ABSTRACT

A door latch having a rotatable latch member containing a latch hook and handle, and a movable bolt member. The latch member is fixedly mounted on a rotatable hub which has an eccentric camming pin positioned thereon. The camming pin moves within a follower aperture in the bolt member causing the latter to move to a latched or retracted position corresponding to that assumed by the latch hook upon movement of the handle. Means prevent the bolt, when in the extended position, from being depressed by force applied directly thereto.

10 Claims, 12 Drawing Figures
DOOR LATCH MECHANISM

The present invention relates to a latching mechanism which is especially suitable for mounting in connection with sliding doors. My invention particularly concerns a surface mounted latch mechanism containing an associated hold-down bolt and latch hook, both of which are movable, upon actuation of a single hand lever, from a fully retracted unlatched position within the housing to an extended latched position for mating with a keeper.

BACKGROUND OF THE INVENTION

Door latches involving a movable latch associated with a bolt have, of course, been known for many, many years. For well over a decade, latches employing these elements, whether surface or internally mounted, have also generally been known for use in sliding doors. Such latches characteristically employ a latch hook mounted on the door stile, to mate with a slot or aperture in a latch keeper mounted on the jamb. Recently, Hull U.S. Pat. No. 3,596,954 issued disclosing a sliding door latch assembly employing a retractable latch hook and a hold-down bolt. In the Hull structure, however, the hold-down bolt is immovable, forming part of the casing of the latch mechanism itself. Such a structure does have the advantage of providing an effective means, when the sliding door is closed, of preventing an intruder from forcing the door by lifting it upwardly off its mount. However, it suffers from a clear and practical disadvantage. The hold-down bolt, which permanently protrudes from the door and latch, provides a dangerous obstruction to persons and objects passing through the doorway.

SUMMARY OF THE INVENTION

The present invention provides a novel, relatively inexpensive latch mechanism which exhibits the advantages of a retractable latch hook and sturdy hold-down bolt which are so desirable in connection with latch mechanisms for sliding doors. In my novel latch mechanism, however, the hold-down bolt is fully retractable, along with the latch hook, merely upon shifting of a hand lever, the bolt shifting mechanism operating off of a simple camming mechanism. Yet the bolt can be retracted only by moving of the lever (or from actuation of a keylock in opposite side of the door). The latch bolt cannot be retracted by attempting to force it directly into retracted position, such as an intruder would attempt to do.

The manner in which my novel latch mechanism operates, and the advantages which it enjoys over prior art structures, will be apparent from the following description taken in conjunction with the appended drawing, in which like reference characters refer to corresponding parts in the several views, and in which:

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a general side view of a portion of a sliding door stile and jamb with the latch mechanism and keeper mounted respectively thereon:

FIG. 2 is an end view of the latch mechanism taken generally along lines 2--2 of FIG. 1:

FIG. 3 is a detailed section view of the latch and keeper taken along section lines 3--3 of FIG. 2, with the side of the latch adjacent the keeper being further broken away to show the slots through which the latch hook and bolt extend:

FIG. 4 is a section view of the latch mechanism only, similar to FIG. 3 but wherein the mechanism is in the unlatched position with the latch hook and bolt retracted:

FIG. 5 is a section view taken along lines 5--5 of FIG. 3:

FIG. 6 is a section view taken along lines 6--6 of FIG. 3:

FIG. 7 is a view in perspective of the base member on which various parts of the mechanism are supported internally of the latch housing:

FIG. 8 is a view in perspective of the retractable bolt member of my novel latch mechanism;

FIG. 9 is a view in perspective of the latch member;

FIG. 10 is an enlarged plan view of a portion of the bolt member showing the configuration of a cam follower aperture:

FIG. 11 is a view in perspective of the camming hub; and

FIG. 12 is a plan view of a portion of the latch and bolt members in the latched position taken from the side opposite that shown in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now especially to the drawings, a preferred embodiment of my novel latch mechanism is seen to comprise generally a housing 10, supporting a door handle 12, an elongate base 14 which fits within the housing 10, a retractable bolt member 16, a latch member 18, and a camming hub 20 which extends through the bolt and latch members. Also, leaf spring 22 bears against the hub 20 to assist in maintaining the bolt and latch members in their respective open and closed positions, as hereinafter described.

