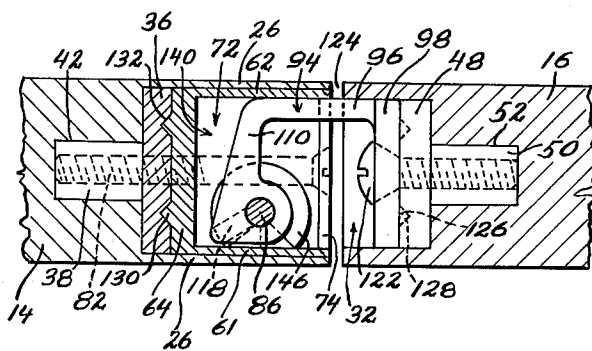


FIG. 5

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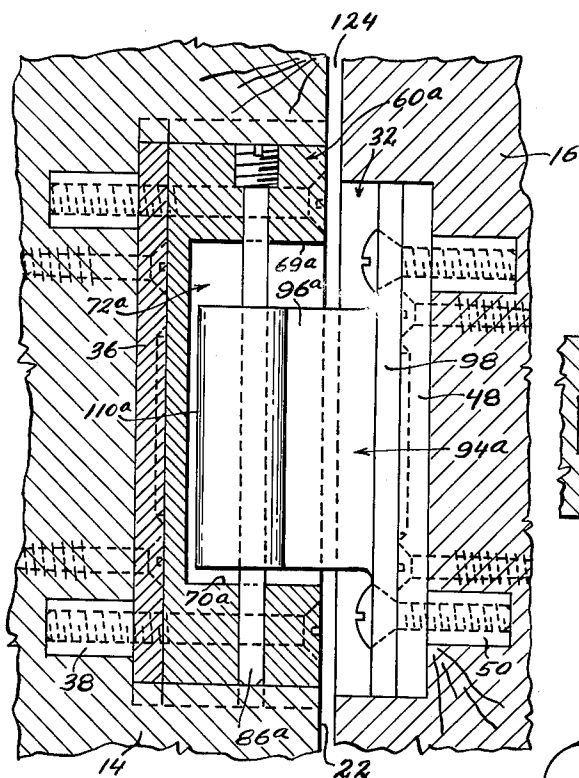
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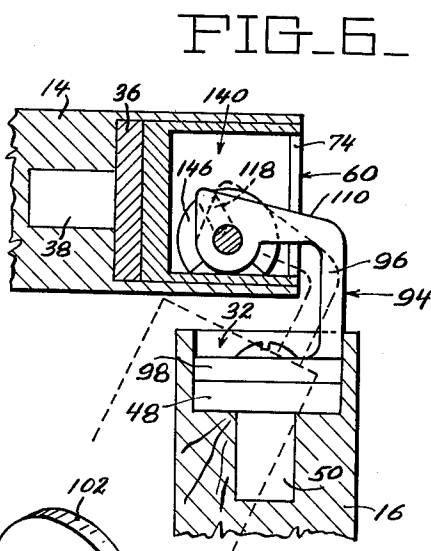
CONCEALED GRAVITY HINGE AND CONCEALED COMPANION HINGE ASSEMBLIES

Filed Jan. 2, 1964

3 Sheets-Sheet 3



FIG_11_



FIG_6_

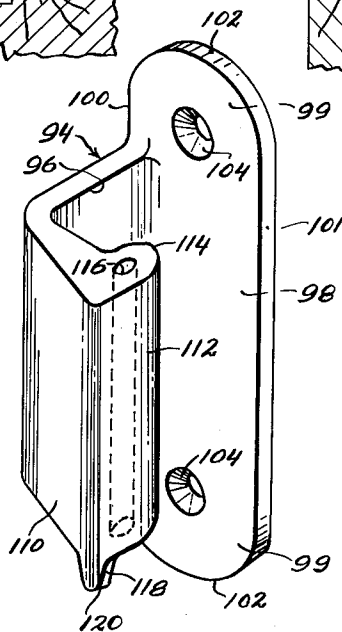


FIG 10.

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CONCEALED GRAVITY HINGE AND CONCEALED COMPANION HINGE ASSEMBLIES

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20 Claims. (Cl. 16-164)

This invention relates to concealed door hinge assemblies for a self-closing door and more particularly to a wholly concealed gravity hinge assembly and a concealed companion hinge assembly.

In hinge assemblies heretofore employed for doors of toilet compartments the lowermost hinge assembly customarily was a gravity hinge which operated to raise the door when swung open or closed so that when the door is released the force of gravity will permit the gravity hinge to operate to swing the door in the opposite direction to an at rest position. Such a gravity hinge generally placed adjacent the bottom edge of the door required a companion hinge assembly adjacent the top of the door construction to permit the vertical movement of the door. In the mounting of such hinge assemblies on the movable door and stationary pilaster or stile, each assembly was provided with a bracket structure externally secured to the door and pilaster or stile which detracted not only from the appearance of the toilet compartment door and stile but resulted in the visible collection of dust and dirt thereon with attendant unsanitary and unsightly conditions.

