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Wu

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(54) **DOOR LOCK PERMITTING EASY CHANGE IN LOCK CORE ASSEMBLY ORIENTATION**

(71) Applicant: **I-TEK METAL MFG. CO., LTD**, Tainan (TW)

(72) Inventor: **Chang-Ren Wu**, Tainan (TW)

(73) Assignee: **I-Tek Metal Mfg. Co., Ltd.**, Tainan (TW)

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(51) **Int. Cl.**

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E05B 55/00	(2006.01)
E05B 3/00	(2006.01)
E05B 65/06	(2006.01)
E05B 9/08	(2006.01)

(52) **U.S. Cl.**
CPC ***E05B 63/04*** (2013.01); ***E05B 3/00*** (2013.01); ***E05B 55/005*** (2013.01); ***E05B 65/06*** (2013.01); *E05B 9/084* (2013.01); *E05B 13/108* (2013.01); *Y10T 70/7661* (2015.04)

(58) **Field of Classification Search**
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USPC ..... 70/215, 216, 461, 224, 367–374, 381,70/462, 466, DIG. 31, DIG. 39
See application file for complete search history.

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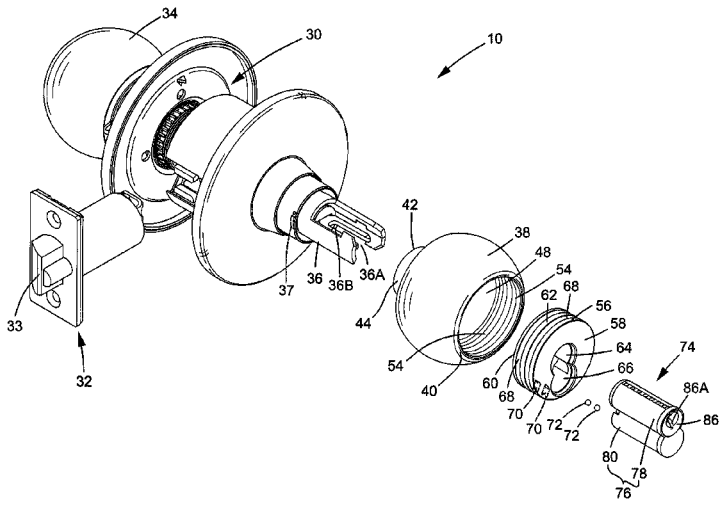
Primary Examiner — Lloyd Gall
(74) *Attorney, Agent, or Firm* — Alan D. Kamrath; Kamrath IP Lawfirm, P.A.

(57) **ABSTRACT**

A door lock (**10**) includes a driving device (**30**) having an outer spindle (**36**) and an outer handle (**38**) mounted to the outer spindle (**36**). A mounting member (**56**) is rotatably mounted in a compartment (**46**) of the outer handle (**38**). A positioning member (**72**) is movably received in a groove (**54**) of the outer handle (**38**). When a lock core (**74**) disengages from the mounting member (**56**), the mounting member (**56**) cannot move along a longitudinal axis but can pivot about a pivotal axis relative to the outer handle (**38**) to change a positional relationship between first and second holes (**64**, **66**) of the mounting member (**56**). After the lock core (**74**) engages with the mounting member (**56**), the mounting member (**56**) cannot pivot about the pivotal axis relative to the outer handle (**38**).

12 Claims, 11 Drawing Sheets



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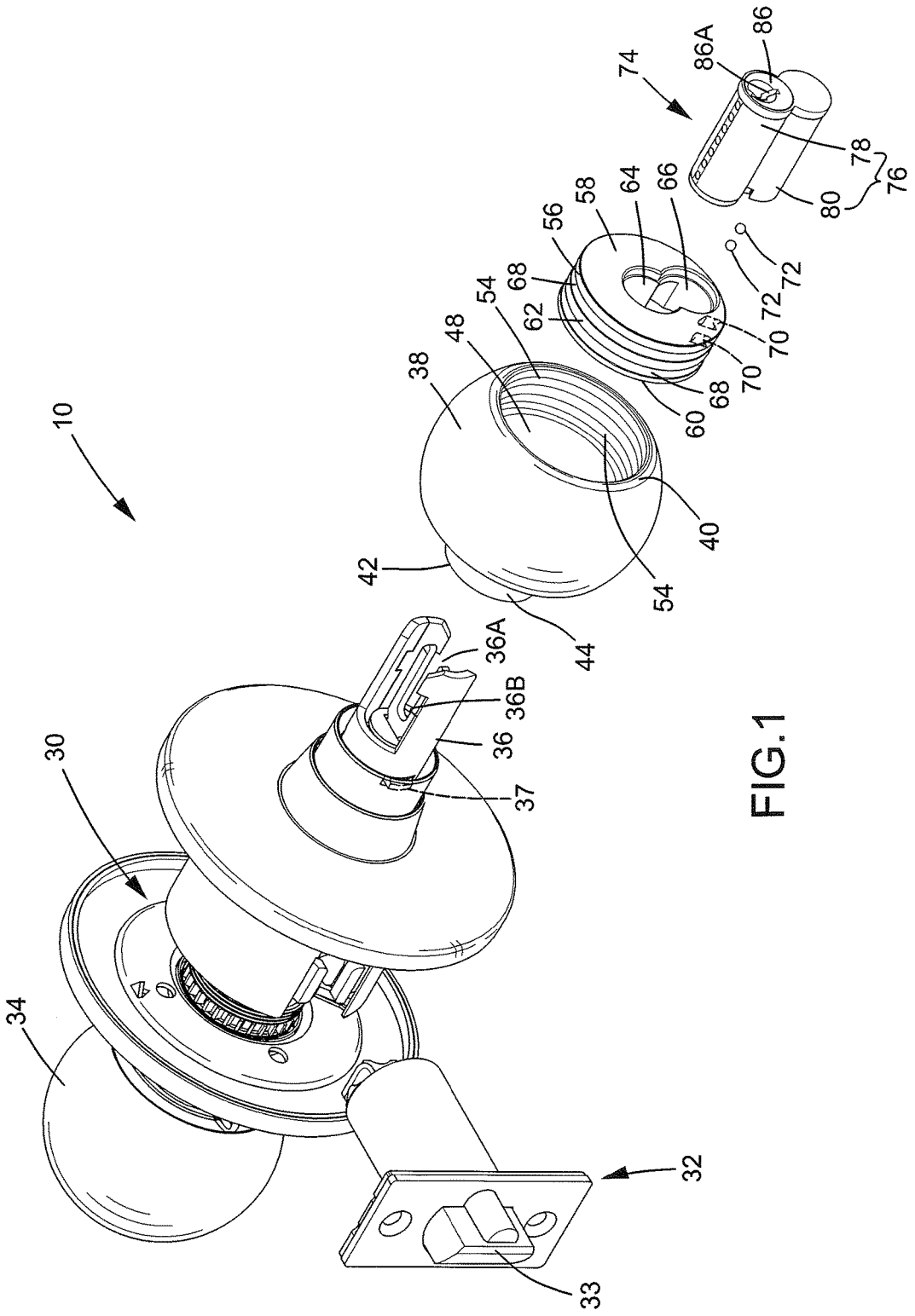
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FIG.1

