Dec. 27, 1949 F. G. HOMAN 2,492,478

DOOR HINGE

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Fig. 1

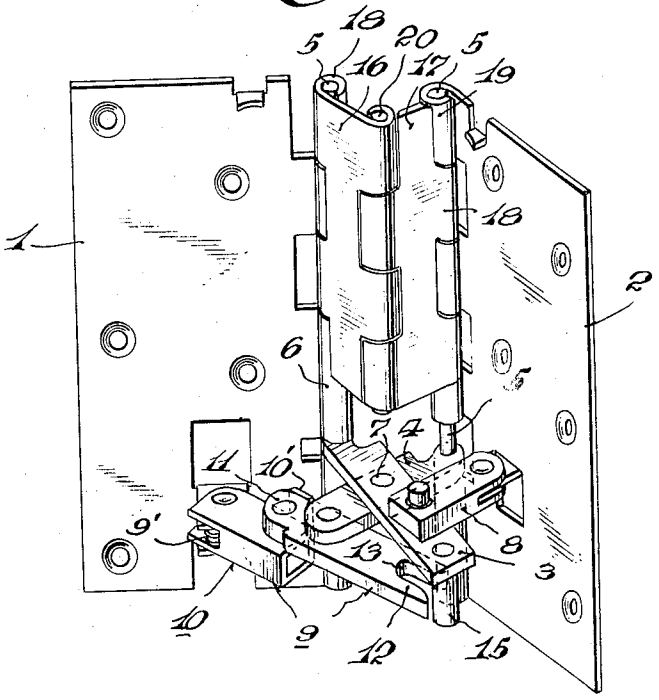


Fig. 2

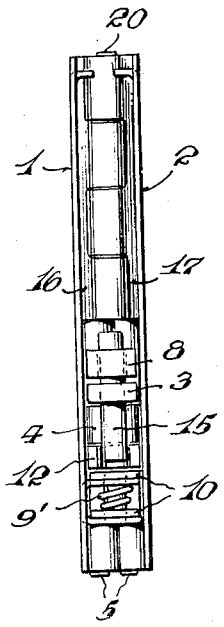


Fig. 3

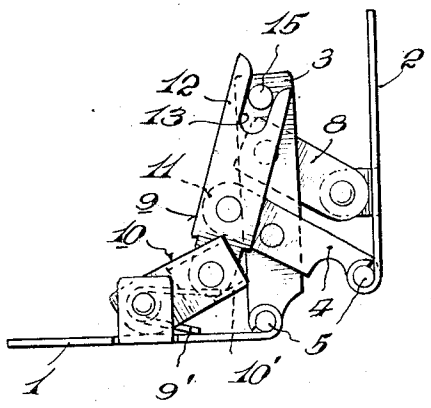
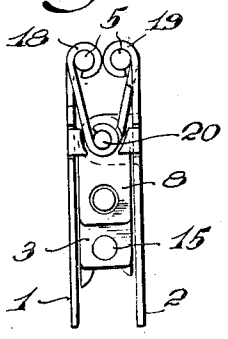


Fig. 4



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DOOR HINGE

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8 Claims. (Cl. 16—164)

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This invention relates to concealed butt hinges, and pertains more particularly to hinges which are adapted to be fixed between the edge of a door and the jamb, and which are so arranged as to be wholly concealed in the door joint when the door is in closed position.

Ordinarily such hinges present the problem of arrangement of a pivot structure wholly within the joint between the door and jamb, which will permit the door to swing open without interference with the jamb and other structure surrounding the opening. Heretofore, hinges have been proposed comprising two main leaves one each of which is affixed to the door edge and jamb respectively, and a pair of intermediate leaves hinged together along one pair of edges and to the respective leaves along their other edges. While such hinges permit the concealment of the hinge and opening of the door, by reason of the flexible interconnection of the two leaves due to the three pivotal connections between them, they are not satisfactory. This is due to the fact that the flexibility of the hinge, due to the presence of the three pivots, permits relative motion of the leaves that is uncontrolled and erratic, since the door may move in various rectilinear directions and swing about any of the pivotal connections.

The primary important object of this invention is the provision of a novel and effective mechanism in a concealed butt hinge, for providing a rigidly controlled lateral movement of a pivot point about which the door may swing, to permit the pivot point to be moved out of the door opening sufficiently so that the door may clear the structure about the door opening as it swings.

