United States Patent [19]

MacDonald

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[54] **DOOR LATCH SET**

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[73] Assignee: **Cardinal of Adrian, Inc.,** Dryden, Mich.

[22] Filed: **Jan. 18, 1973**

[21] Appl. No.: **324,604**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 227,407, Feb. 18, 1972.

[52] **U.S. Cl.** **292/171,** 292/353, 70/451

[51] **Int. Cl.** **E05c 1/12**

[58] **Field of Search** ..... 292/356, 353, DIG. 38, 292/171; 70/451, 461

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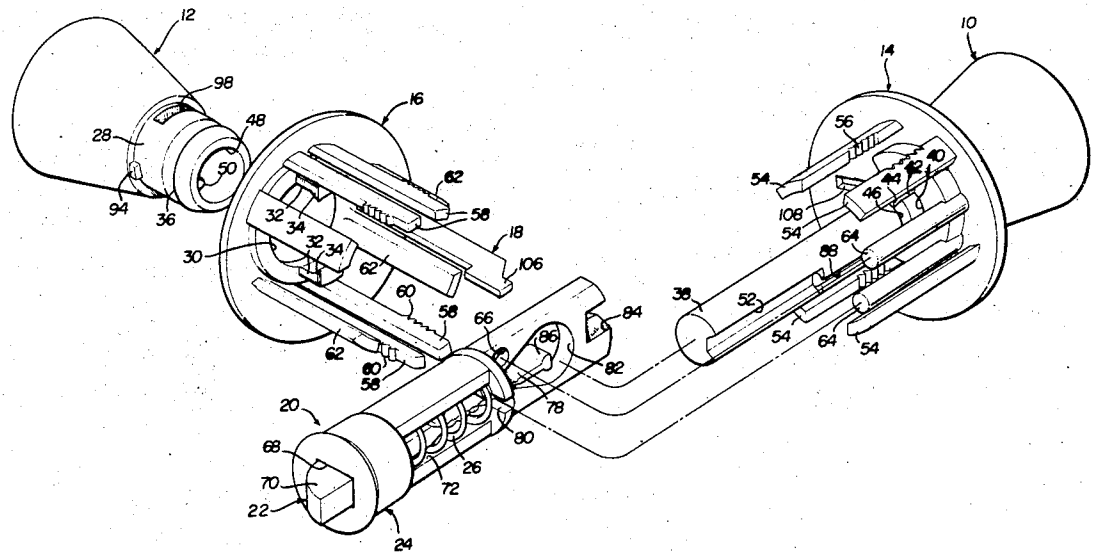
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Primary Examiner—Jordan Franklin
Assistant Examiner—Peter Nerbun
Attorney, Agent, or Firm—Cullen, Settle, Sloman & Cantor

[57] **ABSTRACT**

A door latch set consists of two knob-door plate subassemblies and a latch assembly, all of which can be assembled together and retained within the door without the need for any supplementary non-integral fastening or connecting elements. Each knob is rotatably retained within its door plate by a snap interlock, and the two door plates retain each other within the door by opposed toothed faces on resilient fingers. The latch is a flexible strap which winds around a knob spindle to retract upon knob rotation, and the latch assembly is retained within the door by interlocking means on one of the door plates.