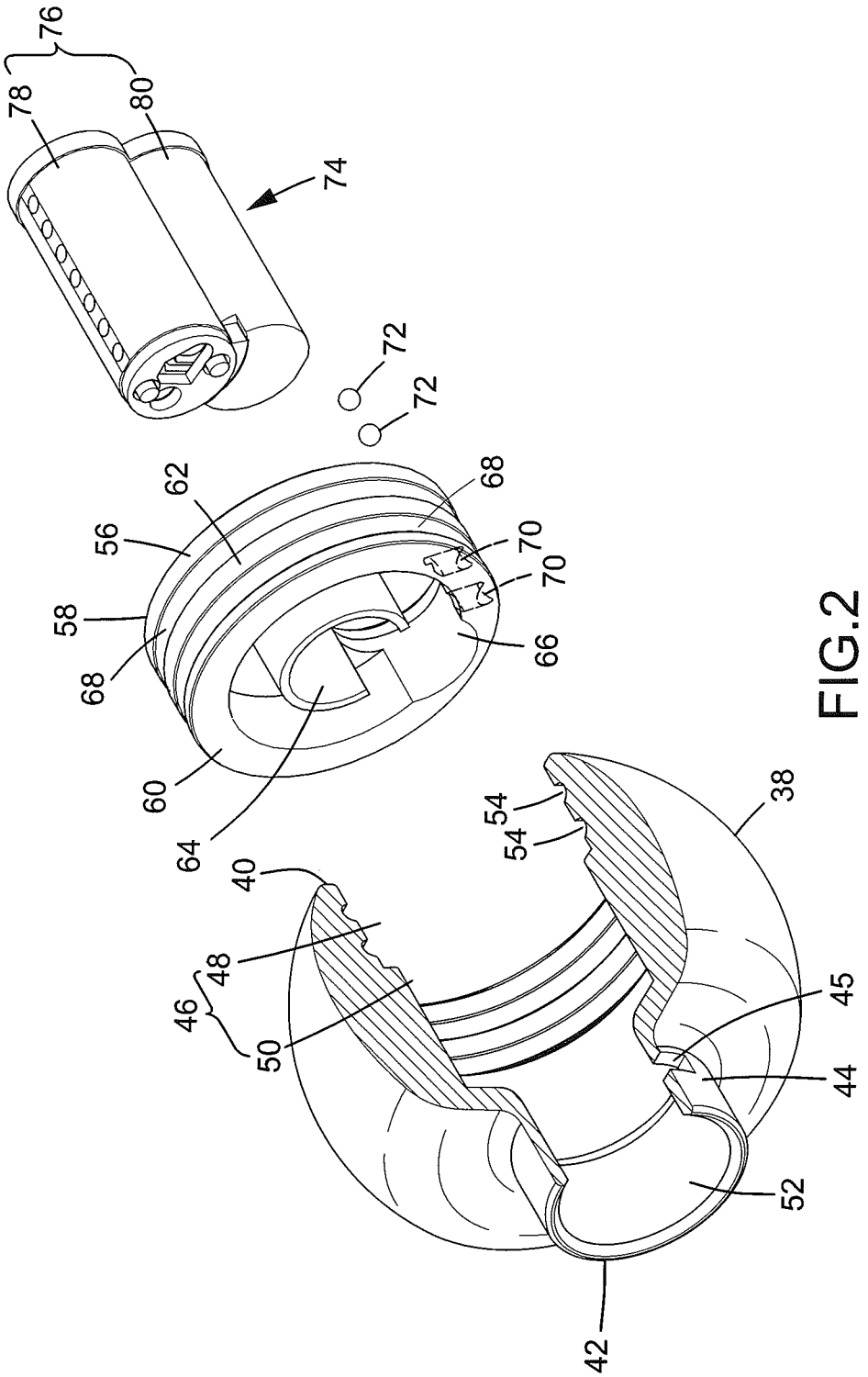
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FIG.2

