United States Patent

McLeland et al.

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[54] **HINGE STRUCTURE FOR A CLOSURE MEMBER**

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[51] **Int. Cl.** **E05d 7/04**

[58] **Field of Search** 160/206, 199; 16/129, 132, 16/134; 49/388

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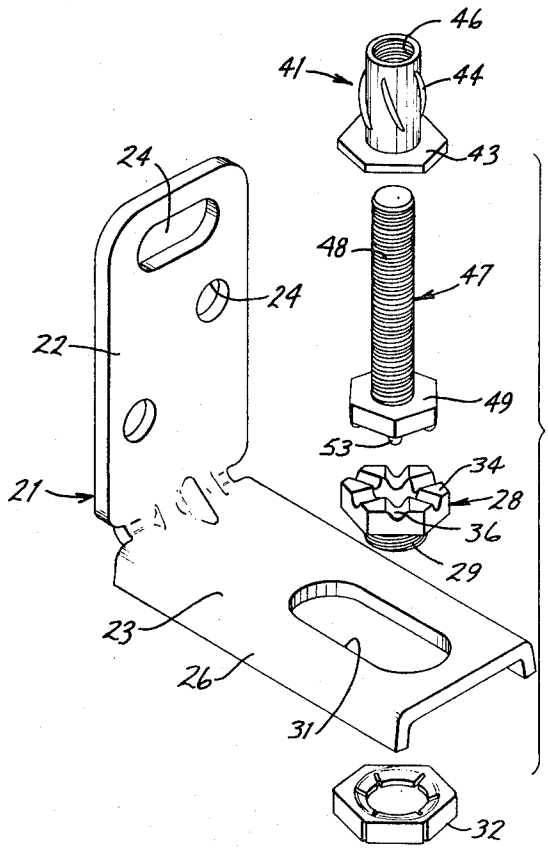
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[57] **ABSTRACT**

A hinge structure for adjustably and pivotally supporting a door upon a door frame, said hinge structure including a support bracket means mounted on the frame and pivot pin means mounted on the door for engagement with said bracket means. The engaging surfaces of the pivot pin means and bracket means have cooperating structure for yieldably resisting pivotal movement between the pivot pin means and the bracket means. The pivot pin means is threadedly mounted in a sleeve which is secured within the edge of the door so that pivotal movement of the door is effected by rotational movement between the pin means and the sleeve means.

2 Claims, 5 Drawing Figures



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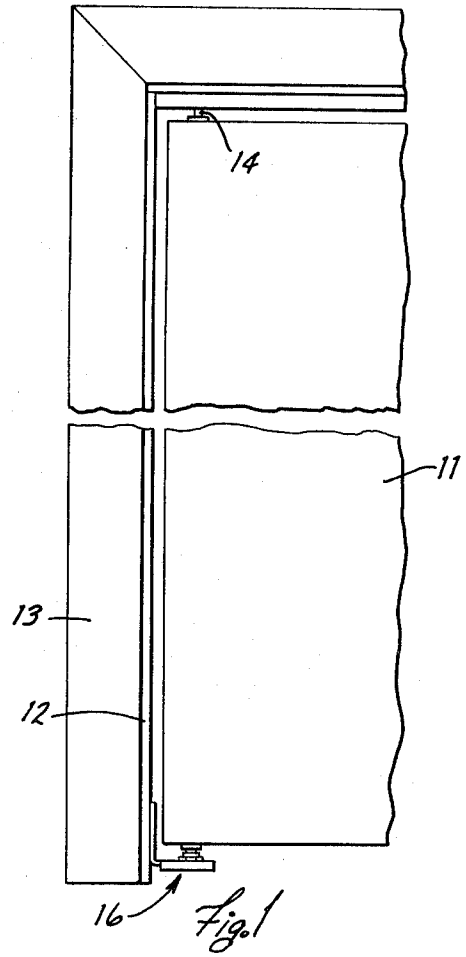