The latch assembly is surface mounted upon the stile 23 of a sliding door, so as to mate with keeper 24 surface mounted on the jamb 25, so that aligned slots 26 and 28 of the keeper mate with and receive the bolt member 16 and latch member 18 when the door is closed and the latch mechanism is locked.

The latch housing 10 and handle portion 12 are formed of extruded aluminum, the housing having two parallel side members 32 and 34 joined by face 26 from which handle 12 extends generally parallel and adjacent to side 32. A pair of counter-sunk screw holes 38 and 39 are drilled in the face, by which the latch assembly is surface mounted to the door stile 23.

The elongate base 14, formed from a bar of rigid plastic material such as polymethylacrylate ("Lucite"), is of generally rectangular cross-section so as to fit snugly within the housing 10. As shown more particularly in FIG. 7, the base 14 is provided with a machined inner surface 40 and smooth flat exposed surface 41 co-extending with the edges of housing sides 32 and 34. Mounting screw holes 42 and 43 extend through the base 14 from inner surface 40 to outer surface 41, in registration with holes 38 and 39 in the housing 10.

Machined surface 40 of base 14 is provided with three distinct levels 44, 46 and 48. From level 48, the base 14 is drilled through to provide a hearing 49 for hub 20. The three levels 44, 46 and 48 of the base accommodate, in order, leaf spring 22, latch member 18 and bolt member 16, all three of which are maintained
in position by hub 20, the circular end 50 of which is rotatably mounted in bearing 49 of the base.

Hub 20, as best shown in FIG. 11, is configured in levels 51, 52 and 54, numbered in order from circular end 50, which correspond with levels 44, 46 and 48 of the base 14. At level 51, the hub is provided with two flattened surfaces 56 and 58 opposite which leaf spring 22 is disposed in a lengthwise machined slot 60 comprising level 44 of base 14. The spring bears firmly but yieldingly against the respective flat surfaces 56 and 58, depending upon whether the latch is in the latched or unlatched position.

In actuality, level 51 in hub 20 is evidenced only by flattened surfaces 56 and 58, and level 44 in base 14 is seen only as slot 60. Otherwise, the previously described circular bearing surfaces of the base and hub continue through these respective levels, up to levels 46 and 52, respectively. At mid-level 46, base 14 houses latch member 18. At the corresponding level 52, hub 20 is provided with an eccentrically mounted square stud 62, the extremity of which juts beyond the circular bearing surface of the hub and bears against the flat surface of level 46 in the base to assist, along with spring 22, in maintaining proper positioning of the hub.

Latch member 18 is centrally provided with a square aperture 63 by which the latch member is mounted on the square stud 62 in fixed relation with respect to the hub 20. The latch member contains a hook 64 and a handle 66 which extend in generally opposite directions from the center aperture 63. Upon grasping the handle which extends through slot 68 in side 32 of housing 10, the hook can be moved back and forth from an extended latched position (FIG. 3), with the hook protruding through slot 70 in side 34 (the flat surface 56 of the hub in this instance being acted upon by leaf spring 22), to an unlatched position (FIG. 4) fully retracted within the base 14 (the flat surface 58 of the hub 20 then being in contact with the spring 22).

On the end 50, hub 20 is provided with a slot 40 for receiving the spindle of a key or other type lock (not shown) mounted in the door stile to allow locking of the latch from the outdoor side.

Level 48 of base 14 is conformed to retain the retractable bolt member 16, hub 20 at the corresponding level 54 being provided with circular cam pin 72 disposed upon square stud 62, eccentrically also with respect to the rotational axis of hub 20.