A further important object of this invention is to provide a novel mechanism of the above character that will limit the swinging movement of the door to a substantially arcuate path about the movable pivot point as a center, thereby producing a movement that closely resembles that of a door swung on a conventional butt hinge with pivot points supported laterally of the door and clear of the opening.

Another important object of this invention is to provide a mechanism of the above character which includes an assembly of links and levers so connected to the leaves as to convert swinging movement of the door-carrying leaf so as to impart to the inner edge of the leaf a lateral movement that will, during swinging of a door supported on the leaf, carry the door to a point that will permit it to swing about the edge of the

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leaf and clear the structure surrounding the door opening.

Still another important object of this invention is to provide a mechanism which is so arranged as to limit swinging movement of the door to a path centered about the edge that is moved laterally, thereby avoiding erratic movement that would result were the swinging free to take place about a plurality of pivots, such as is included in the mechanism.

A still further important object of the invention is to provide hinge mechanism of the above character which is simple in construction, readily installed in operative position, and one that may be readily manufactured and placed upon the market at a reasonable cost.

The foregoing and other objects and advantages will be readily apparent throughout the course of the following description and drawing, in which,

Figure 1 is a perspective view of a hinge provided with the controlling mechanism forming the subject matter of the instant invention,

Figure 2 is a front elevation of the hinge in its closed position,

Figure 3 is a bottom plan view of the hinge shown in Fig. 1, and

Figure 4 is a top plan view of the hinge shown in Fig. 2.

Referring in detail to the drawing, the hinge comprises a pair of main leaves 1 and 2, one of which may be fixed to a jamb and the other to the edge of a door that is to be swung from the jamb. To the inner edge of each leaf, 1, 2, is pivoted the end of one of a pair of levers 3, 4, as by means of pins 5 around which the marginal portions of the leaves are bent, as at 6. The levers 3 and 4 are disposed between the leaves and are pivoted together by a pin 7. The levers are in face to face arrangement, and are extended beyond their pivotal connection, forming crossed levers the portions of which lying beyond the pivot point are connected through links to intermediate portions of the leaves opposite to the ones to which their inner ends respectively are pivoted. Thus a link 8 is pivoted to the lever 3 and to the leaf 2. The end of the lever 4 is connected by a link 9 to an intermediate portion of leaf 1.

The link 9 is of special form, comprising a section 10 that is pivoted to the leaf 1 between the upper and lower edges of the latter, and a section 11 one end of which is pivoted to the end of the section 10 and which section 11 is also pivoted intermediate its ends to the end of lever 4. The sections 10 and 11 of link 9 are in face to face

arrangement and the section 11 is in face to face relation with lever 4, which latter is in turn in face to face relation with lever 3, the latter having the same arrangement relative to link 8. Section 11 is extended beyond the lever 4 and at its free extremity the section is bifurcated so as to form a fork 12 which defines a slot 13. The inner edge of section 10 carries an upstanding flange 10' arranged along the over-lap between the sections 10 and 11, which flange forms a stop to limit relative swinging movement of the two sections and causes them to act as a single rigid arm following contact between the edge of section 11 and the face of the flange, when contact therebetween occurs during swinging movement of the leaves away from each other. The link 9 is normally urged outwardly away from the leaf 1 by a spring 9' and in addition is effectively a toggle arm that is pivoted to an intermediate portion of the leaf 1. Lever 3, pivoted to the edge of leaf 1, which is also the leaf to which the toggle link 9 is pivoted, carries at its distal end a projecting pin 15 which depends at right-angles thereto, and which is arranged to cooperate with the bifurcated end 12 of section 11 by entering the slot 13 and bearing against one or the other of the walls defining its sides, depending on the direction of swinging of the leaves, to thereby swing section 10 so as to bring the two sections to linear arrangement during opening movement of the leaves, and to break the toggle joint during their closing movement.

The various elements of the link and lever system are so arranged upon their various pivots, and the latter are so arranged relative to each other, that the elements lie in parallel relation when the leaves are closed. With the hinge disposed in a vertical closed position, the elements form a vertical stack, the sides of which are arranged along planes that are parallel to each other and to the inner faces of the leaves. It is one feature of this mechanism that the leaves are brought into parallel relation when the hinge is closed, insuring proper registration of the door with the opening within which it is swung by the hinge.

