

[54] DOOR LATCH

3,655,230 4/1972 Armstrong..... 292/169

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[57] **ABSTRACT**

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[51] Int. Cl. E05b 3/00

[58] **Field of Search** 16/110 R, 111 R,
16/112, 114 R; 292/336.3, 167, 169, 170,
DIG. 31, DIG. 38, DIG. 53; 70/449, 462

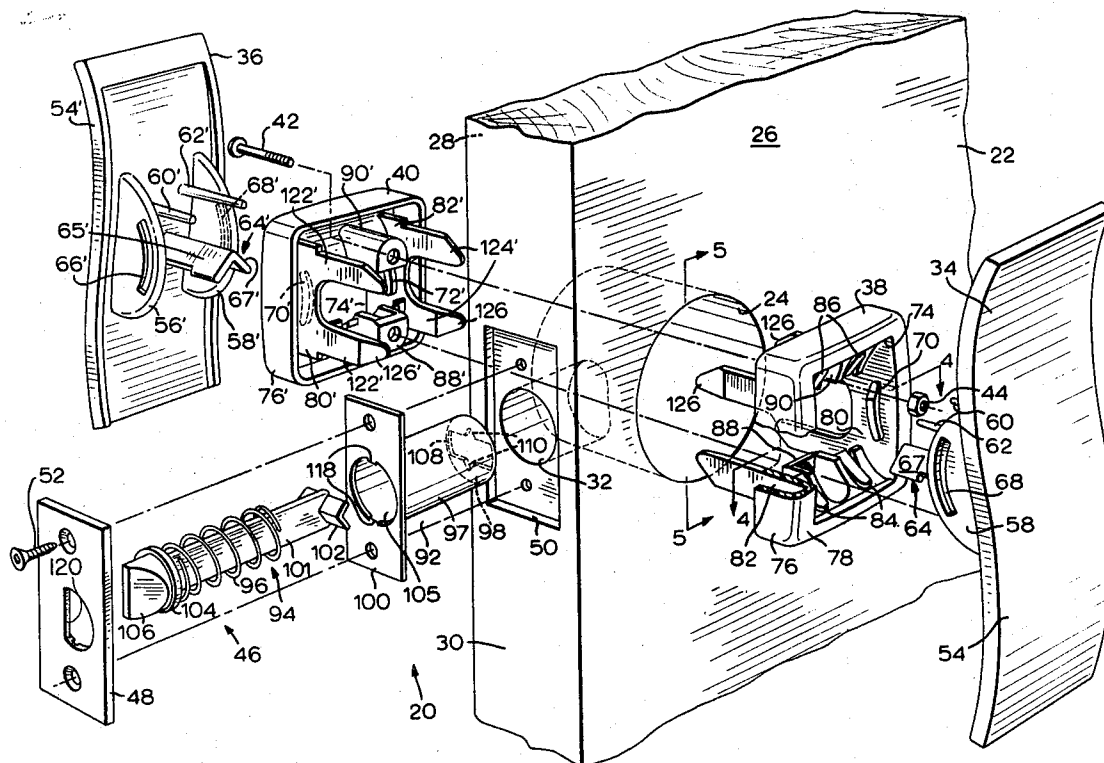
A door latch having interchangeable handles for attachment to a suitably prepared door by a pair of interchangeable handle mounting elements. A latch bolt is also adapted for positioning in the door in engagement with cam ends of the handles so that movement at the handles results in movement of a slider in the latch bolt for opening the door. Each handle is pivotally coupled to a corresponding element by a combination of curved ribs and grooves and a resilient finger on the handle rides on a stress-limiting ramp formed in the element to bias the handle into a normal position.

