Feb. 21, 1956 T. F. ANDERSON ET AL 2,735,144

HINGE ASSEMBLIES FOR SWINGING DOORS

Original Filed June 19, 1951 3 Sheets-Sheet 1

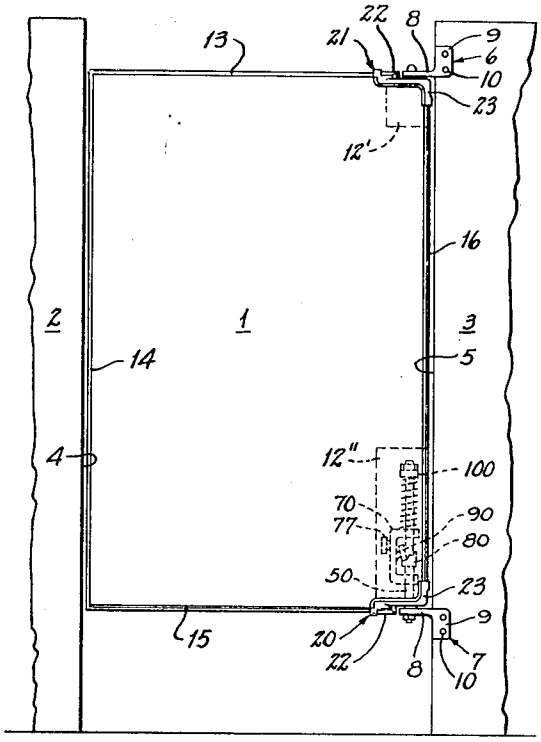


Fig. 1

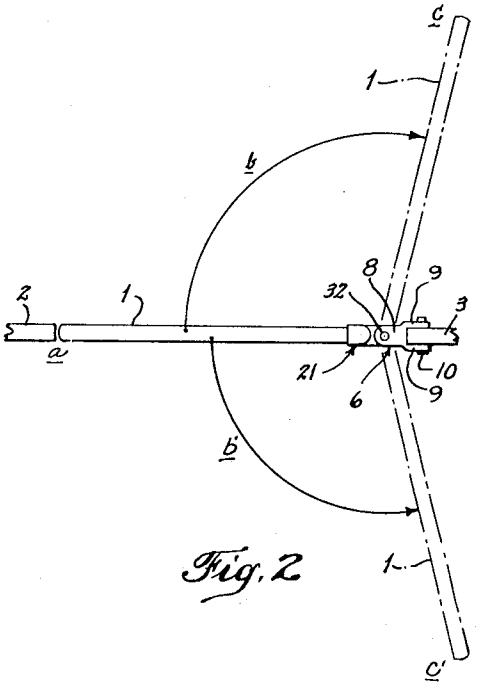


Fig. 2

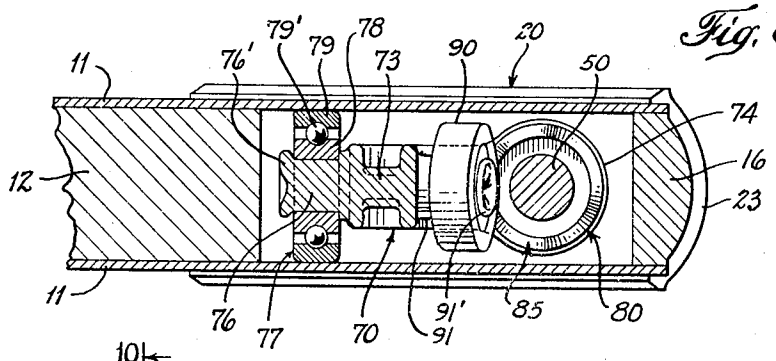


Fig. 8

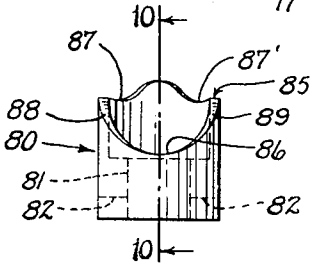


Fig. 9

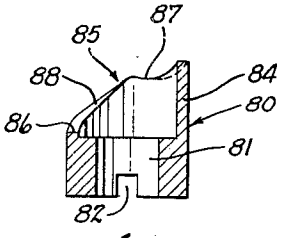


Fig. 10

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HINGE ASSEMBLIES FOR SWINGING DOORS

