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E. L. SCHLAGE ET AL

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SWINGING BOLT DOOR LATCH

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INVENTORS

ERNEST L. SCHLAGE
RALPH E. NEARY

BY

Luther E. West
ATTORNEYS
Our invention relates to means for latching together a door and a door frame in the customary fashion for manual operation and is particularly concerned with a door latch in which the bolt does not reciprocate to and fro, as is usually the case, but rather swings, generally in an arc. The arrangement is such that the provision of a swinging bolt results in various benefits.

An object of the invention is to provide a swinging bolt door latch in which the extent of projection of the bolt is somewhat more than is normally obtainable in a reciprocating bolt latch having a related construction.

Another object of the invention is to provide a swinging bolt door latch interchangeable with reciprocating bolt latch units of recognized kinds.

Another object of the invention is to provide a swinging bolt door latch capable of being effectively deadatched.

Another object of the invention is to provide a swinging bolt door latch having very little if any lost motion in its deadatching arrangement.

Another object of the invention is in general to provide an improved door latch mechanism.

Other objects together with the foregoing are attained in the embodiments of the invention described in the accompanying description and illustrated in the accompanying drawings, in which:

FIGURE 1 is a cross section on a generally horizontal median plane through a swinging bolt door latch constructed in accordance with the invention, the mounting being shown in door open position with portions broken away;

FIGURE 2 is a cross section, the plane of which is indicated by the line 2—2 of FIGURE 1;

FIGURE 3 is a cross section on a median plane showing the structure of FIGURE 1 in a different position, the door being closed;

FIGURE 4 is a cross section, approximately on a vertical median plane, through the structure as shown in FIGURE 3;

FIGURE 5 is an elevation of the face plate and attendant swinging bolt door latch construction, a portion of the structure being broken away;

FIGURE 6 is a detail to an enlarged scale showing the deadatching mechanism in operation;

FIGURE 7 is a cross section on a vertical median plane similar to FIGURE 4 but showing the parts in a different position of operation;

FIGURE 8 is a view similar to FIGURE 7 but showing the parts in a still further position of operation;

FIGURE 9 is a cross section, the plane of which is indicated by the line 9—9 of FIGURE 2;

FIGURE 10 is a cross section, the plane of which is indicated by the line 10—10 of FIGURE 2;

FIGURE 11 is a cross section, the plane of which is indicated by the line 11—11 of FIGURE 2;

FIGURE 12 is a cross section on a horizontal median plane through a modified form of device pursuant to the invention;

FIGURE 13 is a view on a vertical, approximately median plane through the form of device shown in FIGURE 12;

FIGURE 14 is an elevation of a face plate and attendant latch bolt structure, a portion of the figure being broken away;

FIGURE 15 is an elevation of a modified form of latch bolt structure, a portion of the figure being broken away;

FIGURE 16 is a detail showing generally in cross section on a vertical plane the modified form of latch bolt structure shown in FIGURE 15;

FIGURE 17 is an isometric view of the form of device shown in FIGURES 15 and 16;

FIGURE 18 is a side elevation with a portion broken away on a vertical median plane disclosing a form of invention employing a circular face plate; and

FIGURE 19 is a cross section, the plane of which is indicated by the line 19—19 of FIGURE 19.

In its customary environment the swinging bolt door latch of the invention in its presently preferred form is mounted on a door panel 6 supported by hinges 7 on a door frame 8 to swing about a vertically extending axis. The door frame 8 includes a door jamb 9 having a door stop 11 thereon. On the door jamb a strike plate 12 is installed. This is a member, usually metallic, that is secured to the door jamb over an enclosure 13 lining a recess 14 opening through an aperture 16 in the strike plate 12. A wing 17 or lip extends outwardly from the main portion of the strike plate 12 in order to serve as an entering ramp or cam for some of the lock mechanism.

The door panel 6 is provided with a bore 21 entering from the door edge 22 in the customary way. The bore 21 merges with a cross bore 23 in which a lock actuator 24 is mounted. Since the lock actuator is entirely standard, it is not described in detail. It is inclusive of an outer, generally circular, casing 26 fitting closely within the bore 23 and serving as a mounting for a knob mechanism effective to reciprocate a slide 27 to and fro. The slide customarily is provided with a spring structure which urges the slide toward the left in FIGURE 2. Rotation of the door handle or knob in either direction moves the slide 27 toward the right in FIGURE 2.