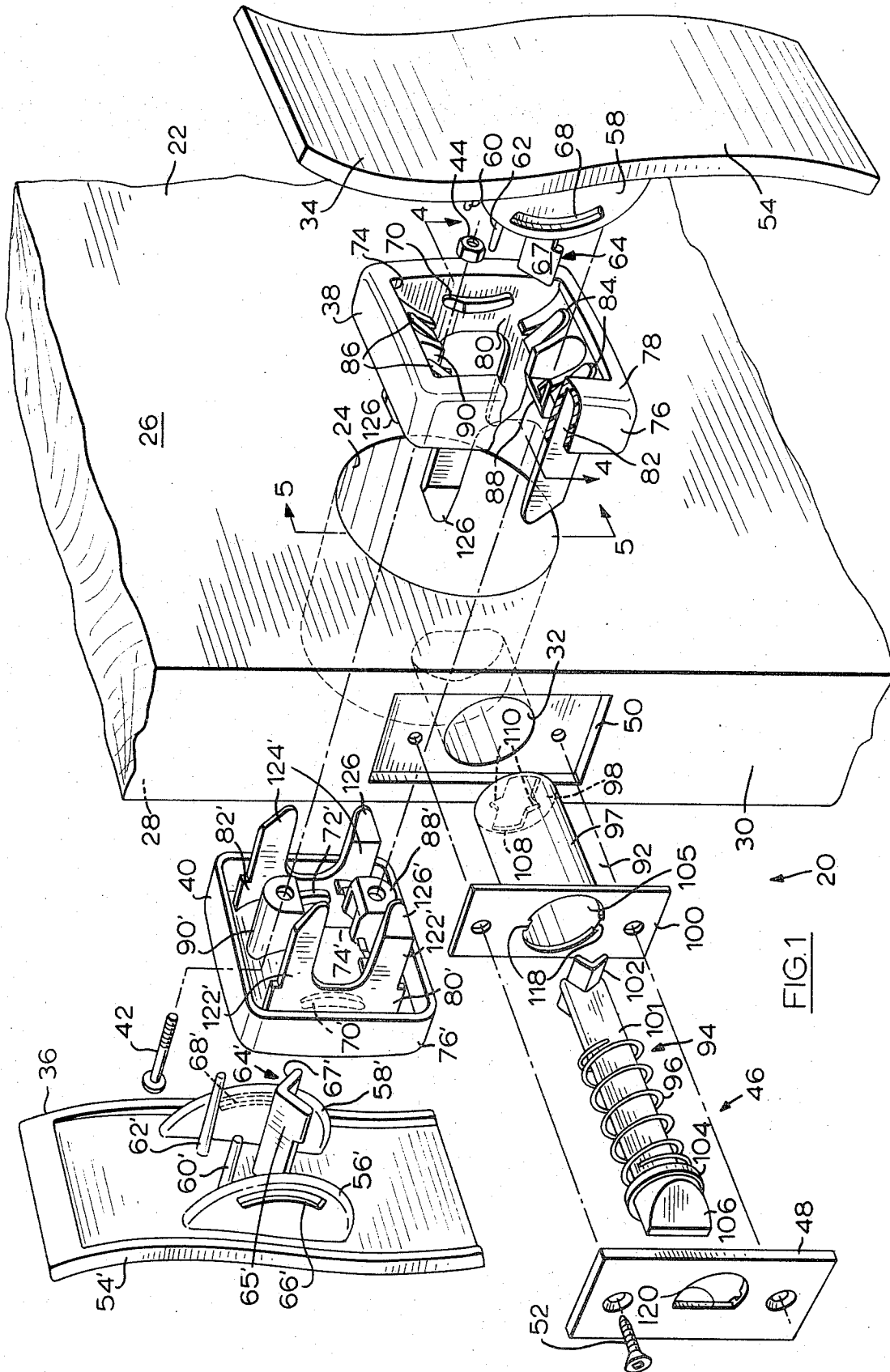
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18 Claims, 9 Drawing Figures