It is therefore an object of this invention to provide a gravity hinge assembly wherein all component parts thereof are to be contained entirely within the door and the pilaster or stile so as to be completely concealed thereby.

It is also an object of this invention to provide a companion hinge assembly for use with said gravity hinge assembly permitting free vertical movement of the door, that is similarly contained entirely within the door and the pilaster or stile so as to be completely concealed thereby.

An additional object of this invention relates to the particular adaptability and use of the concealed gravity hinge assembly and the concealed companion hinge assembly with doors, pilasters or stiles, jambs or other structural parts constructed of wood, either solid or hollow with wood panels, wherein the surfaces of the wood are coated with a covering of Formica or other plastic material or with metal; or of a metal panel construction; or of any combinations of these.

A further object of this invention is to provide a concealed gravity hinge assembly and a concealed companion hinge assembly, each of which is of a comparatively simple nature and comprises but few parts; that is easy to assemble and install, that is efficient and practical, that will be quite smooth in its operation and of an overall design effecting ease of manufacture at relatively low cost.

Another object of this invention is to provide both in a gravity hinge assembly and a companion hinge assembly a construction wherein for each hinge assembly a half of the assembly is inserted in the door and a half of the assembly is inserted in the pilaster or stile and arranged so that when the door is closed the hinges are concealed with no part thereof, fixed or movable, visible and projecting outwardly of the door and pilaster or stile.

Accordingly it is a further object of this invention to provide upper and lower pairs of opposed horizontally aligned recesses extending inwardly from the opposed faces of the door and the pilaster or stile, each receiving a half

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of a U-shaped hinge member, there being secured at the base of each opposed recess an anchor plate. For the lower pair of recesses one end of the hinge member is fitted within one recess and rigidly secured to the anchor plate therein, the other end of the hinge member being fitted within a housing and pivotally connected thereto and including a coacting cam structure to effect the desired gravity return action, the housing being fitted within the other recess and rigidly secured to the anchor plate therein; the entire arrangement and construction being such that the anchor plates will take the load, stress and strain of the hinge member connections and compensate for the weakening of the door and pilaster or stile by the formation of the recesses particularly if the same are of wood. The companion concealed hinge assembly is similarly formed but lacks the coacting cam structure and is positioned within the upper pair of recesses.

Other objects and advantages of the invention will be understood by reference to the following specification and accompanying drawings wherein there is illustrated a selected embodiment of the improved hinge construction and a typical installation thereof.

In the drawings:

FIG. 1 is a perspective view of a toilet compartment having a door swingably mounted on a stile by the concealed hinge assemblies of the invention.

FIG. 1a is a plan view partly in section of the forward end of the toilet compartment showing the door in closed position.

FIG. 2 is a vertical sectional view of the concealed gravity hinge assembly as mounted on the door and stile, taken on line 2-2, FIG. 1a as viewed from the inside of the toilet compartment.

FIG. 3 is a vertical sectional view taken on line 3-3, FIG. 2.

FIG. 4 is a vertical sectional view taken on line 4-4, FIG. 2.

FIG. 5 is a detail horizontal sectional view taken on line 5-5, FIG. 2, with the door in closed position.

FIG. 6 is a sectional view, similar to FIG. 5, showing the door in different open positions.

FIG. 7 and FIGS. 8 and 9 are respectively, plan and side elevational views of the gravity cam.

FIG. 10 is a perspective view of the hinge plate of the gravity hinge assembly.

FIG. 11 is a vertical sectional view, similar to FIG. 2, showing the companion hinge assembly.

Referring to FIGS. 1 and 1a there is shown a toilet compartment 10 of the type illustrated in the patent of Nathan Schooler, No. 2,865,476 granted December 23, 1958, embodying spaced wall mounted cantilevered partitions 12, 12', having secured to the forward ends thereof stiles 14, 14'. A swingable door 16 shown in partly open position is hingedly mounted on stile 14 by a concealed lower gravity hinge assembly 18 and by an upper concealed companion hinge assembly 20. While the door 16 is shown mounted on its right side (as viewed from outside of the toilet compartment) to the adjacent stile 14, it is to be understood that such is merely illustrative of the embodiment of the invention to be hereinafter described, which invention is equally applicable to the mounting of the door 16 on its left side, as shown in the above referred to patent, and whether or not the door swings into or outwardly of the toilet compartment.

In the present embodiment the door 16 and stile 14 are formed of wood and/or having a finish covering of Formica or other plastic material, or sheet metal, suitably bonded to the wood surface.