Adapted to be disposed within the bore 21 is a tubular housing 31 provided with a hook plate 32 extending therefrom at one end. The hook plate is designed to interengage with the lips 33 and 34 of the casing 28, so that the housing is connected to and is accurately located with respect to the casing.

At its opposite end, the housing 31 is formed with an outer-turned flange 36 disposed between an exposed, apertured face plate 37 and an apertured backing plate 38. The backing plate is held in position by riveted portions 39 of the face plate also forming guides for fastening screws 41. These secure the face plate and its backing plate in a mortised portion 42 of the door panel. The arrangement is such that the housing 31 is substantially in registration with the apertures in the face plate and the backing plate. The face plate 37, particularly as shown in FIGURE 5, is provided with an opening 46 approximately opposite the opening 16 in the strike plate 12 when the door is closed. The opening 46 is specially contoured to afford a suitable passageway for a swinging latch bolt 47 as well as for a deadatching plunger 48.

 Appropriately mounted with respect to the housing 31 for swinging movement relative thereto and for motion through the opening 46, the latch bolt 47 is approximately a quadrant in configuration and is provided with a boss 49 encompassing a pivot pin 51. This is captured between the face plate 37, the housing 31 and the backing plate 38, being appropriately confined in part in channels sunk into the face plate 37 and confined in part by the edges of cut-away parts of the housing 31. The swinging bolt 47 has a lower surface 52 that is approximately radial and an arcuate upper surface 53 merging with a radial inner boundary. The exposed portion is provided with a bevelled striking face 54 designed to cooperate with the wing or lip 17.
The latch bolt 47 is not continuous, but is provided with a central slot 55 designed to receive a hook 56 at the forward end of an operating bar or retractor 57. The hook 56 is defined by a substantially vertical interior surface 58 and a compound surface 59 spaced therefrom a substantial distance. The exterior configuration of the hook is such that it does not at any time abut any of the bounding surface 61 of the slot 55. The operating bar 57 is plate-like and has a lower portion 62 running upon the interior surface of the housing 31. The bar 57 is contoured to provide a leg 63 extending through an opening in a transverse wall 64 disposed across the interior of the housing. At its extended end the operating bar has a pair of notches 66 and 67 in part defined by a terminal end 68 so that the operating bar and the slide 27 are interengaged with some free motion to allow for differences in mounting. When the slide 27 is translated, the operating bar 57 is also translated and moves the hook 56 with respect to the housing in a rectilinear path and also moves the hook with respect to the swinging latch 47.

In order that the swinging bolt and the operating bar can be properly interrelated to carry out the purposes of the invention, the latch bolt is provided with a pair of pins 71 and 72. These pins are mounted in the latch bolt so they extend horizontally parallel to the pin 51. They are sufficiently smaller in size than the opening of the hook so that they do not normally contact both of the walls 58 and 59 simultaneously. The pin 72 is preferably somewhat smaller in diameter than the pin 71 and is spaced radially farther from the pivot pin 51 than the pin 71. While it is preferred to provide a pair of pins as shown, as an alternative construction the pins can be replaced by a single body of similar envelope configuration.

Since it is desired that the operating bar 57 normally be urged in a forward or leftward direction as seen in these figures with the surface 58 approximately against the pin 71, a spring mechanism is provided. The operating bar 57 between its ends is provided with an offset spring support 81 serving as a locating and engaging point for one end of an expansion coil spring 82. The other end of the spring 82 rests against a spring guide 83 on a spring rocker 84 having a leg 86 fullcrummed against the wall 64. Since the rocker 84 is movable only a small amount, the spring 82 normally exerts substantial force against the operating bar to urge the operating bar forward. The forward motion of the operating bar is transmitted through the pins 71 and 72 to the latch bolt. To serve as a stop, the latch bolt, as shown in FIGURE 3, is provided with a stop projection 87 designed in its outermost or extreme projected position to abut against the inward surface of the face plate 37.