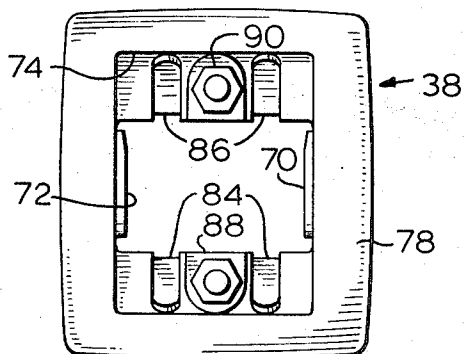


FIG. 2

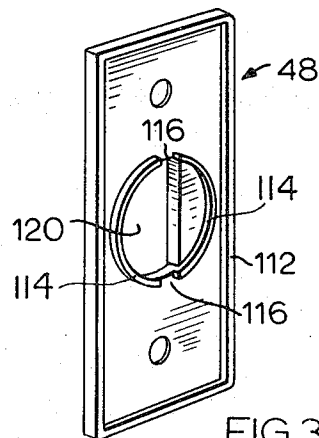


FIG. 3

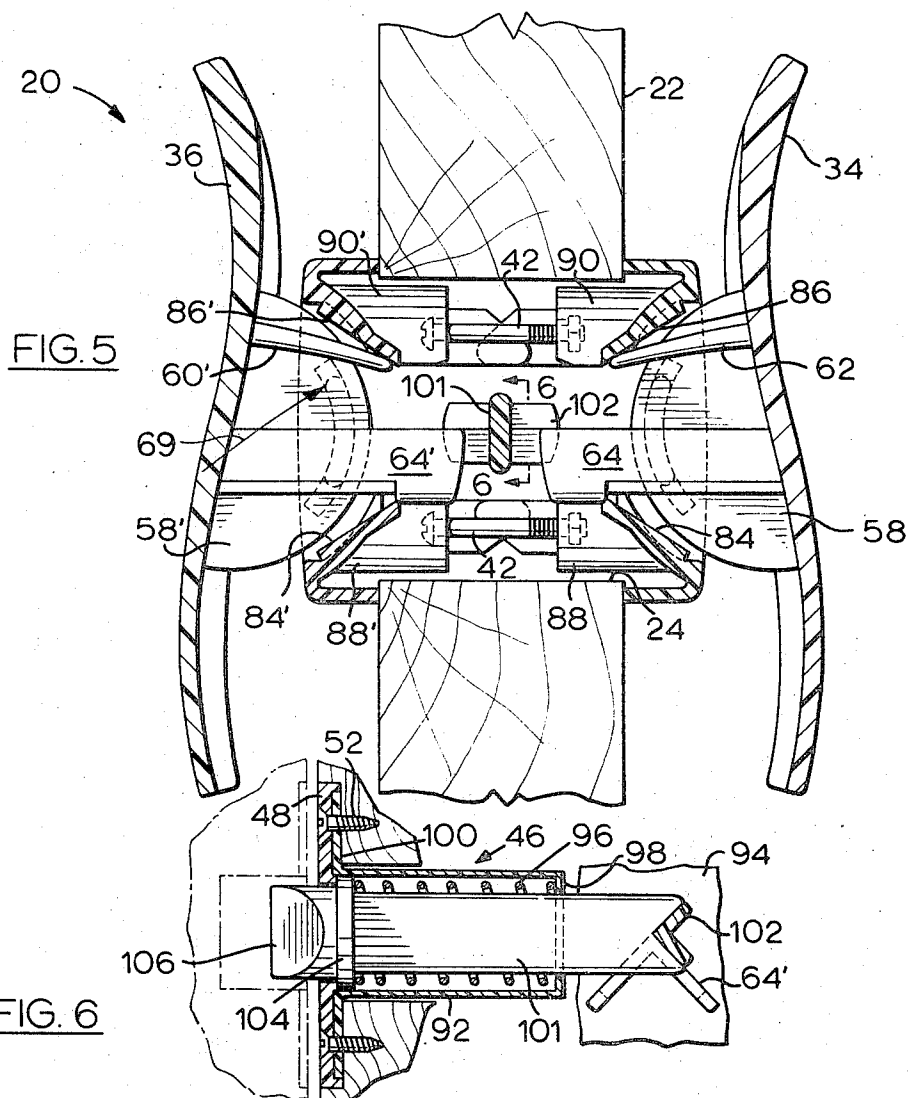
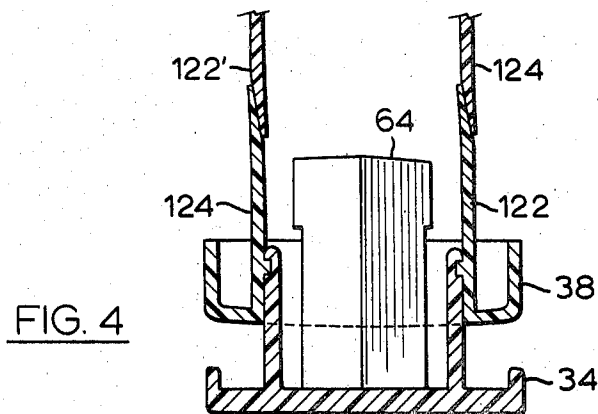
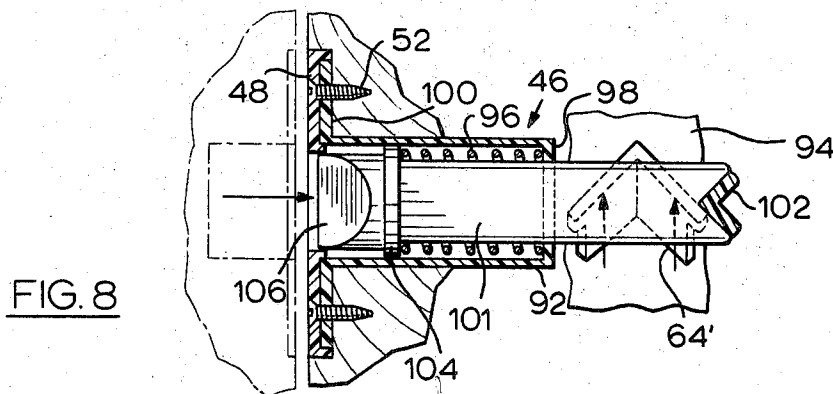
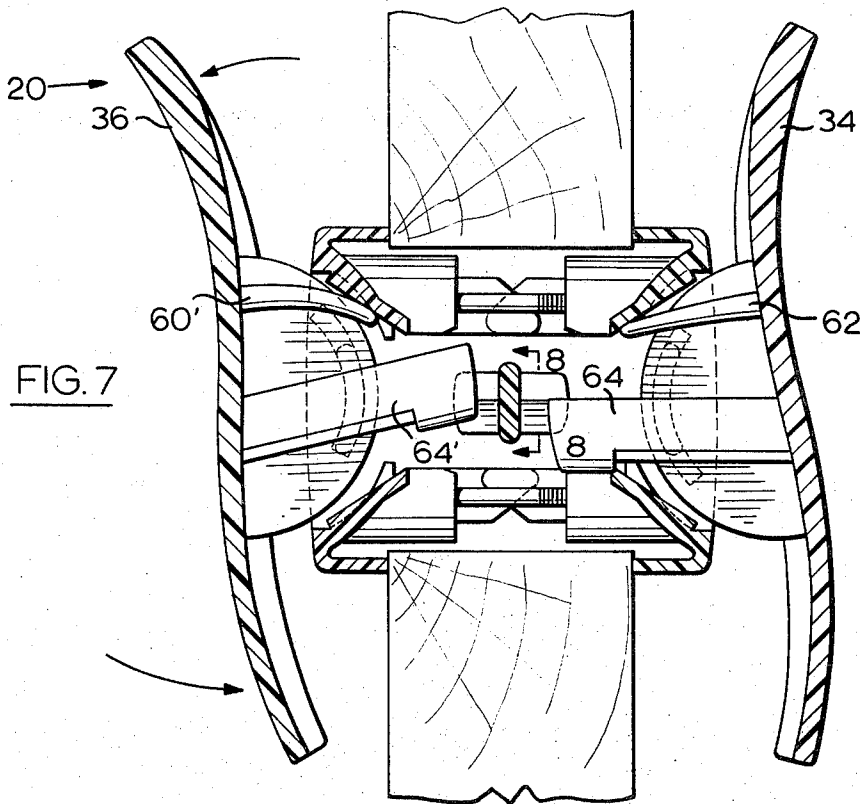