9 Claims, 9 Drawing Figures



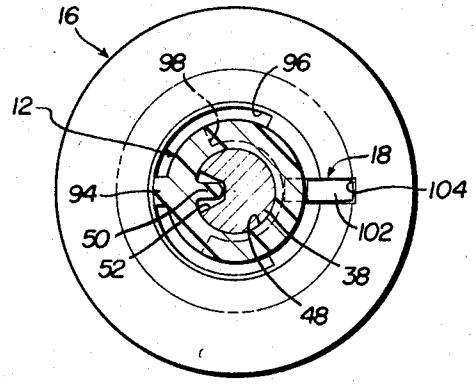


FIG. 2

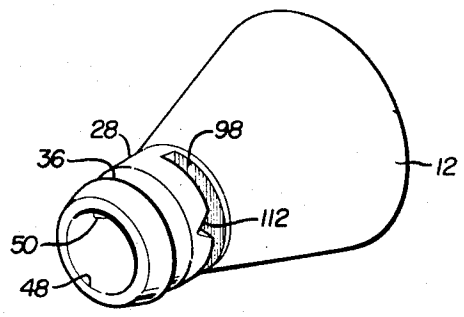


FIG. 3

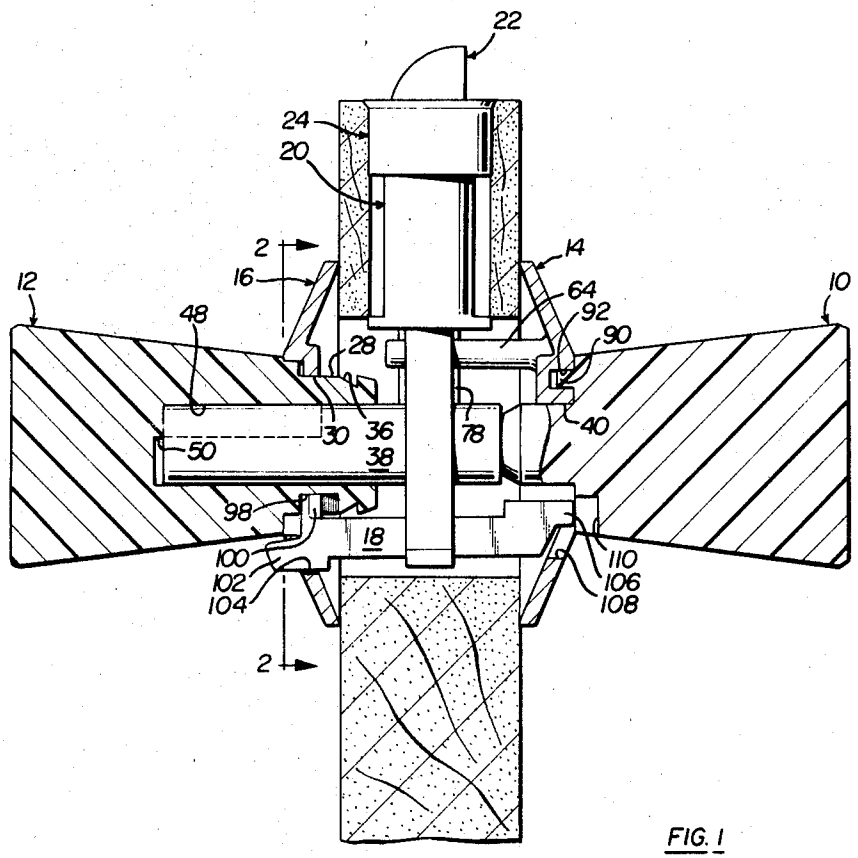
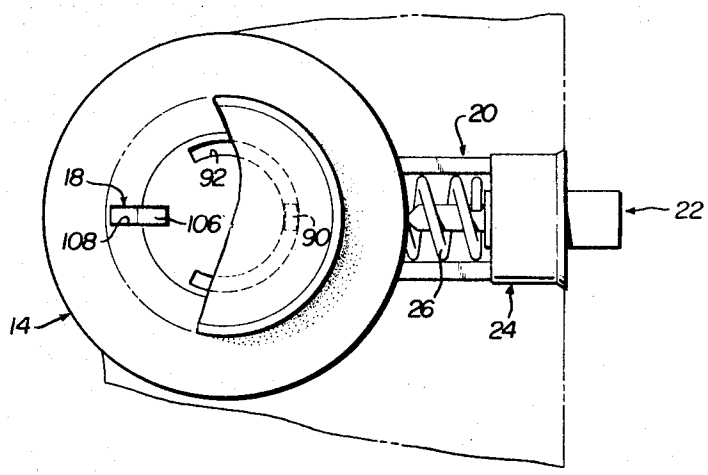


FIG. 1

FIG. 5


20
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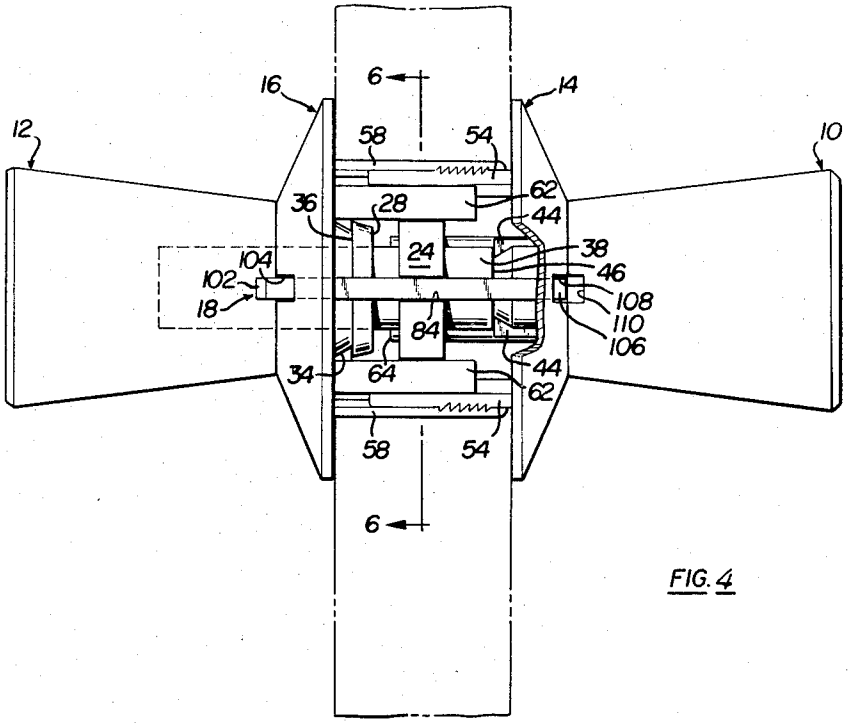