Bolt member 16 comprises an elongate arm 74 journaled at its upper end upon post 76 in base 14 through which is extended the aforementioned mounting screw hole 42. At the lower end of arm 74 is located hold-down bolt 78 which is offset with respect to the arm so as to align with hook 64 of latch member 18 (FIG. 8). Centrally of arm 74 is a follower aperture 80, the configuration of which shortly will be described, into which extends the cam pin 72 of hub 20. It will be seen that the bolt member can be swung about post 76 from an unlatched position with the hold-down bolt 78 retracted within the housing 10 to a latched position with the bolt extending through slot 82 in side 34 of the housing which aligns with latch hook slot 70. Since the distance between the follower 80 and the axis at post 76 is less than that between the bolt 78 and said axis, a relatively small displacement of the follower in response to cam action imparts the relatively greater arcuate displacement of the bolt 78 in its travel. Side edge 84 of the bolt member arm 74 is so configured that when the bolt is in the extended or latched position the arm abuts interior of side 34 of housing 10, thus forming a stop for the bolt member.

The configuration of the aforementioned follower aperture 80 of bolt member 16 is important to the operation and security aspects of the latch mechanism, as the edges of the aperture follow the cam pin 72 as hub 20 rotates in response to movement of latch handle 66. Thus, as shown in FIG. 10, edge 86 of the follower aperture 80 causes bolt 78 to move from the retracted unlatched position to the extended or latched position as the cam pin moves counter-clockwise. At the same time, as the handle 66 is moved, the latch hook 64 likewise moves to the extended position. Similarly, the opposite edge 88 of the follower aperture 80 serves to retract the bolt from the extended to the retracted position as pin 72 moves clockwise in response to downward movement of the handle 66 (also retracting hook 64).

It will be noted that edge 86 is provided with a slight shoulder 90, against which bears pin 72 when the bolt is in the extended or latched position. This shoulder prevents the bolt from being forced to a retracted position (causing the latch to raise in response to a reverse camming action of aperture 80 on pin 72), such as would occur when an intruder attempts to gain entrance by attempting to work the bolt to a retracted position by jiggling. Shoulder 90 is so configured as to block the arcuate path which camming pin 72 must take if hub 20 is to rotate and raise the latch hook. More precisely, the configuration of the follower aperture 80 is determined as follows. Particular reference being made to FIG. 10. First, the retracted position of the arm 74 is determined in relation to the corresponding position of cam pin 72 and a circle 92 struck or scribed on the arm 74 just slightly larger than the diameter of the pin. Then, another circle 94 of like diameter is scribed on the arm corresponding with the position of Pin 72 in the extended or latched position of the bolt, thus defining shoulder 90. In order to allow room for pin 72 to move within aperture 80, the opposite shoulder defined between the two scribed circles 92 and 94 is ignored and a smooth arcuate edge 88 is instead struck such that any point thereof is spaced from the point of shoulder 90 a distance at least larger than the diameter of pin 72.

As shown in FIGS. 3 and 12, when in the latched or extended position bolt member 16 and latch member 18 engage one another to assist also in preventing the latch from being retracted through reverse camming action by attempted depression of the bolt directly. Thus, the latch member 18 is provided with an arcuate protrusion 96 which bears against the angled edge 98 at the rear of offset bolt 78 on the back side of arm 74.

In mounting, the latch mechanism of the present invention is attached to the door stile with side 34 of the housing 10 positioned parallel to and alongside the edge of the door but normally recessed so as not to interfere with the channeled jamb (not shown) conventionally employed with sliding doors. This type of jamb serving the function of preventing an intruder from inserting a thin blade or other instrument through the door opening so as to force the hook latch upwardly. The keeper 24 is matingly positioned on the jamb so that the two aligned slots 26 and 28 receive the latch and bolt when the mechanism is in the latched position.
My latch mechanism contains an automatic "kick-off" should the door be closed when the latch is in the extended latched position with the hook 64 and bolt 78 protruding from housing 10. As the door is closed, angled surface 100 of the hook strikes the edge of slot 26, forcing the hook upwardly and causing latch member 18 and therewith hub 20 to rotate in the clockwise direction, thus retracting the latch and bolt. The design of the spring contacting detent surfaces 56 and 58 in level 51 of the hub assist in the latch kick-off. Thus, when the hook 64 is in the extended latched position, with spring 22 riding on detent surface 56, corner 102 of the hub defined at the junction of the detent surfaces 56 and 58 is seen to be located only slightly over center in respect to the biasing force applied by leaf spring 22. (FIG. 3.) Hence, only a slight clockwise movement of the latch and hub, as occurs when angled surface 100 strikes keeper 24, will cause corner 102 to move back over center in the direction of retraction, whereupon spring 22 biases the hub to the retracted position with surface 58 being contacted by spring 22.