The concealed gravity hinge assembly

Referring to FIG. 2 it will be seen that the concealed gravity hinge 18 is contained in part within a side edge

portion of stile 14 and in part within an adjacent opposed side edge portion of door 16. Thus, there is formed in the stile 14 inwardly of the side edge 22 thereof, a vertical elongated recess 24 having parallel side walls 26, 26, a vertical back wall 28, and upper and lower arcuate walls 30. A similarly formed recess 32 but of less vertical length is formed in the door 16 inwardly of the side edge 34 thereof. It is to be noted that the recesses 24, 32 are of such a width as to provide a maximum width to allow for the hinge assembly parts to be fitted therein with a minimum thickness for the side walls of the recess, see FIG. 4. The recesses 24, 32 are in horizontal opposed relation as shown in FIG. 2.

Fitted within the recess 24 is an anchor plate 36 having a shape complementary to the shape of the recess such as to snugly fit therein and to seat against the recess back wall 28. The anchor plate 36 is relatively thick to provide high strength against flexure and bending, and is provided with a rearwardly extending integral boss 38 adjacent each of the arcuate ends thereof. The bosses 38 are cylindrical in form and of a length at least three times the thickness of the anchor plate 36, and are parallel and vertically spaced at the vertical center line thereof. Provided axially through each boss 38 and the anchor plate 36 is a threaded bore 40. Snugly receiving the bosses 38, preferably by a press-fit, are drilled openings 42 normal to the recess back wall 28. Between the bosses 38, there is provided at least two countersunk openings 44 to receive the heads of fastening screws 46. To additionally secure the anchor plate 36 in place, an epoxy adhesive may be employed to bond the same to the wood engaging surfaces of the recess back wall 28 and openings 42. It is apparent that the attachment of the anchor plate 36, to the recess back wall 28 is such as to preclude any twisting, turning or movement laterally or vertically thereof relative to the recess 24 and/or stile 14.

Similarly seated within the door recess 32 on the back wall thereof is an anchor plate 48 the construction of which is similar in all respects to the anchor plate 36. Bosses 50 on anchor plate 48 have a press-fit in openings 52 and fastening screws 54 (with countersunk heads) secure the anchor plate 48 in position, which may additionally be secured by an epoxy adhesive in the manner as indicated above with reference to the anchor plate 36.

Formed for placement within the stile recess 24 is a hinge housing 60 having vertical side walls 61, 62, a vertical back wall 64, upper and lower end support portions 65, 66 that are solid, of considerable vertical dimension and having arcuate outer surfaces 67, 68 and parallel, horizontal upper and lower walls 69, 70, all to define a rectangular recess 72 within said hinge housing. The back wall 64 is made relatively thick for load supporting purposes, while the side walls 61, 62 are relatively thin to provide a maximum width for the recess 72. Spanning the hinge housing side walls 61, 62 at the lower end thereof and integral therewith and with the lower end support portion 66 is a front wall 74 that provides at the bottom of recess 72 a substantially square pocket 76 for a purpose to be hereinafter described.

Each end support portion 65, 66 is provided with a horizontal fastener receiving opening 80 that is countersunk at its entry end, the openings 80 lying substantially in the vertical longitudinal center plane of the hinge housing, and are so positioned as to be in axial registry with the threaded bores 40 in the anchor plate 36 when the hinge housing is positioned within the stile recess 24.

The overall dimensions of the hinge housing 60 are such that the same will snugly fit within the stile recess 24, with its back wall 64 abutting the anchor plate 36, and the front of the hinge housing, including front bottom wall 74, will lie flush with the side edge 22 of the stile 14. The hinge housing 60 is secured to the stile 14 by the screw fasteners 82 which extend through openings 80 into the threaded bores 40 of the anchor plate; the entire construction thus providing for an exceedingly strong and

rigid connection of the hinge housing to the stile and compensating for the weakening of the stile in the formation of the recess 24 therein.

Provided within the hinge housing 60 is a removable hinge pin 86 which extends vertically lengthwise thereof and within the housing recess 72. Thus, there is formed in the upper and lower end support portions 65, 66 vertical axially aligned bores 87, 88 which are positioned somewhat centrally with relation thereto, see FIG. 2, and between the openings 80 for threaded fasteners 82 and housing side wall 61, see FIG. 3. The upper bore 87 is formed at its upper end with a threaded enlarged diameter bore 89. The hinge pin 86 is formed at its upper end with an enlarged diameter threaded head 90. The hinge pin 86 is positioned in the hinge housing 60 by inserting the same downwardly through bores 87 and 88, and is secured in place by the threaded engagement of head 90 in threaded bore 89, as will be apparent from FIGS. 2 and 3. It is thus seen that the hinge pin 86, is fixed with relation to the hinge housing 60, and in the attachment of the housing to the anchor plate 36 cannot be removed or tampered with.