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FIG. 4

FIG. 7

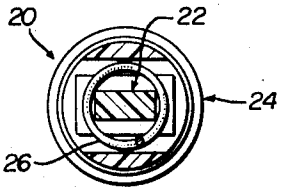
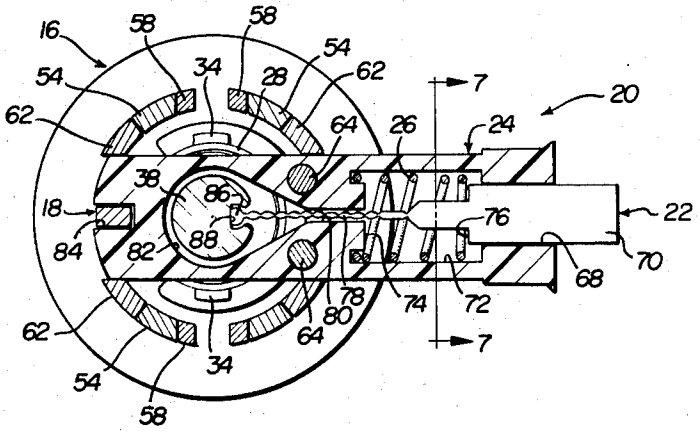


FIG. 6



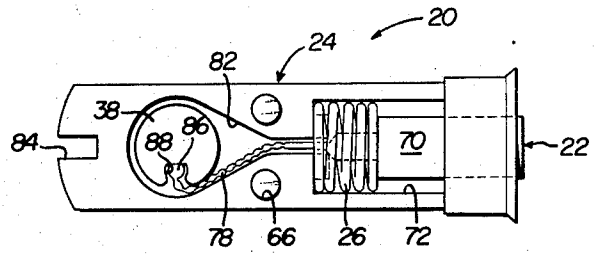


FIG. 8

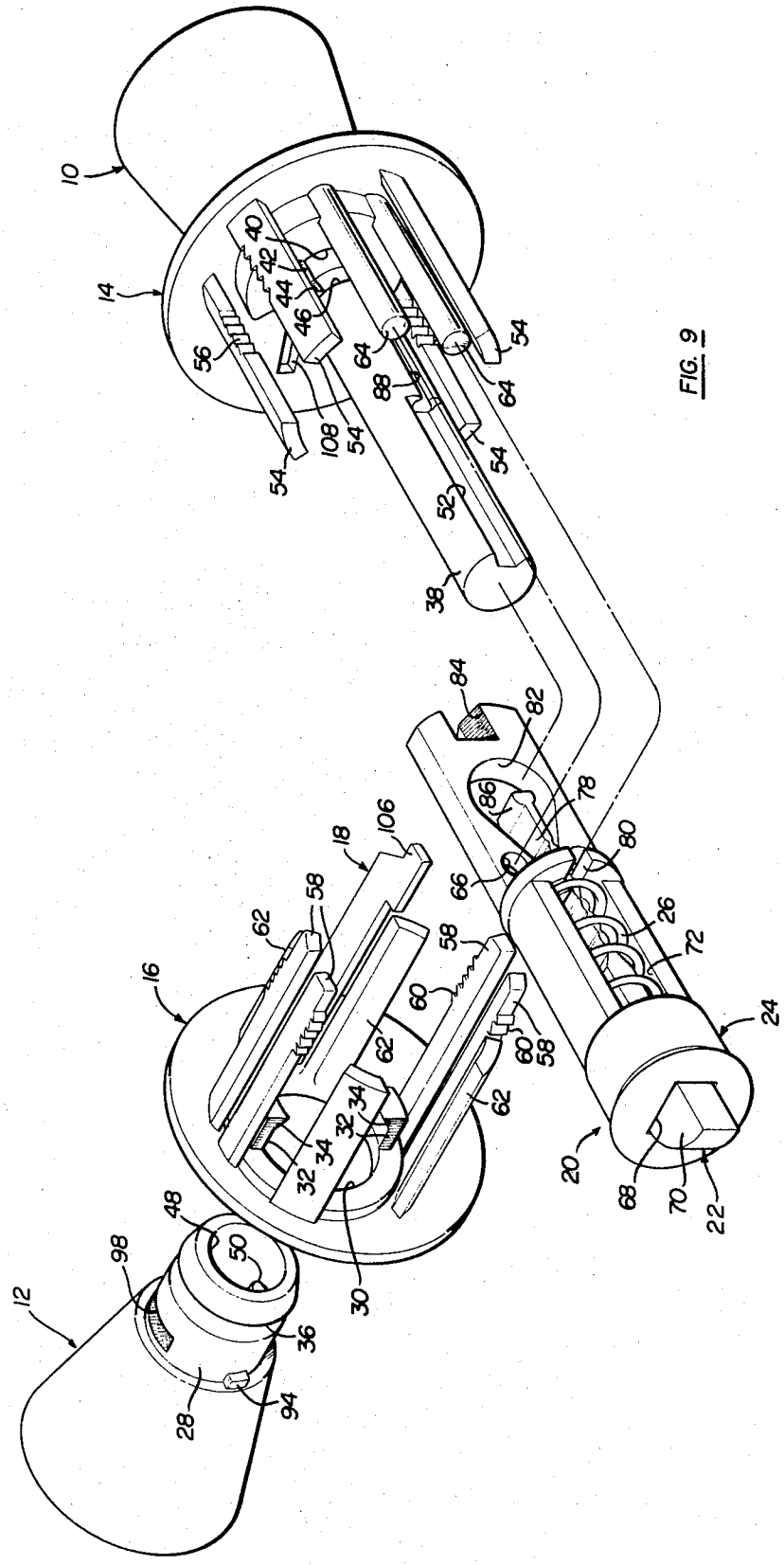

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12
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28
94

FIG. 9

DOOR LATCH SET

PRIOR APPLICATIONS

This application is a continuation-in-part of my earlier pending application Ser. No. 227,407, filed Feb. 18, 1972 and entitled "Door Latch Set."

BACKGROUND OF INVENTION

The purpose of this invention is to provide a door latch set which is substantially less expensive to manufacture and assemble than the present commercial latch sets, without sacrifice of any operational features. This objective has been accomplished in the present invention by the elimination of a great number of the parts conventionally found within a latch set and by the use of molded plastic for all of the parts except the spring.

The reduction in the number of parts as well as the complete elimination of any separate fastening elements required to complete the assembly has substantially reduced not only the cost of manufacture, but also the cost of labor involved in assembling the latch sets to the door.

These advantages will be more readily understood by reference to the following specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a horizontal sectional view of the door latch set of this invention mounted within a door.

FIG. 2 is a section viewed in the direction of arrows 2—2 of FIG. 1.

FIG. 3 is a perspective view of one of the knobs of FIG. 1.