When mounted as shown for a right-hand opening door (view from the indoor side), shoulder 104 on bolt member 16 bears against slot 82 of housing 10 to prevent lifting of the door from its mount. When the latch is reversed (upside down) as for use with a left-opening door, the upper (then lower) surface of hold-down bolt 78 bears against upper (then lower) edge of slot 82 to prevent lifting of the door. Also, while my latch mechanism has particular significance and has been described above in connection with surface mounted latches, the structure can be readily adapted to an internal latch for a sliding door. From the foregoing description of the preferred embodiment of my latch mechanism, various other equivalent structures doubtless suggest themselves.

What I claim is:
1. In a door latch, the combination comprising:
   a housing,
   a latch member having a latch hook and a handle, said member being rotatably mounted about a fixed transverse axis for movement of said hook back and forth from an extended position for engaging a keeper to a retracted position within said housing,
   a bolt member mounted in said housing for movement back and forth from an extended position within said keeper to a retracted position within said housing,
   a cam fixed in relation to said latch member and rotatable therewith, and
   a follower carried by said bolt member and engaged by said cam to move said bolt to the retracted and extended position corresponding with that assumed by said latch hook upon movement of said handle.
2. The device of claim 1, wherein said cam and follower means prevent depression of the bolt and rotation of the latch member in response to force applied directly to said bolt.
3. The device of claim 2, wherein a protrusion on the latch member interferes the bolt member when the latch and bolt are in the extended position, preventing depression of the bolt by force applied directly thereto.
4. The device of claim 1, wherein the latch member is fixedly mounted on a rotatable camming hub, an eccentric camming pin positioned on said hub which moves in an arcuate path upon rotation of the hub in response to movement of the latch handle,
a follower aperture in said bolt member within which is disposed said camming pin, the latter engaging the edges defining said follower aperture to move said bolt member into the corresponding latched or retracted position assumed by the latch hook upon movement of said handle.
5. The device of claim 4, wherein spring means urge the camming hub to remain in either of the extended latched or retracted positions assumed by the latch hook and bolt.
6. The device of claim 4, wherein the edge of the follower aperture engaged by the camming pin as the latch member is moved from the retracted to extended position is provided with a shoulder which, when the bolt is in the extended position, bears against said pin preventing depression of the bolt by force applied directly thereto.
7. The device of claim 1, wherein said bolt member comprises a bolt mounted for arcuate movement on an elongate arm about a second fixed transverse axis, the follower being carried by said arm.
8. The device of claim 7, wherein said follower is located on said bolt arm between said second axis and said bolt, the displacement of the bolt exceeding that of the cam in response to movement of the hook.
9. The device of claim 7, wherein said handle is fixed in relation to said latch hook and extends from said housing opposite the side thereof from which extend said hook and said bolt.
10. In a door latch, the combination comprising:
    a housing,
    a latch member having a latch hook swingably mounted for movement of said hook back and forth from an extended position for engaging a keeper to a retracted position within said housing,
    a bolt member mounted in said housing for movement back and forth from an extended position within said keeper to a retracted position within said housing,
    a cam fixed in relation to said latch member and movable therewith, and
    a follower carried by said bolt member and engaged by said cam moving said bolt to the retracted and extended position corresponding with that assumed by said latch hook upon movement thereof.

* * * *