Fig. 1

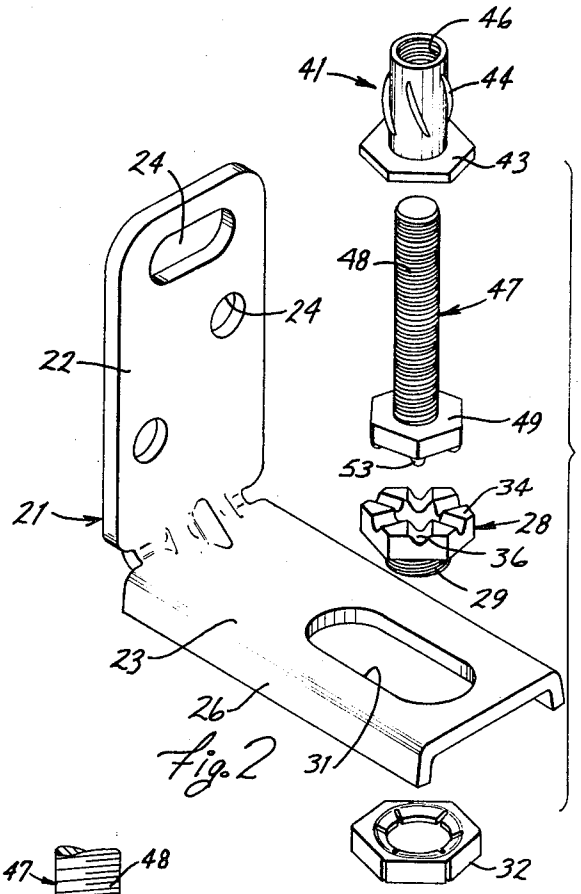


Fig. 2

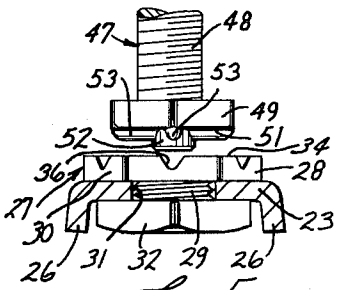


Fig. 5

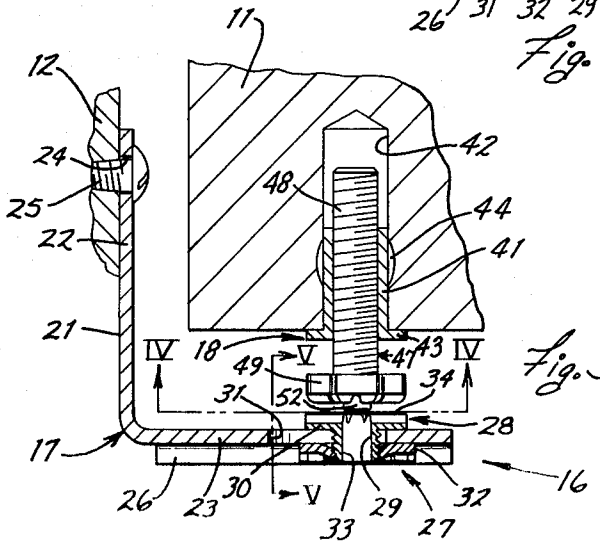


Fig. 3

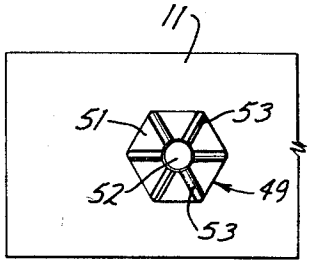


Fig. 4

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HINGE STRUCTURE FOR A CLOSURE MEMBER

FIELD OF THE INVENTION

This invention relates in general to a hinge structure for an upright closure member and, more particularly, to a type thereof having means for vertically and horizontally adjusting the position of the closure member relative to its supporting frame structure.

BACKGROUND OF THE INVENTION

Pivot mechanisms for supporting doors are some of the oldest and most well known mechanical devices. However, no one has previously successfully provided an inexpensive and easily adjustable hinge structure for pivotally supporting a closure member, for example a door, whereby said door can also be easily and quickly removed from or installed in its normal position of operation.

Persons acquainted with installation and manufacture of doors, such as those used in folding door units, are well aware of the difficulties encountered when an attempt is made to install a pair of pivotally supported doors in a door frame so that they are accurately aligned both vertically and horizontally with the frame and with each other. That is, normally the installation of such doors is effected after a frame is completed and, in fact, may be effected by somebody other than the carpenter who built or installed the door frame structure. In spite of the efforts of the carpenter to build the door frame accurately and with the best available materials, changes often occur in the shape of the door frame after it is completed. Moreover, even though the installation of the doors in the door frame is effected with great care, it is almost impossible to be sure that the doors will remain accurately aligned after the installation is complete unless some provision is made in the mounting or hinge structure for adjustment of the door both vertically and laterally.

