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MacDonald

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[54] **DOOR LATCH SET**

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

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[52] **U.S. Cl.** **292/171**
[51] **Int. Cl.** **E05c 1/12**
[58] **Field of Search**..... 292/DIG. 38, 171, 141, 292/337, 359

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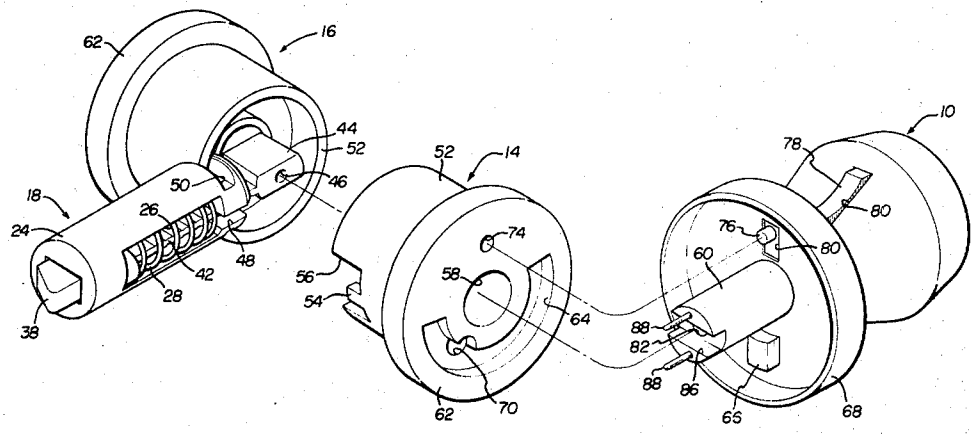
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Primary Examiner—James R. Boler
Assistant Examiner—Peter Nerbun
Attorney, Agent, or Firm—Cullen, Settle, Sloman & Cantor

[57] **ABSTRACT**

A molded plastic door latch set comprises two knobs, two sleeves, and a latch assembly, with the knob and sleeve pairs being substantially identical. Only three screws are required to assemble the set and secure it within a door. Rotation of the knobs actuates the latch by winding a flexible portion of the latch around the knob spindle.