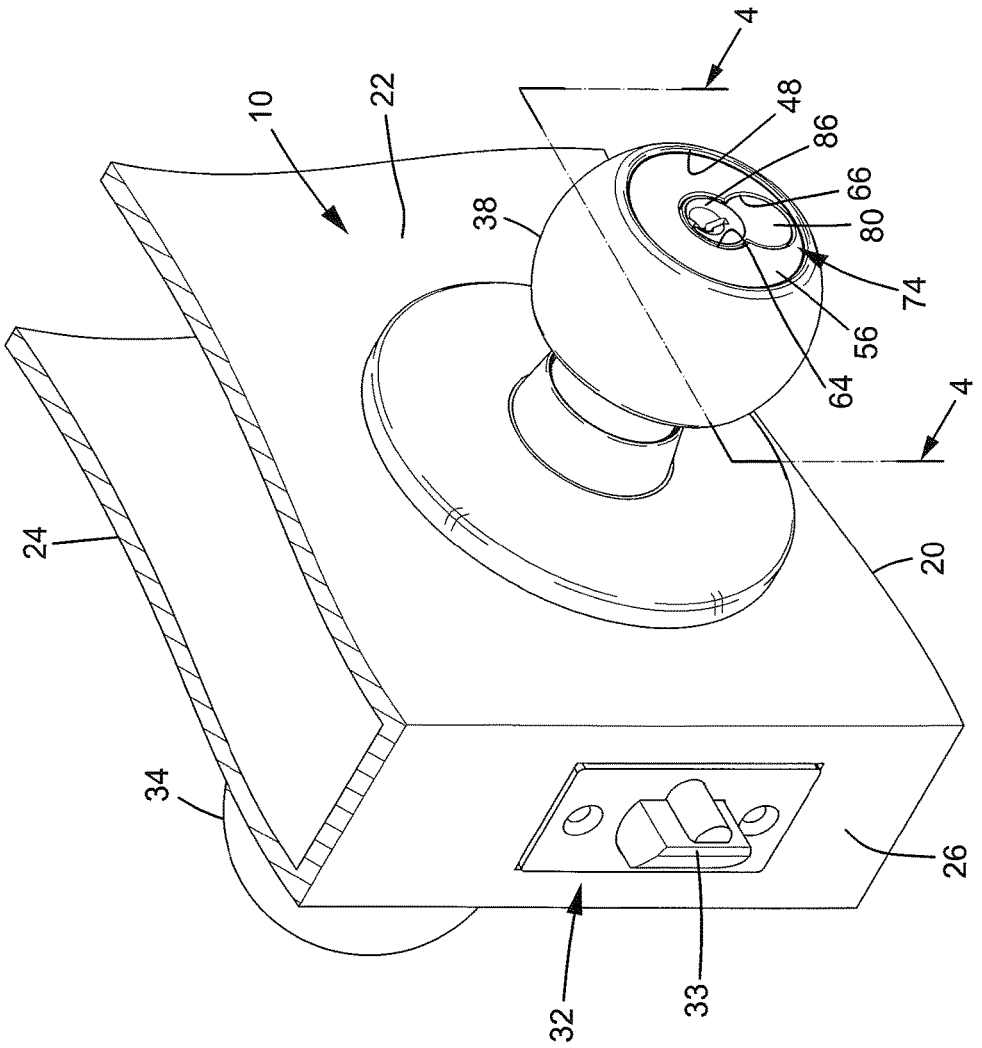

FIG.3

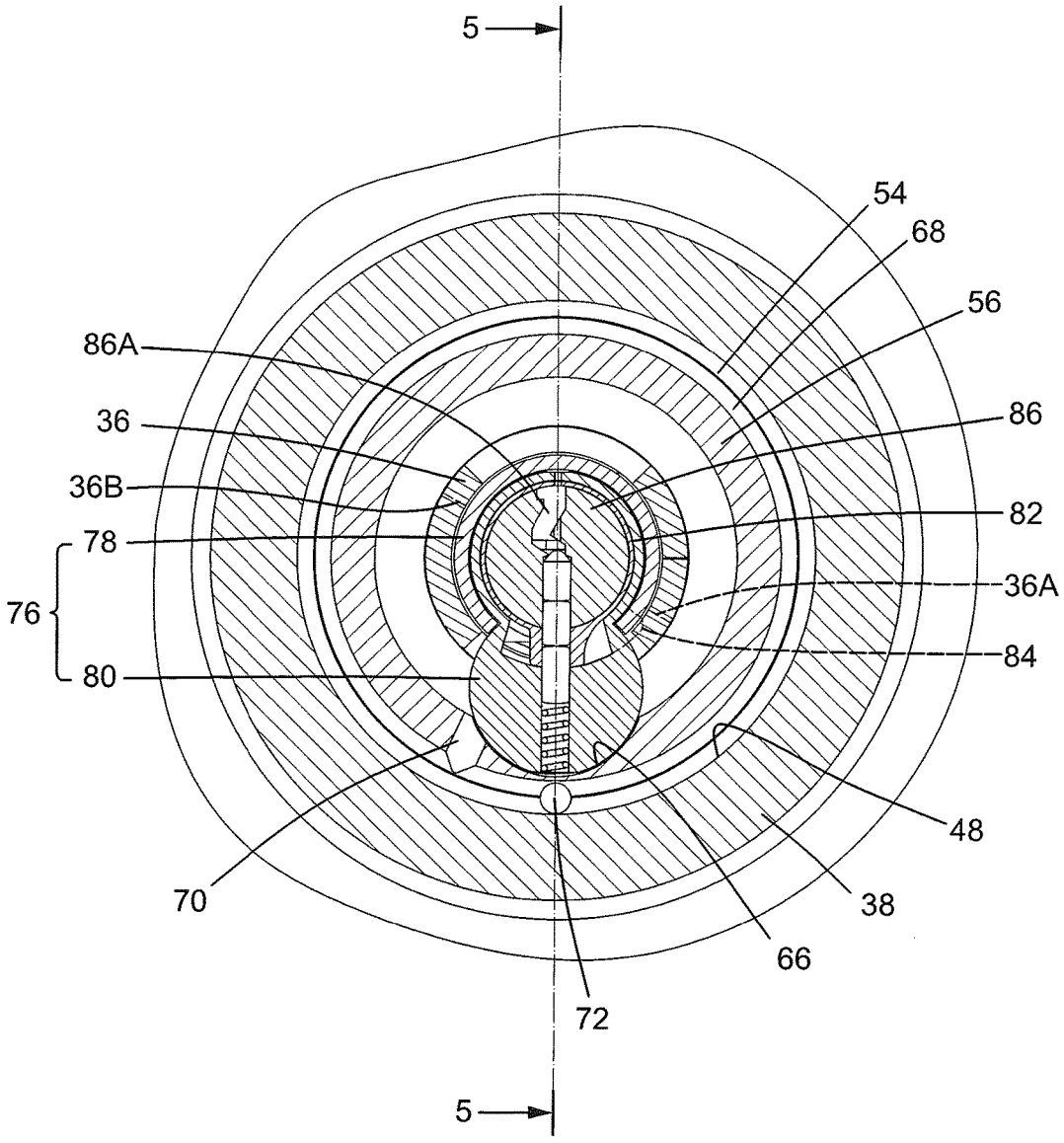

FIG.4

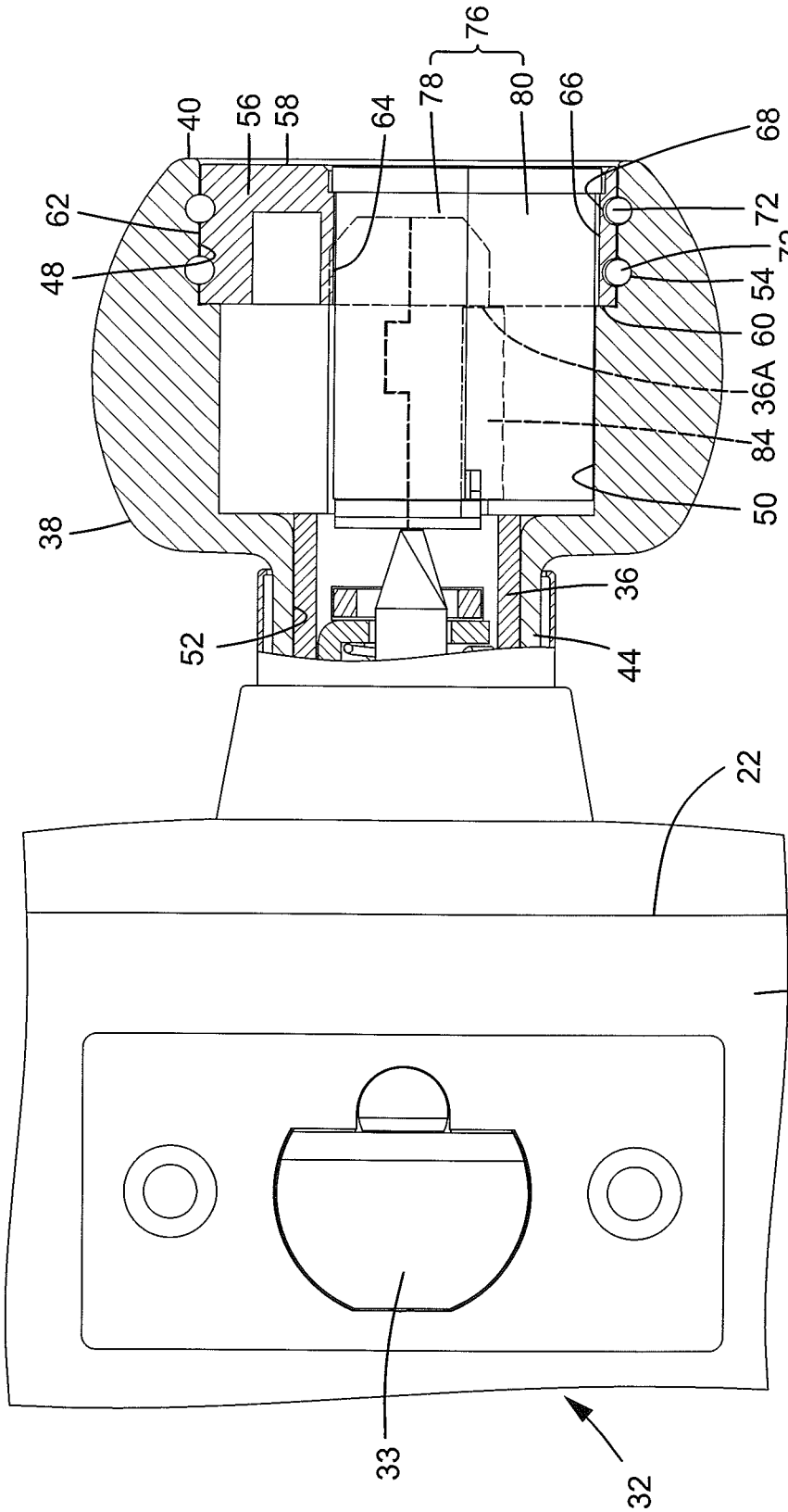
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FIG.5