FIG. 4 is a vertical elevation of the assembled door latch set of FIG. 1, showing the door in phantom.

FIG. 5 is an end view of the assembled latch set of FIG. 1, showing the door in phantom and showing a portion of one knob broken away.

FIG. 6 is a section viewed in the direction of arrows 6—6 of FIG. 4.

FIG. 7 is a section viewed in the direction of arrows 7—7 of FIG. 6.

FIG. 8 is a view similar to FIG. 6, but showing the latch member retracted as a result of rotation of the door knob.

FIG. 9 is a partially exploded view of the elements of the door latch set of this invention.

DETAILED DESCRIPTION OF THE DISCLOSURE

Referring to FIGS. 1, 4 and 6 of the drawings, the improved door latch set of this invention generally comprises an integrally formed knob shaft unit 10, a second knob 12, a pair of annular door plates 14 and 16, a privacy lock bolt 18 and a latch assembly 20, the latter comprising a latch member 22 slidably mounted within guide cylinder 24 and biased to its extended position by spring 26.

As will be appreciated more fully following a detailed description of all of the components, the door latch set here disclosed consists of three sub-assemblies which can be assembled within the door without the use of any supplementary screws or other fastening elements. These three sub-assemblies are best shown in FIG. 9. The first sub-assembly consists of knob-shaft unit 10 and door plate 14. The second sub-assembly consists of knob 12, door plate 16 and privacy locking bolt 18. The third sub-assembly is the latch assembly 20, consisting of latch member 22, guide cylinder 24 and spring 26.