17 Claims, 6 Drawing Figures



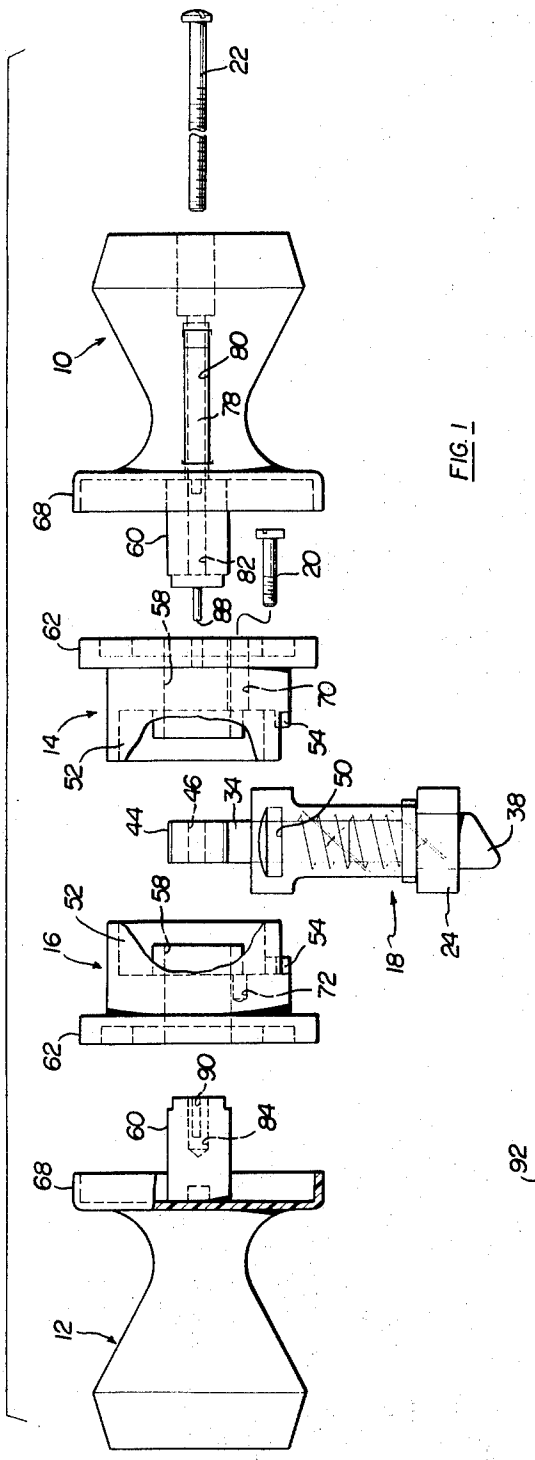

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FIG. 1

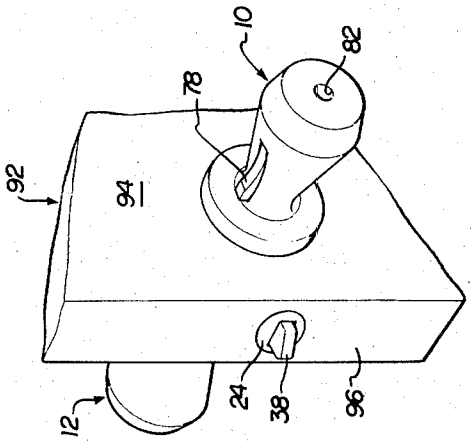

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FIG. 2

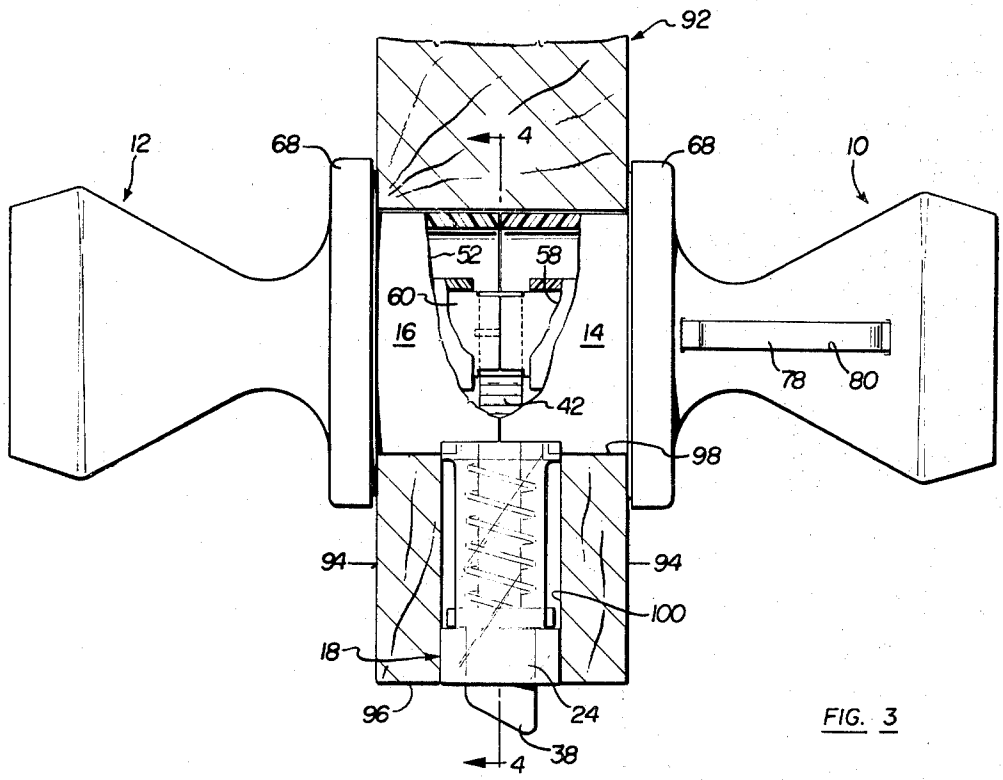


FIG. 3

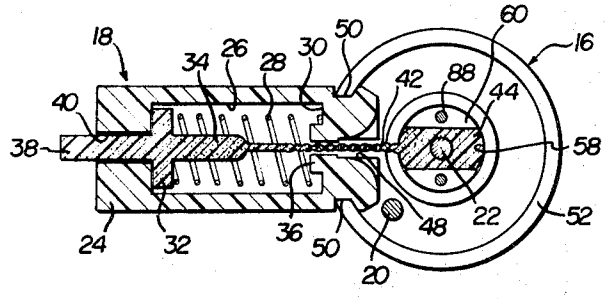


FIG. 4

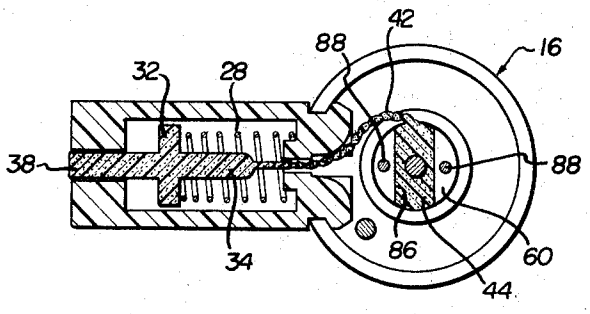


FIG. 5

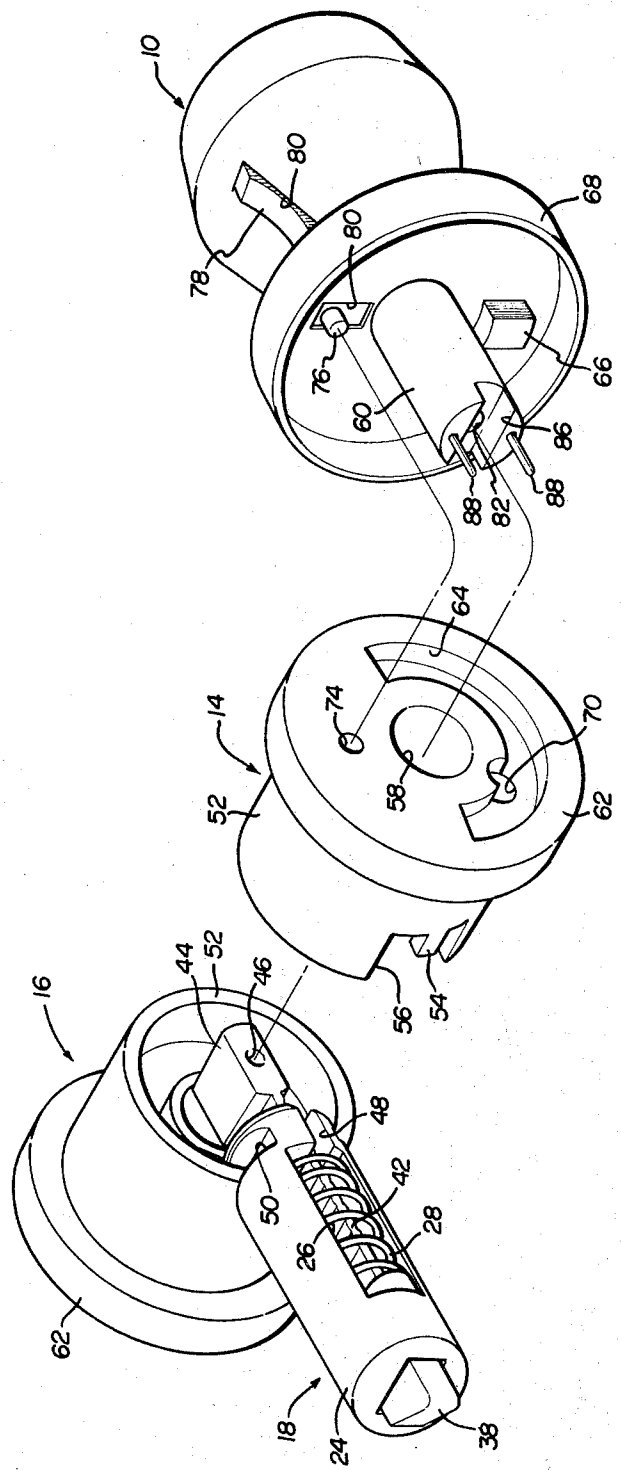

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FIG. 6

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 present commercial latch sets, without sacrifice of any operational features. This objective has been accomplished by 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 the majority of the parts.

By using molded plastic rather than the more costly metals, and by substantially reducing the number of elements within the latch sets, the cost of manufacure of the parts has been substantially reduced. Equally significantly, the cost of labor in assemblying the latch set and of securing it within the door has also been substantially reduced.