In operation, and assuming the hinge assembly to be in closed position, Figure 2, with the hinge leaf 1 secured to a door jamb (not shown) and with the hinge leaf 2 secured to a door (not shown), initial outward swinging of the leaf 2 about its associated adjacent pivot 5, will cause the leaf 2 and connected door to tend to move bodily outwardly of the door frame while at the same time to swing in an arc about the said associated and immediately adjacent pivot 5 until the leaf 2 and attached door has reached the open position of the parts, as shown in Figure 1 of the drawings, and in which latter position the depending pin 15 has become disengaged from the wall defining slot or notch 13 formed in the free end of section 11 of link 9. Such opening movement may then continue at least until the leaves 1 and 2 are parallel and aligned.

The action thus described is the direct result of the construction and interconnection of the leaves, links and levers forming the generally lazy tong system hereinbefore set forth.

Thus initial opening or separative movement of the leaf 2 with respect to leaf 1 will create a pull through link 8 upon the free part of lever 3 to which it is attached.

Continued swinging movement of lever 3 about the pivot 5 associated with leaf 1 will then cause separation of the pivots 5 due to the fact that

lever 4 is pivoted at one end to the pivot 5 of leaf 2, at the intermediate pivot 7 to lever 3 and at its opposite end to section 11 of link 9 which is in turn connected to leaf 1.

The purpose of the link 9 composed of sections 10 and 11, is to prevent or overcome any tendency of the parts to become locked on dead center during closing movement of the door.

Thus when the leaf 2 has been moved a predetermined distance toward the leaf 1 in the closing movement of the parts, the depending pin 15 carried by lever 3 will strike one leg of the forked or slotted end 12 of section 11 of link 9 and will thereafter cause the joint between sections 10 and 11 to break in a direction so that the abutting edge of section 11 will move away from upstanding flange 10' carried by section 10. As the pivotal movement of sections 10 and 11 continues, force is applied to leaf 2 through its pivot 5 and the link 4 to insure smooth collapsing movement of the parts.

It is believed to be obvious that swinging movement applied to either leaf relative to the other will result in the operation of the parts just described.

The result of these two movements is that the opening and closing operations of the door are approximately that of a door that is swung on a conventional type butt hinge, while the present hinge has the further advantage of being fully concealed between the door and jamb when the door is closed.

The arrangement as described above is of itself capable of performing the functions of both hinge and controlling mechanism. However, in some instances it may be desirable to swing the door on a hinge that includes a more conventional type of concealed hinge structure and use the described system for controlling the action of the hinge, thereby relieving the controlling system of the weight of the door.

To this end, the main leaves may have interposed between them a pair of intermediate leaves 16 and 17, the outer edges of which may be respectively pivoted to the same edges of the main leaves as are the levers 3 and 4, as by having marginal portions bent around the pins 5 at 18, in alternation with similarly bent portions 19 of the main leaves. The inner edges of the intermediate leaves are pivoted together by a conventional type of hinge joint 20, which is coaxial with pin 7. In this structure the hinge provided by the main leaves and intermediate leaves serves to carry the weight of the door, while the link and lever mechanism operates as described above to control the relative movement of the main leaves.

It is to be understood that the form of my invention herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to, without departing from the spirit of my invention, or the scope of the subjoined claims.

I claim:

1. In a butt hinge comprising a leaf formed for connection to a door jamb and a door-carrying leaf formed for connection to the edge of a door; motion-controlling pivot means connecting the leaves comprising a pair of levers pivoted together between the leaves and each being also pivoted to an edge of one of the leaves, a pin carried by the free end of one of said levers and extending at right angles thereto, and a link pivoted to each leaf between the edges thereof

and also to the lever that is pivoted to the edge of the other leaf, one of said links being formed with a notch for receiving said pin when the motion-controlling pivot means is actuated toward door-closing position, whereby pressure exerted by the pin-carrying lever is transmitted through the notched link to assist in moving the leaves together.

2. In a butt hinge comprising a leaf for fixing to a door jamb and a door-carrying leaf for fixing to the edge of a door; a motion-controlling pivot mechanism connecting the leaves comprising a pair of levers crossed between their ends, the said levers being pivoted together at their crossing point and each having an end pivoted to the edge of one of the leaves, a downwardly extending pin carried by one of said levers, and a pair of links one each being pivoted respectively to one of the levers outwardly of their crossing point, and to the leaf to which the other lever is pivoted, one of said links comprising a jointed toggle arm having a notched free end to receive and to be engaged by said downwardly extending pin when the leaves are moved toward door-closing position.

