

06 APR 2000

1

LOCK APPARATUS FOR A DOOR

This invention relates to a lock apparatus for a door, more particularly to a lock apparatus having a rotatable operating knob which is operable for controlling a latch bolt that is mounted on a peripheral edge portion of a door member distant from the operating knob.

Figure 1 illustrates a door assembly 1 having first and second door panels 11, 11' which are disposed side-by-side and which are hinged respectively to right and left portions of a door frame 14 that surrounds the door panels 11, 11'. The door panels 11, 11' are pivotable toward and away from the door frame 14 for closing and opening the entrance formed by the door frame 14. The first door panel 11 is provided with conventional sliding latch bolts 13 at its upper and lower edge portions for locking the first door panel 11 to the door frame 14. The second door panel 11' is provide with a rotary lock device 12 at an intermediate part of a left edge portion thereof adjacent to the first door panel 11 for locking the second door panel 11' to the first door panel 11. Figure 2 illustrates another door assembly 2 having a rectangular door frame 20 and a foldable sliding door unit 21 which spans an opening defined by the door frame 20. The sliding door unit 21 includes two door panels 211 connected foldably to each other. One of the door panels 211 has upper and lower

edge portions provided with sliding latch bolts 22 for engaging top and bottom rail portions 201, 202 of the door frame 20 so as to lock the sliding door unit 21 to the door frame 20 at a closed state.

5 Since the latch bolts 13, 22 are provided at the upper and lower edge portions of the door panels 11, 211, when it is desired lock or unlock the door panel 11, 211, a person usually has to stretch his/her arm upwardly to permit operation of an upper one of the latch
10 bolts 13, 22, and to squat down to permit operation of a lower one of the latch bolts 13, 22. The sliding latch bolts 13, 22 in the door assemblies 1, 2 are thus relatively inconvenient to operate.

Therefore, the object of the present invention is
15 to provide a lock apparatus which has an operating knob that is convenient to operate for controlling a latch bolt distant from the operating knob.

According to this invention, the lock apparatus includes a latch actuator, an elongated linking unit,
20 a latch bolt, and a rotatable operating knob. The latch actuator includes a rotary disc and a spindle which is secured to the rotary disc and which has an axis perpendicular to the rotary disc. The spindle has a first end projecting forwardly from the rotary disc.
25 The rotary disc is rotatable about the axis of the spindle, and has a latch mounting portion which is displaced from the spindle in a radial direction with

respect to the spindle. The linking unit extends in a longitudinal direction perpendicular to the axis of the spindle. The linking unit has a first end mounted on the latch mounting portion of the rotary disc, and an
5 opposite second end distal to the rotary disc. The linking unit is movable by the rotary disc in the longitudinal direction when the rotary disc is rotated about the axis of the spindle. The latch bolt is connected to the second end of the linking unit, and
10 is movable with the linking unit in the longitudinal direction. The operating knob is coupled to the first end of the spindle for co-rotation with the spindle and the rotary disc such that operation of the operating knob can cause the rotary disc to rotate about the axis
15 of the spindle for moving the latch bolt in the longitudinal direction. The operating knob is operable to move between a locking position, in which the latch bolt is moved away from the latch actuator, and an unlocking position, in which the latch bolt is moved
20 toward the latch actuator.

Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiment with reference to the accompanying drawings, of which:

25 Figure 1 is a perspective view of a door assembly incorporating a conventional sliding latch bolt;

Figure 2 is a perspective view of another door assembly incorporating another conventional sliding latch bolt;

Figure 3 is an exploded perspective view of a preferred embodiment of a lock apparatus according to the present invention;

Figure 4 is a fragmentary sectional view of the preferred embodiment in an unlocking state;

Figure 5 is a perspective view illustrating a door assembly incorporating the lock apparatus of the preferred embodiment;

Figure 6 is a fragmentary sectional view of the preferred embodiment when an operating knob is disposed between a locking position and an unlocking position;

Figure 7 is a fragmentary sectional view of the preferred embodiment in a locking state; and

Figure 8 is a rear elevational view of the door assembly of Figure 5.

Referring to Figures 3 and 4, the preferred embodiment of the lock apparatus 4 of the present invention is adapted to be mounted on a door member 64 having front and rear side walls 641, 642 and upper and lower edge portions. The lock apparatus 4 is shown to include a latch actuator 40, a rotatable operating knob 43, an escutcheon plate 42, a pair of latch mounting seats 5, a pair of latch bolts 521, and a pair of elongated linking units 50.