Original Filed June 19, 1951 3 Sheets-Sheet 2

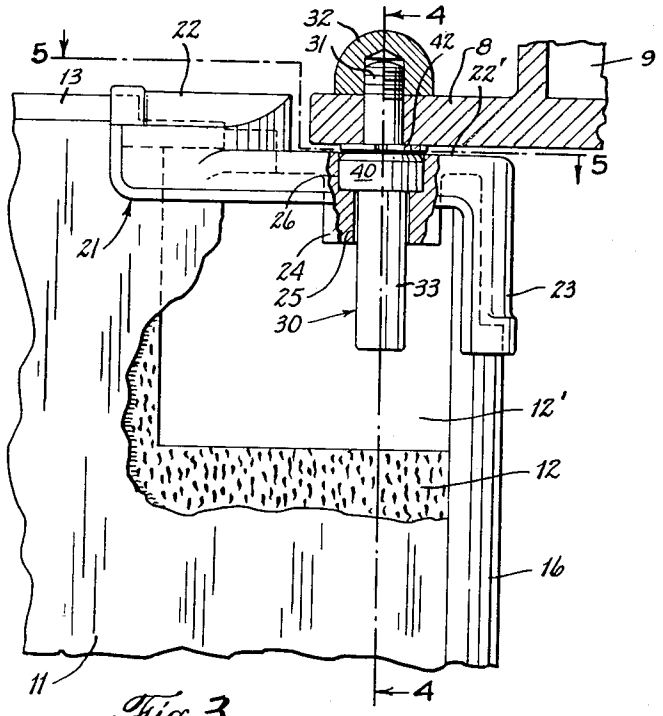


Fig. 3

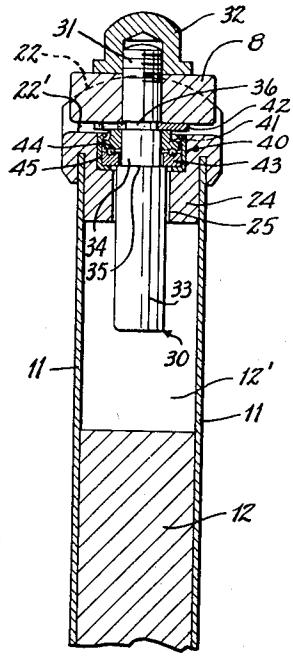


Fig. 4

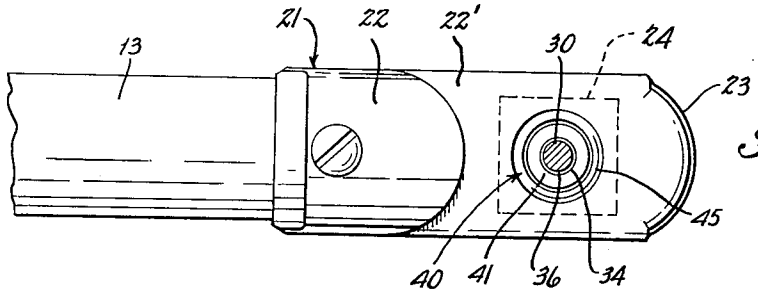


Fig. 5

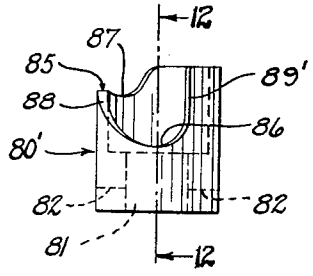


Fig. 11

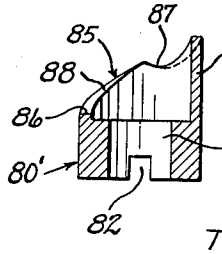


Fig. 12

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HINGE ASSEMBLIES FOR SWINGING DOORS

Original Filed June 19, 1951 3 Sheets-Sheet 3

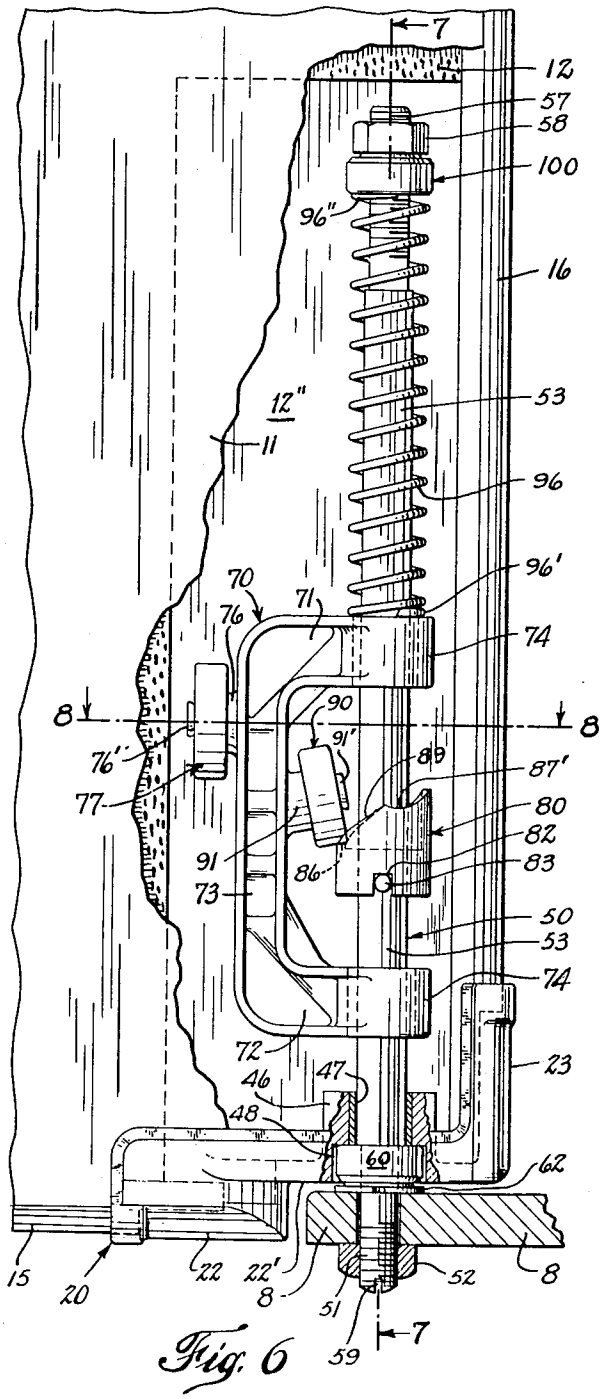


Fig. 6

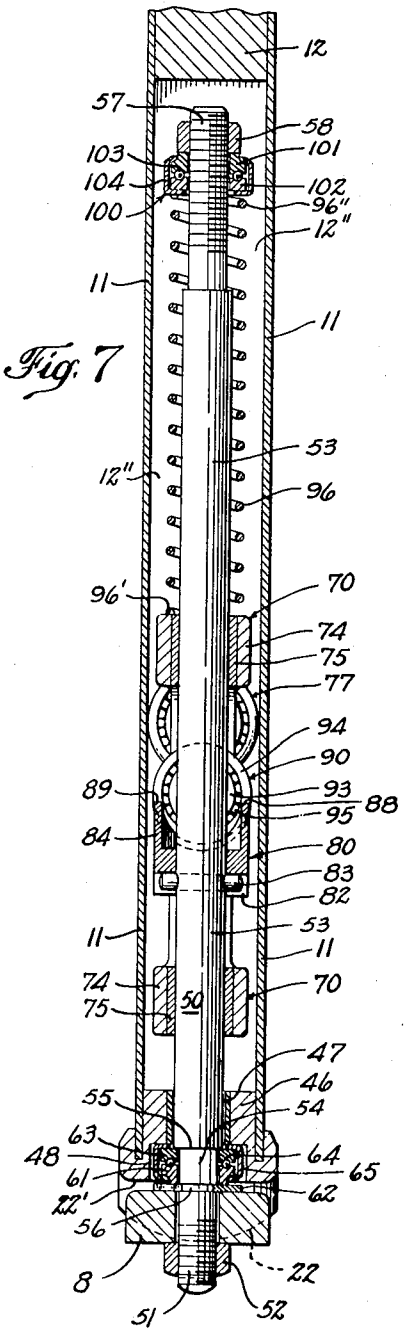


Fig. 7

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United States Patent Office 2,735,144
Patented Feb. 21, 1956