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

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view in exploded form of the latch set of this inention.

FIG. **2** is a perspective view of the latch set of FIG. **1** installed within a fragmentarily illustrated door.

FIG. **3** is a plan view, partly in section, through an assembled latch set mounted within a door.

FIG. **4** is a cross sectional elevation viewed in the direction of arrows **4—4** of FIG. **3**, and showing the latch set in its normal extended latched position.

FIG. **5** is a view similar to FIG. **4**, but showing the latch in its retracted released position.

FIG. **6** is an exploded perspective view of the latch set of this invention, with one knob being omitted for clarity.

DETAILED DESCRIPTION OF THE INVENTION

Referring first to FIG. **1**, the latch set of this invention generally comprises a pair of knobs **10, 12**, a pair of sleeves **14, 16**, a latch assembly **18**, a pair of sleeve screws **20** (only one of which is illustrated) and a knob screw **22**. Thus, at the time of assembly of the latch set into a door, the workman has only five elements to handle, all of which are assembled to each other and to the door by means of only three screws.

Referring first to latch assembly **18**, best understood by reference to FIGS. **4–6**, this sub-assembly includes a guide cylinder **24** having an enlarged side and end-opening chamber **26** within which is mounted a compression spring **28**. The ends of spring **28** bear against inner end wall **30** of chamber **26** and radial flange **32** on latch actuator **34**, thus biasing latch actuator outwardly (to the left as shown in FIGS. **4–6**) to the extended latching position. A pair of spring locating bosses **36** on end wall **30** normally locate and retain spring **28** and prevent it from slipping out of chamber **26**.

The latch **38** itself is formed integrally with the outer or left end of latch actuator **34**, and is mounted to slide longitudinally within slot **40** in guide cylinder **24**. The intermediate portion of latch actuator **34** is formed as a flexible strap, capable of flexing in one longitudinal plane as shown by comparison of FIGS. **4** and **5**. The inner or right end **44** of latch actuator **34** is enlarged for

connection with other elements of the latch set, as will be described below, and is provided with a transverse hole **46** through which knob screw **22** passes at the time of assembly. A transverse diametral slot **48** is formed at tne inner end of guide cylinder **24**, to permit assembly of latch actuator **34**, as will be further described below. It is to be understood that the entire latch member, comprising an actuator **34**, latch tip **38** and enlarged inner end **44**, is fabricated of a single piece of plastic, preferably molded polypropylene.

Still referring to FIGS. **4–6** in particular, guide cylinder **24** has a pair of transverse slots **50** formed in the top and bottom surface thereof adjacent the inner end. Slots **50** are engaged by portions of wall **52** of sleeves **14, 16** at the time of assembly. The entrance of parts **56** of walls **52** of sleeves **14–16** into slots **50** of cylinder **24** will, as shown in FIGS. **4** and **5**, provide an interlock between the rotor means (**10-12-14-16**) and the cylinder **24**. Since actuator **34** is locked in the cylinder **24**, there will arise an interlock between the rotor means and the actuator **34**. Also as shown in FIGS. **4** and **5**, the hollow central parts **57** of the sleeve **14** and **16** have longitudinal side slots **57***a*, as well as bores **58**. Side slots **57***a* provide an interlock with the headed end **44** of actuator **34**. These interlocks prevent the latch assembly and particularly the actuator from separating from the rotor means after assembly of the latch assembly and the rotor means in such order. Similarly, a short finger **54** in a cut-out portion **56** of sleeve wall **52** enters each end of slot **48** in guide cylinder **24**. The function of these connections will be understood from the explanation below.

As best shown in FIGS. **1** and **6**, sleeves **14, 16** are each provided with a longitudinal bore **58** adapted to receive and provide a bearing surface for spindle **60** of knobs **10, 12**. Each sleeve **14, 16** has an outer radial flange **62**, the outer face of which is provided with a semi-circular arcuate slot **64**. Slot **64** receives a projection **66** on the inner face of the integrally formed escutcheon plate **68** of each knob. The ends of slot **64** thus act as stops for projection **66**, to limit the rotation of the knobs to 90° either way from the normal position.