For coaction with the hinge pin 86 there is provided a hinge plate 94 shown in perspective in FIG. 10. The hinge plate 94 is preferably formed as a one-piece rigid casting or forging of U-shaped formation and includes an intermediate vertical substantially rectangular plate 96 integrally joined along one vertical side thereof to an edge portion of a vertical door attaching plate 98, the end portions 99 of which extend above and below the upper and lower edges of the plate 96. The attaching plate 98 has parallel vertical sides 100, 101 and arcuate upper and lower ends 102. Preferably the back surface of plate 96 of the hinge plate and the side 100 of the attaching plate 98 lie in the same vertical plane, as clearly shown in FIG. 5, whereby plate 96 and attaching plate 98 are at right angles to each other. Countersunk openings 104 for fastener elements are provided in each of the end portions 99.

Disposed at right angles to the intermediate plate 96 and integrally joined to the other vertical side thereof is a vertical hinge arm 110 which preferably substantially uniformly diverges in thickness from its juncture with the intermediate plate 96 toward its outer terminal end 112. In the terminal end 112 of the hinge arm 110 to one side thereof and opposite the attaching plate 98, as at 114, there is provided a vertical hinge pin bore 116. The hinge arm 110 is of a height equal to the height or vertical dimension of the intermediate plate, and formed integral with the underside of the hinge arm, laterally of the hinge pin bore 116, is a downwardly projecting cam follower 118 the underside of which is rounded as at 120 for mating coaction with a cam to be hereinafter described.

The attaching plate 98 of the hinge plate 94 has the same shape as the anchor plate 48 secured within the door recess 32 and thus snugly seats within the door recess in abutting engagement with the anchor plate, and is rigidly secured thereto by the screw fasteners 122 which extend through the anchor plate 48 for threaded engagement with the threaded bore therein and that in the bosses 50.

The aforementioned parts of the hinge assembly 18 and the stile and door recesses are so dimensioned as to provide a slight clearance or gap 124 between the door and stile to permit the door 16 to swing clear of the side edge 22 of the stile 14.

To insure a more positive interlock between the door attaching plate 98 and the anchor plate 48 there may be provided on the inside face of the attaching plate 98 a pair of projecting ribs 126 which seat within corresponding shaped grooves 128 formed in the opposed face of anchor plate 48, see FIG. 5. This rib and groove interlock positively prevents any lateral movement of the attaching plate on the fixed anchor plate when secured to each other by the screw fasteners 122. Similar interlocking ribs 130 and grooves 132 may be provided between the vertical

back wall 64 of hinge housing 60 and anchor plate 36, for a like purpose, see FIG. 5.

To provide for the gravity return action of the door 16 from open position to its normal at rest position there is seated within the pocket 76 at the bottom of the recess of the hinge housing a cam block 140. The cam block 140 is preferably made of a self-lubricating plastic such as nylon, Teflon, Debrin or Nylatron and as shown in FIGS. 7, 8 and 9 includes a substantially square base 142 dimensioned to removably seat within the hinge housing recess pocket 76, see FIGS. 2, 3 and 5. Upstanding from the base 142 is a cam column 144, the top face of which has formed thereon a contoured part circular cam surface 146 that is intersected by the side 148 of the cam block, see FIG. 7. As shown, the cam column is eccentric with reference to the base 142, and provided centrally in the cam column is a bore 150 for receiving the hinge pin 86. The cam surface 146 has a spiral rise upwardly from each side of its lowest zone formed along line x-y. With the cam block 140 placed within the recess pocket 76, the cam follower 118 of the hinge arm 110 will seat on the cam surface 146 for movement therealong upon swinging of the door 16. At the normal, at rest, position of the door 16, the cam follower 118 will seat at the lowest zone of the cam surface along line x-y. In this position the door 16 will be slightly ajar, inwardly of the toilet compartment, in the manner as shown in FIG. 1. Swinging movement of the door 16 towards closed or open positions will cause the cam follower 118 to ride up on the spiral cam surface 146, at the same time raising the door. Upon release, gravity forces will act to force the cam follower 118 to ride down the cam surface 146 to return the door 16 to its normal, at rest, position with the cam follower seated along line x-y as hereinabove explained.

It is to be understood that the cam surface 146 may be changed to provide for different at rest positions of the door 16, such as with the door ajar outwardly of the toilet compartment, closed or fully open. In such cases a cam block 140 having the desired cam surface is placed in the pocket 76 prior to assembly of the hinge structure. Due to the substantially square formation of the pocket 76 and the base 142 of the cam block, no twisting or turning of the cam block is possible and the same will always remain in its selected operative position.

Other forms of cam follower and cam surface may be utilized in lieu of cam follower 118 and cam surface 146, as for example, the roller and cam track of the gravity hinge shown in the patent of Nathan Schooler, No. 3,059,270, granted October 23, 1962.