Heretofore, a common method of effecting vertical adjustment of a pivoted door was to threadedly insert the pivot pin into the door (usually at the lower edge thereof) and provide a support bracket for pivotally supporting the lower end of the pivot pin. However, particularly where the door is of average or larger size, the pivotal engagement between the pin and the support bracket frequently becomes obstructed by dirt or damage so that the threaded pivot pin is caused to rotate with respect to the door, often unidirectionally in small increments, until the door is obviously out of alignment, even to the point of jamming the door against the frame. Accordingly, it then becomes necessary to readjust or realign the door.

However, readjusting the position of the door is not as simple as it appears. Each time the pivot pin must be adjusted with respect to the door, it tends to increase the size of the opening in the door which receives the pivot pin and, accordingly, this increases the changes of more frequent subsequent readjustments, due to a jammed pivot. Attempts have been made to press sleeves in the door structure in order to minimize wear when adjustment is required and, generally speaking, such arrangements have proven satisfactory for reducing wear. However, these devices have not eliminated the source of the problem, namely, jamming at the pivotal contact surfaces with resultant turning of the pivot pin relative to the door.

In the course of examining the problem, it became apparent that, in the aforesaid conventional pivoted hinge structure, all of the support of the door by the hinge structure was concentrated on a very small pivot contact area. Also, the pivot contact area was constantly exposed to dirt and damage. On the other hand, if this pivot contact area could be transferred, enlarged, and protected, the source of the existing problem would be avoided. As will be developed hereinafter, this end was accomplished by transferring the pivot contact area from a pivotal engagement between the pivot pin and its support bracket to a pivotal engagement between the pivot pin and a door-mounted sleeve in which the pivot pin is threadedly received. In other words, the previous problem of relative movement between door and pivot pin, which was to be avoided, would now be used to advantage.

Accordingly, a primary object of this invention is the provision of a pivot-type hinge construction for a door whereby the pivotal movement is effected between the hinge pin and a member, such as a sleeve, mounted in the door with which the hinge pin is threadedly engaged so that the area of the relatively movable hinge surfaces is relatively large and is protected from dirt and damage.

A further object of this invention is the provision of a hinge mechanism, as aforesaid, in which the rotational position of the hinge pin relative to its supporting bracket can be changed easily in order to adjust the elevation of the door with respect to its frame.

A further object of this invention is the provision of hinge construction, as aforesaid, having means for adjusting the door horizontally of its frame structure.

Other objects and purposes of this invention will become apparent to persons familiar with door hinge constructions upon reading the following descriptive material and examining the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a broken fragment of a door and door frame including a hinge structure embodying the invention.

FIG. 2 is an exploded perspective view of said hinge structure.

FIG. 3 is an enlarged, sectional view of the hinge structure.

FIG. 4 is a sectional view substantially as taken along the line IV—IV in FIG. 3.

FIG. 5 is a sectional view taken along the line V—V of FIG. 3.

For convenience in description, the terms "upper", "lower", "right", "left" and words of similar import will have reference to the invention and the door associated therewith as appearing in FIG. 1. The terms "inner", "outer" and derivatives thereof will have reference to the geometric center of said hinge structure and parts associated therewith.

SUMMARY OF THE INVENTION

The objects and purposes of the invention, including those set forth above, have been met by providing a hinge structure for a swingable closure member, such as a door, having a hinge pin threadably received into an axially vertical sleeve, which is fixedly connected to the door whereby swinging or pivotal movement of the door is effected by relative pivotal movement between

the threaded sleeve and the threaded hinge pin. The hinge pin is releasably but nonrotatably supported on a bracket member fixedly secured to the door frame. The hinge pin and bracket have cooperating engaging surfaces which prevent rotation of the hinge pin during normal swinging movement of the door, but which, due to the provision of a releasable detent-like structure provided between the supporting surfaces, permit selected rotation of the hinge pin relative to the bracket for permitting adjustment of the vertical position of the door relative to the surrounding door frame.