As best shown in FIGS. **1** and **6**, sleeve **14** is provided with a pair of longitudinal clearance holes **70** (only one of which was shown) to receive sleeve screws **20**. Similarly, sleeve **16** is provided with a pair of threaded blind holes **72** (one of which is shown in FIG. **1**) positioned to align with holes **70** at the time of assembly.

As shown in FIG. **6**, sleeve **14** is provided with a privacy lock hole **74** which is normally aligned with tip **76** of a privacy lock member **78** slidably mounted in a slot **80** of knob **10**. Knob **10** has a deep clearance hole **82** along its longitudinal axis to receive knob screw **22**, while knob **12** has a threaded hole **84** into which screw **22** is received at the time of assembly.

As best shown in FIGS. **4–6**, the inner ends of both knob spindles **60** have a transverse slot **86** dimensioned to snugly fit over the enlarged inner end **44** of latch actuator **34**.

The inner end of spindle **60** of knob **10** has a pair of longitudinally projecting pins **88**, which fit into holes **90** at the inner end of spindle **60** of knob **12** at the time of assembly. These pins function to cause the two knobs to rotate together whenever one of them is turned.

It will be observed that sleeves **14, 16** are substantially identical. One difference is that sleeve **14** has clearance holes **70** for screws **20** while sleeve **16** has blind threaded holes **72.** Another difference is that the sleeves are mirror images of each other with respect to the position of cut-out **56** in wall **52.**

Similarly, knobs **10** and **12** are substantially identical, the only difference being that one is provided with slot **80** for privacy lock member **78** and with a clearance hole **82** for screw **22** rather than a blind threaded hole **84.** It is noteworthy that each of the knobs is a single integrally formed molded plastic part, including a knob portion, a spindle and an escutcheon plate.

ASSEMBLY AND OPERATION

The assembly of latch sub-assembly **18** will be described first. It will be noted that transverse slot **48** completely severs the two sides of the inner end of guide cylinder **24.** This is essential to permit assembly of latch actuator **34.** The first step in assembly is to further spread apart the two halves of guide cylinder **24.** Then, latch actuator **34,** with spring **28** already on it and compressed to shorten its length, is rocked into chamber **26** from one side, with latch tip **38** being inserted into longitudinal slot **40** of the cylinder. The spreading apart of slot **48** facilitates this assembly. Once actuator **34** is coaxially positioned within cylinder **24,** the initial pre-compression of spring **28** may be released. The innermost coil of spring **28** surrounds spring-locating bosses **36,** to both retain the spring from slipping out of chamber **26** and to prevent the split inner end of cylinder **24** from spreading apart during handling. Similarly, spring **28** prevents latch actuator **34** from sliding sideways out of the cylinder.

The insertion and assembly of the latch set into a door will now be described. Referring to FIG. **3,** a conventional interior door **92** includes a pair of opposed faces **94** and a latching edge **96.** As is conventional, a through hole **98** is bored through the door between faces **94,** and blind hole **100** is bored into door edge **96** to intersect through hole **98.**

The first step of assembly is to insert latch assembly **18** into blind hole **100.** It will be understood that actuator **34,** though flexible enough for wind up operation, is stiff enough to find its proper place in hole **98** as the latch assembly is inserted properly into blind bore **100.** Hence, the headed end **44** of the actuator **34,** so properly placed, will be received in the bores or barrels of spindles **60** of the rotor means, because of side slots **57***a*, and the slots **50** of guide cylinder **24** will receive side parts **54** of walls **52** of sleeves **14** and **16** of the rotor means during the next step of assembly now to be described, for the desired interlocks. Sleeves **14, 16** are then inserted from the opposite sides of through hole **98,** with the angular position of the sleeves and the depth of latch assembly **18** being arranged so that finger **54** of the sleeves will enter slot **48** of guide cylinder **24,** and so that sleeve walls **52** will enter top and bottom slots **50** of guide cylinder **24.** The interengagement of these elements, best shown in FIG. **6,** serves several functions. It assures the proper depth of latch assembly **18** within blind hole **100** and maintains such depth. It also assures the proper angular orientation of latch assembly **18** within blind hole **100,** so that bevelled latch tip **38** will reciprocate in the proper plane. Placement of finger **54** in slot **48** assures that slot **48** will not collapse and cause latch actuator **34** to bind. Furthermore, the interengagement of these elements assures the proper angular orientation of sleeves **14, 16** in through hole **98** of the door, so that they will be properly aligned with each other for assembly with screws **20.**