In the operation of this portion of the structure, the parts are normally in the positions shown in FIGURES 1 and 2, and the urgency of the spring 82 holds the latch bolt in projected position. If the door upon which the lock is mounted is then swung toward and into closed position, substantially as shown in FIGURE 1, the cammed striking face 54 of the latch bolt encounters the extended wing 17 of the strike plate. This imposes on the latch bolt a force represented by the arrow 88 in FIGURE 2, tending to rotate the latch bolt about the axis of the horizontal pivot pin 51.

The latch bolt in first swinging immediately starts the operating bar on a rectilinear path of translation into the housing since the pins 71 and 72 are advantageously effective to translate the operating bar and to compress the spring 82. The arrangement is preferably such that the pin 71 closest to the pivot pin 51 is first effective and acts against an upright surface 60. Because of the favorable positions of the parts, only a small force is necessary to begin the described motions. As the door continues to swing closed, the latch bolt swings farther inward until it arrives near an inner or extreme retracted position substantially as shown in FIGURE 7. In travelling between the FIGURE 2 and the FIGURE 7 position, the swinging latch bolt moves the pins 71 and 72 such that the latch bolt and the operating bar have substantially no lost motion between them in their FIGURE 7 position as distinguished from the situation in FIGURE 2, in which there is substantial lost motion. By this arrangement, the latch bolt can have a maximum projection measured from the outermost position of the latch bolt to the face plate 37 of a predetermined amount, say three-quarters of an inch, whereas the operating bar 57 need have a total travel of something less than the predetermined amount, for example one-half inch.

When the latch bolt has swung nearly to its extreme inward position as shown in FIGURE 7 and the door has closed far enough so that the latch bolt overlies the opening 16 in the strike plate, then the just compressed spring 82 is effective to project the operating bar and the latch bolt back into the extreme projected position as shown in FIGURE 2. With this mechanism, therefore, the structure operates readily during the closing of a door.

When the mechanism is operated by rotation of the lock unit handle or knob and the retraction of the slide 27, then the operating bar 57 first overcomes the lost motion between the face 59 of the hook and the pins 71 and 72. As soon as the surface 59 abuts the pins 71 and 72, as shown in FIGURE 5, further retraction of the operating bar rotates the latch bolt about the axis of the pin 51 until it again is in a position substantially as shown in FIGURE 7. When then the handle or knob is released and the latch bolt is free or is in position in registry with the opening 16, the latch bolt and the retractor or operating bar are restored to initial condition.

Under many circumstances it is desired to provide a deadlatching arrangement in connection with the swinging bolt door latch. In that event, means are provided for preventing the external depression of the swinging door latch bolt unless the deadlatching arrangement is appropriately conditioned. To provide the deadlatching function, a stop bar 91 is mounted within the housing 31. The stop bar 91 is in the form of a bell crank lever bifurcated to provide ends 92 straddling the axis of the mechanism and designed to be fullcrummed against the transverse wall 64. Since the spring 82 acts against the rocker 84, which has bifurcated terminals resting against the ends 92, the effect is to provide a reduced force of the spring acting to move the stop bar 91 counterclockwise as seen in FIGURE 2.

Included in the stop bar is an arched lever arm 94 centrally disposed and having a free end 96 designed to move in a path intersecting the swinging path of the latch bolt 47. As the stop bar swings, the lever arm 94 moves from an upper position as shown in FIGURE 2 into a lower position with the lever arm 94 resting against an inclined stop surface 97 on the upper portion of the operating bar. The free end 96 of the lever arm 94 lies then just beneath a notch 98 formed transversely in the latch bolt.

In the deadlatching position, the stop bar 91 is so rotated as to lie in its lowermost position against the stop surface 97. If then the latch bolt 47 is rotated clockwise as seen in FIGURE 6, the wall of the notch 98 immediately comes into contact with the end 96, which is well supported on the operating bar surface 97. This is not laterally movable to any substantial extent as its lower end 62 rides on the housing 31. It is then not possible further to rotate the latch bolt to a releasing position and a deadlatching feature is thus obtained. When the latch bolt does not over-ride the end 96 of the stop bar 91, or otherwise free, the urgency of the spring 82 can be over- come and the stop lever can be lifted by a cam slide 101 loosely fastened around and riding on the operating bar 57. The slide 101 extends substantially transversely and is partly supported by a leg 102 resting on the inside surface
of the housing 31. The slide 101 is urged into a forward position in which it underlies a cam depression 103 struck downwardly in the center of the lever arm 94. The dimensions are such that when the cam depression 103 and the cam radially engagement, the end 96 is lifted or held out of the path of rotation of the latch bolt.