FIG. 6



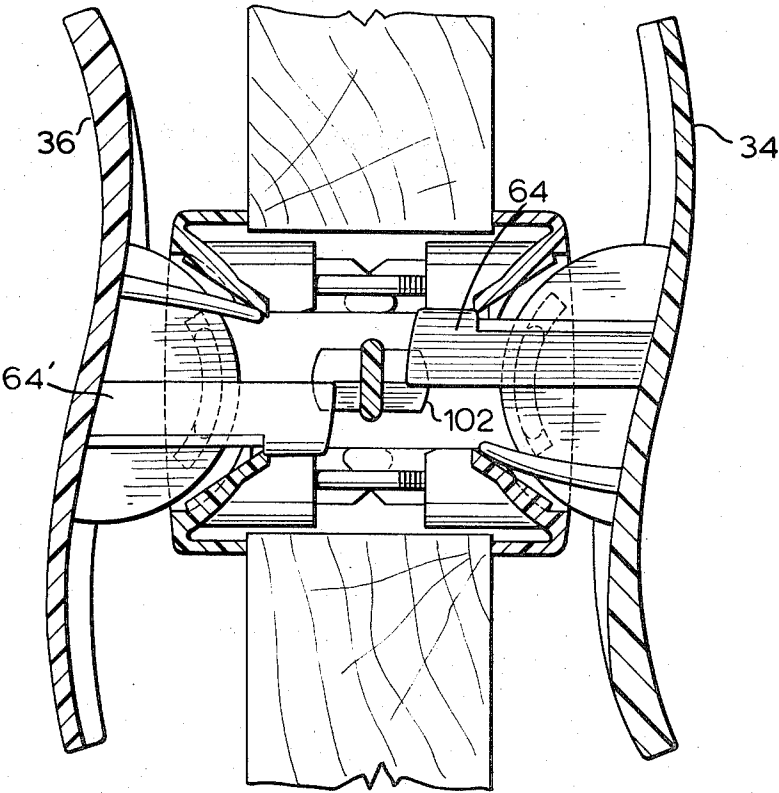


FIG. 9

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DOOR LATCH

This invention relates to a door latch for use on doors to retain the door in a closed position, the door latch being operable manually from either side of the door to open and close the door.

Although there are many types of door latches available, they fall into two main types. The first type has a door knob or the like for turning about an axis passing through the door. The door knob is coupled to a latch bolt such that on turning the knob the latch bolt is withdrawn to open the door. A second type has a handle of some kind which is pivoted about an axis parallel to a face of the door to release the latch bolt. The present invention provides an improved door latch which is primarily of the second type.

In one of its aspects the present invention provides a door latch for attachment to a door having a first opening extending from a surface of the door perpendicular to the surface, and a second opening extending from an upright edge of the door into the first opening, the axes of the openings being substantially perpendicular. The door latch includes a handle mounting element defining a ramp, and fastener means for attaching the element to the door with the element in contact with the door surface and covering an end of the first opening and such that the ramp converges with the axis of the first opening. The door latch also includes a handle having a resilient finger. The handle and the mounting element combine to define means permitting the handle to be pivotally coupled to the element with a distal end of the finger in sliding contact with the ramp. On assembly the finger is stressed sufficiently to retain the handle in a normal position and is further stressed upon pivoting the handle into a deflected position. The finger end and ramp are arranged so that as the finger end slides on the ramp when moving the handle from the normal position to the deflected position, bending stresses in the finger are limited so that the material of the finger is not deformed permanently. A latch bolt is also provided and a housing and a slider engaged in the housing for movement between a normal position and a withdrawn position. The latch bolt is proportioned for engagement in the second opening, and the handle and latch bolt define means for operably coupling the handle to the latch bolt on assembly of the door latch so that said pivotal movement of the handle towards the deflected position results in moving the latch bolt slider inwardly from the normal position to the withdrawn position.