Each knob and its associated door plate has a resilient interlock which holds the elements of each pair together as a sub-assembly simplify handling prior to and during the ultimate assembly of the latch set to the door. Referring to FIGS. 1, 3 and 9, knob 12 is provided with a short extension 28 which projects through central hole 30 in door plate 16. Door plate 16 has a pair of diametrically opposite resilient locking fingers 32 having inwardly extending tips 34 (see FIG. 9) which are spread radially outwardly as knob extension 28 passes through central hole 30 but which then springs back inwardly to seat in annular groove 36 of knob extension 28. Once seated, knob 12 and door plate 16 are firmly interlocked, though capable of the necessary relative rotation because of the continuous circumferential groove 36 within which locking finger tips 34 may ride.

Similarly, with respect to knob-shaft unit 10 and its associated door plate 14, shaft 38 projects through central hole 40 in door plate 14, which in turn is provided with locking fingers 42 having tips 44 which seat in annular groove 46 on shaft 38 (see FIGS. 4 and 9).

Knobs 10 and 12 interlock for simultaneous rotation by means of bore 48 in knob 12 which receives the long extended shaft 38 formed integrally with knob 10. As best shown in FIGS. 1—3 and 9, bore 48 has a single longitudinal spline 50 which engages a wide slot 52 in shaft 38 to interlock the two knobs for simultaneous rotation.

The two knob-door plate sub-assemblies are retained to each other and to the door by a series of resilient toothed retention fingers on the door plates. Referring to FIGS. 4, 6 and 9, door plate 14 has four retention fingers 54 provided with toothed portions 56, while door plate 16 also has four retention fingers 58 provided with toothed portions 60. As will be appreciated from FIGS. 6 and 9, the eight retention fingers 54 and 58 are circumferentially spaced so that when these two sub-assemblies are axially aligned and simultaneously pressed inwardly through opposite sides of the receiving hole in a door, the opposed pairs of retention fingers will engage each other. The fingers 58 of each pair will be squeezed toward each other by their engagement with the advancing fingers 54 of each pair. The opposed toothed portions 56 and 60 ride over each other, somewhat in the manner of a ratchet, and such teeth are shaped so as to permit inward advance relative to each other during assembly, while normally preventing relative movement in the opposite direction. The two knob-door plate sub-assemblies are pushed toward each other until the door plates abut the opposed faces of the door. The interlocking teeth 56, 60 then retain these two sub-assemblies within the door.

The door plate 16 is further provided with four locating fingers 62 which straddle and assist in positioning guide cylinder 24 (see FIGS. 6 and 9). Guide cylinder 24 is securely locked in place in the final assembly by means of a pair of locking pins 64 on door plate 14 (see FIG. 9). During the final assembly of the three above-described sub-assemblies, latch assembly 20 is initially positioned within a receiving hole in the edge of the door. As the two knob-door plate sub-assemblies are inserted into opposite ends of the face-to-face hole in

the door, locking pins 64 pass through the receiving holes 66 in guide cylinder 24 to prevent its withdrawal from the door (see FIGS. 1, 6 and 9).

The details of the latch assembly 20 are best shown in FIGS. 6 to 9. Guide cylinder 24 is provided with a rectangular longitudinal latch passage 68 which receives the large rectangular cross-sectional portion 70 of latch member 22. Passage 68 opens up into a large spring chamber 72 which is provided at its opposite end with a circular spring retaining shoulder 74 which prevents spring 26 from accidentally slipping sideways out of the open-sided chamber 72.

Latch member 22 has a shoulder 76 against which spring 26 bears to normally bias the latch member to its fully extended position, as shown in FIG. 6. Latch member 22 is provided with a thin flexible strap portion 78 which passes through a slot 80 in guide cylinder 24, which slot opens into a somewhat pear-shaped shaft-receiving chamber 82. During assembly, slot 80 is manually spread to permit passage of enlarged end 86. Thereafter, spring 26 is seated over shoulder 74, and the spring thus prevents subsequent spreading apart of slot 80.

The inner end of cylinder 24 is provided with a slot 84 through which privacy locking bolt 18 passes.