3. In a butt hinge comprising a leaf for fixing to a door jamb, a door-carrying leaf for fixing to the edge of a door, and a pair of levers pivoted to each other and to the edges of the respective leaves; a motion-controlling link pivoted to each of the levers and to the leaf to the edge of which the other lever is pivoted, one of the said links comprising a toggle arm having a joint between its pivotal connections with the leaf and the lever.

4. In a butt hinge comprising a leaf for fixing to a door jamb and a door-carrying leaf for fixing to the edge of a door; a pair of levers pivoted respectively to the edges of the respective leaves and pivoted together, a motion-controlling link pivoted to each of the levers and to the leaf to the edge of which the other lever is pivoted, one of the said links comprising a toggle arm having a joint between its pivotal connections with the leaf and the lever and being adapted to be locked in open position as the leaves are separated, and means carried by the lever that is pivoted to the same leaf as the said toggle arm for contacting the said arm and breaking the joint as the leaves are swung together.

5. In a butt hinge comprising a leaf for fixing to a door jamb, a door-carrying leaf for fixing to the edge of a door, and a pair of levers crossed intermediate their ends and pivoted together at their crossing point, each of the said levers having an end pivoted to an edge of the respective leaves; a link pivoted to one of the leaves intermediate its edges and to the lever pivoted to the other leaf, a toggle arm pivoted to the other leaf and the other lever and arranged to be straightened out to form a rigid link that cooperates with the first link to control relative motion of the levers and leaves as the leaves are swung apart, and means carried by the lever that is pivoted to the same leaf as the toggle arm for contacting the said arm and breaking the toggle joint as the leaves are swung together, the link, levers, and toggle arm sections being arranged successively along the axes of the pivots, and the pivots being so arranged as to move the said elements into parallel superposed relation as the leaves are swung together.

6. In a concealed butt hinge comprising a pair of main leaves for securing to a jamb and a door respectively, and a pair of intermediate leaves pivoted together along meeting outer edges and respectively pivoted to the main leaves along inner edges; means for laterally moving the pivot between one of the intermediate leaves and a main leaf and swinging the said main leaf about the said pivoted edge when a swinging force is applied to the said main leaf, said means comprising a pair of levers pivoted to the edges of the main leaves to which the intermediate leaves are pivoted, and pivoted together coaxially with the pivot between the intermediate leaves, and a link pivoted to each of the respective levers, each link also being pivoted to the main leaf to which the other lever is pivoted, one of said last named links comprising a toggle arm having a joint between its pivotal connections with the leaf and the lever.

7. In a concealed butt hinge comprising a pair of main leaves for securing to a jamb and a door respectively, and a pair of intermediate leaves pivoted together along meeting outer edges and respectively pivoted to the main leaves along inner edges; means for laterally moving the pivot between one of the intermediate leaves and a main leaf and swinging the said main leaf about the said pivoted edge when a swinging force is applied to the main leaf, said means comprising a pair of levers pivoted to the edges of the main leaves, the said levers being crossed and pivoted together at their crossing point coaxially with the pivot between the intermediate leaves, and links pivoted to the respective levers, each link being also pivoted to the leaf to which the other lever is pivoted, one of the links being jointed between its pivotal connections with the lever and leaf, the outer end of the said link extending beyond the pivot to the lever, and the lever that is pivoted to the same leaf as the said jointed link extending beyond its pivot to the other lever and having a surface arranged to contact the end of the jointed link and break the joint of the link as the leaves are swung toward each other.

8. In a butt hinge comprising a main leaf for fixing to a door jamb, a door-carrying main leaf for fixing to the edge of a door, a pair of levers pivoted to each other and to the edges of the respective leaves, a motion-controlling link pivoted to each of the levers and to the leaf to the edge of which the other lever is pivoted, one of the said links comprising a toggle arm having a joint between its pivotal connections with the leaf and the lever, and a pair of auxiliary leaves pivoted together and connecting said main leaves, the pivotal connection between the auxiliary leaves being substantially coincident with the pivotal connection between the levers.

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