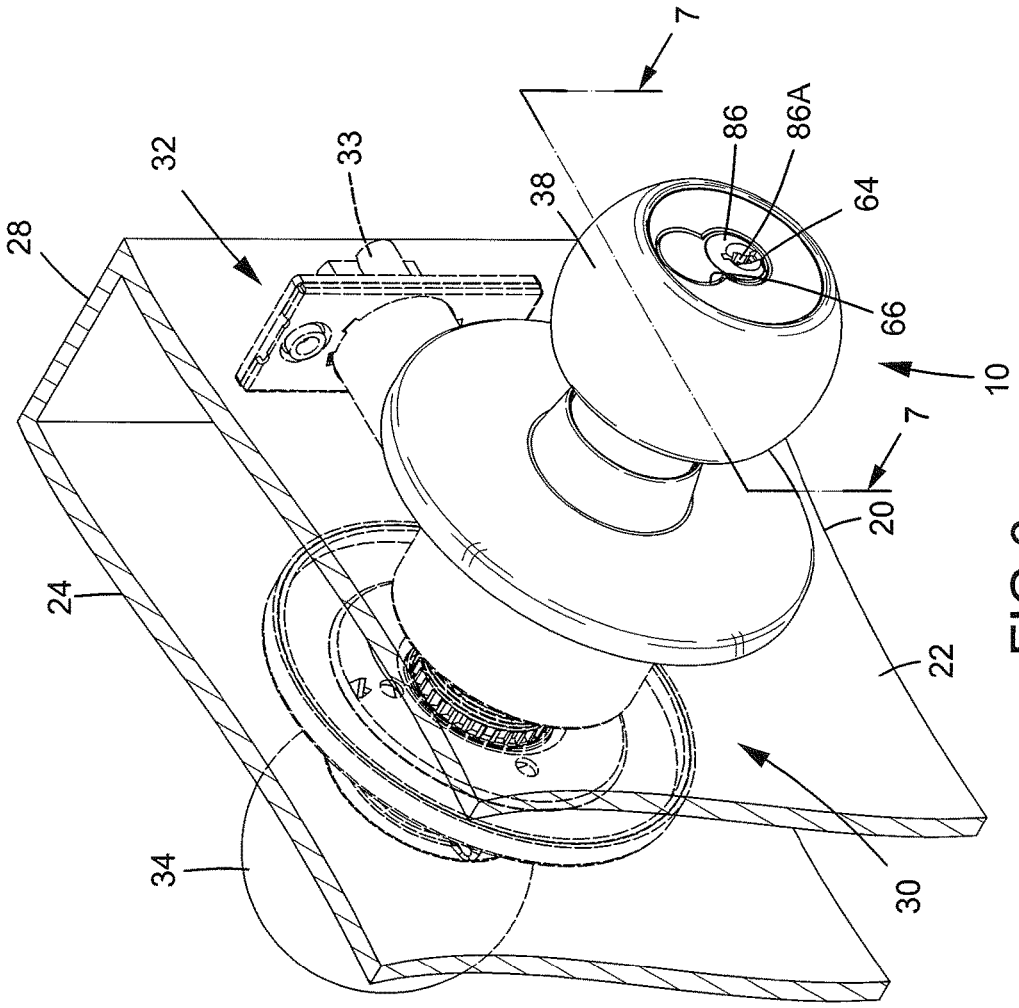

FIG.6

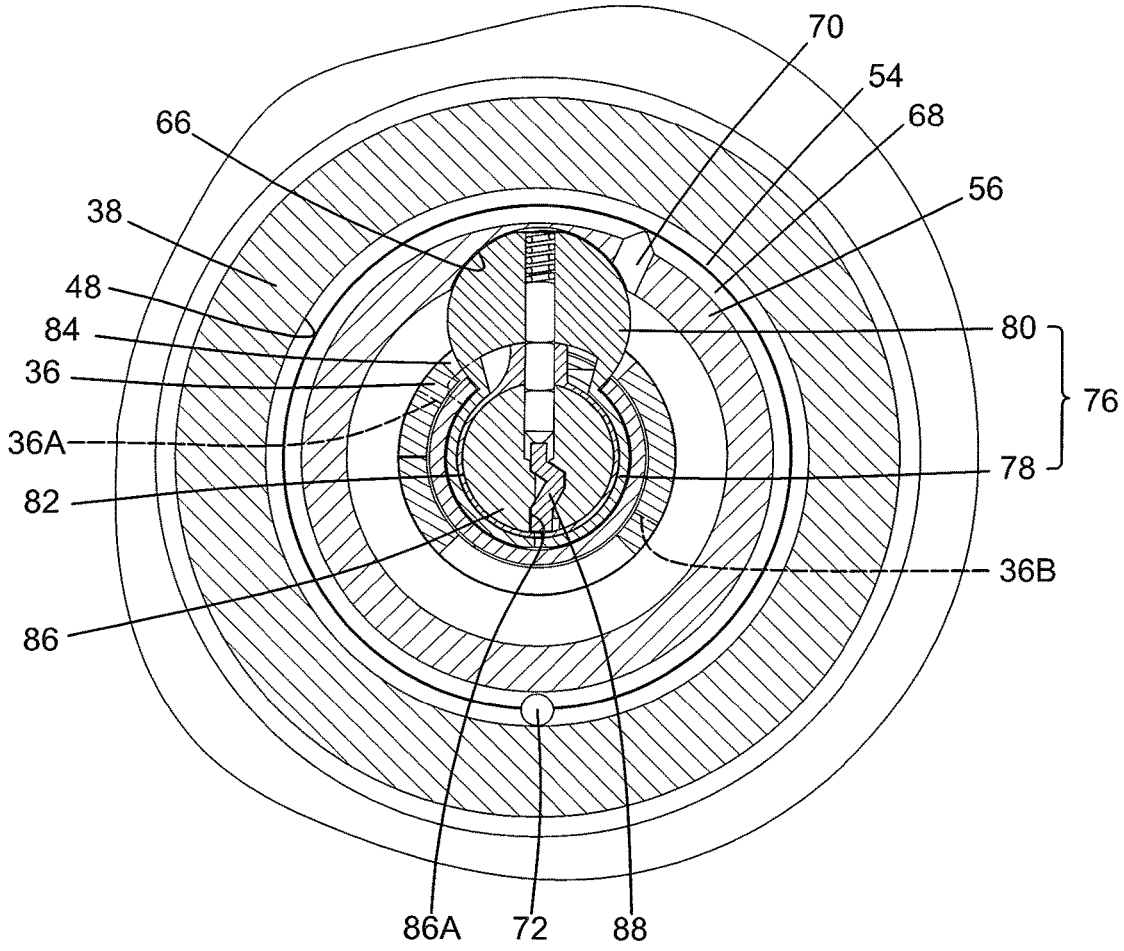

FIG.7

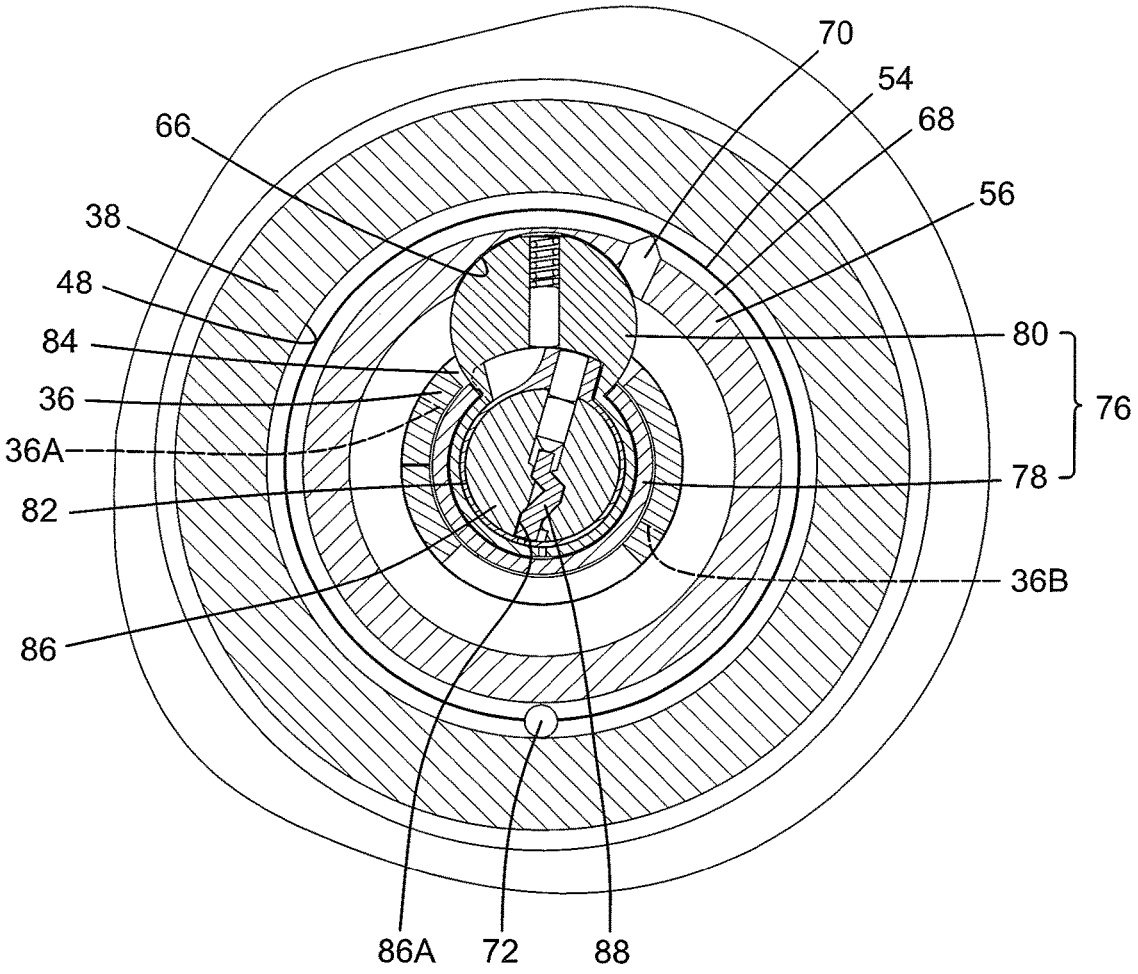

FIG.8

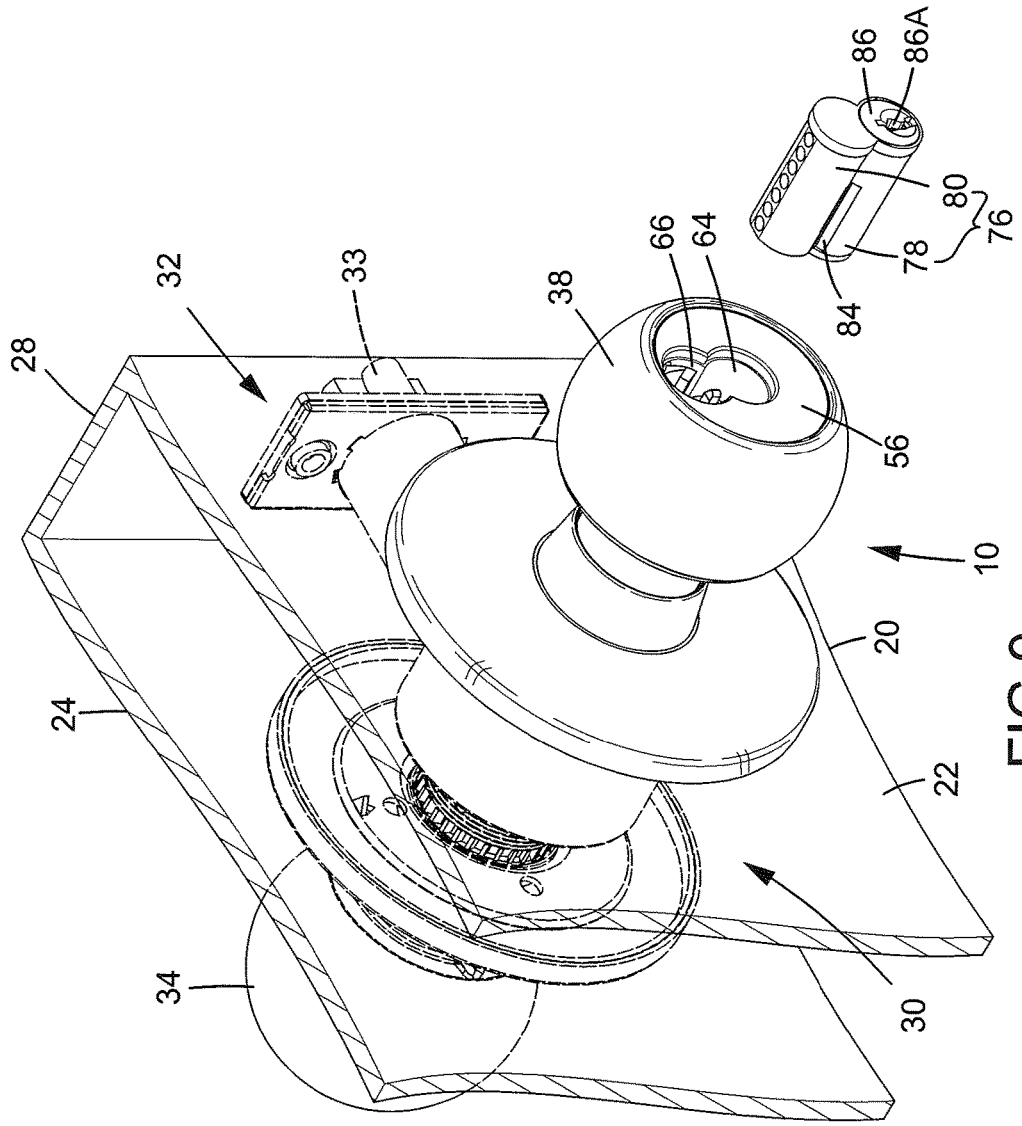

FIG.9

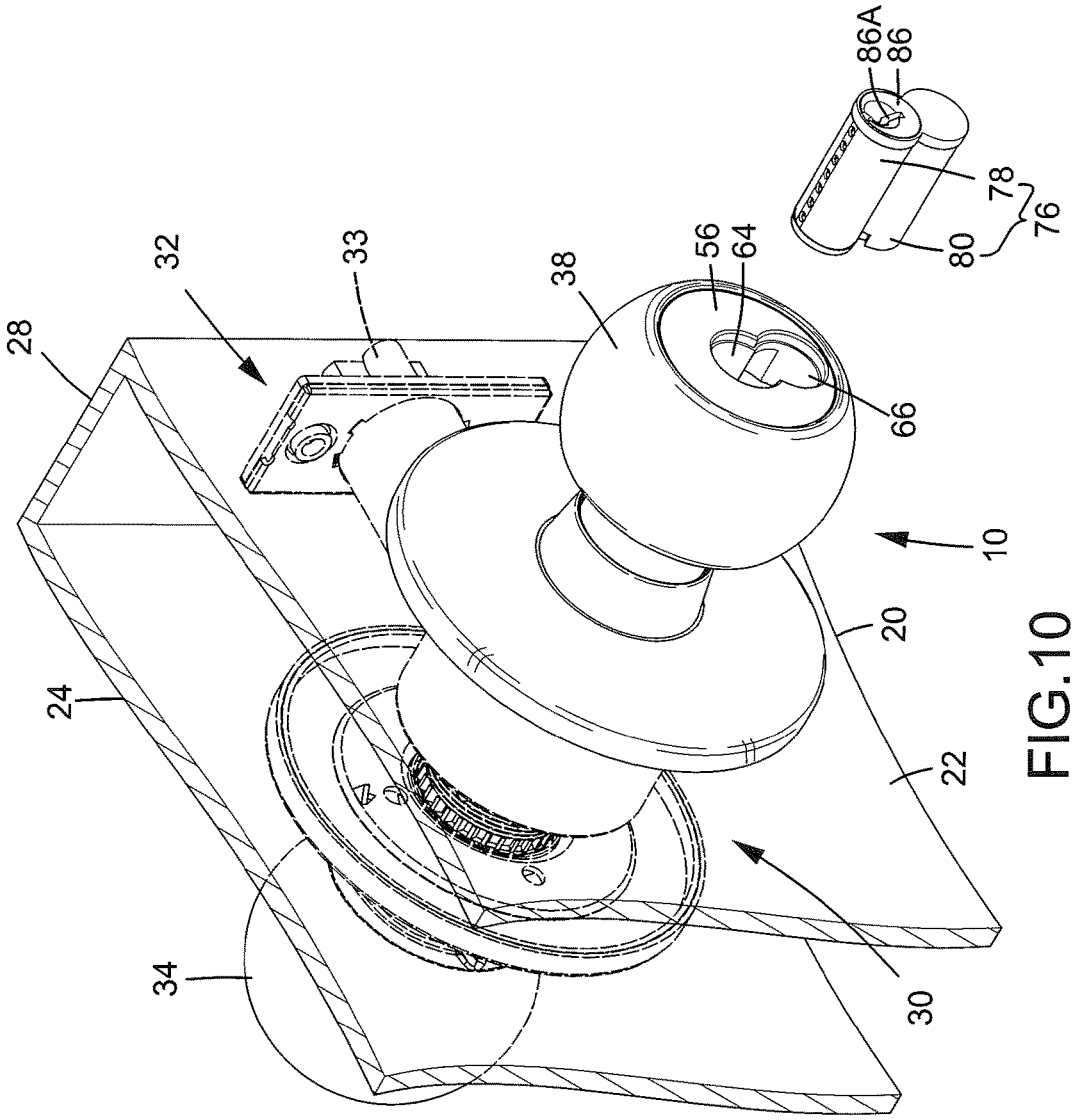

FIG.10

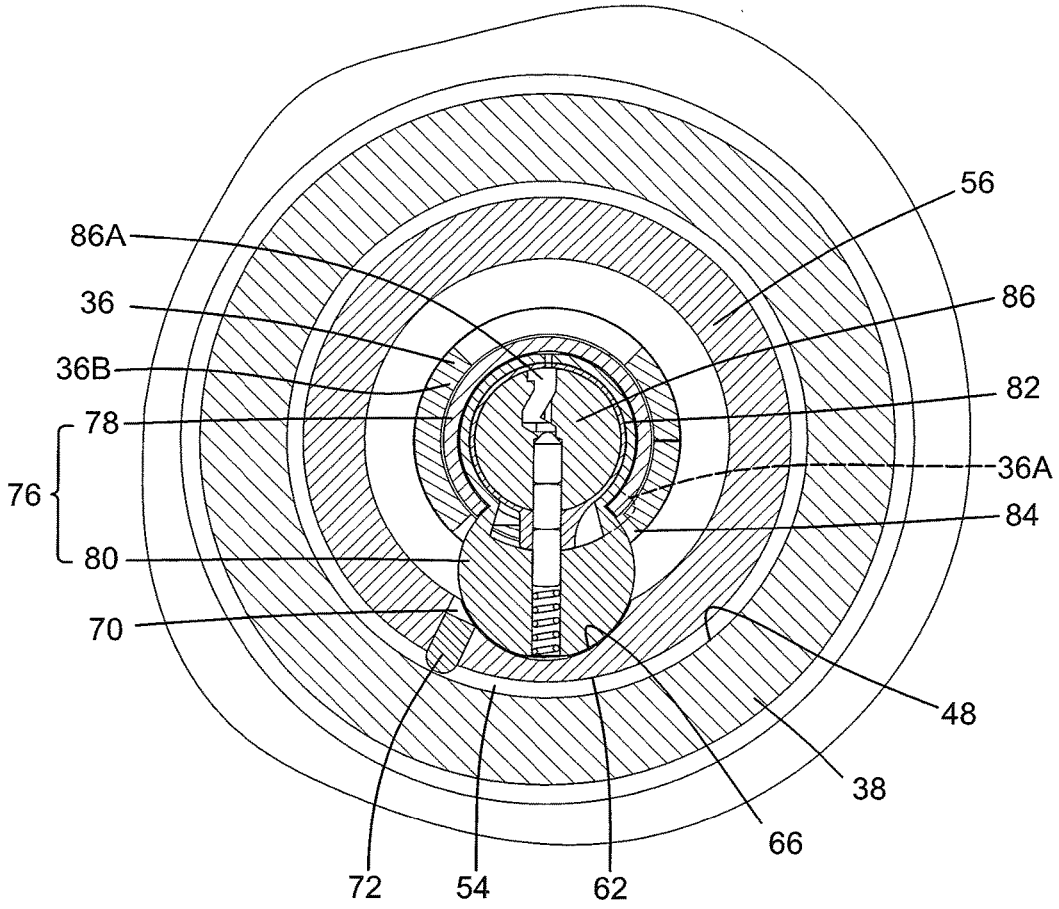

FIG.11

DOOR LOCK PERMITTING EASY CHANGE IN LOCK CORE ASSEMBLY ORIENTATION

BACKGROUND OF THE INVENTION

The present invention relates to a door lock permitting easy change in the lock core assembly orientation and, more particularly, to a door lock permitting an assembly orientation of a lock core of the door lock to be adjusted to the correct assembly orientation no matter the door is right-handed or left-handed, such that the orientation of the key inserted by the user is the same.

Doors are classified into left-handed type and right-handed type according to the type of the wall separating spaces. A left-handed door has a side end pivotably mounted to a door frame, and a door lock is mounted to a right side of the left-handed door, permitting opening and closing by the right side of the left-handed door. A right-handed door has a right side pivotably mounted to a door frame, and a door lock is mounted to a left side of the right-handed door, permitting opening and closing by the left side of the right-handed door. A pivotal direction of a lock core of the door lock mounted to the left side of the door is opposite to a pivotal direction of a lock core of the door lock mounted to the right side of the door, such that the orientation of the keyway of the lock core of the door lock mounted to the left side of the door is opposite to the orientation of the lock core of the door lock mounted to the right side of the door. Thus, the direction of rotating a key for unlocking the door lock could be different, too.