The latch actuator 40 is adapted to be disposed in the door member 64, and includes a circular rotary disc 41 and a cylindrical spindle 45 which is secured to the rotary disc 41 and which has an axis perpendicular to the rotary disc 41. The spindle 45 has a first end 454 projecting forwardly from the rotary disc 41, and an opposite second end 453 projecting rearwardly from the rotary disc 41. The first end 454 has a non-circular cross-section, and is formed with an axial threaded hole 455. The second end 453 is formed with a bit-engaging groove 456 (see Figure 4) adapted for engaging a bit portion (not shown) of a driving tool, such as a screwdriver. The rotary disc 41 has a front side formed with a pair of indented latch mounting portions 411 which are displaced radially from the spindle 45 and which are diametrically opposite to each other with respect to the axis of the spindle 45. Each of the latch mounting portions 411 is formed with an engaging hole 412.

The escutcheon plate 42 is adapted to be fastened to the front side wall 641 of the door member 64, and is formed with a central spindle hole 421 that permits extension of the first end 454 of the spindle 45 therethrough. The escutcheon plate 42 is further formed with a pair of curved openings 423 which are diametrically opposite to each other with respect to the spindle hole 421, and has a pair of curved spring

members 422 disposed respectively in the openings 423. Each of the spring members 422 has a connecting end connected integrally to the escutcheon plate 42, and a distal end formed with a retaining protrusion 424 that projects forwardly. The escutcheon plate 42 has upper and lower end portions formed with fastener holes 425 that permit extension of screw fasteners 71 therethrough for fastening the escutcheon plate 42 to the front side wall 641 of the door member 64.

10 The rotatable operating knob 43 is disposed in front of the escutcheon plate 42, and has a cylindrical coupling portion 431 which extends toward the escutcheon plate 42 and which has a rear end wall 438 in contact with the escutcheon plate 42. The operating
15 knob 43 is formed with an axial spindle hole 432 which is formed through the operating knob 43 and which has an internally threaded hole portion 434. The rear end wall 438 is formed with a pair of first retaining holes 433 which are diametrically opposite to each other with
20 respect to the spindle hole 432 and which are displaced radially from the spindle hole 432, and a pair of second retaining holes 436 which are diametrically opposite to each other with respect to the spindle hole 432 and which are displaced radially from the spindle hole 432.
25 Each of the second retaining holes 436 is angularly displaced from an adjacent one of the first retaining holes 433 by an angle of 90 degrees. The first end 454

of the spindle 45 extends into the spindle hole 432. A screw member 72 is extended into the spindle hole 432 from a front side of the operating knob 43, and engages threadedly the internally threaded hole portion 434 in the operating knob 43 and the threaded hole 455 in the first end 454 of the spindle 45 so as to couple the operating knob 43 co-rotatably to the spindle 45 and the rotary disc 41.

The linking units 50 extend in a longitudinal direction perpendicular to the axis of the spindle 45. Each of the linking units 50 includes a linking rod 53 and a sliding block 52 connected to the linking rod 53. The linking rod 53 has a bent first end 531 which extends into a respective one of the indented latch mounting portions 411 of the rotary disc 41 and which engages the engaging hole 412 in the respective latch mounting portion 411 of the rotary disc 41. The sliding block 52 is connected to a second end of the linking rod 53, and has a distal end 525 opposite to the first end 531 of the linking rod 53. The sliding block 52 is formed with two limiting projections 522 which are spaced apart along the length of the linking unit 50. When the operating knob 43 is operated to cause rotation of the rotary disc 41 about the axis of the spindle 45, the linking units 50 are movable in the longitudinal direction.

Each of the latch mounting seats 5 is adapted to be mounted securely at a respective one of the upper and lower edge portions of the door member 64, and has a surrounding wall 51 that defines a slide channel 511 therein. Each latch mounting seat 5 has an open first end that opens toward the rotary disc 41 and that is communicated with the slide channel 511. The open first end of the latch mounting seat 5 permits the distal end 525 of the sliding block 52 to extend slidably into the slide channel 511. Each latch mounting seat 5 further has a second end formed with a latch hole 513 communicated with the slide channel 511. The surrounding wall 51 is formed with a limiting flange 512 that extends radially into the slide channel 511 and that is disposed between the limiting protrusions 522 of the sliding block 52.