Means are provided for moving the cam slide 101. As shown particularly in FIGURE 3, the cam slide is provided with an offset portion 106 bent and bifurcated to afford a fork 107 lying between the walls of a groove 108 in the deadlatching plunger 48. A coil spring 111 impells the plunger 48 toward a projected position by the spring 112, which abuts one end of the plunger and also abuts a spring seat 112 formed on the rocker 84. The plunger 48 is substantially circular cylindrical in configuration except that it is cut away to provide a flat face 116 resting against the side face of the swinging latch bolt.

When plunger 48 is in its forward position, as shown in FIGURE 1, the spring 111 is expanded, the cam slide 101 is in a forward position as shown in FIGURE 2, and the lever end 96 is held up, so that there is no restriction of inward movement of the latch bolt. When the door is closed, the deadlatching plunger 48 cannot attain its fully projected position, since it is held against the strike plate 12 as shown in FIGURE 3. Under those circumstances, the spring 111 remains in a stressed condition and the cam slide 101 is moved rearwardly as shown in FIGURE 4 from beneath the cam depression 103. The springs 112 and 114 are then both effective to rock the stop bar 91 in a counterclockwise direction, as shown in FIGURE 4, until it rests against the inclined surface 97. Thereafter, any attempt to rotate the latch bolt by pressure upon the latch bolt is ineffective since the end notch of the latch bolt encounters the end of the stop bar.

Under deadlatching circumstances, when the slide 27 is retracted by operation of the door knob or handle, the initial translation of the operating bar 57 toward the right takes up the lost motion between the surfaces 59 and the pins 71 and 72. Also, during that time, a cam face 121 on the operating bar rides against the cam depression 103 and, overcoming the urgency of the springs 82 and 113, lifts the stop bar 91. The end 96 is then out of the path of the latch bolt. When the lost motion is substantially taken up and the operating bar is approximately in the position shown in FIGURE 8, further movement of the slide 27 translates the operating bar 57 to the right and swings the latch bolt into a retracted position substantially as shown in FIGURE 7.

As the latch bolt swings from its projected position to its retracted position, it also is effective to withdraw the plunger 48. The cam slide 101 is engaged by a pair of shoulders 123 on the operating bar 57 as the operating bar moves toward the right in FIGURE 2, for example, thus making sure that the plunger 48 is in its retracted position when the door approaches its closed position. When the latch bolt swings into the strike box 13, simultaneously the plunger 48 projects until it abuts the strike plate 12.

In some instances, it is desired to utilize a similar construction in which not only the latch bolts swing, but likewise the deadlatching plunger swings. For this reason, an arrangement substantially as shown in FIGURES 12, 13 and 14 is provided. In this case, the housing 131 is mounted as before. Actuation is by a slide 132. Within the housing 131 is a cross plate 133 serving as a guide for an operating bar 134 having a hook 136 at its forward end. Walls 137 and 138 of the hook are spaced apart to provide a notch bigger than a cross pin 139 spanning a central slot 141 in a swinging latch bolt 142. A pivot pin 143 is captured in a face plate 144 and a contoured portion of the housing flange held by a backing plate 146 extending to the face plate as before. In this instance, the connection between the latch bolt 142 and the pin 143 is by means of a slot 147 so that ready disconnection can be had at this point, although the latch bolt cannot be projected unduly because of a side stop 149 which abuts the inner surface of the face plate 144.

The hook 136 and the adjacent latch bolt surfaces 148 are so shaped and positioned that external pressure directly upon the latch bolt causes the surface 145 to rotate and cam against the surface of the hook 136 and to translate the operating bar through a complete inward stroke. The operating bar 134 is guided by extensions 151 and 152 riding on the inside surface of the housing 131 as well as by the walls of a suitable aperture 153 in the plate 133. The operating bar is normally urged forwardly into a projected position by the spring 154 at one end bearing against a hook plate 156 and extralining the operating bar 134 against the extensions 151 and 152. At the other end the spring 154 rests on a rocker plate 157 having a long leg fulcrumed against the cross plate 133 and having bifurcated short legs resting against a divided arm of a stop bar 158 serving as a part of a deadlatching mechanism.