2,735,144

HINGE ASSEMBLIES FOR SWINGING DOORS

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Original application June 19, 1951, Serial No. 232,414, now Patent No. 2,604,683, dated July 29, 1952. Divided and this application March 11, 1952, Serial No. 275,912

5 Claims. (Cl. 20—16)

This invention relates to hinge assemblies for swinging doors, and more particularly to an improved hinge assembly designed to be concealed within the door structure and yet operate to automatically swing the door to the desired open or closed position. This application is a division of our copending application Serial No. 232,414 filed June 19, 1951 which issued July 29, 1952, as Patent No. 2,604,683.

Gravity hinges as commonly employed embody a roller mounted on a structure attached to the door and designed to roll over an inclined track fixed to the adjacent door frame, the door being mounted to have vertical movement to take advantage of gravity force to operate the door. To secure proper gravity action, and the relation necessary between the roller and inclined cam track, the minimum diameter of the case or housing which enclose the working part of the hinge should be in the approximate order of two inches or more. The enlarged casing requires that the gravity hinge be mounted below the bottom edge of the door, or set in a notched cutout in the rear edge of the door. Since the hinge casing is exposed to view, it must be chrome plated or finished so that the installation presents a reasonably attractive appearance. Since vertical door movement must be provided for, gravity hinges as presently constructed cannot be used on doors sized to occupy the entire door opening as defined by the door frame.

In the design of toilet partitions, hospital cubicles, service rooms and compartments where sanitation is important, it is highly desirable that the doors and wall surfaces present smooth and regular contours so that they may be easily cleaned and kept sanitary. Gravity hinges heretofore employed, set in exposed position below the lower edge of the door or recessed into the rear edge of the door, present objectionable exposed surfaces and irregularities which gather dirt and are difficult to keep clean.

Door hinge assemblies made in accordance with this invention are constructed to be contained and concealed within the door body. Notching or defacement of the door and door frame is thus avoided. The operating parts of this hinge assembly may be encased and concealed within door bodies of any thickness down to approximately one inch in thickness or less. Mechanism is provided for exerting an impelling force on the door to forcibly swing the door into closed residence position or open residence position, without raising or lowering movement of the door. Thus this improved hinge assembly finds application to numerous types and sizes of doors, and can be used in locations where raising and lowering movement of the door, as occasioned by gravity hinges, is not desirable or permissible.

Since the operating mechanism of this improved hinge assembly is concealed within the door, the parts thereof do not require special finishing or chrome plating, and are fully protected from dirt and weather deterioration.

Means are provided by which the residence position of the door may be accurately adjusted by the simple manipulation of a part thereof exposed at the lower edge of the door. This improved door hinge assembly may be mounted on any type or shape of hinge bracket, permitting a wide latitude in the design of the hinge bracket to harmonize with the door and door frame architecture.

An object of this invention is to provide an improved hinge assembly which overcomes the objectionable features of gravity hinges as commonly used.

Another object of this invention is to provide an improved hinge assembly operative to automatically swing the door with which it is associated to any desired residence position, and constructed to permit concealment of the hinge assembly within the normal thickness of the door body.

Another object of this invention is to provide an improved hinge assembly operative to automatically swing the door with which it is associated to any desired residence position, substantially without frictional resistance, and without causing lowering or raising movement of the door.

Another object of this invention is to provide an improved hinge assembly for swinging doors constructed to permit concealed encasement thereof within the door body, which is operative to urge the door to predetermined residence position without causing raising or lowering movement of the door, which is economical to manufacture and assemble, which can be conveniently and easily installed in the door, and quickly adjusted from a point exterior of the door.

Other objects and advantages of this invention will become apparent as the disclosure proceeds.

Although the characteristic features of the invention will be particularly pointed out in the claims appended hereto, the invention itself, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part hereof, in which—

Fig. 1 is an elevational view of a typical door mounted in a door frame by means of the improved hinge assembly constructed in accordance with this invention;

Fig. 2 is a top plan view of the door and door frame as illustrated in Fig. 1, this view showing the door in various open and closed positions to illustrate the operating characteristics of this improved hinge assembly;

Fig. 3 is an enlarged elevational view of the upper hinge structure, parts of the door and upper hinge bracket being shown broken away to illustrate structural details;

Fig. 4 is an enlarged vertical cross sectional view through the upper hinge structure showing fragmentary parts of the door and the upper hinge bracket as the same would appear when viewed along line 4—4 of Fig. 3.

Fig. 5 is an enlarged fragmentary horizontal view of the upper horizontal edge of the door as viewed along line 5—5 of Fig. 3, this view showing the horizontal face of the upper door bracket with the bearing unit seated therein and a cross section of the associated hinge pintle;

Fig. 6 is an enlarged elevational view of the lower hinge structure, parts of the door and the lower hinge bracket being shown broken away to illustrate structural details;

Fig. 7 is an enlarged vertical cross sectional view through the lower hinge structure showing fragmentary parts of the door and lower hinge bracket as the same would appear when viewed along line 7—7 of Fig. 6;

Fig. 8 is an enlarged fragmentary horizontal sectional view of the door and lower hinge structure as viewed along line 8—8 of Fig. 6;

Fig. 9 is a side elevational view of a cam track member which may be associated with the lower hinge structure;

Fig. 10 is a vertical cross sectional view of the cam track member as viewed along line 10—10 of Fig. 9;

Fig. 11 is an elevational view of a cam track member

of modified form which may be selectively associated with the lower gravity hinge structure; and

Fig. 12 is a vertical cross sectional view of the modified form of cam member as viewed along line 12—12 of Fig. 11.