The use of two diametrically opposed screws **20** for clamping sleeves **14, 16** together is highly desirable, to assure that the inner ends of the sleeves abut each other without cocking so that bores **58** are in proper axial alignment to receive spindles **60** of knob **10, 12.**

It is important that the inner ends of sleeves abut each other because of the carefully controlled axial length of the assembly, which is designed to cause the inner ends of spindle **60** to abut each other while retaining **0.030–0.040** of axial play of the assembled knobs relative to the sleeves. This assures that the knobs will rotate freely without rubbing or binding upon the outer faces of the sleeves or the door faces **94.**

The next step of the assembly is to insert spindle **60** of the knobs into bores **58** of the sleeves, while angularly positioning the knobs so that pins **88** will align with and enter pin holes **90** of the opposing knob spindle. As the inner ends of the knob spindles meet, the transverse slot **86** in each spindle will slide over and grip the enlarged inner end **44** of latch actuator **34,** as shown in FIG. **4.**

The assembly is comleted by inserting knob screw **22** into deeply recessed clearance hole **82** and through clearance hole **46** in end **44** of latch actuator **34** and into threaded hole **84** of knob **12.** Tightening of screw **22** draws the two knobs tightly together for simultaneous rotation through connecting pins **88.** Rotation of the knobs causes rotation of the inner end **44** of latch actuator **34,** which in turn partially winds strap portion **42** around spindles **60** to retract latch tip **38** to its withdrawn released position, as will be seen by a comparison of FIGS. **4** and **5.**

The flexibility of the strap portion **42** of latch actuator **34** not only permits it to be wound during rotation of one of the knobs, but also permits it to buckle in compression without rotating the knobs when latch tip **38** is cammed inwardly upon engagement with the latch keeper as the door closes.

Privacy lock **78** is actuated by simply sliding it axially inward with the thumb, causing tip **76** to enter hole **74** in sleeve **14,** as shown by FIGS. **2** and **6.** This secures both knobs against rotation. The lock is released simply by pulling backward on lock **78** with the thumb.

A significant advantage of the present assembly is that only three screws are required, and all of them are concealed from view yet readily accessible.

As described above, the number of parts has been reduced substantially in the latch set of the present invention, and the use of molded plastic for most of the parts entirely eliminates the need for any machining operations. This reduction is a result of the simplified mechanism for converting knob rotation to latch retraction, and of the combining of normally separate elements into unitary parts. At installation into a door, the workman need only handle two knobs, two sleeves, a latch assembly and three screws. The only metal parts required are the spring, threee screws and two pins, and these are all readily available standard components. Thus, the cost of manufacture as well as the time and cost of assembly are substantially reduced.

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 manually operated door latch set;
a manually rotatable rotor means for retracting a latch and formed and mounted for latch retracting manual rotation in either of two opposite directions from its normal latching position;
a latch sub-assembly formed as a complete sub-assembly with all parts thereof having formations for mutually cooperating with one another to hold one another together to form such sub-assembly;
with said parts comprising:
a guide;
a compression spring means contained within said guide and operable to normally maintain said rotor means and latch in their normal latching positions; and
a latch actuator also in said guide and having on an outer end a latch and an abutment for said spring means, and having on its inner end a connection formation for connecting the actuator to the rotor means, whereby rotation of such rotor means in either of said two directions causes the actuator to be pulled into latch retracted position;
with the actuator being flexible enough so that as it is pulled for latch retraction it can flex and be wound upon the rotor means;
the location and formation of the connection between the actuator and the rotor means being at that part of the rotor means nearest the latch when the rotor means and the actuator and latch are in their normal latching position, whereby rotation of the rotor means in either direction directly and immediately causes winding up of the actuator and retraction of the latch;
said rotor means also having a connection formation;
with said connection formation being male and female members formed on the actuator and rotor, respectively, said female member opening in a direction parallel to the axis of rotation of said rotor and receiving said male member so as to enable coupling, gripping and holding of the actuator and rotor with each other directly and automatically, merely upon complete insertion of the actuator and rotor, in proper sequence in their respective locations in a door, at right angles to each other;
with the actuator being rigid enough at the time the latch subassembly is inserted into the bore to enable the actuator to maintain its rigidity and stability sufficient to insure the connection formation of the actuator finding and maintaining its proper location in the rotor means receiving hole for automatic connection cooperation of the actuator connection formation and the connection formation of the rotor means when the rotor means is inserted in the rotor means receiving hole.