Each of the latch bolts 521 is disposed slidably in the slide channel 511 in a respective one of the latch mounting seats 5, and is connected respectively to the distal end 525 of the sliding block 52 of a corresponding one of the linking units 50 for movement with the linking unit 50 in the longitudinal direction relative to the latch mounting seat 5 to project from the latch hole 513 and to retract into the latch hole 513.

The lock apparatus 4 of the present embodiment is suitable for use with various types of door assemblies, such as a door assembly with a pair of door panels that

are hinged respectively to opposite parts of a door frame, similar to the door assembly shown in Figure 1, or a door assembly with a foldable sliding door unit, similar to the door assembly shown in Figure 2. Figure 5 illustrates a door assembly 6 to which the lock apparatus 4 of the present embodiment is adapted to applied. The door assembly 6 includes a rectangular door frame 63, and a sliding door unit 60 disposed in the door frame 63. The sliding door unit 60 includes first and second door panels 62, 61 and a door member 64 disposed between and interconnecting the first and second door panels 62, 61. The first door panel 62 has a right edge hinged to the door frame 63, and a left edge connected foldably to the second door panel 61 by means of the door member 64. The lock apparatus 4 of the present embodiment is adapted to be mounted on the door member 64 for locking the door member 64 to top and bottom rail portions 631, 632 of the door frame 63 when the door unit 60 is moved to a closed position.

Referring again to Figures 3 and 4, in use, the operating knob 43 is operable to rotate about the axis of the spindle 45 to cause rotation of the spindle 45 and the rotary disc 41 with the operating knob 43. At this time, the latch mounting portions 411 on the rotary disc 41 are moved about the axis of the spindle 45 for moving the linking units 50 in the longitudinal direction, thereby causing the latch bolts 521 to move

with the linking units 50 relative to the latch mounting seats 5.

Referring to Figure 7, the operating knob 43 is operable to rotate in a direction for moving to a locking position, in which each of the latch bolts 521 is moved away from the latch actuator 40 for projecting from the latch hole 513 in the corresponding latch mounting seat 5 so as to be adapted to engage a respective one of the top and bottom rails 631, 632 of the door frame 63 (see Figure 5). At this time, the retaining protrusions 424 on the escutcheon plate 42 extend resiliently and respectively into the first retaining holes 433 in the operating knob 43 for engaging releasably the same so as to retain the operating knob 43 in the locking position. A lower one of the limiting projections 522 on the sliding block 52 of a respective one of the linking units 50 abuts against the limiting flange 512 on the surrounding wall 51 of the respective latch mounting seat 5 to limit further movement of the linking unit 50 and the latch bolt 521 relative to the latch mounting seat 5.

Referring to Figure 4, the operating knob 43 is further operable to rotate in an opposite direction for moving to an unlocking position, in which each of the latch bolts 521 is moved toward the latch actuator 40 for retracting into the latch hole 513 so as to be adapted to disengage from the door frame 63 (see Figure

5) . At this time, the retaining protrusions 424 on the escutcheon plate 42 extend resiliently and respectively into the second retaining holes 436 for engaging releasably the same so as to retain the operating knob 43 in the unlocking position. An upper one of the limiting projections 522 on the sliding block 52 of a respective one of the linking units 50 abuts against the limiting flange 512 on the surrounding wall 51 of the respective latch mounting seat 5 to limit further movement of the linking unit 50 and the latch bolt 521 relative to the latch mounting seat 5.

Referring to Figure 6, during movement of the operating knob 43 from the locking position to the unlocking position, the resilient protrusions 424 are pushed rearwardly by the rear end wall 438 of the coupling portion 431 of the operating knob 43 for disengaging from the first retaining holes 433 (see Figure 7), and slide along the rear end wall 438 for extension into the second retaining holes 436 (see Figure 4) .

Referring to Figures 4 and 8, the rear end 453 of the spindle 45, which is formed with the bit engaging groove 456 that is adapted for engaging a driving tool, is exposed from the rear side wall 642 of the door member 64. In case the lock apparatus 4 is accidentally locked, such as by a child, or in case of an emergency situation, the lock apparatus 4 can still be operated from a rear

side of the door unit 60 with the use of the driving tool for operating the spindle 45 and the rotary disc 41, thereby permitting movement of the latch bolts 521 for unlocking the door unit 60.

5 It has been shown that, with the use of the lock apparatus 4 of the present invention, the latch bolts 521 mounted on the upper and lower edge portions of a door member 64 can be controlled simply by operating the operating knob 43 mounted on a central portion of
10 the door member 64. The lock apparatus 4 is thus relatively convenient to operate.