Similar reference characters refer to similar parts throughout the several views of the drawings and specification.

The improved hinge assembly constructed in accordance with this invention may be associated with almost any type of door and door frame, including doors which occupy the full area of the door opening as defined by the door frame, as well as doors which are variously spaced from the door sill and/or the door head frame. For purposes of illustration there is shown in Fig. 1 one form of door 1 with which this improved hinge assembly may be associated, the door frame member 2 and the jamb edge 5 of the rear frame member 3.

The door is hingedly mounted upon an upper hinge bracket 6 and a lower hinge bracket 7 which may be of any desired construction. As illustrated in Fig. 1, each hinge bracket may comprise a horizontal arm 8 having rearwardly projecting spaced wings 9. Bolts 10 extending through the wings 9 and through the rear frame member 3 may be provided to firmly secure the hinge brackets in fixed position. It will be appreciated that the hinge brackets may be of any desired shape or design to provide a support for the hinge pintles, and may be variously secured or attached to the rear frame member.

The door 1 may be constructed in any desired shape and size of metal, wood or other material, and may vary from approximately one inch in thickness to two or more inches in thickness. As shown in the drawings for purposes of illustration, the door 1 may comprise a pair of metal side wall forming panels 11 arranged in spaced relationship. The space between the side wall panels 11 may be packed with suitable sound deadening insulation 12, except for the limited spaces 12′ and 12″ which receive parts of the upper and lower hinge structures. A top edging strip 13, a front edging strip 14, a bottom edging strip 15 and a rear edging strip 16 may be crimped, welded or otherwise formed or secured to the adjacent edges of the side wall panels 11 to provide a strong and sturdy door construction.

The rear corners of the door may be reinforced and strengthened by a bottom bracket 20 and a top corner bracket 21 secured to the door structure, the brackets presenting contours which interfit and harmonize with the adjacent door edging sections. Each corner bracket is sturdily constructed and may be formed as a metal casting, presenting a horizontal leg 22 and a vertical leg 23. Each upper and lower horizontal leg 22 may be provided with an inset face portion 22′, as shown more particularly in Figs. 1, 3 and 6, so that the horizontal arm 8 of the adjacent hinge bracket will interfit therewith, maintaining the overall height of the door substantially uniform throughout. To attain line symmetry, the horizontal arm 8 of the top hinge bracket 6 may extend in substantially the same plane as the top edging strip 13 of the door, and the horizontal arm 8 of the lower hinge bracket 7 may extend in substantially the same plane as the bottom edging strip 15 of the door. A neat and symmetrical door construction and door mounting is thus provided in which the projecting horizontal arms 8 of the hinge brackets are contoured within the door dimensions to present smooth flowing lines of attractive appearance.

The upper rear edge of the door is pivotally mounted on the horizontal arm 8 of the uper hinge bracket 6 by means of an upper hinge structure as shown more particularly in Figs. 3, 4 and 5. The horizontal leg 22 of the upper corner bracket 21 presents a boss portion 24 projecting inwardly between the panel sheets 11 of the door. The boss portion 24 has a bore 25 which receives an upper pintle rod 30. The inset face portion 22′ of the corner bracket 21 also presents a pocket 26 designed to receive a bearing unit 40.

The pintle rod 30 is provided with a threaded end portion 31 which extends through the horizontal arm 8 of the top hinge bracket 6 and is fixed thereto as by a cap nut 32. The shank 33 of the pintle rod 30 extends into the free space 12′ between the door facing sheets 11, and presents a reduced neck portion 34 which extends through the bearing unit 40 and an inset shoulder 35 adjacent which the bearing unit 40 is designed to seat. The bearing unit 40 presents a section 41 adapted to seat against a clamp ring 42. The inner periphery of the clamp ring 42 seats within a groove 36 formed in the pintle rod 30 adjacent the reduced neck portion 34 thereof. The bearing unit 40 also includes a rotatable section 43 which forms a bearing raceway with the companion section 41 within which ball bearings 44 are positioned. A bearing cup 45 enclosing the bearing sections 41 and 43 seat within the bearing pocket 26, and is supported by the rotatable bearing section 43 to rotate with the swinging movement of the door 1; the pintle rod 30, the companion bearing section 41 and the clamp ring 42 normally remaining stationary. When the nut 32 is tightened, the horizontal arm 8 of the hinge bracket 6 is clamped between the nut 32 and the clamp ring 42 to maintain the pintle rod 30 in rigidly fixed position. As thus constructed, the upper edge of the door has a ball bearing mounting which reduces frictional resistance to swinging movement of the door.

The door 1 is supported upon the horizontal arm 8 of the lower hinge bracket 7 and is connected thereto by a hinge structure constructed as shown more particularly in Figs. 6 to 12 inclusive. As shown in Figs. 6 and 7, the horizontal leg 22 of the lower corner bracket 20 has a boss portion 46 projecting inwardly between the panel sheets 11 of the door. The boss portion 46 presents a bore 47 through which the lower pintle rod 50 projects. The inset face 22′ of the lower corner bracket 20 also presents a pocket 48 designed to receive and contain a thrust bearing unit 60.

The lower pintle rod 50 is positioned in axial alignment with the upper pintle rod 30 and has a shank portion 53 which projects for a substantial distance into the free space 12″ between the panel sheets 11. The lower pintle rod 50 is provided with a threaded end portion 51 at the lower end thereof which extends through the horizontal arm 8 of the lower hinge bracket 7 and is normally fixed thereto by a nut 52. The lower end of the pintle rod 50 is provided with a slot 59 to which a screw driver may be applied to effect orientation of the pintle rod 50, when the nut 52 is loosened or removed, for a purpose which will presently appear.