The stop bar fulcrums on the cross plate 133 and has a lever arm 159 extending forwardly to an end 161 adapted to lie in the path of the swinging latch bolt 142. The lever arm at its free end is guided by the walls of a central slot 162 embracing the extension 151. A spring 164 at one end bears against the edge of the rocker plate 157 and at the other end bears against a spring seat 166 extending laterally from a deadlatching bar 167. A transverse portion 168 of the bar 167 embraces and rides upon the operating bar 134 normally pressing against shoulders 169 and 171 thereon. In this position, the cross portion 168 rides under a cam depression 172 in the middle of the lever arm 159 and thus holds the lever out of the path of the swinging latch bolt. At its forward end, the deadlatching bar 167 is provided with a vertical slot 174 receiving a cross pin 177 carried by a plate-like deadlatching plunger 178 mounted to swing on the pivot pin 143.

When the latch bolt 142 is depressed from its projected to its retracted position and moves the operating bar 134 therewith, the cross portion 168 is likewise moved by the abutting shoulders 169 and 171. The corresponding motion of the deadlatching bar 167 simultaneously or very nearly so swings the deadlatching plunger 178 inwardly as well. When the latch bolt again swings outwardly, the deadlatching plunger 178 swings outwardly as well. If the plunger 178 cannot swing out but is held in by abutment with a strike box, the cross portion 168 is held to the rear of the cam depression 172. The springs 154 and 164 are thus able to swing the stop bar 158 downwardly and the point 161 of the lever arm 159 rests in the path of the latch bolt. The latch bolt therefore swings into its retracted position by external force. If, however, the slide 132 is moved toward the right in FIGURE 13, the operator bar 134 is thereby moved to the right. The cam depression 172 is thereupon lifted by a cam face 181 on the operator bar 134 and the point 161 is lifted from the path of the swinging latch bolt 142. This can then be fully retracted or withdrawn.

In some instances it is desired to have the deadlatching plunger independent of the springs provided in the remainder of the structure. As particularly shown in FIGURES 15, 16 and 17, a quadrant latch bolt 190 is mounted to swing on a cross pivot pin 191 as before. Also mounted to swing on the cross pin 191 is a deadlatching plate 192. This plate is normally impelled toward its projected position by a coil spring 193, one end of which is disposed between the face plate 194 and a backing plate 196, and the other end of which rests against the inward edge of the plate 192. The spring 193 urges the plate 192 into a forward position, but the forward motion is limited by a stop extension 197 projecting transversely from the plate 192 and lying within a recess 198 in the latch bolt 190. Thus, when the latch bolt 190 is swung inwardly from its projected to its retracted position, the wall of the recess 198 abuts the stop 197 and causes the plate 194 plates thereafter to revolve in unison against the urgency of the springs 193 and 154. However, if the latch plate
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192 abuts the face of a strike plate, then it cannot project and permits a stop bar 199 to swing downwardly into the path of the swinging latch bolt 190 as before.

It is not necessary that the face plate be rectangular in contour, and some users prefer a circular face plate. As shown in FIGURES 18 and 19, a construction like that previously described can be used with the flange 201 at the forward end of the casing 202 being received within the rim 203 of a circular face plate 204 having an appropriate aperture therein to receive a swinging latch bolt 206 and a reciprocating deadlatching plunger 207. The rim can be staked or spun over to hold the flange 201 in place and the face plate and casing in assembled condition.

What is claimed is:

1. A swinging bolt door latch comprising a face plate having an opening therein, a housing connected to said face plate, a latch bolt, means for mounting said latch bolt on said housing to swing about a fulcrum for movement through said opening between a retracted position and a projected position, an operating bar, means for mounting said operating bar for translation in said housing, a hook at one end of said operating bar, having oppositely disposed engagement walls spaced apart a predetermined distance when measured in one direction, and means on said latch bolt extending between said walls and having when measured in said direction a dimension substantially less than said predetermined distance to afford less motion between said surfaces and said means and having when measured in another direction a dimension at least equal to said predetermined distance to preclude lost motion between said surfaces and said means.