DETAILED DESCRIPTION

FIG. 1 illustrates a portion of a substantially conventional closure member or door 11 positioned within an opening defined by a door frame 12, which door frame is secured to and disposed within an opening provided in a wall or partition 13. The door 11 has an upper corner thereof pivotally interconnected to the frame 13 by means of a conventional pivot or hinge device 14. A combined support and hinge structure 16 is mounted on the frame 13 adjacent the lower corner of the door 11 for pivotally supporting the door 11. The hinge structure 16, which comprises the present invention, cooperates with the hinge device 14 for defining a substantially vertically extending pivot axis around which the door 11 can freely swing or pivot relative to the frame 12.

The hinge structure 16 includes support means 17 adapted to be secured to the door frame 12 and pivot means 18 connected to the door 11 and engaged with the support means 17. The support means 17 includes an L-shaped bracket 21 having substantially vertical and horizontal legs 22 and 23, respectively. The vertical leg 22 is provided with a plurality of conventional openings or slots 24 through which screws 25 are received for securing the bracket 21 to the frame 12.

The horizontal bracket leg 23 has a downwardly opening channel-shape defined by flanges 26 disposed adjacent the opposite longitudinal edges thereof. The horizontal leg 23 is also provided with a pivot support 27 thereon, which includes a bolt 28 having its hexagonal head 30 disposed adjacent the upper surface of the leg 23. The bolt 28 has a threaded shank 29 which extends downwardly therefrom through an elongated slot 31 formed in the leg 23. A hexagonal lock nut 32, which is disposed below the leg 23 and nonrotatably held within the channel defined by the side flanges 26, is threadably engaged on the shank 29 for securing the bolt 28 in a stationary position relative to the bracket 21. The slot 31 provided in the horizontal leg 23 permits the pivot support 27 to be selectively adjusted longitudinally of the leg during initial installation or thereafter to insure proper alignment of the door or its hinge axis. The slot 31 also has a lateral width slightly greater than the width of the threaded shank 29 for permitting limited lateral adjustment of the support means.

The bolt 28 is provided with an axial opening 33 and a substantially flat upper support surface 34. A plurality of diametrically disposed grooves 36 are provided in the surface 34. The grooves 36 each preferably have an approximately V-shaped cross section. In the disclosed embodiment, as illustrated in FIG. 2, the bolt head 30 has three intersecting grooves 36 which are preferably uniformly angularly spaced and thereby form six groove segments disposed substantially uniformly and radially around the central opening 33.

The bolt head 30, being hexagonal, for example, can be engaged by a conventional wrench for rotating the bolt relative to the leg 23 for securing the bolt 28 relative to the bracket leg. However, the nut could be provided with a rectangular or other configuration suitable for gripping by a tool. The lock nut 32, on the other hand, is preferably of a size such that it substantially totally occupies the space between the side flanges 26 so that the nut 32 will be nonrotatably held between the flanges, whereupon no additional tool is necessary for holding the lock nut when the bolt 28 is turned.

The support means 18 includes a sleeve 41 which is adapted to be disposed within a vertical bore 42 formed in the lower corner of the door 11. The sleeve 41 includes an annular flange 43 adjacent the lower end thereof adapted to abut against the lower edge of the door. The sleeve 41 also has a plurality of spaced and similar spiral ribs 44, which ribs project therefrom and penetrate into the material of the door defining the bore 42 for nonrotatably securing the sleeve 41 relative to the door 11.

The sleeve 41 is provided with a threaded opening 46 extending therethrough for threadably receiving a threaded hinge pin 47. The hinge pin 47 includes an elongated threaded shank 48 which is engaged with the sleeve 41 and, in this embodiment, normally extends from both ends of the sleeve to insure that the hinge pin will have adequate threaded engagement with the sleeve 41 over a substantial range of vertical adjustment of the door 11.

The hinge pin 47 is provided adjacent the lower end thereof, with an enlarged adjustment head 49, which is positioned below the lower edge of the door and is disposed for engagement with the pivot support 27. The adjustment head 49 is provided with a flat lower surface 51 from which a central pin-like projection 52 extends downwardly beyond the lower surface 51. The pin-like projection 52 has a diameter slightly smaller than the diameter of the opening 33 and is adapted to be disposed within the opening 33 when the bearing surface 51 engages support surface 34. The pin-like projection 52, when disposed within the opening 33, thus prevents undesired lateral movement of the hinge pin, hence of the door, relative to the frame.

The hinge pin adjustment head 49 has a plurality of radially disposed ribs 53 which project downwardly from lower bearing surface of the head 49. The six ribs 53 have a V-shaped cross section and they are arranged so that they are snugly received into the cooperating grooves 36 when the hinge pin bearing surface 51 is disposed in bearing engagement with the upper support surface 34.