The lower end portion of the pintle rod 50 presents a reduced neck portion 54 which extends through the bearing unit 60 and defines an inset shoulder 55 adjacent which the bearing unit 60 is designed to seat. The bearing unit 60 presents a section 61 designed to seat against a clamp ring 62. The inner periphery of the clamp ring 62 seats within a groove 56 formed in the pintle rod 50 adjacent the reduced neck portion 54 thereof. The bearing unit 60 also includes a rotatable section 63 which forms a bearing raceway with the companion section 61 within which ball bearings 64 are positioned. A bearing cup 65 embraces the bearing sections 61 and 63, seats within the bearing pocket 48, and is supported by the rotatable bearing section 63 so that the bearing cup 65 and the rotatable bearing section 63 will rotate with the swinging movement of the door 1; the pintle rod 50, the companion bearing section 61 and the clamp ring 62 normally remaining stationary. When the nut 52 is tightened, the horizontal arm 8 of the hinge bracket is thus clamped between the nut 52 and the clamp ring 62 to maintain the pintle rod 50 in rigidly fixed position. As thus constructed, the lower edge of the door also has a ball bearing mounting which reduces frictional resistance to swinging movement of the door.

Mechanism wholly contained within the door body and housed in the space 12″ between the door panel sheets

11, is mounted on the elongated shank portion 53 of the lower pintle rod 50 to automatically return the opened door to closed position. This mechanism, as shown in Figs. 6 to 12 inclusive, comprises a U-shaped rider bracket 70 having spaced upper and lower legs 71 and 72 extending substantially horizontally within the door and connected by a base section 73. The upper and lower legs 71 and 72 terminate in aligned collar portions 74 through which the shank 52 of the lower pintle rod 50 extends. Each collar portion 74 contains a bearing sleeve 75 so that the rider bracket 70 is free to swing on the normally stationary pintle rod 50 and to also move lengthwise thereof substantially without friction during swinging movement of the door.

The base section 73 of the rider bracket 70 extends substantially parallel to but inwardly spaced from the pintle rod 50 and when installed is contained within the free space 12'' between the door panel sheets 11 as shown in Fig. 6. A bearing stud 76, as shown in Figs. 6, 7 and 8, projects outwardly from the base section 73 of the rider bracket 70 and supports a ball bearing roller 77 whose axis is parallel to the panel sheets 11 of the door. The roller 77 has an inner ring section 78 fixed to the bearing stud 76 and is embraced by an outer ring section 79. The inner ring section 78 and the outer ring section 79 of the roller 77 define a bearing raceway therebetween for ball bearings 79', thereby insuring substantially frictionless rotation of the outer ring section 79 on the inner ring section 78 as the rider bracket vertically reciprocates during swinging movement of the door. The outer end of the bearing stud 76 may be provided with a flared head portion 76' to retain the roller 77 thereon. It will be noted by referring to Figs. 7 and 8 that the rotatable ring section 79 of the roller 77 is positioned to selectively roll against either one of the adjacent inside faces of the door panel sheets 11 when the rider bracket 70 is vertically manipulated along the shank 53 of the pintle rod 50 by door swinging action.

The rider bracket 70 is supported on the pintle rod 50 by a cylindrical cam member mounted on the pintle rod 50 and positioned between the door panel sheets 11. The cam member has an axial bore 81 through which the shank 53 of the pintle rod extends. The lower edge of the cam member may be provided with a pair of diametrically spaced notches 82 through which a lock pin 83 extends. The lock pin 83 also extends diametrically through the shank 53 of the pintle rod 50 so that the projecting end portions of the lock pin 83 provide a fixed support for the cam member. A series of vertically spaced holes extending diametrically through the shank 53 of the pintle rod 50 may be provided to permit elevational adjustment of the cam member.

The cam member 80 as shown in Figs. 9 and 10 is provided with an upwardly extending tubular wall 84 whose upper free edge defines a trackway 85 on which a bearing roller 90 is associated with the rider bracket 70 may roll. The cam track 85 presents a valley point 86 which is connected by smoothly contoured inclined trackway sections 88 and 89 to spaced ridge points 87 and 87'. The cam member 80 is so mounted on the shank 53 of the pintle rod 50 that the valley point 86 of its trackway normally defines the closed position of the door and the depressed ridge points 87 and 87' define the maximum opened positions of the two-way swinging door when mounted to swing in either direction *b* or *b'* as shown in Fig. 2.

The cam roller 90 is mounted on a bearing stud 91 projecting from a sturdy neck portion 92 which may be formed integral with the base section 73 of the rider bracket 70. As shown in Figs. 6, 7 and 8, the bearing stud 91 is positioned between the upper and lower legs 71 and 72 of the rider bracket 70 and may project towards the shank 53 of the pintle rod 50 at an upwardly inclined angle. The roller 90 comprises an inner bearing ring 93 which is fixed to the bearing stud 91, and an outer bearing ring 94. The inner and outer ebaring rings 93 and 94 define a bearing raceway therebetween for the reception of ball bearings 95. The bearing stud 91 may be provided with a head portion 91' to retain the cam roller 90 thereon. The cam roller 90 is designed to roll over the trackway of the cam member and provides support for the rider bracket 70.

A helical loading spring 96 telescopes over the shank 53 of the pintle rod 50, with the lower end 96' of the spring seating against the collar portion 74 of the upper leg 71 of the rider bracket 70. The upper end 96'' of the helical spring 96 seats against a bearing unit 100. The upper end portion 57 of the pintle shank 53 is threaded to receive a nut 58, so that the bearing unit 100 is clamped between the nut 58 and the upper end 96'' of the helical spring 96. The bearing unit 100 permits substantially frictionless rotation of the helical spring 96 with the swinging movement of the rider bracket 70.

