March 9, 1965 F. J. RUSSELL 3,172,691

LOW FRICTION LATCH BOLT AND HINGE GUIDE

Filed Feb. 6, 1963 2 Sheets-Sheet 1

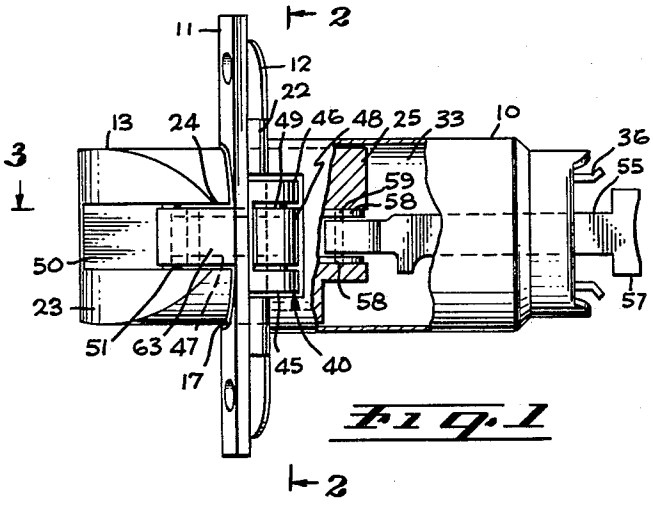


Fig. 1

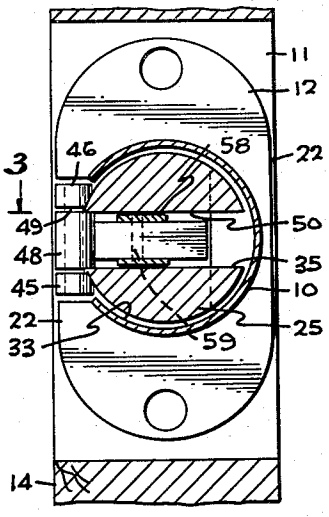


Fig. 2

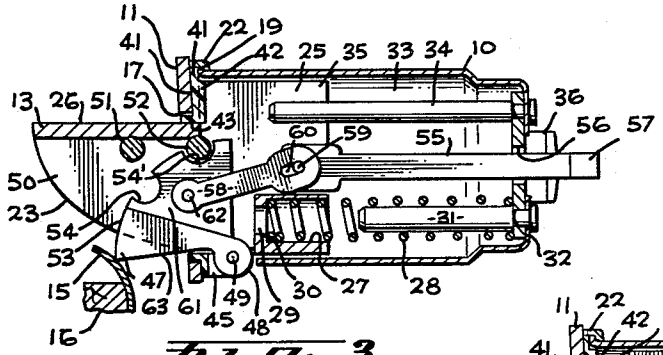


Fig. 3

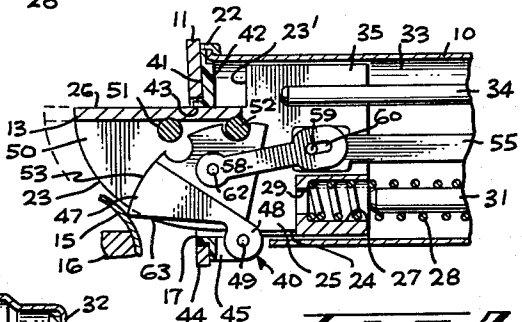


Fig. 4

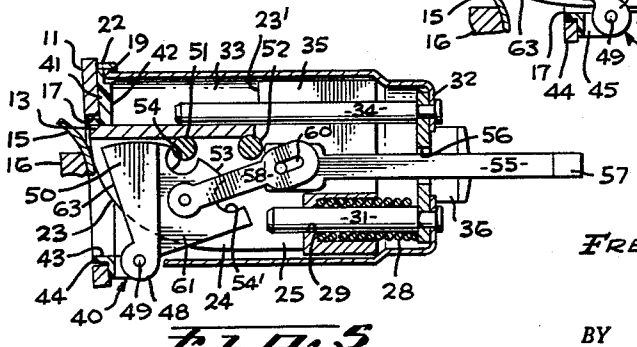


Fig. 5

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LOW FRICTION LATCH BOLT AND HINGE GUIDE