2. A swinging bolt door latch as in claim 1 in which said means on and said latch bolt has an envelope of non-circular configuration.

3. A swinging bolt door latch comprising a face plate having an opening therein, a housing having an opening therein, means connecting said face plate and said housing in substantial abutment with said openings in alignment, a pivot pin positioned between and confined by said face plate and said housing alongside said openings, a latch bolt rotatably mounted on said pivot pin and movable through said openings between a projected position and a retracted position, and means engaging said latch bolt and disposed in said housing for so moving said latch bolt.

4. A swinging bolt door latch comprising a mounting having an opening therein, a latch bolt, means for supporting said latch bolt on said mounting for swinging movement through said opening between a projected position and a retracted position, an operating bar, means for supporting said operating bar on said mounting for rectilinear translation, means for interconnecting said operating bar and said latch bolt for lost motion, an operating bar spring engaging said mounting and said operating bar for urging said operating bar to take up said lost motion and for urging said operating bar and said latch bolt forward toward projected position said operating bar being solely under the urgency of said operating bar spring, and stop means on said latch bolt and said mounting for limiting forward movement of said latch bolt at said projected position.

5. A swinging bolt door latch comprising a face plate having an opening therein, a housing having an opening therein, means for securing said housing and said face plate together with said openings in alignment, a latch bolt, means for mounting said latch bolt on said housing for swinging movement through said openings, an operating bar, means for mounting said operating bar in said housing for rectilinear translation, means for joining said operating bar and said latch bolt, a stop bar having opposite sides, means for mounting said stop bar on said housing for movement into and out of a jamming position with said opposite sides gripped between said latch bolt and said operating bar, and an actuator mounted in said housing and extending through said openings for so moving said stop bar.

6. A swinging bolt door latch comprising a mounting having an opening therein, an elongated operating bar, means for supporting said operating bar on said mounting for translation in the direction of the length of said operating bar, a latch bolt having a stop surface thereon, means for supporting said latch bolt on said mounting for swinging movement through said opening and for movement into a position in which said stop surface is substantially parallel with an elongated side of said operating bar, a stop bar, and means for supporting said stop bar on said mounting for movement into and out of a position between said substantially parallel stop surface and said side of said operating bar.

7. A swinging bolt door latch comprising a mounting having an opening therein, a latch bolt, means for mounting said latch bolt to swing through said opening about a horizontal axis when said door latch is installed on a door swinging about a vertical axis, a pair of pins mounted on said latch bolt vertically spaced apart and extending parallel to said horizontal axis, and an operating bar on said mounting and having a wall movable thereon in sequential engagement with both of said pins for swinging said latch bolt.

8. A swinging bolt door latch comprising a mounting having an opening therein, a latch bolt, means for mounting said latch bolt to swing through said opening about an axis extending transversely of said mounting, an operating bar, means for guiding said operating bar for translation relative to said mounting, means forming a hook on said operating bar, and means on said latch bolt and adapted to be engaged by said hook with a loco-motion connection in one position of said latch bolt and with a direct motion connection in another position of said latch bolt.

9. A swinging bolt door latch as in claim 8 in which said means engaged by said hook rotates about said axis when said latch bolt swings and presents different dimensions of said means to said hook.

10. A swinging bolt door latch comprising a mounting having an opening therein, a latch bolt, means for mounting said latch bolt to swing through said opening about an axis extending transversely of said mounting, an operating bar, means for guiding said operating bar for translation relative to said mounting, a hook partially defined by facing walls on said operating bar, and means on said latch bolt and adapted to be disposed within said hook, said means having a narrow shape in one direction to occupy only some of the space between said facing walls in one relative position of said latch bolt and said operating bar and also having a long shape in another direction to occupy all of the space between said facing walls in another relative position of said latch bolt and said operating bar.

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MARVIN A. CHAMPION, Primary Examiner.

EDWARD C. ALLEN, Examiner.

J. R. MOSES, Assistant Examiner.