2. In a door latch set according to claim 1, the improved actuator comprising a one-piece flexible strap having the latch and spring means abutment formed integrally on one end of the strap, and the connection formation also formed integrally on the other end of the strap; with the strap portion between such formations being flexible for winding up.

3. In a door latch set according to claim 1, a unitary self-contained subassembly assemblable as a complete unit with respect to the manually rotatable rotor means; said subassembly comprising a sleeve as said guide, the spring means and actuator therein; with he latch projecting out of one end of the guide and the connection formation of the actuator projecting out of the other end of the guide;
said subassembly being insertable as a unit into a normally provided bore of a door edge, with the connection formation being the leading part of the subassembly during its insertion into said blind bore.

4. In a door latch set according to claim 3, the improved actuator comprising a one-piece flexible strap having the latch and spring means abutment formed integrally on one end of the strap, and the connection formation also formed integrally on the other end of the strap; with the strap portion between such formations being flexible for winding up.

5. For use with a door having the conventional edge-opening blind bore and face opening hole intersecting it: an improved latch assembly for the blind bore and rotor means for the face opening hole, which comprises:
a rotor means formed to be insertable into the face opening hole and having an exposed manually accessible outer part and an inner part;
and a latch subassembly formed as a complete and unitary subassembly to be insertable as a complete subassembly into said blind bore, with said latch subassembly comprising three parts, namely, a sleeve-like guide having restricted openings at its inner and outer ends, a compression spring means, and an elongated substantially rigid and alignment holding and stable latch actuator therein, and with all three parts so formed and located relatively as to be mutually holding for forming the complete and unitary subassembly;
the actuator having at its outer end a latch projecting through and out of the outer opening of the guide and having at its inner end a connection formation projecting through and out of the inner end opening of the guide, and also having a flexible windable portion between its ends and with the latch having a spring means abutting and abutted portions;
said rotor means having on its inner portion a holding and gripping and coupling formation located at that part of the rotor means directly in line with and nearest the axis of insertion of the actuator in the bore for cooperating directly with the inner end connection formation of the actuator and formed for coupling automatically to and gripping and holding such connection formation firmly and for operatively relatively connecting said rotor means and actuator as a result of nothing more than relative movement in a predetermined assembly sequence of the subassembly and rotor means along the bore and the hole axes respectively for mutual coupling automatically and mutual holding of the latch subassembly and particularly the actuator in the blind bore, ad for enabling manual rotation of the rotor means to exert a winding pull on the actuator for latch retraction and for spring compression by flexing the flexible part of the actuator; and for enabling release of the rotor means to permit the spring means to expand for latch extension and to

cause return unwind of the actuator; with said connection formation being male and female members formed on the actuator and rotor, respectively, said female member opening in a direction parallel to the axis of rotation of said rotor and receiving said male member;

the actuator being rigid enough at the time the latch subassembly is inserted into the bore to enable the actuator to maintain its rigidity and stability sufficient to insure the connection formation of the actuator finding and maintaining its proper location in the rotor means receiving hole for automatic connection cooperation of the actuator connection formation and the connection formation of the rotor means when the rotor means is inserted in the rotor means receiving hole.

6. The latch assembly of claim **5,** wherein the rotor means is so formed and mounted that it can be freely rotated manually for latch retraction in either of two opposite directions from normal, with the actuator and the connection and holding formations being so formed and located that wind pull on the actuator will be exercised at once as the rotor means is rotated manually in either direction.

7. The latch assembly of claim **5,** wherein the actuator is of one molded plastic piece having the central flexible part, and with the two end portions thereof being enlarged, relatively inelastic, integral parts of the actuator.

8. An improved latch assembly and rotor means according to claim **5,** wherein the actuator, though flexible, is rigid enough and non-limp enough to maintain itself in stable condition during assembly of the latch assembly and the rotor means even though assembly insertion is exercised in a horizontal direction, whereby the inner end of the actuator will position itself properly with respect to a rotor means later to be inserted into the face hole for mutual cooperation and holding with said rotor means.