Inner end 86 of strap portion 78 of latch member 22 is enlarged for locking with a longitudinal slot 88 in shaft 38. As best shown in FIGS. 6 and 9, narrow slot 88 is aligned with and forms a continuation of the wider slot 52. It will be understood that as knob-shaft unit 10 is inserted through shaft receiving chamber 82 of guide cylinder 24, the enlarged end 86 of latch member 22 will first enter wider slot 52 of shaft 38. Slot 52 thus guides end 86 of the strap during continued inward advancement of shaft 38, until the end 86 enters narrower slot portion 88. Since slot 88 is undercut, the enlarged end 86 cannot be radially withdrawn therefrom, and latch member 22 is interlocked with the two knobs 10, 12, so that end 86 of latch member 22 will rotate with slot 88 of shaft 38 as either knob is turned, as shown in FIG. 8. Rotation of either knob thereby retracts latch member 22 against the compression of spring 26, to release the latch from the latch keeper element of the door jamb (unillustrated). The thin section of strap portion 78 of latch member 22 is flexible enough to permit the necessary bending action shown in the sequence of FIGS. 6 and 8. Should latch member 22 be moved by the latch keeper or striker, rather than by manual rotation of the knobs, such motion will be absorbed by buckling of strap portion 78, without necessarily causing knob rotation.

As shown in FIGS. 1 and 5, knob 10 is provided with a small axial projection 90 which rides in an arcuate groove 92 in door plate 14. These cooperating elements form a rotation stop which limits the degree of rotation permitted of knob 10 relative to door plate 14. As shown in FIG. 5, the length of groove 92 has been selected to permit knob rotation through a total arc of about 260 degrees, by way of example. This is sufficient to permit full withdrawal or retraction of latch member 22 to its unlatched position.

Similarly, as shown in FIGS. 1, 2 and 9, knob 12 is provided with a projection 94 which rides in arcuate groove 96 of plate 16, to limit rotation of knob 12 relative to door plate 16.

As best shown in FIGS. 1 and 4, privacy locking bolt 18 forms a portion of the sub-assembly of knob 12 and door plate 16. An arcuate groove 98 in knob 12 (FIGS. 1 and 3) receives a privacy lock release follower tab 100, while privacy lock actuating tab 102 projects outwardly through slot 104 in door plate 16 (see FIGS. 1 and 2). At the opposite end of privacy locking bolt 18, locking tab 106 projects axially through slot 108 in door plate 14, and selectively enters receiving slot 110 in knob 10 (see FIGS. 1, 4 and 5).

To move privacy locking tab 105 from its illustrated released position to its enlarged position, actuating tab 102 is pressed inwardly to advance privacy locking bolt 18 to the right, as shown in FIGS. 1 and 4. Once locking tab 106 is seated in slot 110, knob 10 can no longer be rotated. In this condition, privacy lock release follower tab 100 is seated in the righthand portion of arcuate groove 98 of knob 12 (see FIG. 1), which portion corresponds to the V-shaped enlargement 112 of groove 98, as shown in FIG. 3.

To release the privacy lock, it is only necessary to rotate knob 12, which rotation causes the side ramps or camming surfaces of the V-shaped enlargement 112 to cam follower tab 100 to the left (as shown in FIG. 1) to withdraw locking tab 106 from slot 110 of the opposite knob 10. In the released position of the privacy lock, tab 100 freely rides in the main portion of arcuate groove 98 of knob 12. The oversize width of slot 52 relative to spline 50 (as shown in FIG. 2) permits the initial free rotation of knob 12 required to cause such release of the privacy lock. Continued rotation of knob 12 is transmitted through spline 50 to shaft 38 to open the door.

From the above description, it will be evident that the door latch set of this invention can be economically manufactured and assembled, without any sacrifice in performance. With the exception of the spring, all of the elements are plastic, and no machining is required. No screws or other fastening elements are necessary to assemble the latch set to the door. The three subassembly units are merely brought into proper alignment within the holes previously prepared in the door, and the two knob-door plate subassemblies are pressed together to interlock the entire construction. Disassembly can be provided for, if desired, by providing a pair of diametrically opposite radial slots in the narrow circumferential edge of door plate 14 where it abuts the face of the door. If such fingers are radially aligned with the two pairs of retention fingers 58, the radial insertion of a blade-like tool through such slots will permit inward or downward deflection of such fingers to disengage teeth 60 of fingers 58 from teeth 56 of fingers 54, thereby permitting withdrawal of the sub-assemblies.

To permit the use of this novel door latch set with a door of any thickness, while retaining the disassembly method described above, retention fingers 58 can be provided with pre-weakened notches along their lengths, which can then be broken off at the desired point so that they will project through the full thickness of any size door. Similarly, the use of long pins 64 on door plate 14 to engage with holes 66 in a guide cylinder 24 assures an interlocking relationship for a variety of door thicknesses.

Assembly - Preliminary:

(1) Pair A; Rotor or knob 10 (with shaft 32 integral with knob 10) is locked to plate 14 by the coaction of lugs 32–34 of plate 14 with groove 36 of knob 10.