CLAIMS:

1. A lock apparatus comprising:

- 5 a latch actuator including a rotary disc and a spindle which is secured to said rotary disc and which has an axis perpendicular to said rotary disc, said spindle having a first end projecting forwardly from said rotary disc, said rotary disc being rotatable about the axis of said spindle and having a latch mounting portion which is displaced from said spindle
- 10 in a radial direction with respect to said spindle;
- an elongated linking unit extending in a longitudinal direction perpendicular to the axis of said spindle, said linking unit having a first end mounted on said latch mounting portion of said rotary
- 15 disc, and an opposite second end distal to said rotary disc, said linking unit being movable by said rotary disc in the longitudinal direction when said rotary disc is rotated about the axis of said spindle;
- a latch bolt connected to said second end of said
- 20 linking unit and movable with said linking unit in the longitudinal direction; and
- a rotatable operating knob coupled to said first end of said spindle for co-rotation with said spindle and said rotary disc such that operation of said operating
- 25 knob can cause said rotary disc to rotate about the axis of said spindle for moving said latch bolt in the longitudinal direction, said operating knob being





operable to move between a locking position, in which said latch bolt is moved away from said latch actuator, and an unlocking position, in which said latch bolt is moved toward said latch actuator.

5 2. The lock apparatus according to Claim 1, wherein said latch mounting portion of said rotary disc is formed with an engaging hole, said first end of said linking unit extending into said latch mounting portion for engaging said engaging hole.

10 3. The lock apparatus according to Claim 1, further comprising an escutcheon plate disposed between said operating knob and said rotary disc, said escutcheon plate permitting extension of said spindle therethrough and being formed a resilient retaining protrusion which projects forwardly toward said
15 operating knob, said operating knob having an end wall formed with angularly displaced first and second retaining holes which are displaced radially from the axis of said spindle, said retaining protrusion
20 extending into and engaging releasably said first retaining hole when said operating knob is moved to the locking position for retaining said operating knob in the locking position, said retaining protrusion
25 extending into and engaging releasably said second retaining hole when said operating knob is moved to the unlocking position for retaining said operating knob in the unlocking position.

This Sheet Has Been Replaced





4. The lock apparatus according to Claim 3, wherein said first retaining hole is displaced from said second retaining hole by an angle of 90 degrees.

5. The lock apparatus according to Claim 3, wherein said
5 escutcheon plate is formed with an opening, and includes a spring member disposed in said opening, said spring member having a connecting end connected integrally to said escutcheon plate and a distal end formed with said retaining protrusion.

10 6. The lock apparatus according to Claim 1, further comprising:

a latch mounting seat formed with an elongated slide channel that extends along the longitudinal direction of said linking unit, said slide channel having an open
15 end to permit said second end of said linking unit to extend into said slide channel, said latch bolt being disposed slidably in said slide channel, said latch mounting seat being formed with a latch hole that is communicated with said slide channel and that permits
20 said latch bolt to project therefrom when said operating knob is operated to move to the locking position.

7. The lock apparatus according to Claim 6, wherein said latch mounting seat has a surrounding wall which
25 defines said slide channel, said surrounding wall being formed with a limiting flange that extends radially into said slide channel, said second end of said linking





unit being provided with a sliding block that extends slidably into said slide channel via said open end of said latch mounting seat, said sliding block being formed with first and second limiting projections that are spaced apart in the longitudinal direction and that has said limiting flange disposed therebetween for limiting movement of said latch bolt due to movement of said operating knob between locking and unlocking positions.

8. The lock apparatus according to Claim 1, wherein said spindle further has a second end projecting rearwardly from said rotary disc and formed with a bit engaging groove adapted for engaging a tool bit of a driving tool so as to permit said latch actuator to be operated by the driving tool for moving said latch bolt in the longitudinal direction.

9. The lock apparatus according to Claim 1, wherein said rotary disc has a front side, said latch mounting portion being formed on said front side of said rotary disc and being indented for extension of said first end of said linking unit thereinto.

10. The lock apparatus according to Claim 1, wherein said rotary disc is generally circular in shape and is formed with a pair of said latch mounting portions which are diametrically opposite to each other with respect to the axis of said spindle, said lock apparatus including an opposite pair of said linking units having





said first ends mounted on said latch mounting portions, respectively, and an opposite pair of said latch bolts connected to said second ends of said linking units, respectively.