This and other aspects of the invention will be better understood with reference to the drawings, in which:

FIG. 1 is an exploded perspective view of a door latch according to the invention and of a portion of a door having suitable openings for receiving the door latch;

FIG. 2 is a front view of a handle mounting element;

FIG. 3 is a rear perspective view of a cover plate;

FIG. 4 is a sectional top view on line 4—4 of FIG. 1 showing parts of the door latch;

FIG. 5 is a sectional side view on line 5—5 of FIG. 1 showing the assembled door latch in a normal position;

FIG. 6 is a sectional side view on line 6—6 of FIG. 5 showing a latch bolt in a normal position;

FIG. 7 is a view similar to FIG. 5 showing the door latch in a deflected position;

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FIG. 8 is a view on line 8—8 of FIG. 7 showing the latch bolt in a withdrawn position resulting from deflection of the door latch; and

FIG. 9 is a further view similar to FIG. 5 showing an alternative embodiment of the door latch.

Reference is made first to FIG. 1 to describe the general arrangement of a door latch 20 with reference to a typical door 22. After describing the arrangement, the specific parts of the door latch will then be described followed by a description of the assembly and operation of the door latch.

Door latch 20 is adapted to be fitted into a cylindrical first opening 24 passing through the door 22 between first and second door faces 26, 28 and a second and smaller cylindrical opening 32 which extends horizontally from an edge 30 to meet the opening 24 substantially at right angles. The door latch includes a pair of interchangeable handles 34, 36 adapted to snap into respective interchangeable handle mounting elements 38, 40. These elements are attached to the door by a pair of bolts 42 (one of which is shown) and associated nuts 44. Once in place, the handles are pivotally coupled to the respective elements 38, 40 for co-operation with a latch bolt 46 which fits in the opening 32 and is held in place by a cover plate 48. This plate fits snugly in a suitable shaped depression 50 in the edge of the door such that an outer face of the cover plate 48 is flush with the edge 30 when assembled on the door and held in place by a pair of screws 52 (one of which is shown).

Because the handles 34, 36 are interchangeable, only those parts of each handle which can be seen in FIG. 1 need be described. When referring to handle 36, primed numerals will be used to distinguish this handle from handle 34. Similarly element 40 will be given primed numerals to distinguish parts of this element from corresponding parts of element 38.

Handle 36 consists of a generally S-shaped outer portion 54' having a pair of inwardly projecting lugs 56', 58' disposed in substantially parallel relationship and having generally semi-circular shapes. A pair of resilient fingers 60', 62' extend inwardly between the lugs 56', 58' and are disposed symmetrically between the lugs and slightly above the vertical centres of the lugs. Below the fingers 60', 62', a cam 64' extends symmetrically between the lugs 56', 58' and has a pair of equally inclined cam faces 65', 67' for operable cooperation with the latch bolt 46 as will be described.

Lugs 56' and 58' of handle 36 define respective curved grooves 66', 68' in surfaces of the lugs remote from the cam 64'. These grooves are curved on a radius of curvature centred about a line passing horizontally through the outer portion 54' and adjacent the outer end of cam 64' as indicated in FIG. 5 by arrow 69. Complementary curved ribs 70', 72' for locating in the grooves 66', 68' are formed on the mounting element 40 to pivotally couple the handle 36 to the element 40 as will be described.

As seen in FIG. 2, the handle mounting element 38 is of a generally square shape when viewed down the axis of door opening 24 and defines a square opening 74 into which the inwardly projecting parts of handle 34 can be engaged. The element 38 has a peripheral outer wall 76 (FIG. 1) dependent inwardly from a front wall 78 which defines the opening 74.

Referring now to FIG. 1 and in particular to the element 40, a pair of forked locating portions 80', 82' de-

pend from upright sides of opening 74' and extend in parallel relationship inwardly towards corresponding locating portions 80, 82 of element 38. These portions and their relative positions on assembly will be described with reference to FIG. 4.

As seen in FIGS. 1 and 2, the handle-mounting element 38 includes pairs of ramps 84, 86 formed between the locating portions 80, 82 and to either side of respective bosses 88, 90. The ramps extend axially and converge relatively sharply towards the axis of the opening 24. Bosses 88, 90 are provided to receive bolts 42 which are used on assembly as will be described.

The ramps 86 are aligned with respective fingers 60, 62 so that after assembly, distal ends of these fingers slide on ramps 86 when the handle 34 is moved to open a door. Details of this arrangement and its operation will be described with reference to the assembly and operation of the door latch.

The latch bolt 46 consists of a housing 92, a slider 94 adapted to slide in the housing, and a coil spring 96 located loosely about the slider for biasing the slider outwardly. The housing includes a generally tubular portion 97 and has an inner end wall 98 and an outer rectangular flange 100. The slider consists essentially of a relatively thin section 101 having a generally rectangular cross-section, a cam follower 102 at an inner end of the section 101 and a short cylindrical portion 104 adjacent an outer end. The portion 104 is proportioned to slide in an opening 105 defined by the housing 92 and a conventional latch bolt end portion 106 extends outwardly from the portion 104 for engagement with a conventional latch keep shown in ghost outline in FIGS. 6 and 8.