(2) Pair B; Rotor or knob **12** is locked to plate **16** by the coaction of lugs **32-34** of plate **16** with groove **36** of knob **12.**

(3) Latch subassembly **20** (FIG. **13**) is formed.

Assembly - Final:

(4) Latch subassembly **20** (FIG. **3**) is inserted in the edge latch or the blind hole of a door, so that the leading end (right end FIG. **3**) of such subassembly **20** is properly located in the through rotor hole of the door.

(5) Pair B is inserted axially into the rotor hole (left, FIG. **3**).

(6) Pair A is inserted axially into the rotor hole (right, FIG. **3**).

Automatic Interlocking and Keying:

(7) Shaft or spindle **38** keys pair A to pair B at slot **52** and key **50.**

(8) Shaft or spindle **38** interlocks pair A to latch **78** at slot **88** and headed end **86.**

(9) Pair A interlocks to guide cylinder **24** of latch subassembly **20** at pins **64** and holes **66.**

(10) Pair A interlocks to pair B at fingers **54,56** and **58,60.**

(11) Pins **62** of pair B orients latch assembly **20** and pair B relatively during insertion of pair B in the through hole of the door.

This invention may be further developed within the scope of the following claims. Accordingly, the above specification is to be interpreted as illustrative of only a single operative embodiment of this invention, rather than in a strictly limited sense.

I now claim:

1. In a door latch set for use in a door having a face-to-face rotor receiving through hole and an edge-opening latch bolt receiving blind hole perpendicularly intersecting said rotor hole, and wherein a latching element reciprocates within the latch hole between latched and unlatched positions upon rotation of either of two rotors rotably mounted in and at opposite ends of the rotor hole;

the improved means for keying said two rotors for simultaneous rotation and for interlockingly coupling said latching element to said rotors so that it will respond to such rotation; comprising:

an elongated shaft extending coaxially from a first of said rotors for rotation therewith and adapted to extend at least halfway through the rotor hole, said shaft being provided with an elongated exposed open ended side slot extending longitudinally from its inner end towards said rotor, at least a portion of the length of said slot being undercut so that the side opening of said slot is narrower than the base thereof;

the second rotor having a coaxial bore at its inner end adapted to receive said shaft when the latch set is assembled, said second rotor further having a longitudinally extending key-like rib projecting into said bore and adapted to enter and fit snugly in said shaft slot on axial assembly movement of the shaft and second rotor relatively;

the innermost tip of said latching element being enlarged and shaped so as to enter and be received in said undercut portion of said shaft slot when the shaft is slid axially in a relative longitudinal direction towards said second rotor, the enlarged tip of said latching element within the undercut slot preventing its withdrawal from said undercut portion of said shaft slot when the shaft is rotated;

said interconnection of said rib and said shaft causing said rotors to be keyed and to rotate together upon rotation of either one, and such rotation causing longitudinal movement of said latching element within the latch hole of the door.

2. A door latch set according to claim **1** wherein at least the intermediate portion of the latching element is sufficiently flexible to enable the latching element to wind about said shaft in response to said tip portion thereof being carried around said shaft axis within said shaft slot.

3. In a door latch set for use in a door having a face-to-face through hole and an edge-opening blind hole perpendicularly intersecting said through hole, and wherein said latch set comprises two plate knob pairs, each pair having a knob rotatably mounted in an associated door plate, and interlocked thereto against axial separation;

with the two pairs being located in axial alignment on opposite sides of the door through hole;

and a latch member operatively connected to the plate-knob pairs to reciprocate between latched and unlatched positions, the latch member being slidably mounted in a guide means adapted to be inserted in the blind hole of the door;

the improved means for assembling and retaining these elements within the door, comprising:

knob retaining means integrally formed on each knob and its associated door plate axially to interlock each knob to its plate, and normally prevent withdrawal of each knob from its associated door plate axially;

each door plate having elongated interlocking resilient toothed fingers integrally formed therewith and so dimensioned and positioned that the interlocking toothed resilient fingers of one door plate automatically engage and interlock with those of the other door plate within the door through hole at the time of assembly to a door axially to interlock the two pairs automatically and normally prevent axial withdrawal of said door plates from each other and from the door through hole;

and elongated pins integrally formed on one of the door plates and adapted to engage and retain the guide means within the door blind hole;

whereby the mere insertion of the two knob and door plate pairs as subassemblies into opposite ends of the door through hole following insertion of the guide means into the door blind hole effects an operative assembly and retention of the two pairs and the guide means to one another, without the need for any supplementary non-integral fastening elements.