The bearing unit 100 as shown in Figs. 6 and 7 may comprise a rotatable bearing section 102 and a fixed bearing section 101 whose rotation is resisted by frictional contact with the nut 58. The fixed section 101 and the rotatable section 102 of the bearing unit 100 define a bearing raceway therebetween for the reception of ball bearings 103. A bearing cup 104 encloses the bearing sections 101 and 102 and seats against the upper end 96'' of the helical spring 96. By manipulating the nut 58, the helical spring 96 may be compressed to any desired degree to thereby exert a predetermined downward thrust or pressure load on the upper leg 72 of the rider bracket 70. This predetermined pressure load is in turn transmitted by the rider bracket 70 to its cam roller 90 which is supported by the normally fixed cam member attached to the pintle rod 50 as previously described.

The cam member 80 is so mounted on the pintle rod 50 that its valley point 86 is oriented to normally maintain the door in the closed position *a* as shown in Fig. 2. When the door 1 is physically swung in the direction *b* as shown in Fig. 2, the cam roller 90 may travel from its residence position at the valley point 86, upwardly along the inclined track section 88 into residence position at the depressed ridge point 87, thereby maintaining the door in opened position as shown at *c* in Fig. 4. When a slight closing force is applied to the door, the spring loaded rider bracket 70 will swing the door through the arc *b* as shown in Fig. 2 to its closed position *a*. If the door is physically swung in the opposite direction through the arc *b'* as shown in Fig. 2, the cam roller 90 will travel from its residence position at the valley point 86 of the cam track 85 upwardly along the opposite inclined track section 89 until the cam roller 90 is in residence at the depressed ridge point 87' of the cam track to thereby maintain the door in open position *c'* as shown in Fig. 2. The door may be moved to closed position by exerting a light initial closing push to the door, whereupon the cam roller 90 will roll down the inclined track section 89 to residence position at the valley point 86 under the swinging impetus of the spring loaded rider bracket 70.

If it is desired to have the door open in one direction only, a cam member 80' of the type shown in Figs. 11 and 12 may be mounted on the pintle rod 50 as by the lock pin 83. The cam member 80' may be constructed substantially similar to the cam member shown in Figs. 9 and 10 except for a change in shape of the tubular camming wall 84' thereof. As shown in Figs. 11 and 12, the camming wall 84' is shaped to provide a one way cam track 85' whose valley point 86 locates the door in closed position, and an inclined track section 88 which terminates in a depressed ridge portion 87 which may be located beyond the 90° open position, so that the door will be maintained in open residence position from 90° to approximately 180° from its closed position, with the door swinging in through the arc *b* as shown in Fig. 2. The tubular wall 84' of cam member 80' may also present a substantially vertical edge 89' rising from the valley

point 86 of the cam track to serve as a stop abutment for the cam roller 90.

It will be noted that the cam members 80 and 80' may be made interchangeable to provide for a two-way or one-way swing mounting for the door in accordance with customer requirements. By a selected shaping of the cam track any desired door swinging action may be achieved.

The spring loaded rider bracket 70 provides a radial arm whereby substantial swinging force is exerted on the door when the cam roller 90 rolls over the inclined sections of the cam member, even though the radius of the cam track is relatively small. By an appropriate manipulation of the adjusting nut 58, the swinging force exerted on the door tending to return it from opened to closed position may be increased or diminished as desired. This swinging force exerted on the door is further augmented by the relatively steep inclination of the inclined track sections 88 or 89 and by the further fact that the door pushing roller 77 which applies the closing force to the door permits the rider bracket 70 to reciprocate vertically on the pintle rod 50 substantially without friction. Swinging movement of the door is further augmented and enhanced by providing the cam roller 90 will ball bearings, and by providing the upper and lower bearing units 40 and 60 on which the door is supported with ball bearings.

Means are provided to effect adjustment of the pintle rod 50 to retain the door in correct residence position with the front edge of the door in true alignment with the jamb edge 4 of the front frame member 2. This adjustment is effected externally of the door, by simply loosening the exposed nut 52 which clamps the pintle rod 50 in fixed position to the horizontal arm 8 of the lower hinge bracket 7. By means of a screw driver applied to the exposed screw driver slot 59 in the pintle rod 50, the pintle rod 50 may be turned to orient valley point of a cam member fixed thereto in a position to retain the door in selected closed position. The nut 52 may then be retightened to firmly secure the pintle rod 50 against movement. Orientation of the door to accurate closed position may thus be easily effected at any time without removing the door from its pivot mountings.

The door is substantially fully constructed to any design or shape before the upper and lower hinge assemblies are connected thereto. The door as fabricated is provided with the free spaces 12' and 12'' between the panel sheets 11 thereof to receive parts of the hinge structures.

In connecting the upper hinge structure to the door body, the upper bearing unit 40 is first telescoped over the threaded end portion 31 of the upper pintle rod 30 to embrace the reduced neck portion 34 thereof, with the bearing cup 45 seating adjacent the inset shoulder 35 of the pintle rod 30. The clamp ring 42 is then telescoped over the threaded end portion 31 of the hinge pintle 30 and the clamp ring compressed so that its inner periphery seats within the pintle groove 36 to thereby provide a support for the upper bearing unit 40. The shank portion 33 of the pintle rod 30 is then telescoped through the bore 25 in the boss portion 24 of the top corner bracket 21 so that the bearing unit 40 seats within the bearing receiving pocket 26 in the horizontal leg 22 of the corner bracket 21, with the shank portion 33 of the pintle rod 30 projecting into the door space 12'. If desired, the top corner bracket 21 may be secured to the door either before or after the shank portion 33 of the pintle rod 30 is inserted through the bore 25 of the bracket. The horizontal arm 8 of the upper hinge bracket 6 can then be applied to the threaded end portion 31 of the pintle rod 30 and clamped against the clamp ring 42 by the cap nut 32.