The assembly of the hinge parts is effected by first placing the selected cam block 140 within the pocket 76 of the hinge housing 60 making sure that the side 148 is placed opposed to hinge housing wall 61, see FIG. 5, the hinge pin 86 being initially removed; then inserting the hinge arm 110 of the hinge plate 94 into the housing recess 72 with the cam follower 118 projecting downwardly, and lastly inserting the hinge pin 86 downwardly through bore 87 in upper support portion 65, bore 116 in hinge cam 110, bore 150 in cam block 140, and bore 88 in lower end support portion 66 with the hinge pin head 90 in threaded engagement with upper threaded portion 89 of bore 87. Viewing FIG. 2, it will be seen that with the cam follower 118 seated on cam surface 146 (at its lowest zone, line x-y), that the top edge of the hinge plate 94 and hinge arm 110 is spaced a sufficient distance below the top wall 69 of housing recess 72 in order to accommodate upward movement of the hinge plate as the cam follower rides up on the cam surface, the hinge arm 110 sliding on hinge pin 86. With the anchor plates 36 and 48 secured in position within the respective recesses in the stile and door, the door attaching plate 98 of the hinge plate 94 is secured to its associated anchor plate 48 by the screw fasteners 122, and the hinge housing 60 is positioned within the stile recess 24 and secured to its associated anchor plate 36 by the screw fasteners 82. The com-

panion hinge assembly 20 to be hereinafter described is similarly assembled, and connected to door and stile in the same manner.

Due to the solid nature of the upper and lower end support portions 65, 66 of the hinge housing interconnected by the housing walls 61, 62 and 64, and the fastener screws 82 extending through the support portions to secure the housing to the anchor plate 36, an exceedingly strong and rigid support is provided for each end of the hinge pin 86 such as to relieve the edge portion of the stile of stress and strain. Similarly the attachment of the hinge plate 94 to the door through attaching plate 98 and anchor plate 48 will effect the same strong and rigid support for the hinge plate and relieve the edge portion of the door of stress and strain.

With the door 16 in fully closed position, the intermediate plate 96 of the hinge plate 94 is seen to engage the side wall 62 of the hinge housing, see FIG. 5. However, to insure that the door 16 cannot be swung outwardly of the toilet compartment and thus damage the hinge, the door 16 is provided at its other edge with the customary stop 152 that engages the stile 14', see FIG. 1a, and will thus positively prevent such outward movement. The door 16 is also provided with a latch 154 in the manner well known.

FIG. 6 illustrates the relationship of the concealed gravity hinge parts with the door 16 in partly open and fully open positions.

The companion hinge assembly

The upper concealed companion hinge assembly 20 is essentially the same as the lower concealed gravity hinge assembly 18 except that it lacks the coacting cam construction, and referring to FIG. 11, it will be seen that the parts thereof that are identical with the concealed gravity hinge assembly are designated by the same reference numerals. The hinge housing 60a is shown as of less vertical length than the hinge housing 60 for the reason that it lacks the front bottom wall 74 and the pocket 76 for the cam block 140. Thus, in the housing 60a, the recess 72a is completely open to the stile side 22 from its top wall 69a to its bottom wall 70a. Further, lacking the coacting cam construction, the top and bottom edges of the hinge cam 110a are flat and coextensive with the top and bottom edges of the intermediate plate 96a of the hinge plate 94a. As with the hinge plate 94 of the concealed gravity hinge, the hinge plate 94a can slide up and down on the hinge pin 86a on swinging of the door.

Although both the concealed gravity hinge assembly and its concealed companion hinge assembly have been shown in the described embodiment as used with a wood stile and a wood door, it is to be understood that the same hinge assemblies may equally as well be used with a metal panel door, stile or pilaster of the type shown in the above referred to Patents Nos. 2,865,476 and 3,059,270. In such a metal panel door, stile or pilaster recesses are provided to receive the hinge assembly parts with supporting brackets therein forming a fixed part of the metal panel door, stile or pilaster serving as the anchor plates aforesaid, to which brackets the associated hinge parts are to be connected in the manner as described hereinabove.

It should be understood that various changes in details of the herein disclosed structures may be made within the scope of the appended claims.