The end wall 98 of latch bolt housing 92 defines an opening 108 adapted to permit the cam follower 102 to pass through the opening. A pair of opposed notches 110 form part of opening 108 and are adapted to guide the slider portion 101 as it moves longitudinally and to prevent rotation of the slider relative to the housing. With the slider 94 in place in the housing 92, (as seen in FIG. 6) the spring 96 is compressed slightly between the slider cylindrical portion 104 and the end wall 98.

As seen in FIG. 3 the cover plate 48 which retains the latch bolt 46 in second door opening 32 is bordered on its reverse side by a peripheral lip 112 and has a pair of curved lips 114 defining a major portion of a circle. The lips are separated at their ends to provide a pair of diametrically opposed location notches 116. As seen in FIG. 6, when the latch bolt housing is assembled and the cover plate added, the housing flange 100 fits within the peripheral lip 112 of the cover plate. Also, it will be evident from FIGS. 1 and 3 that in the FIG. 6 assembled condition the projections 118 at the front of the latch bolt housing engage in cover plate notches 116 for positive location of the latch bolt relative to the cover plate.

As seen in FIG. 1, the cover plate 48 has a generally D-shaped opening 120 through which the end portion 106 of the slider 94 projects. The complementary shapes of the opening 120 and the end portion 106 permit the end portion to slide relative to the plate within limits. Excessive outward movement of the slider is prevented by the slider portion 104 engaging the inner surface of the plate 48.

Before assembling the door latch on door 22, the openings 24 and 32 are drilled in the door and then

preparation of the door is completed by forming the depression 50 in the door edge 30.

The door latch 20 is assembled in the door 72 by first engaging one of the mounting elements 38, 40 in opening 24. Assuming element 40 is engaged in the opening, the element is positioned so that the locating portions 80', 82' are vertical. It will be seen from FIG. 1 that these portions define respective pairs of projections 122', 124', the projections of each pair being spaced apart vertically sufficient to slidably receive tubular portion 97 of the latch bolt. The locating portions on each handle mounting member are proportioned and positioned relative to one another for relatively loose engagement in opening 24. This loose engagement permits the assembly to absorb limited errors when placing openings 24 and 32 in the door as will be described.

Element 38 is then engaged in the opening 24 and bolts 42 and nut 44 are used to tighten the elements 38, 40 into firm engagement with respective door surfaces 26, 28. Once these elements are assembled, the projections 122', 124' and 122, 124 are as shown in FIG. 4. It will be seen from this and other figures that each of the distal ends of the projections 122, 124 and 122', 124' defines a complementary inclined surface 126 which meets in face-to-face relationship with a corresponding inclined surface 126 of another projection assembly. As a result, the projections combine to form an elongated opening having a height sufficient to just receive the tubular portion of the latch bolt housing 92 so that the vertical position of the cam follower 102 will be located relative to the elements 38, 40 and hence relative to the cams 64, 64' after assembly of the handles. The surfaces 126 are arranged so that either one of the elements 38, 40 can be rotated through 180° and assembled in this position.

After completing the assembly of the mounting elements 38, 40, the handles 34, 36 are added by simply pushing the handles inwardly until the grooves 66, 68 and 66', 68' engage respective ribs 70, 72 and 70', 72' on handle mounting elements 38, 40. The respective fingers 60, 62 and 60', 62' will then be in engagement with ramps 86, 86' as better seen in FIG. 5. Also the lower extremities of cams 64, 64' are then in engagement with upper ends of the ramps 84, 84' to prevent downward movement of the arms. The fingers are then stressed to retain the handles in normal positions.

Reference is now made to FIG. 5. The projections 70, 70' are shorter than corresponding grooves 66, 66' so that the handles 34, 36 can be made to slide on the projections 70, 70' (as well as on similar projections 72, 72'). The shapes of the projections and grooves are such that when the handles slide they also pivot about the centre of curvature of these shapes. Consequently, to a user, the handles appear simply to pivot about an axis to permit moving the handles into deflected positions for opening or closing the door. The respective handles 34, 36 can be moved clockwise and anticlockwise until associated ribs 70, 72 and 70', 72' meet ends of associated grooves.

The assembly is completed by entering a preassembled latch bolt 46 into opening 32 (FIG. 1) with the cam follower 102 turned through 90° with respect to its position in FIG. 1. In this position the cam follower will pass between the cams 64, 64'. To achieve this the slider 94 is pushed into the housing 92 against spring 96 and then with the housing flange 100 adjacent door edge 30 the latch bolt is turned into the required posi-

tion. This position can either be as shown in FIG. 1 or in a position turned through 180° with respect to the FIG. 1 position depending upon whether or not the door opens to the left or to the right. Next, the cover plate 48 is added and held in place by screws 52. As seen in FIG. 6, the cam follower 102 is now in engagement with the cam 64' (and also with cam 64).