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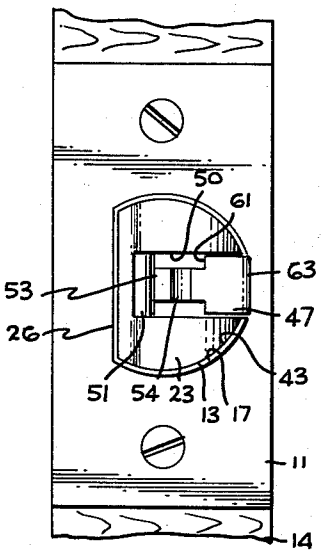


Fig. 6

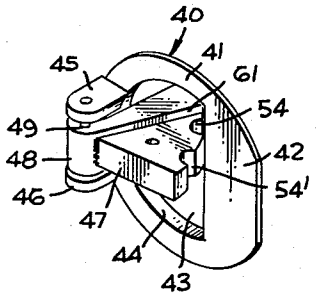


Fig. 7

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LOW FRICTION LATCH BOLT AND HINGE GUIDE

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The invention relates to door locks and has special reference to a latch assembly of a door lock. In the present instance, the type of latch assembly involved is one wherein the latch bolt protrudes for a considerable distance outwardly from the latch face and into engagement with the customary strike plate, as is frequently the case where latch assemblies, of the kind under consideration, are used on a pair of fire doors.

A common construction for a latch assembly is one which provides a metal front plate having an opening adapted to receive the latch bolt which is likewise made of metal and to provide for it a sliding fit as the latch bolt is reciprocated when the door is opened and closed. The common construction thus made reference to require a metal-to-metal engagement of the latch bolt with the front plate hole, and engagement of this kind results in considerable wear on one or both parts. Also, in the absence of lubrication, and especially where there is a relatively long throw for the latch bolt, considerable frictional resistance is built up. Although frictional resistance could be reduced by using grease for the frictionally engaging parts, this expedient is objectionable for door hardware, since the grease is very apt to soil the hands or clothing of a person who has access to the door on which the latch assembly is mounted.

Further still and in view of the wear which takes place as a result of metal-to-metal engagement of the parts, the parts get loose and cause rattling of the parts when in use, and sometimes there is a feeling of lack of security in the closure. Where considerable throw is needed for the latch bolt, that is to say, under circumstances where the latch bolt protrudes outwardly from the front plate at a distance greater than usual, difficulty is experienced in depressing the latch bolt as it strikes the lip of the strike plate. To close the door either requires slamming the door closed with considerable force or the employment of some auxiliary agency to start the depressing of the latch bolt before full cam action takes place in order to minimize wear and damage to the parts.

It is therefore among the objects of the invention to provide a new and improved low friction guide for a latch bolt so as to minimize wear to a substantial degree over that heretofore experienced.

Another object of the invention is to provide in a latch bolt action not only a low friction guide for eliminating wear of the parts, but which also is of such construction as to provide an advantageous pivot point for an auxiliary latch bolt retracting mechanism in the form of a retractor lever.

Still another object of the invention is to provide a new and improved retractor lever device for starting the retraction of a latch bolt, both when the door is closing and when the latch bolt tailpiece is retracting by operation of an appropriate retract mechanism.

Still another object of the invention is to provide a new and improved low friction latch bolt guide and an accompanying retractor lever which is simple and positive in its assembly and of such construction that fabrication and assembly can be accomplished with very little additional cost in either materials or assembly time.

Still further among the objects of the invention is to provide a multiple purpose low friction guide for a latch bolt which serves as a low friction guide for latch bolt reciprocating movement, as a low friction mounting for an auxiliary retractor lever mechanism, and also as a washer to improve the engagement of the latch bolt casing with the customary front plate.

With these and other objects in view, the invention consists in the construction, arrangement and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a longitudinal view, partially broken away, showing the strike camming side of a latch assembly incorporating the invention.

FIGURE 2 is a cross sectional view on the line 2—2 of FIGURE 1.

FIGURE 3 is a longitudinal sectional view of the latch assembly taken on the line 3—3 of FIGURE 1.

FIGURE 4 is a fragmentary longitudinal sectional view similar to FIGURE 3, but showing the relative position of the parts at a door closing position slightly advanced from the position of FIGURE 3.