I claim:

1. A concealed hinge assembly mounting a door on a door support each having a recess extending inwardly thereinto from opposed edge faces thereof and oppositely disposed with each said recess of substantially uniform height and width from its opening at an edge face to its back wall, comprising,

(a) anchor means positioned at the base of each recess in abutting engagement with the back wall thereof and secured thereto,

- (b) a hinge housing positioned in one recess and formed complementary thereto whereby to engage the inside surface thereof to be supported thereby and secured to the anchor means therein,
 - (c) a hinge plate having a hinge arm at one end thereof and an opposed attaching plate at the other end thereof,
 - (d) said hinge arm being positioned within said hinge housing,
 - (e) a hinge pin supported directly by said hinge housing at the top and bottom thereof and on which said hinge arm is pivotally and axially mounted,
 - (f) said attaching plate being positioned in the other recess and secured to the anchor means therein,
 - (g) whereby said hinge assembly and its attachment to said door and door support is entirely enclosed within said recesses as to be wholly concealed when the door is closed.
2. The concealed hinge assembly of claim 1, wherein
- (a) said hinge housing provides at the top and bottom thereof an upper and a lower support portion each of a substantially uniform thickness from front to rear integrally joined by parallel vertical side walls and a vertical rear wall to define therewithin a housing recess,
 - (b) said upper and lower support portions each being of a substantially greater thickness than the thickness of said side walls and rear wall and being each provided with a vertical bore,
 - (c) said bores being coaxial and located between one side wall of said hinge housing and the vertical longitudinal center plane thereof,
 - (d) said hinge pin extending through said bores with its intermediate portion lying within said housing recess, and
 - (e) coacting means between an end of said hinge pin and the bore in one of said support portions for supporting said hinge pin in fixed vertical position.
3. The concealed hinge assembly of claim 1, wherein
- (a) each said anchor means comprises an anchor plate complementary in shape to its associated recess and having a vertical front planar surface on which said hinge housing is seated,
 - (b) there being a threaded fastener receiving opening adjacent each end of said anchor plate,
 - (c) there being at least a pair of inner fastener receiving openings in each anchor plate between the end threaded fastener receiving openings therein,
 - (d) fastener elements extending through said inner fastener receiving openings for securing the anchor plates each against the back wall of an associated recess, respectively, to said door and door support,
 - (e) a threaded fastener element at each end of said hinge housing extending through a bore therein and threadedly engaging an end threaded fastener receiving opening in its associated anchor plate for securing said hinge housing thereto, and
 - (f) a threaded fastener element at each end of the attaching plate of said hinge plate extending through openings therein and threadedly engaging an end threaded fastener receiving opening in its associated anchor plate for securing said hinge plate thereto.
4. The concealed hinge assembly of claim 1, wherein
- (a) each said anchor means comprises an anchor plate complementary in shape to its associated recess and having a vertical front planar surface on which said hinge housing is seated,
 - (b) a rearwardly projecting boss at each end of each anchor plate to snugly fit within an opening extending inwardly from the back wall of each recess,
 - (c) there being an axial threaded bore extending through each boss and anchor plate,
 - (d) fastener elements extending through openings in each anchor plate for securing the same to its associated recess back wall and engageable, respectively, with said door and door support, and

- (f) threaded fastener elements extending through openings in said hinge housing and the attaching plate of said hinge plate engageable with said threaded bores for respectively securing said hinge housing and said hinge plate to their associated anchor plates.
5. The concealed hinge assembly of claim 1, including
- (a) coacting interlocking means on the hinge housing and its associated anchor means and on the attaching plate of the hinge plate and its associated anchor means,
 - (b) said hinge housing and said attaching plate in their secured relation to their respective anchor means abutting the same and said coacting interlocking means acting to resist lateral movement therebetween in all directions whereby to prevent the application of strains or stress to the side portions of said door and door post forming said recess side walls.
6. The concealed hinge assembly of claim 1, including
- (a) coacting cam and follower means positioned between said hinge arm and a lower part of said hinge housing,
 - (b) said cam means being non-rotatably fixed relative to said lower hinge housing part, and
 - (c) said follower means being connected to said hinge arm for movement therewith and operative upon pivotal movement of said hinge arm to ride up on said cam means whereby to elevate said door, lowering of said door and reverse pivotal movement of said hinge arm being effected by gravity action.
7. The concealed hinge assembly of claim 1, including
- (a) a pocket at the lower end of said hinge housing,
 - (b) cam means removably seated in said pocket and held thereby in non-rotatably fixed relation thereto, and
 - (c) follower means on the lower end of said hinge arm movable therewith and operative upon pivotal movement of said hinge arm when the door is moved in one direction to ride up on said cam means whereby to elevate said door, lowering of said door and reverse pivotal movement of said hinge arm to move said door in an opposite direction being effected by gravity action.
8. A concealed hinge assembly mounting a door on a door support each having a vertical recess extending inwardly therein from opposed edge faces thereof and oppositely disposed, each recess having relatively thin side walls and a vertical back wall and each recess being of a substantially uniform height and width from its opening at an edge face to its back wall, comprising,
- (a) an anchor plate for each recess complementary in shape thereto and seated against the back wall thereof,
 - (b) fastener elements extending through openings in said anchor plates for securing the same within their associated recesses respectively to the door and door support,
 - (c) a hinge housing complementary in shape to the door support recess and comprising an upper support portion, a lower support portion, a vertical rear wall and vertical parallel side walls to define a rectangular housing recess, said hinge housing being positioned wholly within said door support recess with its rear wall in abutting engagement with the anchor plate therein,
 - (d) a threaded fastener element extending through a horizontal bore in each support portion and threadedly engageable with a corresponding threaded opening in the associated anchor plate for securing said hinge housing thereto,
 - (e) said upper and lower support portions being each provided with a vertical bore,
 - (f) said vertical bores being coaxial and located between one side wall of said hinge housing and the vertical longitudinal center plane thereof,
 - (g) a removable hinge pin extending through said ver-