The lower hinge structure as shown in Figs. 6 and 7 is assembled by placing the cam member 80 or 80' between the upper and lower legs 71 and 72 of the rider bracket 70 and applying them to the shank portion 53 of the pintle rod 50 by first inserting the threaded end portion 57 of the pintle rod 50 through the bearing sleeve 75 associated with the lower leg 72 of the rider bracket 70, then telescoping the bearing member 80 or 80' over the threaded end portion 57 of the pintle rod, then inserting the end portion 57 of the pintle rod through the bearing sleeve 75 in the upper leg 71 of the bearing bracket 70, and then sliding the rider bracket 70 and the cam member 80 or 80' into position on the shank portion 53 of the pintle rod 50. The lock pin 83 is then inserted through the shank portion 53 of the pintle rod to provide a fixed support for the cam member 80 or 80'. The helical spring 96 is then telescoped over the threaded end portion 57 of the pintle rod 50 so that its lower end 96' seats against the collar portion 74 of the upper rider bracket leg 71. The bearing unit 100 is then telescoped over the threaded end portion 57 of the pintle rod 50 to seat against the upper end 96'' of the helical leading spring 96, and the nut 58 then applied and tightened so that the helical spring 96 will exert the desired loading pressure on the rider bracket 70 and cam roller 80.

The lower threaded end portion 51 of the pintle rod may then be telescoped through the bore 47 of the boss portion 46 of the unattached lower corner bracket 20. The bearing unit 60 is then telescoped over the threaded end portion 51 of the pintle rod 50 to seat within the bearing receiving pocket 48 of the corner bracket 20. The clamp ring 62 is then clamped into position so that its inner periphery seats within the pintle rod groove 56. The shank portion 53 of the pintle rod 50, with the nut 58, bearing unit 100, helical loading spring 96, rider bracket 70 and cam member 80 or 80' all mounted thereon as above described, is then telescoped into the space 12'' within the door body before the corner bracket 20 is secured to the door body. The corner bracket 20 may be secured to the door body either before or after the bearing unit 60 and the clamp ring 62 have been applied to the pintle rod 50. The threaded end portion 51 of the pintle rod is then inserted into the conformed hole in the arm 8 of the lower hinge bracket 7 and the nut 52 applied thereto to rigidly clamp the hinge bracket arm 8 between the nut 52 and the clamp ring 62.

The door is thus fully assembled with the upper and lower hinge structures and associated upper and lower corner brackets 21 and 20 fully mounted thereon, and with the arms 8 of the upper and lower hinge brackets 6 and 7 secured to the pintle rods by the holding nuts 32 and 52, before the spaced wings 9 of the upper and lower hinge brackets 6 and 7 are attached to the rear door frame member 3 as by the bolts 10. By thus fully attaching and assembling the upper and lower hinge structures to the door body before the upper and lower hinge brackets 6 and 7 are attached to the rear door member 3, assembly and erection of the door is greatly expedited and smooth swinging action obtained. After the door has been mounted on the rear door frame member 3, attention can be given to the orientation of the lower pintle rod 50 by the application of a screw driver to the screw driver slot 59 in the end thereof to establish the desired residence position of the closed door as previously described.

The upper and lower bearing units 40 and 60 insure substantially frictionless swinging movement of the door so that the helical cam loading spring 96 may exert its maximum door swinging effect. Swinging movement of the door is further facilitated by the bearing unit 100 which seats against the upper end of the helical spring and by the provision of roller bearing mountings for the cam roller 90 and pressure roller 77. Thus the swinging mechanism associated with the pintle rod 50 will operate to swing relatively heavy doors as thus mounted even though the cam member 80 or 80' of relatively small diameter is used.

It will also be appreciated that the upper pintle rod

30 may be elongated in the form of the lower pintle rod 50 and thus equipped with a rider bracket 70 mounting a pressure roller 77 and cam roller 90 designed to roll against the cam track of a cam member 80 or 80' associated with the upper pintle rod, with the cam loading pressure applied by a helical spring 96. When the door is equipped with swinging mechanism of the type illustrated in Figs. 6 and 7 at both the upper and lower ends thereof, the heaviest doors may be automatically operated.

Door hinge assemblies constructed in accordance with this invention present a number of important advantages over gravity hinges as heretofore constructed and employed. This improved hinge assembly operates automatically and requires no elevating and lowering movement of the door for its proper functioning. The door can be made the full size of the door opening, with the door accurately lined up with the door jamb. Since the hinge assembly is fully concealed within the door, the operating parts are protected from dust, dirt and the weather, do not require special finishing, and can thus be made of less expensive materials. The same size and design of hinge assembly can be used for numerous different types and kinds of doors, thus making unnecessary special door hinge assemblies to accommodate various types of doors. Since effective operation of this improved hinge assembly is independent of the type and kind of mounting brackets employed, the door hinge brackets can be simplified and streamlined into numerous and various shapes, harmonizing with the architectural lines of the door and door frame. By the use of these improved hinge assemblies, projecting hinge parts which gather dust and dirt may be avoided, and greater latitude permitted in the design of doors and door frames in harmony with the advanced architectural designs.

While certain novel features of the invention have been disclosed herein, and are pointed out in the claims, it will be understood that various omissions, substitutions, and changes may be made by those skilled in the art without departing from the spirit of the invention.

We claim:

1. In combination with a door presenting side wall forming facing panels secured together in spaced relationship, a door hinge assembly which includes, a corner reinforcing bracket having a vertical leg embracing the rear vertical edges of said spaced facing panels, a horizontal leg integral with said vertical leg and presenting a horizontal web and a pair of spaced side flange portions overlapping and embracing therebetween adjacent horizontal edge portions of said spaced facing panels, and a boss portion integral with said horizontal leg and extending into the door body between said spaced facing panels, said boss portion having a vertical extending pintle rod receiving bore whose outer end merges into an enlarged bearing receiving pocket axially aligned with said bore, a hinge bracket having a door-jamb attaching part projecting beyond the rear edge of the door and a horizontal arm extending therefrom and overlying the web of said corner bracket, a pintle rod having a shank extending through said bearing pocket and bore and into the body of the door between said facing panels and an outer end portion extending outwardly of said bearing pocket, means for securing the outer end portion of said pintle rod to the horizontal arm of said hinge bracket, and a bearing unit pocketed between said bearing pocket and said horizontal arm and in axial alignment with the axis of said pintle rod.