4. In a door latch set for use in a door having a face-to-face through hole and an edge-opening blind hole perpendicularly intersecting said through hole, and wherein said latch set comprises a pair of door knobs each rotatably mounted in an associated door plate located in axial alignment on opposite sides of the door through hole and a latch member operatively connected to the door knobs to reciprocate between latched and unlatched positions;

the improved means for assembling and retaining these elements within the door, comprising:

an elongated shaft extending coaxially from a first of said knobs for rotation therewith and adapted to extend at least halfway through the door through hole, said shaft being provided with an end opening exposed elongated side slot extending longitudinally from its inner end towards said first knob, at least a portion of the length of said slot being undercut so that the side opening of said slot is narrower than the base thereof;

the second knob having a coaxial bore at its inner end adapted to receive said shaft when the latch set is assembled, said second knob further having a longitudinally extending key-like rib projecting into said bore and adapted to enter and snugly fit into said shaft slot on assembly for keying the shaft and bore relatively;

the innermost tip of said latching element being enlarged and shaped so as to enter and be received in said undercut portion of said shaft slot when the shaft is slid in a relative longitudinal direction towards said second knob, the enlarged tip of said latching element preventing its withdrawal from said undercut portion of said shaft slot when the shaft is rotated;

said interconnection of said rib and said shaft causing said knobs to rotate together upon rotation of either one, and such rotation causing longitudinal movement of said latching element within the blind hole of the door;

knob retaining means integrally formed on each knob and its associated door plate axially to interlock each knob to its plate and normally prevent withdrawal of each knob from its associated door plate axially;

each door plate having elongated resilient toothed fingers integrally formed therewith and so dimensioned and positioned that the toothed resilient fingers of one door plate automatically engage and interlock with those of the other door plate within the door through hole at the time of assembly to a door, axially to interlock the two plates automatically and normally prevent axial withdrawal of said door plates from each other and from the door through hole;

whereby the mere insertion of the two knob and door plate pairs as subassemblies into opposite ends of the door through hole following insertion of the guide means into the door blind hole effects an operative assembly and retention of the two pairs and the latch element to one another, and a rotation keying of the two knobs to each other, all without the need for any supplemental nonintegral fastening elements.

5. A door latch set according to claim **4**, wherein at least the intermediate portion of the latching element is sufficiently flexible to enable the latching element to wind about said shaft in response to said tip portion thereof being carried around said shaft axis within said shaft slot.

6. An improved door latch set including a latch actuator and two opposed rotors;

cooperating formations on the inner parts of the two rotors for keying them relatively to rotate together, such formations so functioning by axial movement of the two rotors towards each other, to key the two rotors together against relative rotation when they have been interkeyed;

cooperating formations on the inner part of a first one of the rotors and the inner end of the latch actuator for coupling such first rotor and the latch actuator to each other by axial movement of such first rotor, i.e. the same axial movement that keys the rotors to each other against relative rotation;

such last named coupling formations comprising an enlarged male end on the actuator and a female formation on the first rotor, opening in the direction of movement of such first rotor towards the other rotor to which it moves for keying;

whereby keying of the two rotors relatively, and coupling of the first rotor to the actuator, are performed simultaneously, and merely by movement of the two rotors towards each other axially, after the latch actuator has been properly positioned, transverse to the axis of the rotors, with its male end in the path of movement of the female formation of such first rotor towards the other rotor to be accepted by such female formation.

7. A door latch set according to claim **6** wherein the female formation on the first rotor is formed and positioned to receive, in one axial motion first the male end of the actuator for coupling and then the keying formation of the other rotor for keying.

8. An improved door latch set according to claim **6** including also

two opposed annular door plates;

with each rotor having on its outer end a knob, and each rotor telescoped into and journalled in a plate to form with it a preassembled operating pair;

cooperating formations on the rotor and plate of each pair for detachably connecting such parts to each other by axial insertion of a rotor into a plate and interlocking such parts to each other against axial separation when they have been so interconnected;

cooperating formations on the two plates for detachably connecting such plates to each other by axial movement of the two plates towards each other and thus interlocking the two plates to each other against axial separation when they have been so interconnected, with the rotors previously mounted and journalled in the plates;

whereby pair-to-pair assembly and axial interlocking of the two pairs, and keying of the two rotors relatively, and coupling of the first rotor to the actuator, all are performed simultaneously, and merely by movement of the two pairs towards each other axially, after the latch actuator has been properly positioned, transverse to the axis of the rotors, with its male end in the path of movement of the female formation of such first rotor towards the other rotor to be accepted by such female formation.

9. A door latch set according to claim **8** wherein the interlocking formations of the two plates are axially extending elongated spring fingers with ratchet teeth.

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