- tical bores with its intermediate portion lying within said housing recess,
- (h) a hinge plate comprising an intermediate plate, a hinge arm and an attaching plate, said hinge arm and attaching plate extending laterally outwardly from opposite vertical ends of said intermediate plate in opposed substantially parallel relation,
- (i) said hinge arm having a vertical bore at its terminal end and positioned within said housing recess with said hinge pin extending through the vertical bore of said hinge arm to provide for pivotal and axial movement of said hinge arm on said hinge pin,
- (j) said attaching plate being complementary in shape to said door recess and positioned therein in abutting engagement with the anchor plate therein,
- (k) a threaded fastener element extending through an opening at the top and bottom of said attaching plate and threadably engageable with a corresponding threaded opening in the associated anchor plate for securing the attaching plate thereto,
- (l) whereby said hinge assembly and its attachment to said door and door support is entirely enclosed within said recesses thereof as to be wholly concealed when the door is closed.
9. The concealed hinge assembly of claim 8, wherein
- (a) the intermediate plate of said hinge plate and the hinge arm carried thereby are each of a vertical length less than the vertical length of said hinge housing recess whereby said hinge arm may slide up or down axially on said hinge pin.
10. The concealed hinge assembly of claim 8, wherein
- (a) said hinge arm diverges in thickness from its juncture with the intermediate plate to its terminal vertical end, and
- (b) said vertical bore is located eccentrically therein and at the side of said terminal end opposite said attaching plate.
11. The concealed hinge assembly of claim 8, including
- (a) a boss at the upper and lower end portion of each anchor plate formed integral therewith and which projects rearwardly from an inside face thereof,
- (b) there being a threaded bore in each boss extending axially therethrough and through its associated anchor plate providing said threaded opening therein,
- (c) said threaded fastener elements being threadably engageable in said threaded bores, and
- (d) each boss being snugly fitted within a complementary opening extending from a recess back wall into the door and door support, respectively.
12. The concealed hinge assembly of claim 8, wherein
- (a) the upper and lower support portions of the hinge housing each extend from front to rear thereof and are, at least in the vertical longitudinal plane of the hinge housing, of a substantial vertical length such as to fully support and brace the upper and lower end portions, respectively, of said hinge pin, and
- (b) said hinge housing recess rear wall being of a thickness substantially greater than the thickness of the hinge housing side walls.
13. The concealed hinge assembly of claim 8, including
- (a) a cam member within said housing recess seated on the lower support portion and engaging at least two of the inside vertical wall surfaces of said housing recess,
- (b) there being a vertical bore in said cam member through which said hinge pin extends,
- (c) a cam follower carried by the lower terminal end of said hinge arm and seated on said cam member,
- (d) said cam member having a contour cam surface such that the cam follower will ride up thereon in the swinging movement of said door in one direction from its normal at rest position to axially elevate the same upwardly on said hinge pin, downward axial movement of said door and reverse swinging movement thereof being effected by gravity action to return said door to its normal at rest position.
14. The concealed hinge assembly of claim 13 including
- (a) a front bottom wall at the lower end of said housing recess joining said lower support portion and the housing side walls to provide a pocket at the bottom of said housing recess,
- (b) said cam member having a base portion seated in said pocket for non-turning movement therein,
- (c) a cam column upstanding from said base portion, and
- (d) said cam contour surface being at the top of said cam column.
15. A concealed hinge assembly mounting a door on a door support each having a recess extending inwardly thereinto from opposed edge faces thereof and oppositely disposed, comprising,
- (a) a hinge housing positioned in one recess and secured therein,
- (b) a hinge plate having a hinge arm at one end thereof and an attaching plate at the other end thereof,
- (c) a hinge pin supported at its ends respectively by the upper and lower ends of said hinge housing,
- (d) said hinge arm being positioned within said hinge housing and pivotally mounted on said hinge pin for axial movement thereon,
- (e) a cam member having an axial bore fixedly positioned within the hinge housing at the lower end thereof with said hinge pin extending through said axial bore,
- (f) a cam follower carried by the lower end of said hinge arm and seated on said cam member,
- (g) said cam member having a contour cam surface such that the cam follower will ride up thereon upon relative pivotal movement between said hinge arm and said hinge pin one direction to axially move the hinge arm upwardly on said hinge pin, downward axial movement of said hinge arm and reverse relative pivotal movement between said hinge arm and hinge pin being effected by gravity action,
- (h) said attaching plate being positioned in the other recess and rigidly secured therein,
- (i) whereby said hinge assembly and its attachment to said door and door support is entirely enclosed within said recesses as to be wholly concealed when the door is closed.
16. A hinge plate for a concealed hinge assembly comprising,
- (a) an intermediate plate, polygonal in form, having top and bottom edges and parallel vertical sides,
- (b) a hinge arm integral with said intermediate plate extending laterally from one vertical side thereof,
- (c) said hinge arm diverging in thickness from its juncture with said intermediate plate to its free terminal end,
- (d) an attaching plate integral with said intermediate plate and extending laterally from the other vertical side thereof,
- (e) said hinge arm and said attaching plate being in opposed relation,
- (f) there being a vertical hinge pin receiving bore extending eccentrically through said free terminal end of said hinge arm and at the side of said free terminal end opposed to said attaching plate,
- (g) there being fastener receiving openings in said attaching plate, and
- (h) a cam follower means carried by the lower end of