OPERATION

While the operation of the hinge construction described above will be apparent from such description to persons acquainted with devices of this type, a brief summary of the operation will be given hereinafter for convenience.

When the door 11 is initially installed within the opening defined by the frame 12, the pivot support 27 is adjusted longitudinally and/or laterally with respect to the lower bracket arm 23 so that it is properly

aligned with the upper hinge device **14**. The bolt **28** is then rotated into firm engagement with the bracket arm **23**.

The sleeve **41** is fixedly secured within the door and the hinge pin **47** is threadably received within the insert **41**. The door **11** is then mounted within the opening defined by the door frame by first engaging the hinge device **14** and then locating the pivot means **18** directly above the pivot support **27**. The door is then lowered until the pin-like projection **52** extends into the opening **33** and the lower bearing surface **51** is in bearing engagement with the upper support surface **34**. A slight pivoting movement of the door may be required to position the ridges **53** within the grooves **36**. When the door is disposed in this position, most of its weight will be transmitted downwardly through the hinge pin **47** onto the upper support surface **34**. This downwardly directed force will be sufficient to maintain the adjustment head **49** of the hinge pin in nonrotatable engagement with the bolt **28**, whereby relative rotation will occur between the hinge pin **47** and the sleeve **41** when the door is pivoted.

During normal horizontal swinging movement of the door **11**, relative pivotal movement will occur between the sleeve **41** and the threaded hinge pin **47**. However, the hinge pin **47** can be rotated relative to the bolt **28** for adjustment purposes.

The swinging movement of the door will cause a slight vertical movement of the door, due to the pitch or lead of the cooperating threads. However this vertical movement of the door is so small that it is insignificant.

If it should become necessary to adjust the vertical position of the door **11** relative to the surrounding frame **12**, then the door **11** will be held against swinging, while the head **49** is engaged and turned by a wrench. The torque applied to the hinge pin **47** will be sufficient to cause the ridges **53** to be cammed upwardly out of the grooves **36**, whereupon the hinge pin **47** can then be selectively rotated a desired amount, which rotation of the hinge pin **47** will cause it to be threaded into or out of the stationary sleeve **41**, depending upon the direction of rotation of the hinge pin. Thus, rotation of the hinge pin will change the location of the hinge pin relative to the door, which in turn results in the vertical adjustment of the door.

During the above rotational adjustment, the pin-like projection **52** remains positioned within the opening **33** so as to prevent the hinge pin from being axially disconnected from the pivot support. Further, due to the provision of the grooves **36** and ribs **53**, rotation of the hinge pin **47** will produce a clicking sound or feel which will enable the person performing the adjustment to readily gauge the degree of adjustment being accomplished.

While the disclosed embodiment of the invention utilizes three grooves and ridges extending diametrically across their respective surfaces (which result in six equally spaced ridge and groove segments), it will be readily recognized that other members and arrangements of grooves and ridges could be furnished for the same purposes. Moreover, while the disclosed embodiment has the ridges on the hinge pin and the grooves on the bolt head, the relative positions could be reversed without exceeding the scope of the invention.

While the invention includes spiral-like ridges **44** on the sleeve **41** for securing same within the door, it will be readily apparent that numerous other types of structure could be provided for this purpose. For example, radial teeth on the sleeve or a plurality of axially extending spikes on the flanges could penetrate the door for nonrotatably securing the sleeve to the door.

While the drawings illustrate the invention in association with a single swingable closure device or door **11**, said door could be one of two or more panels hingedly connected along their vertical edges. Further, the hinge structure **16** is particularly suitable for use with closure devices which possess a pair of swingable doors mounted upon the opposite sides of a door frame, which doors must be accurately aligned both vertically and horizontally with the frame and with each other. If the pairs of doors are of the bifold type, which are used extensively in homes and commercial buildings, the invention disclosed herein is especially useful.

Although a particular preferred embodiment of the invention has been disclosed in detail for illustrative purposes, it will be recognized that variations or modifications of the disclosed apparatus, including the rearrangement of parts, lie within the scope of the present invention.