Before describing the operation of the door latch in the form described thus far, it is to be noted that the shapes of the various parts permit interchangeability firstly of the elements 38, 40 which can be assembled in one of two positions separated by 180°, and secondly of the handles which are assembled with the cams 64, 64' below the associated fingers 60, 62 and 60', 62'. Also, the latch bolt can be positioned in one of two positions as described and the ribs could be formed on the handles with grooves being formed in the handle mounting elements.

Reference is now made to FIG. 7 which shows the handle 36 in a deflected position for releasing the latch bolt 46 (FIG. 1). The handle has been rotated in an anticlockwise direction (as drawn) into a deflected position until this movement is stopped by the ribs 70', 72' engaging ends of respective grooves 66', 68'. At this point the arm 64' has forced the cam follower 102 axially into a withdrawn position as shown in FIG. 8. Due to this movement, the fingers 60', 62' have been deflected as ends of these fingers slid up respective ramp 86'. This arrangement permits deflection of the fingers sufficient to store energy in the fingers for returning the handle 36 to the normal position without deflecting the fingers beyond the elastic limit of the material of the fingers. However, it will be appreciated that the angle between the fingers and the corresponding ramps is such that sliding takes place once the handle is released.

The major parts of the door latch are preferably of a polyoxymethylene sold under the trade mark DELRIN 500. In the preferred embodiment the only parts which are metallic are the spring 96, the screws 52, the bolts 42 and the nuts 44. It will however, be appreciated that variations in the material used can be made provided that the substitute materials have the required characteristics exhibited by the exemplary materials used in the preferred embodiment.

As previously mentioned, all of the major parts of the door latch can be assembled in several ways. Because of this it is possible to vary the movement of the handles as required. For instance, in FIG. 9 an embodiment is shown in which the previously described handle 34 and associated mounting element 38 have been moved through 180 degrees with respect to the position previously described. This will be evident from a comparison of FIGS. 5 and 9. Consequently, both handles now operate by rotating in an anticlockwise direction as shown in FIG. 9. The door would then be opened either by pulling at the top of handle 36 or pushing at the top of handle 34. The cam 64 now rides on an upper surface of cam follower 102 and cam 64' rides on a lower surface of follower 102.

In the event that only one handle is to be used (as would be the case for some cupboard or closet doors) the opening 24 can be made to extend partly through the door. The opening must be of sufficient length to contain one of the handle mounting elements and provide space for the interaction of this element with latch bolt 46. In place of bolts 42 and nuts 44, a pair of wood

screws would be used to hold the element in place with the wood screws engaged in the wood at the end of shortened opening 24.

What I claim as my invention is:

1. A door latch engaged in a door having a first opening extending from a surface of the door perpendicular to the surface, and a second opening extending from an upright edge of the door into the first opening, the axes of the openings being substantially perpendicular and the door latch comprising:

a handle mounting element defining a ramp;

fastener means attaching the element to the door with the element in contact with the door surface and covering an end of the first opening such that the ramp converges with the axis of the first opening;

a handle having a resilient finger, the handle and the handle mounting element defining means whereby the handle is pivotally coupled to the element with a distal end of the finger in sliding contact with the ramp, the finger being stressed sufficiently to retain the handle in a normal position and being further stressed upon pivoting the handle into a deflected position, the finger end and ramp being arranged so that the finger end slides on the ramp as the handle moves between the normal and deflected positions to limit bending stresses in the finger so that the material of the finger is not deformed permanently;

a latch bolt having a housing and a slider engaged in the housing for movement between a normal position and a withdrawn position, the latch bolt being engaged in the second opening; and

the handle and latch bolt defining means operably coupling the handle to the latch bolt so that said pivotal movement of the handle towards the deflected position results in moving the latch bolt slider inwardly from said normal position to said withdrawn position.

2. A door latch as claimed in claim 1 in which the pivotal coupling means comprises a pair of curved ribs on one of the handle and the mounting element and a complementary pair of curved grooves in the other of the handle and the element, the grooves housing respective ribs for sliding movement therein whereby the handle pivots about an axis substantially coincident with the centre of curvature of the ribs and grooves.

3. A door latch as claimed in claim 1 in which said means operably coupling the handle to the latch bolt comprises a cam fixedly coupled to the handle and a cam follower fixedly coupled to the latch bolt slider, the cam and the cam follower being in sliding contact so that in pivoting the handle from the normal to the deflected position the slider is moved from the normal to the withdrawn position.

4. A door latch as claimed in claim 1 in which said axis about which the handle pivots is substantially parallel to the axis of the second opening.

5. A door latch as claimed in claim 1 in which the handle and the element are of a polyoxymethylene sold under the trade mark DELRIN 500.