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the free terminal end of said hinge arm and located laterally of said vertical bore.

17. A hinge housing for a concealed hinge assembly, comprising,

- (a) upper and lower support portions, 5
- (b) a rear wall, and
- (c) parallel side walls all integrally joined to define a vertically elongated housing recess, with said rear wall and the front of said housing having parallel exposed faces, 10
- (d) said housing being symmetrical about a longitudinal vertical central plane thereof normal to said rear wall,
- (e) there being a vertical hinge pin receiving bore in each of said support portions, coaxially related to each other located between one side wall of said housing and said central plane, and 15
- (f) there being a horizontal fastener receiving opening extending through each support portion, and
- (g) a cam block receiving pocket at the lower end of said housing recess defined in part by said lower support portion. 20

18. A cam block for a concealed gravity hinge assembly comprising,

- (a) a polygonal base, 25
- (b) a cam column upstanding from the top of said base having its vertical axis eccentric with relation to the vertical axis of said base and having at least one vertical side thereof coextensive with a side of said base,
- (c) there being a hinge pin receiving bore extending vertically through said cam column and base and located adjacent said coextensive sides of said base and column, and
- (d) a cam surface at the top of said column rising substantially spirally upwardly in at least one direction from a predetermined low zone thereon. 35

19. An anchor plate for a concealed hinge assembly comprising,

- (a) a flat elongated plate member of uniform thickness, having front and rear faces, parallel side edges and being symmetrical about a longitudinal vertical central plane normal to said faces, 40
- (b) an integral boss at each end of said plate member each normal to the rear face thereof and positioned at said central plane,
- (c) there being a threaded fastener receiving bore extending axially through each boss and said plate member, and
- (d) there being a pair of fastener receiving openings in said plate member between said bosses with each opening located adjacent to a boss and being counter-sunk at the front face of said plate member. 45 50

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20. A concealed hinge assembly mounting a door on a door support each having a recess extending inwardly thereinto from opposed edge faces thereof and oppositely disposed, comprising:

- (a) a hinge housing positioned in one recess,
- (b) a hinge plate having a hinge arm at one end thereof and an attaching plate at the other end thereof,
- (c) a hinge pin carried by said hinge housing,
- (d) said hinge arm being positioned within said hinge housing and mounted on said hinge pin for pivotal and axial movement thereon,
- (e) a seat at the lower end of said hinge housing,
- (f) a two element gravity cam unit between the lower end of said hinge arm and the seat on the lower end of said hinge housing,
- (g) one element of the cam unit being positioned on said seat in non-rotatable fixed relation thereto,
- (h) the other element of the cam unit being carried by the lower end of said hinge arm, and
- (i) said attaching plate being positioned in the other recess and secured therein,

whereby pivotal movement of said hinge arm on the hinge pin when the door is moved in one direction will effect a riding up of the cam element carried thereby on the other fixed cam element to elevate said door, the lowering of said door and reverse pivotal movement of said hinge arm to move said door in the other direction being effected by gravity action, and said hinge assembly and its attachment to said door and door support being entirely enclosed within said recesses as to be wholly concealed when said door is closed. 30

References Cited by the Examiner

UNITED STATES PATENTS

859,174	7/07	Gee	16—153
1,083,622	1/14	Kusterer	16—135
1,109,876	9/14	Soss	16—128
1,249,700	12/17	Way	16—135
1,325,221	12/19	Way	16—135
1,668,137	5/28	Anderson	16—128 X
2,577,738	12/51	Byram	16—153 X
2,904,824	9/59	Kuehl	16—153
3,056,640	10/62	Squire	312—138 X
3,059,270	10/62	Schooler	16—154

FOREIGN PATENTS

18,993	8/14	France.
1,011,591	4/52	France.
157,574	1/21	Great Britain.

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