FIGURE 5 is a longitudinal sectional view similar to FIGURES 3 and 4, but showing the latch bolt in the position it would occupy immediately prior to a full closing of the door.

FIGURE 6 is a front elevational view of the latch assembly.

FIGURE 7 is an end face perspective view of the low friction latch bolt and hinge guide wherein significant parts of the guide are mounted in an assembly preparatory to incorporation in the device.

In a chosen embodiment of the invention incorporating an example which is illustrative of the invention, there is provided a casing **10** adapted to be secured to a front plate **11** by employment of a fastening plate **12** so that a latch assembly featuring in part a latch bolt **13** is reciprocatively mounted in position. As shown in FIGURE 2, the latch assembly is designed to be mounted in the edge of a door **14**, a fragment of which is shown in FIGURE 2, where it is adapted to cooperate with a strike plate as suggested in FIGURE 3, a portion of the strike plate **15** being shown mounted upon a fragment of door frame **16**.

Following substantially coventional construction, the front plate **11** is provided with a hole **17** through which a latch bolt **13** passes. In order to hold the casing **10** and front plate **11** in assembled relationship, the casing is provided with an annular flange **19** which is engaged by the fastening plate **12**. The front plate **11** is held in engagement with the fastening plate **12** by bosses (not shown) which extend from the back side of the front plate **11** through holes (not shown) in the fastening plate **12** and then are spun or staked together. Spacing flanges **22** on opposite edges of the fastening plate **12** bear against the rear face of the front plate **11**, and provide a slight space between the two. A shoulder portion **23'** of the latch bolt **13** lies in the area behind the front plate **11**, so that the latch bolt cannot be pushed out of the casing, once the front plate **11** and the fastening plate **12** are staked or spun together.

More particularly, the latch bolt **13** on the side normally facing the curved lip of the strike **15** has a curved cam face **23** and a short straight section **24** where the cam face **23** joins a body portion **25**, the body portion being that portion of the latch bolt **13** which always lies within the casing **10**. On the side of the latch bolt **13** opposite the curved cam face **23** side is a flat wall **26**, the flat wall **26** being instrumental in preventing rotation of the latch bolt in its mounting.

At the inner end of the body portion **25** is an opening **27** in which is located a spring **28**. A smaller opening **29**, at the inner end of the opening **27**, provides a shoulder

30 upon which the outer end of the spring 28 is kept. A peg 31 mounted by appropriate means on a bottom wall 32 of the casing 10 serves as a guide for the spring 28. On the opposite side of the casing within a chamber 33 inside the casing, is a second guide peg 34 which may be similarly mounted by conventional means on the bottom wall 32. The guide peg 34 extends through a milled slot 35 in the body portion 25 of the latch bolt 13. The guide peg 34 serves to guide the latch bolt during its movement, the guiding being further enhanced by the peg 31 when the latch bolt 13 moves far enough so that the peg 31 passes into the opening 29. Inside of the bottom wall 32 is a bracket 36 which is made use of in a conventional fashion when the latch assembly is mounted upon one of the usual types of frames with which a latch assembly of this type is customarily used.

A substantial portion of the special subject matter here under consideration is embodied in a combined low friction latch bolt guide and hinge mounting member indicated generally by the reference character 40 and shown in perspective view in FIGURE 7. The member 40 includes in part a flat area 41, the outer portion of which is substantially annular and is interposed between the inside face of the front plate 11 and the outer perimeter of the flange 19. Hence, this flat area 41 serves in part as a washer for the connection between the casing 10, fastening plate 12, and the front plate 11, as well as serving partially to enclose the corresponding end, namely, the outer end of the casing 10 and its chamber 33.

It will also be noted that the flat area 41 is provided with an aperture 43 which has in general the same shape and size as the outside perimeter of the latch bolt 13 and further that it provides a sliding fit for the latch bolt 13. A flange 44 protrudes outwardly from the outer face of the flat area 41 so as to extend into the hole 17 in the front plate 11 and, in effect, to provide a liner for the hole 17.

On the inside face of the flat area 41 are a pair of hinge brackets 45 and 46 for pivotally mounting a retractor lever 47 for actuation of the latch bolt 13. A partially cylindrical boss 48 forming part of the retractor lever 47 fits between the hinge brackets 45 and 46 wherein it is pivotally retained by employment of a pin 49.