2. In combination with a door presenting spaced side wall forming facing panels, a rear edging strip connecting the adjacent rear edges of said facing panels, a horizontal edging strip connecting the adjacent horizontal edges of said facing panels and extending short of the rear vertical edges of said facing panels, of a door hinge assembly which includes, a corner reinforcing bracket having a vertical leg embracing the rear vertical edges of said facing panels and a horizontal leg integral with said vertical leg and extending between said vertical leg and the terminal end of said horizontal edging strip, said horizontal leg presenting a horizontal web and a pair of spaced side flange portions overlaping and embracing therebetween adjacent horizontal edge portions of said spaced facing panels, and a boss portion integral with said horizontal leg and extending into the door body between said spaced facing panels, said boss portion having a vertical extending pintle rod receiving bore whose outer end merges into an enlarged bearing receiving pocket axially aligned with said bore, a hinge bracket having a door-jamb attaching part projecting beyond the rear edge of the door and a horizontal arm extending therefrom and overlying the web of said corner bracket, a pintle rod having a shank extending through said bearing pocket and bore and into the body of the door between said facing panels and an outer end portion extending outwardly of said bearing pocket, means for securing the outer end portion of said pintle rod to the horizontal arm of said hinge bracket, and a bearing unit pocketed between said bearing pocket, and said horizontal arm and in axial alignment with the axis of said pintle rod.

3. In combination with a door presenting spaced side wall forming facing panels, a rear edging strip connecting the adjacent rear edges of said facing panels, a horizontal edging strip connecting the adjacent horizontal edges of said facing panels and extending short of the rear vertical edges of said facing panels, of a door hinge assembly which includes, a corner reinforcing bracket having a vertical leg embracing the rear vertical edges of said facing panels and a horizontal leg integral with said vertical leg and extending between said vertical leg and the terminal end of said horizontal edging strip, said horizontal leg presenting a pair of spaced side flange portions overlapping and embracing therebetween the adjacent horizontal edge portions of said facing panels, said horizontal leg presenting a raised web portion whose outer face extends substantially in the plane of said horizontal edging strip and joined to a web portion whose outer face is inset below the outer face of said raised web portion, a hinge bracket having a door-jamb attaching part projecting beyond the rear edge of the door and a horizontal arm extending therefrom and overlying the inset web portion of said corner bracket with the outer face of said horizontal arm extending substantially in the plane of the outer face of the raised web portion of said horizontal bracket leg, the inset web portion of said horizontal leg having a boss portion extending into the door body between said spaced facing panels, a pintle rod having a shank extending through a bore in said boss portion and an outer end portion secured to the horizontal arm of said hinge bracket, and a bearing unit pocketed between said horizontal arm and inset web portion and in axial alignment with the shank of said pintle rod extending therethrough.

4. In combination with a door presenting spaced side wall forming facing panels, a rear edging strip connecting the adjacent rear edges of said facing panels, a horizontal edging strip connecting the adjacent horizontal edges of said facing panels and extending short of the rear vertical edges of said facing panels, of a door hinge assembly which includes, a corner reinforcing bracket having a vertical leg embracing the rear vertical edges of said facing panels and a horizontal leg integral with said vertical leg and extending between said vertical leg and the terminal end of said horizontal edging strip, said horizontal leg presenting a pair of spaced side flange portions overlapping and embracing therebetween the adjacent horizontal edge portions of said facing panels, said horizontal leg presenting a raised web portion whose outer face extends substantially in the plane of said horizontal edging strip and joined to a web portion whose outer face is inset below the outer face of said raised web

portion, a hinge bracket having a door-jamb attaching part projecting beyond the rear edge of the door and a horizontal arm extending therefrom and overlying the inset web portion of said corner bracket with the outer face of said horizontal arm extending substantially in the plane of the outer face of the raised web portion of said horizontal bracket leg, the inset web portion of said horizontal leg having a boss portion extending into the door body between said spaced facing panels, said boss portion having a vertical extending pintle rod receiving bore whose outer end merges into an enlarged bearing receiving pocket axially aligned with said bore, a pintle rod having a shank extending through said bearing pocket and bore and into the body of the door between said facing panels and an outer end portion extending outwardly of said bearing pocket, means for securing the outer end portion of said pintle rod to the horizontal arm of said hinge bracket, and a bearing unit seating in said bearing pocket and pocketed between said bearing pocket and said horizontal arm and in axial alignment with the axis of said pintle rod.

5. In combination with a door presenting spaced side wall forming facing panels, a rear edging strip connecting the adjacent rear edges of said facing panels, a horizontal edging strip connecting the adjacent horizontal edges of said facing panels and extending short of the rear vertical edges of said facing panels, of a door hinge assembly which includes, a corner reinforcing bracket having a vertical leg embracing the rear vertical edges of said facing panels and a horizontal leg integral with said vertical leg and extending between said vertical leg and the terminal end of said horizontal edging strip, said horizontal leg presenting a pair of spaced side flange portions overlapping and embracing therebetween the adjacent horizontal edge portions of said facing panels, said horizontal leg presenting a raised web portion whose outer face extends substantially in the plane of said horizontal edging strip and joined to a web portion whose outer face is inset below the outer face of said raised web portion, a hinge bracket having a door-jamb attaching part projecting beyond the rear edge of the door and a horizontal arm extending therefrom and overlying the inset web portion of said corner bracket with the outer face of said horizontal arm extending substantially in the plane of the outer face of the raised web portion of said horizontal bracket leg, the inset web portion of said horizontal leg having a boss portion extending into the door body between said spaced facing panels, said boss portion having a vertical extending pintle rod receiving bore whose outer end merges into an enlarged bearing receiving pocket axially aligned with said bore, a pintle rod having a shank extending through said bearing pocket and bore and into the body of the door between said facing panels and an outer end portion extending outwardly of said bearing pocket, means for securing the outer end portion of said pintle rod to the horizontal arm of said hinge bracket, and a bearing unit pocketed between said bearing pocket and said horizontal arm and in axial alignment with the axis of said pintle rod.

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