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

1. A hinge structure for pivotally supporting and adjusting a closure member, such as a door, on an adjacent frame structure, comprising:

bracket means adapted to be secured to said frame structure near the lower end thereof, said bracket means including a fixed support portion having an upwardly facing support surface adapted to be disposed below a portion of said closure member;

internally threaded means adapted to be nonrotatably secured to said portion of said closure member in an axially upright position adjacent said bracket means;

pivot pin means having a threaded portion in threaded engagement with said threaded means for permitting free relative rotation therebetween, said pivot means also including enlarged head means disposed adjacent the lower end thereof and positioned downwardly from said internally threaded means;

cooperating guide means on said pin means and said bracket means for holding said pin means and said bracket means in pivotal relationship;

said cooperating guide means including a pinlike projection fixedly connected to one of said bracket means and said pin means and a substantially cylindrical recess formed in the other of said bracket means and said pin means, said pinlike projection being received in said recess for permitting free rotational movement of said pin means relative to said bracket means around the axis of said pin means while preventing relative lateral displacement therebetween; and

engageable positioning means coacting between said pin means and the support portion of said bracket means for yieldably resisting relative pivotal movement between said pin means and said bracket means during normal pivotal movement of said

closure member relative to said frame structure so that pivotal movement of said closure member relative to said frame structure is effected by relative pivotal movement between said pivot pin means and said threaded means;

said positioning means coacting between the upper surface of said support portion and the lower surface of said head portion and including a plurality of vertical camlike projections formed on one of said surfaces and a plurality of vertically disposed recesses formed in the other surface adapted to receive said projections therein, said projections on said one surface being angularly spaced from one another to define relatively planar support areas of substantial magnitude therebetween, and said recesses as formed in said other surface also being substantially angularly spaced from one another to define relatively planar support areas of substantial magnitude therebetween, whereby said support areas of said surfaces are normally disposed in engagement with one another during normal usage of said hinge structure.

2. A hinge structure for pivotally supporting and adjusting a closure member, such as a door, on an adjacent frame structure, comprising:

bracket means adapted to be fixedly secured to said frame structure near the lower end thereof, said bracket means including a substantially horizontal flange having an elongated slot therein;

pivot support means positioned on said flange and including means extending into said slot, and means coacting with said pivot support means for releasably securing said support means to said flange at any selected position while permitting said pivot support means to be adjusted lengthwise of said slot;

internally threaded means adapted to be nonrotatably secured to said portion of said closure member in an axially upright position adjacent and above said flange;

pivot pin means having a threaded portion in threaded engagement with said threaded means for permitting free relative rotation therebetween;

said pivot pin means including an enlarged head portion provided adjacent the lower end thereof and positioned directly above said pivot support means, said head portion having a lower bearing surface adapted to be disposed in bearing engagement with the upper bearing surface of said pivot support means;

cooperating guide means on said pin means and said pivot support means for holding said pin means and said pivot support means in pivotal relationship;

said cooperating guide means including a pinlike projection coaxially aligned with said pin means and fixedly connected to one of said pivot support means and said pin means, and a substantially cylindrical recess formed in the other of said pivot support means and said pin means, said pinlike projection being freely rotatably received in said recess for permitting free rotational movement of said pin means relative to said pivotal support means about the axis of said pin means while preventing relative lateral displacement therebetween; and

releasable lock means coacting between said pin means and said support means for yieldably opposing relative pivotal movement between said pin means and said support means during normal pivotal movement of said closure member relative to said frame structure, the pivotal movement of said closure relative to said frame structure being effected by relative pivotal movement between said pivot pin means and said threaded means;

said lock means including a plurality of vertically projecting ridges projecting outwardly from one of said bearing surfaces, said ridges being angularly spaced from one another and extending substantially radially relative to the longitudinal axis of said pin means, said projections being substantially angularly spaced from one another to define substantially planar support areas of substantial magnitude therebetween;

said lock means further including a plurality of vertical recesses formed in the other of said bearing surfaces, said recesses extending substantially radially relative to the longitudinal axis of said pin means and being substantially angularly spaced from one another to define substantially planar support areas of substantial magnitude therebetween;

whereby said vertical ridges normally extend into said vertical recesses for nonrotatably connecting said pivot pin means and said support means whereby said pivot pin means is thus maintained stationary relative to said bracket means, said pivot pin means being manually rotatable relative to said support means whereby said ridges are cammed out of said recesses so that said support areas are spaced from one another to thus permit said pin means to be threaded into or out of said threaded means for adjusting the vertical position of said closure member relative to said frame structure.

* * * * *