So that the retractor lever 47 may be able to cooperate with the latch bolt 13, the latch bolt 13 is provided with a recess 50 on its curved cam face 23 side which extends entirely through the protruding outer portion of the latch bolt 13 and partially into the interior as shown advantageously in FIGURES 3, 4, and 5, the breadth of the recess 50 being slightly greater than the breadth of the retractor lever 47 so as to provide ample freedom of movement of the retractor lever 47.

Within the recess 50 of the latch bolt 13 are located two stationarily mounted pins 51 and 52 which, in effect, may be described as driven configurations. On an arcuate face 53 of the retractor lever 47 are complementary semicylindrical recesses 54 and 54' which are designed to receive respectively the pins 51 and 52 at different cycles of operation, as shown in FIGURES 3, 4, and 5.

Located within the chamber 33 is a tailpiece 55 which extends inwardly through the chamber 33 and then through a hole 56 in the bracket 36 and thence to a location where a cross bar 57 on the tailpiece 55 is provided for the purpose of making an appropriate attachment to a conventional latch retract mechanism. At its outer end, the tailpiece extends into the slot 35 in the inner body portion 25 of the latch bolt 13 and at that location is connected to a link 58 by means of a pin 59. A slot 60 in the link 58 in which the pin 59 is located is elongated in order to provide a desirable lost motion connection, as shown, between the tailpiece 55 and the link 58 as shown. The other end of the link 58 is pivotally secured to the retractor lever 47 within a recess 61 in the retractor lever 47 by means of a pin 62. In initial extended position, the latch bolt 13 and attached parts of the device have the relationship as shown in FIGURE 3. In this relationship,

the spring 28 has pushed the latch bolt 13 as far outwardly as it can go, namely, until the shoulder portion 23' abuts against the adjacent face on the inner side of a thickened portion 42 of the latch bolt guide and hinge mounting member 40. Since the latch bolt 13 is forced outwardly, as shown, so also will be the hinge brackets 45 and 46 and accordingly the pivotal mounting of the retractor lever 47. At the same time the pin 52 within the recess 50 of the latch bolt 13 will cause the retractor lever 47 to be rotated in a counter-clockwise direction as viewed in FIGURE 3 to the maximum extent of its movement, so that a strike edge 63 of the retractor lever 47 will protrude outwardly beyond the surface of the cam face 23 of the latch bolt 13, as shown in FIGURE 3.

When the door 14 in which the latch assembly is mounted is to be closed, it will swing so that a strike edge 63 of the retractor lever 47 will hit the curved lip of the strike plate 15. As movement continues, the parts will pass from the relative positions shown in FIGURE 3 to the relative positions shown in FIGURE 4. This happens because the retractor lever 47 is rotated slightly in a clockwise direction as viewed in FIGURES 3 and 4. When this is occurring, the lost motion provided by the slot 60 is taken up, and, thereafter, the wall of the recess 54' will engage with the pin 52 and action of the retractor lever 47 will in that manner cause partial withdrawal of the latch bolt 13 to the position shown in FIGURE 4.

After the latch bolt 13 and the retractor lever 47 have reached the positions shown in FIGURE 4, the next increment of movement of the latch bolt 13 as the door continues to close will be for the cam face 23 to engage the curved lip of the strike plate 15. From here on, retraction of the latch bolt 13 will be accomplished by this action until the parts assume the relationship shown in FIGURE 5. As this movement occurs and the semicylindrical recess 54' becomes disengaged from the pin 52, the semicylindrical recess 54 will next become engaged with the pin 51 and the retractor lever 47 will continue to be retracted, but this time because of being pulled into retracted positions by action of the latch bolt 13. From here as the door continues to be closed, the latch bolt 13 will move until the latch bolt 13 coincides with the customary conventional opening (not shown) in the strike plate 15, at which point, by action of the spring 28 the latch bolt 13 will be extended to temporarily latch the door in closed position.

From the description of the parts given, it will be noted that the latch bolt guide and hinge mounting member 40 provides the low friction element of the combination. It is advantageously constructed of a nonmetallic plastic material such as a synthetic plastic resin, typical commercial examples of which are nylon and Delrin. These materials have very low friction surface characteristics, and hence, there is a very low friction contact between any relatively sliding portions of the device. This means that there is a low friction engagement between the outside circumference of the latch bolt 13 and the flange 44. Simultaneously, the member 40 serves as a pivot hinge point for the retractor lever 47.