Replaceable figure 8-shaped lock cores have been proposed by manufacturers to solve this problem. Specifically, two keys are provided for a figure 8-shaped lock core, one of which can be used to unlock the door lock, and the other can be used to detach the lock core from the door lock to permit a change in the assembly orientation of the lock core. However, the cross sections of the figure-8 shaped lock cores are not circular, such that the cross sections of a compartment for receiving the lock core is not circular, either. Thus, in addition to detaching the lock core, the outer handle must be detached from the door lock for changing the assembly orientation of the lock core. Namely, the outer handle is reassembled to the correct direction (i.e., the opposite direction), and the lock core is recoupled to the outer handle. Furthermore, to achieve an anti-theft effect, the outer handle cannot be directly detached unless the components in the inner handle are detached. Thus, the assembly orientation of the lock core cannot be changed when only the lock core is detached, leading to insufficient utility.

BRIEF SUMMARY OF THE INVENTION

In a first aspect, a door lock includes a driving device having an outer spindle pivotable about a pivotal axis. A latch device is operably connected to the driving device and includes a latch. Pivotal movement of the outer spindle about the pivotal axis causes movement of the latch between a latching position and an unlatching position. An outer handle includes an outer end and an inner end spaced from the outer end along a longitudinal axis. The outer handle further includes a compartment extending from the outer end towards but spaced from the inner end of the outer handle. The compartment includes an inner periphery having a groove. The outer handle further includes an axial hole extending from the inner end of the outer handle and intercommunicating with the compartment. The outer handle is coupled to and jointly pivotable with the outer spindle. A mounting member is rotatably mounted in the compartment of the outer handle and includes a first end face and a second end face spaced from the first end face along the longitudinal axis. The mounting member further includes a first hole extending from the first end face through the second end face and aligned with the axial hole of the outer handle. The mounting member further includes a second hole extending from the first end face through the second end face. The second hole is located on a side of and intercommunicates with the first hole. A positioning member is movably received in the groove of the outer handle. The positioning member permits the mounting member to pivot about the pivotal axis and prevents the mounting member from moving relative to the outer handle along the longitudinal axis. A lock core includes a first portion and a second portion adjoining and extending parallel to the first portion. The lock core is detachably engaged with the mounting member.

When the lock core engages with the mounting member, the first portion of the lock core is received in the first hole of the mounting member, and the second portion of the lock core is received in the second hole of the mounting member, preventing the mounting member from pivoting about the pivotal axis relative to the outer handle.

When the lock core disengages from the mounting member, the mounting member is pivotable about the pivotal axis relative to the outer handle to change a positional relationship between the first and second holes of the mounting member.

In an example, the mounting member further includes an outer periphery extending between the first and second end faces of the mounting member. The mounting member further includes a through-hole extending from an inner periphery of the second hole in a radial direction perpendicular to the pivotal axis through the outer periphery of the mounting member. The through-hole is aligned with the groove of the outer handle. The positioning member includes a first end securely received in the through-hole and a second end slideably received in the groove of the outer handle.

In a second example, the positioning member moves through the through-hole into a space formed by the annular groove of the mounting member and the groove of the outer handle.

In an example, each of the first and second holes has a central axis. The central axes of the first and second holes spaced from each other in a spacing direction. The through-hole has a central axis at a non-parallel angle to the spacing direction.

The lock core can include a positioning sleeve configured to be unlocked and pivoted by a key. The positioning sleeve includes a lug formed on an outer periphery thereof. The key can be operated to pivot the lug between an extended, engagement position and a retracted, detachment position. When the lug is in the extended, engagement position, the lug abuts the second end face of the mounting member to prevent the lock core from disengaging from the mounting member along the longitudinal axis, thereby positioning the lock core. When the lug is in the retracted, detachment position, the lug is spaced from the second end face of the mounting member to permit the lock core to move relative to the mounting member along the longitudinal axis, disengaging the lock core from the mounting member.

The outer spindle can further include a first insertion groove and a second insertion groove spaced from the first insertion groove by 180° in a circumferential direction about the pivotal axis. When the lug is in the extended, engage-

ment position, the lug abuts an inner wall of one of the first and second insertion grooves to prevent the lock core from disengaging from the mounting member along the longitudinal axis, thereby positioning the lock core. When the lug is in the retracted, detachment position, the lug is spaced from the inner walls of the first and second insertion grooves to permit the lock core to move relative to the mounting member along the longitudinal axis, disengaging the lock core from the mounting member and the outer spindle.

In a second aspect, a door lock includes a driving device having an outer spindle pivotable about a pivotal axis. The driving device is adapted to be mounted to a door having a first end face and a second end face opposite to the first end face. The door further includes a first side extending between the first and the second end faces. The outer spindle has a distal end located on an outer end of the first side of the door. A latch device is operably connected to the driving device and includes a latch. Pivotal movement of the outer spindle causes movement of the latch between a latching position and an unlatching position. The latch device is configured to be mounted to one of the first and second end faces of the door. An outer handle includes an outer end and an inner end spaced from the outer end along a longitudinal axis of the outer spindle. The outer handle further includes a compartment extending from the outer end towards but spaced from the inner end of the outer handle. The compartment includes an inner periphery having a groove. The outer handle further includes an axial hole extending from the inner end of the outer handle and intercommunicating with the compartment. The outer handle is coupled to and jointly pivotable with the outer spindle. A mounting member is rotatably mounted in the compartment of the outer handle. The mounting member includes a first end face and a second end face spaced from the first end face along the longitudinal axis. The mounting member further includes a first hole extending from the first end face through the second end face and aligned with the axial hole of the outer handle. The mounting member further includes a second hole extending from the first end face through the second end face. The second hole is located on a side of and intercommunicates with the first hole. A positioning member is movably received in the groove of the outer handle. The positioning member permits the mounting member to pivot about the pivotal axis and prevents the mounting member from moving relative to the outer handle along the longitudinal axis. A lock core includes a first portion and a second portion adjoining and extending parallel to the first portion. The lock core is detachably engaged with the mounting member.

When the lock core engages with the mounting member, the first portion of the lock core is received in the first hole of the mounting member, and the second portion of the lock core is received in the second hole of the mounting member, preventing the mounting member from pivoting about the pivotal axis relative to the outer handle to change a positional relationship between the first and second holes of the mounting member. When the lock core disengages from the mounting member, the mounting member is pivotable about the pivotal axis relative to the outer handle.

When the latch device is mounted to the first end face of the door, the second portion of the lock core is located right below the first portion of the lock core in a vertical direction perpendicular to the pivotal axis. When the latch device is mounted to the second end face of the door, the second portion of the lock core is located right below the first portion of the lock core in a vertical direction perpendicular to the pivotal axis.

In an example, the mounting member further includes an outer periphery extending between the first and second end faces of the mounting member. The mounting member further includes a through-hole extending from an inner periphery of the second hole in a radial direction perpendicular to the pivotal axis through the outer periphery of the mounting member. The through-hole is aligned with the groove of the outer handle. The positioning member includes a first end securely received in the through-hole and a second end slideably received in the groove of the outer handle.

In a second example, the positioning member moves through the through-hole into a space formed by the annular groove of the mounting member and the groove of the outer handle.

In an example, each of the first and second holes has a central axis. The central axes of the first and second holes spaced from each other in a spacing direction. The through-hole has a central axis at a non-parallel angle to the spacing direction.

The lock core can include a positioning sleeve configured to be unlocked and pivoted by a key. The positioning sleeve includes a lug formed on an outer periphery thereof. The key can be operated to pivot the lug between an extended, engagement position and a retracted, detachment position. When the lug is in the extended, engagement position, the lug abuts the second end face of the mounting member to prevent the lock core from disengaging from the mounting member along the longitudinal axis, thereby positioning the lock core. When the lug is in the retracted, detachment position, the lug is spaced from the second end face of the mounting member to permit the lock core to move relative to the mounting member along the longitudinal axis, disengaging the lock core from the mounting member.

The outer spindle can further include a first insertion groove and a second insertion groove spaced from the first insertion groove by 180° in a circumferential direction about the pivotal axis. When the lug is in the extended, engagement position and the latch device is mounted to the first end face of the door, the lug abuts an inner wall of the first insertion groove to prevent the lock core from disengaging from the mounting member along the longitudinal axis, thereby positioning the lock core. When the lug is in the extended, engagement position and the latch device is mounted to the second end face of the door, the lug abuts an inner wall of the second insertion groove to prevent the lock core from disengaging from the mounting member along the longitudinal axis, thereby positioning the lock core. When the lug is in the retracted, detachment position and the latch device is mounted to the first end face of the door, the lug is spaced from the inner wall of the first insertion groove to permit the lock core to move relative to the mounting member along the longitudinal axis, disengaging the lock core from the mounting member and the outer spindle. When the lug in the retracted, detachment position and the latch device is mounted to the second end face of the door, the lug is spaced from the inner wall of the second insertion groove to permit the lock core to move relative to the mounting member along the longitudinal axis, disengaging the lock core from the mounting member and the outer spindle.