6. A door latch engaged in a door having a first opening extending perpendicularly from one surface of the door to the other surface of the door, and a second opening extending from an upright edge of the door into the first opening, the axes of the openings being substantially perpendicular and the door latch comprising:

a pair of handle mounting elements;
 a pair of handles attached to respective handle mounting elements;
 fastener means attaching the element to the door with the elements disposed one at each end of the first opening and in relatively tight engagement with respective said door surfaces;
 each of the elements defining one of a pair of curved ribs and a complementary pair of curved grooves, and each of the handles defining the other of the pair of ribs and the pair of grooves, the pair of grooves housing respective ones of the pair of ribs for sliding movement therein whereby the associated handle pivots about an axis substantially coincident with the centre of curvature of the ribs and grooves;
 a latch bolt having a housing and a slider engaged in the housing for movement between a normal position and a withdrawn position, the latch bolt being engaged in the second opening;
 the handles and the latch bolt defining means operably coupling the handles to the latch bolt so that said pivotal handle movement towards a handle deflected position results in moving the latch bolt slider inwardly from said normal position to said withdrawn position; and
 means resiliently biasing the handles and the latch bolt slider into said respective normal positions.

7. A door latch as claimed in claim 6 in which each of the handles has at least one resilient finger and in which each of the elements defines at least one ramp so that each of the fingers has a distal end in sliding engagement with a corresponding ramp, each of the ramps extending axially into the first opening and converging with the axis of the first opening at an angle such that on moving a handle into said deflected position the corresponding finger slides on the associated ramp and stores energy in the form of bending stresses so that on releasing the handle this energy is sufficient to cause the finger to slide on the ramp thereby returning the handle to the normal position.

8. A latch bolt as claimed in claim 6 in which said means operably coupling the handles to the latch bolt comprises a pair of cams fixedly coupled one to each of the handles and a cam follower fixedly coupled one to each of the slider, the cams and cam follower being in sliding contact so that in pivoting either one of the handles from the normal to the deflected position the slider is moved from the normal to the withdrawn position.

9. A door latch as claimed in claim 6 in which said axes about which the handles pivot are each substantially parallel to the axis of the second opening.

10. A door latch as claimed in claim 6 in which the handles and the elements are of a polyoxymethylene sold under the trade mark DELRIN 500.

11. A door latch engaged in a door having a first opening extending from a surface of the door perpendicular to the surface, and a second opening extending from an upright edge of the door into the first opening, the axes of the openings being substantially perpendicular and the door latch comprising:

a handle mounting element;
 a handle attached to the handle mounting element;
 fastener means attaching the element to the door with the element in contact with the door surface and covering an end of the first opening;

the element defining one of a pair of curved ribs and a complementary pair of curved grooves, and the handle defining the other of the pair of ribs and the pair of grooves, the pair of grooves housing respective ones of the pair of ribs for sliding movement therein whereby the handle pivots about an axis substantially coincident with the centre of curvature of the ribs and grooves;

a latch bolt having a housing and a slider engaged in the housing for movement between a normal position and a withdrawn position, the latch bolt being engaged in the second opening;

the handle and the latch bolt defining means operably coupling the handle to the latch bolt so that said pivotal handle movement towards a handle deflected position results in moving the latch bolt slider inwardly from said normal position to said withdrawn position; and

means resiliently biasing the handle and the latch bolt slider into said respective normal positions.

12. A door latch as claimed in claim 11 in which the handle has at least one resilient finger and in which the element defines at least one ramp so that the finger has a distal end in sliding engagement with the ramp, the ramp extending axially into the first opening and converging with the axis of the first opening at an angle such that on moving the handle into said deflected position the finger slides on the ramp and stores energy in the form of bending stresses so that on releasing the handle this energy is sufficient to cause the finger to slide on the ramp thereby returning the handle to the normal position.

13. A latch bolt as claimed in claim 11 in which said means operably coupling the handle to the latch bolt comprises a cam fixedly coupled to the handle and a cam follower fixedly coupled to the latch bolt slider, the cam and cam follower being in sliding contact so that in pivoting the handle from the normal to the deflected position the slider is moved from the normal to the withdrawn position.

14. A door latch as claimed in claim 11 in which the axis about which the handle pivots is substantially parallel to the axis of the second opening.

15. A door latch as claimed in claim 11 in which the handle and the element are of a polyoxymethylene sold under the trade mark DELRIN 500.

16. In a door latch of the type having at least one handle and associated handle mounting member by which the handle is pivotally mounted on a suitably prepared door, and a latch bolt operably coupled to the handle whereby pivotal handle movement from a normal position to a deflected position results in moving a slider in the latch bolt from a normal position to a withdrawn position, the improvement in which the handle and handle mounting member define respective pairs of curved grooves and complementary curved ribs housed in respective said grooves for sliding movement therein as the handle moves between said normal and said deflected positions so that the handle pivots about an axis substantially coincident with the centre of curvature of the ribs and grooves, and in which the handle mounting element has a ramp, and the handle has a resilient finger which has an end in sliding contact with the ramp, the finger being stressed sufficiently after assembly on the element to retain the handle in a normal position and being further stressed upon pivoting the handle into the deflected position, the finger end and ramp

being arranged so that the finger end slides on the ramp as the handle moves between the normal and deflected positions to limit bending stresses in the finger so that the material of the finger is not deformed permanently.

17. Apparatus as claimed in claim 16 in which the ramp lies substantially in a plane parallel to said axis of

rotation.

18. Apparatus as claimed in claim 16 in which the handle and the element are of a polyoxymethylene sold under the trade mark DELRIN 500.

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