9. An improved latch assembly and rotor means according to claim **7,** wherein the actuator is of one piece having the central flexible part, and with the two end portions thereof being enlarged, relatively inelastic, integral parts of the actuator, and wherein the improved actuator, though flexible, is rigid enough and non-limp enough to maintain itself in stable condition during assembly of the latch assembly and the rotor means, even though assembly insertion is exercised in a horizontal direction, whereby the inner end of the actuator will position itself properly with respect to a rotor means later to be inserted into the face hole for mutual cooperation and holding with said rotor means.

10. For use with a door having an edge-opening blind bore and a face-opening hole intersecting the bore, an improved latch set comprising:

a rotor means formed for insertion into the face-opening hole and having a manually accessible outer part and an inner part;

and a three-piece latch sub-assembly formed as a complete subassembly with all parts thereof having formations for mutually cooperating with one another to hold one another together to form such subassembly;

and to be insertable as a complete subassembly into the blind bore and comprising:

a one-piece sleeve-like guide, an elongated one-piece latch actuator mounted for axial movement within said guide, and

a compression spring means retained within said guide;

said latch actuator having a latch formed integrally on its outer end and normally projecting out of a restricted opening in the outer end of said guide, and also having an enlarged spring abuttment portion adjacent the latch and positioned axially inwardly of said restricted opening and providing a bearing surface against which said spring means acts to bias said latch actuator axially outwardly to its normal latching position;

said latch actuator also having a connection formation formed integrally at its inner end and a flexible intermediate portion between said latch and said connection formation;

said latch actuator being rigid enough and stable enough to maintain its normal position during insertion of the subassembly into the blind bore to insure said connection formation of said latch actuator being normally maintained in stable position substantially on the longitudinal axis of said guide, even during axial insertion of the latch subassembly into the bore in a horizontal position, thereby to assure proper alignment of said connection formation with said rotor means at the intersection of the door bore and door hole during final assembly;

said rotor means having on its inner portion a holding and gripping and coupling formation located at that part of the rotor means nearest and in line with the axis of insertion of the actuator in the bore and so formed that it automatically and directly provides a gripping and coupling connection to said connection formation of said latch subassembly upon insertion of said rotor means and latch subassembly in proper sequence into the hole and bore, respectively, said coupling and gripping connection enabling rotation of the rotor means from its normal latching position to exert a latch retracting pull on said latch actuator, against the force of said spring means, with the flexible portion of said latch actuator winding upon said rotor means during such retraction and with the inner end of the actuator gripped and held and coupled by the rotor means holding formation;

with said connection formation being male and female members formed on the actuator and rotor, respectively, said female member opening in a direction parallel to the axis of rotation of said rotor and receiving said male member;

with the actuator being rigid enough at the time the latch subassembly is inserted into the bore to enable the actuator to maintain its rigidity and stability sufficient to insure the connection formation of the acutator finding and maintaining its proper location in the rotor means receiving hole for automatic connection cooperation of the actuator connection formation and the connection formation of the rotor means when the rotor means is inserted in the rotor means receiving hole.

11. The latch set of claim **10,** whrein the rotor means is so formed and mounted that it can be freely rotated in either of two opposite directions from its normal latched position to produce latch retraction.

12. The latch set of claim 11, wherein the location and formation of the connection between said latch actuator and said rotor means are such that a winding pull on said latch actuator will be induced immediately upon initial rotation of said rotor means in either direction from its normal latching position.

13. The latch assembly of claim 10, wherein the actuator is of one molded plastic piece having the central flexible part, and with the two end portions thereof being enlarged, relatively inelastic, integral parts of the actuator.

14. A door latch set according to claim 1, wherein the connection formations of the actuator and rotor means are formed for interlocking the actuator and rotor means relatively, automatically, upon their relative assembly.

15. A door latch set according to claim 14, wherein said connection formations are so formed that assembly is effected and completed by insertion of the rotor means in its door hole after insertion of the latch assembly in its door bore.

16. A door latch set according to claim 5, wherein the connection formations of the actuator and rotor means are formed for interlocking the actuator and rotor means relatively, automatically, upon their relative assembly.

17. A door latch set according to claim 10, wherein the connection formations of the actuator and rotor means are formed for interlocking the actuator and rotor means relatively, automatically, upon their relative assembly.

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