The present invention will become clearer in light of the following detailed description of illustrative embodiments of this invention described in connection with the drawings.

DESCRIPTION OF THE DRAWINGS

The illustrative embodiments may best be described by reference to the accompanying drawings where:

FIG. **1** is a partly exploded perspective view of a door lock of a first example according to the present invention.

FIG. **2** is an exploded, perspective view of an outer handle, a mounting member, and a lock core of the door lock of FIG. **1**.

FIG. **3** is a perspective view of the door lock of FIG. **1** mounted to a first side of a door and showing that the assembly orientation of the lock core is correct.

FIG. **4** is a cross sectional view taken along section line **4-4** of FIG. **3**.

FIG. **5** is a cross sectional view taken along section line **5-5** of FIG. **4**.

FIG. **6** is a perspective view of the door lock of FIG. **1** mounted to a second side of the door and showing that the assembly orientation of the lock core is incorrect.

FIG. **7** is a cross sectional view taken along section line **7-7** of FIG. **6**.

FIG. **8** is a cross sectional view similar to FIG. **7**, with a lug moved from an engagement position to a detachment position by using a key for detaching the lock core.

FIG. **9** is a perspective view similar to FIG. **6**, with the lock core detached from the mounting member.

FIG. **10** is a perspective view similar to FIG. **9**, with the lock core rotated 180°.

FIG. **11** is a cross sectional view of the outer handle, the mounting member, and the lock core of a second example according to the present invention.

All figures are drawn for ease of explanation of the basic teachings only; the extensions of the figures with respect to number, position, relationship, and dimensions of the parts to form the illustrative embodiments will be explained or will be within the skill of the art after the following teachings have been read and understood. Further, the exact dimensions and dimensional proportions to conform to specific force, weight, strength, and similar requirements will likewise be within the skill of the art after the following teachings have been read and understood.

Where used in the various figures of the drawings, the same numerals designate the same or similar parts. Furthermore, when the terms "first", "second", "lower", "upper", "bottom", "side", "end", "portion", "section", "vertical", "length", and similar terms are used herein, it should be understood that these terms have reference only to the structure shown in the drawings as it would appear to a person viewing the drawings and are utilized only to facilitate describing the illustrative embodiments.

DETAILED DESCRIPTION OF THE INVENTION

With reference to FIGS. **1-10**, a door lock **10** of a first example according to the present invention is mounted to a door **20** including a first side **22** and a second side **24** opposite to and parallel to the first side **22**. Door **20** further includes first and second end faces **26** and **28** extending between first and second sides **22** and **24** and parallel to and opposite to each other.

Door lock **10** includes a driving device **30** and an inner handle **34** operably connected to driving device **30**. Door lock **10** further includes an outer spindle **36** operably connected to the driving device **30**. Outer spindle **36** is pivotable about a pivotal axis and includes an engagement piece **37** provided on an outer periphery thereof. Engagement piece **37** can retract in a radial direction. Two legs are provided on a distal end of outer spindle **36**. A first insertion groove **36**A is provided on a lower side of one of the two legs. A second insertion groove **36**B is provided on an upper side of the other leg and is spaced from the first insertion groove **36**A by 180° in a circumferential direction about the pivotal axis. Door lock **10** further includes a latch device **32** having a latch **33**. Pivotal movement of outer spindle **36** causes movement of latch **33** between a latching position and an unlatching position.

Door lock **10** further includes an outer handle **38** coupled to and jointly pivotable with outer spindle **36**. Outer handle **38** includes an outer end **40** and an inner end **42** spaced from outer end **40** along a longitudinal axis. In this embodiment, the longitudinal axis is coincident to the pivotal axis. A neck **44** is formed on inner end **42**. Outer handle **38** further includes a compartment **46** extending from outer end **40** towards but spaced from inner end **42**. Compartment **46** includes a first section **48** extending from outer end **40** along the longitudinal axis and a second section **50** extending from a bottom end of first section **48**. Second section **50** has an inner diameter smaller than an inner diameter of first section **48**. Two grooves **54** are defined in an inner periphery of first section **48** and are spaced from each other along the longitudinal axis. Grooves **54** are annular in this example. Outer handle **38** further includes an axial hole **52** extending from inner end **42** along the longitudinal axis and intercommunicating with second section **50** of compartment **46**. An inner diameter of axial hole **52** is slightly larger than outer spindle **36**. Neck **44** includes an engagement groove **45** extending radially inwards from an outer periphery of neck **44** and intercommunicating with axial hole **52**.

Outer spindle **36** is coupled in axial hole **52** of outer handle **38**. Engagement piece **37** engages with engagement groove **45** of outer handle **38**. Thus, when outer handle **38** is pivoted, outer spindle **36** is actuated through transmission by engagement piece **37** to pivot about the pivotal axis, which, in turn, actuates inner components of driving device **30**, thereby moving latch **33** from the latching position to the unlatching position.

Door lock **10** further includes a mounting member **56** coupled to outer handle **38**. In this example, mounting member **56** has circular cross sections and includes a first end face **58** and a second end face **60** spaced from first end face **58** along the longitudinal axis and parallel to first end face **58**. Mounting member **56** further includes a first hole **64** extending from first end face **58** through second end face **60** and aligned with axial hole **52** of outer handle **38**. Mounting member **56** further includes a second hole **66** extending from first end face **58** through second end face **60**. Second hole **66** is located on a side of and intercommunicates with first hole **64**. Thus, first and second holes **64** and **66** together have substantially figure-8 shaped cross sections.

In this example, two annular grooves **68** are defined in an outer periphery **62** of mounting member **56** and are spaced from each other along the longitudinal axis. Mounting member **56** further includes two through-holes **70**. Each through-hole **70** extends from an inner periphery of second hole **66** in a radial direction perpendicular to the pivotal axis to one of annular grooves **68**. Each through-hole **70** is aligned with one of annular grooves **68** of mounting member **56** and one of grooves **54** of outer handle **38**. Each of first and second holes **64** and **66** has a central axis. The central axes of first and second holes **64** and **66** are spaced from each other in a spacing direction. Each through-hole **70** has a central axis at a non-parallel angle to the spacing direction.

Mounting member **56** is rotatably mounted in compartment **46** of the outer handle **38**. Annular grooves **68** of mounting member **56** are aligned with grooves **54** of outer handle **38** (FIG. **5**), such that each annular groove **68** and the associated groove **54** together form an annular space. First

end face **58** of mounting member **56** is substantially flush with outer end **40** of outer handle **38**. Second end face **60** abuts an intersection of first and second sections **48** and **50**.

Each of two positioning members **72** in the form of two balls is moved through one of through-holes **70** into one of the annular spaces formed by one of annular grooves **68** of mounting member **56** and one of grooves **54** of outer handle **38**. Thus, each positioning member **72** is movable between mounting member **56** and outer handle **38**. Since the central axis of each through-hole **70** is at a non-parallel angle to the spacing direction of the central axes of first and second holes **64** and **66**, each positioning member **72** which has passed through an associated through-hole **70** falls downward due to the gravitational force and, thus, misaligns from the associated through-hole **70**, preventing positioning member **72** from passing through the associated through-hole **70** in the reverse direction and subsequent disengagement from outer handle **38** and mounting member **56**. Furthermore, the outer diameter of each positioning member **72** is slightly smaller than the radial length of the associated annular space defined by the associated groove **54** and the associated annular groove **68**, such that positioning members **72** between outer handle **38** and mounting member **56** permit outer spindle **36** to pivot relative to outer handle **38** about the pivotal axis and prevent mounting member **56** from disengaging from outer handle **38** along the longitudinal axis.

Door lock **10** further includes a lock core **74** detachably mounted to mounting member **56**. Lock core **74** includes a housing **76** having a first portion **78** and a second portion **80** parallel to and adjoining first portion **78**, such that outer housing **76** has substantially figure-8 shaped cross sections. First portion **78** is pivotably received in a positioning sleeve **82** which has a lug **84** on an outer periphery thereof Lock core **74** further includes a shaft **86** rotatably mounted in positioning sleeve **82**. Shaft **86** includes a keyway **86**A extending from an end face through the other end face of shaft **86**. Two keys can be inserted into keyway **86**A. One of the keys can unlock the locking state of shaft **86** (positioning sleeve **82** remains locked and cannot pivot) and can further drive driving device **30** to move latch **33** between the latching position and the unlatching position. The other key can unlock the locking state of positioning sleeve **82** to permit joint pivotal movement of positioning sleeve **82** and shaft **86**, pivoting lug **84** of positioning sleeve **82** about the pivotal axis between the extended, engagement position outside of homing **76** and the retracted, detachment position inside of housing **76**.