When, as is the case on some occasions, the retractor lever 47 is made of low friction material, there also is a low friction engagement between the strike edge 63 of the retractor lever 47 and the strike plate 15.

While the invention has herein been shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

Having described the invention, what is claimed as new in support of Letters Patent is:

1. In a latch assembly for a lock, a casing, a latch bolt reciprocatably mounted in said casing, a low friction guide for said latch bolt comprising a member of low friction material having one portion thereof re-

tained by said casing, another portion thereof in sliding engagement with said latch bolt and a bracket portion thereof on the side of said member facing said casing, and a latch bolt retractor lever pivotally mounted on said bracket portion and adapted to reciprocate said latch bolt in said casing.

2. In a latch assembly for a lock, a casing, a latch bolt reciprocatably mounted in said casing, and a guide member of low friction material having one portion thereof retained by said casing, another portion thereof in sliding engagement with said latch bolt and a bracket portion on the face thereof facing said casing, said guide member including a retractor lever comprising a body, a pivot connection on one side of said body pivotally connecting said body to said bracket portion on an axis spaced from and in angular relationship to the axis of movement of said latch bolt, a strike face on said body adjacent the pivot connection, and drive means between said retractor lever and said latch bolt adapted to transfer motion said retractor lever to the latch bolt during movement of the latch bolt through a door closing cycle.

3. In a latch assembly for lock, a casing, a latch bolt reciprocatably mounted in said casing, and a guide member of low friction material having one portion thereof retained by said casing and another portion thereof in sliding engagement with said latch bolt, said guide member including a retractor lever comprising a body, a pivot connection on one side of said body pivotally connecting said body to said guide member, a strike face on said body adjacent the pivot connection, and drive means between said retractor lever and said latch bolt adapted to transfer motion from said retractor lever to the latch bolt during movement of the latch bolt through a door closing cycle, said drive means comprising a drive section facing said latch bolt and a plurality of mutually engaging drive configurations respectively on said drive section and on said latch bolt adapted to engage progressively during said door closing cycle.

4. In a latch assembly for a lock, a casing, a latch bolt reciprocatably mounted in said casing, a low friction guide for said latch bolt comprising a member of low friction material having one portion thereof retained by said casing and another portion thereof in sliding engagement with said latch bolt, and a latch bolt retractor lever pivotally mounted on said low friction guide, said retractor lever comprising a member of low friction material having a strike face on one side and having a driving engagement with said latch bolt adapted to reciprocate said latch bolt in said casing.

5. In a latch assembly for a lock, a casing, a latch bolt reciprocatably mounted in said casing, and a guide

assembly comprising a guide member of low friction material having one portion thereof retained by said casing and another portion thereof in sliding engagement with said latch bolt, said guide assembly including a retractor lever comprising a body, a pivot connection on one side of said body pivotally connecting said body to said guide member, a strike face on said body adjacent the pivot connection, said guide member having a location overlying the adjacent inside area of said strike face, and drive means between said retractor lever and said latch bolt adapted to transfer motion from said retractor lever to the latch bolt during movement of the latch bolt through a door closing cycle, said latch bolt having a portion thereof in engagement with said guide member in extended position of said latch bolt.

6. In a latch bolt device a casing having inner and outer ends and a chamber therein, a reciprocating latch bolt assembly in said chamber comprising a latch bolt head at the outer end having a strike face side and a side opposite said strike face side, a front plate attached to the casing in position overyling the outer end of said casing, said front plate having an opening therein for said latch bolt head, and a guide assembly comprising a guide member of low friction material positioned adjacent the inside face of said front plate, said guide member having an opening therein smaller than the opening in said front plate and conforming substantially to the exterior shape of said latch bolt head, said guide assembly including a hinge guide of low friction material comprising a body, a pivot connection on one side of said body pivotally connecting said body to said guide, a strike face on said body adjacent the pivot connection, a drive face on said body on the side opposite said pivot connection, a plurality of drive configurations at spaced locations on said drive face and complementary driven configurations on said latch bolt head adapted to transfer motion from said hinge guide to the latch bolt head during movement of the latch bolt device through a door closing cycle.

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