In a case that mounting member **56** is rotated to a position in which second hole **66** is right below first hole **64** in a vertical direction perpendicular to the longitudinal axis while lug **84** is in the retracted, detachment position, first portion **78** of lock core **74** can be inserted into first hole **64** of mounting member **56** via first end face **58** of mounting member **56**, and second portion **80** is received in second hole **66**. Furthermore, first portion **78** is coupled with outer spindle **36**. The two legs of outer spindle **36** abut the outer periphery of second portion **80** of housing **76**. Thus, lock core **74** cannot pivot relative to outer spindle **36** but can pivot jointly with outer spindle **36**. Lug **84** of positioning sleeve **82** is aligned with first insertion groove **36**A of outer spindle **36**. An outer end face of housing **76** of lock core **74** is substantially flush with first end face **58** of mounting member **56**. The key for operating positioning sleeve **82** can be used to pivot positioning sleeve **82**, moving lug **84** from the retracted, detachment position to the extended, engagement position (FIGS. **4** and **5**). Thus, an end of lug **84** abuts second end face **60** of mounting member **56** and an inner wall of first insertion groove **36**A of outer spindle **36**, such that lock core **74** cannot disengage from outer spindle **36** and mounting member **56** along the longitudinal axis. Furthermore, second portion **80** of lock core **74** is right below first portion **78**. Thus, outer handle **38** can be pivoted to cause joint pivotal movement of outer spindle **36**, mounting member **56**, and lock core **74**.

Assume door **20** is mounted as a left-handed type (second end face **28** is pivotably connected to a door frame), and first end face **26** is movable between a closed position aligned with the door frame and an open position misaligned from the door frame. In this case, door lock **10** is mounted to a location of door **20** adjacent to first end face **26** (FIG. **3**). Specifically, driving device **30** is fixed to first and second sides **22** and **24** of door **20** and is adjacent to first end face **26**. Latch device **32** is fixed to first end face **26** of door **20**, and latch **33** in the latching position is beyond first end face **26**. An inclined face of latch **33** faces second side **24** of door **20**. Inner handle **34** is on second side **24** of door **20**. Outer handle **38**, mounting member **56**, and lock core **74** are on first side **22** of door **20**. Assume that the assembly orientation of lock core **74** is that second portion **80** is right below first portion **78** after door lock **10** has been installed to door **20**, the assembly orientation of lock core **74** is correct and, thus, does not need to change the assembly orientation of lock core **74**. In this case, first side **22** of door **20** is deemed as the outer side, and second side **24** of door **20** is deemed as the inner side. Thus, door **20** is pivoted to open if door **20** is pushed from first side **22** towards second side **24**. On the other hand, door **20** is pivoted to the closed position if door **20** is pushed from second side **24** towards first side **22**.

Inner handle **34** or outer handle **38** can be pivoted to move latch **33** from the latching position to the unlatching position. If door lock **10** is set in the locking state in which outer spindle **36** and outer handle **38** cannot be pivoted (but inner handle **34** can be pivoted), the key for unlocking shaft **86** can be used to rotate shaft **86** to switch door lock **10** to the unlocked state, such that latch **33** can be moved from the latching position to the unlatching position upon pivotal movement of outer spindle **36** and outer handle **38**.

Given first side **22** of door **20** is the outer side and second side **24** is the inner side, if door **20** is mounted in a manner that first end face **26** is pivotably connected to the door frame while second end face **28** is movable between a closed position aligned with the door frame and an open position misaligned from the door frame, door lock **10** must be mounted to a location adjacent to second end face **28** (FIG. **6**). Specifically, driving device **30** is fixed to first and second sides **22** and **24** and is located adjacent to second end face **28** of door **20**, and latch device **32** is fixed to second end face **28**. Latch **33** in the latching position is beyond second end face **28** of door **20**. The inclined face of latch **33** faces second side **24** of door **20**. Inner handle **34** is on second side **24** of door **20**. Outer handle **38**, mounting member **56**, and lock core **74** are on first side **22** of door **20**.

It can be appreciated that it is not necessary to detach components on the side of outer handle **38** during installation of door lock **10** on door **20**. Since outer handle **38** and lock core **74** are assembled together, outer handle **38** is generally mounted to the outer side of door **20** to provide an anti-theft effect. Outer handle **38** cannot be detached without detaching inner handle **34** and the components on the side of the inner handle **34**. Given the above arrangement, if the assembly orientation of lock core **74** is that second portion **80** is right above first portion **78** (which is the wrong direction, see FIGS. **6** and **7**), it is necessary to insert the key **88** for detaching lock core into keyway **86**A (FIG. **7**) and

then pivot the key **88** to pivot positioning sleeve **82**, moving lug **84** from the extended, engagement position to the retracted, detachment position. Thus, lug **84** is spaced from first insertion groove **36**A of outer spindle **36** and second end face **60** of mounting member **56**, permitting lock core **74** to be disengaged from mounting member **56** and outer spindle **36** along the longitudinal axis.

After lock core **74** restricting mounting member **56** has been detached (FIG. **9**), mounting member **56** can be rotated relative to outer handle **38** about the pivotal axis until second hole **66** of mounting member **56** is right below first hole **64** (FIG. **10**). Namely the positional relationship between first and second holes **64** and **66** of mounting member **56** is changed. Next, lock core **74** is reassembled with mounting member **56** and outer spindle **36**. Then, key **88** is used to pivot positioning sleeve **82**, moving lug **84** from the retracted, detachment position to the extended, engagement position. Thus, mounting member **56** is again restricted by lock core **74** and outer spindle **36**, such that mounting member **56** can only pivot together with outer handle **38** and outer spindle **36**. Furthermore, lock core **74** cannot disengage from outer spindle **36** and mounting member **56** along the longitudinal axis. Lock core **74** has been assembled to be in the correct assembly orientation in which second portion **80** is right below first portion **78**. Thus, door lock **10** can be mounted to door **20** with the assembly orientation of lock core **74** remaining the same and correct.

Since door lock **10** permits the assembly orientation of lock core **74** mounted to mounting member **56** can be changed without detaching outer handle **38**, manufacturers do not have to consider whether the assembly orientation of lock core **74** meets the user need, because the assembly orientation of lock core **74** can be changed by using key **88** for detaching lock core **74**. Thus, door lock **10** provides enhanced convenience during installation.

Another feature of door lock **10** is that the central axis of each through-hole **70** of mounting member **56** is at a non-parallel angle with the spacing direction of the central axes of the first and second holes **64** and **66** (namely, each through-hole **70** is not directly below the associated first hole **64** or the associated second hole **66**), such that each positioning member **72** which has passed through an associated through-hole **70** falls downward due to the gravitational force and, thus, misaligns from the associated through-hole **70**. Thus, even if mounting member **56** is rotated before lock core **74** is mounted, it is difficult for each positioning member **72** to disengage from mounting member **56** by passing through the associated through-hole **70** in the reverse direction. The assembly of mounting member **56** and outer handle **38** is, thus, simple.

FIG. **11** shows a door lock **10** of a second example according to the present invention. Door lock **10** of the second example is substantially the same as the first example except that mounting member **56** does not have to include the two annular grooves **68**, and the two positioning members **72** are cylindrical and are engaged with through-holes **70** of mounting member **56** by tight coupling, such that each positioning member **72** has an end slideably received in one of grooves **54** of outer handle **38**. The two positioning members **72** can also prevent mounting member **56** from disengaging from outer spindle **36** and outer handle **38** and can permit mounting member **56** to pivot about the pivotal axis before mounting member **56** engages with lock core **74**.

Due to the feature of the rotatable mounting member **56** after detaching lock core **74**, door lock **10** of the second example also permits a change in the assembly orientation of lock core **74** without detaching outer handle **38**.

Now that the basic teachings of the present invention have been explained, many extensions and variations will be obvious to one having ordinary skill in the art. For example, mounting member **56** can include only one annular groove **68**, outer handle **38** can include only one groove **54**, and a positioning member **72** is received in the annular space defined by annular groove **68** and groove **54**. Furthermore, outer handle **38**, mounting member **56**, lock core **74**, and positioning members **72** can be of other desired forms as conventional including but not limited to of commercially available types.

Thus since the illustrative embodiments disclosed herein may be embodied in other specific forms without departing from the spirit or general characteristics thereof, some of which forms have been indicated, the embodiments described herein are to be considered in all respects illustrative and not restrictive. The scope is to be indicated by the appended claims, rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are intended to be embraced therein.

The invention claimed is:

1. A door lock comprising:

a driving device including an outer spindle pivotable about a pivotal axis;

a latch device operably connected to the driving device, with the latch device including a latch, with pivotal movement of the outer spindle about the pivotal axis causing movement of the latch between a latching position and an unlatching position;

an outer handle including an outer end and an inner end spaced from the outer end along a longitudinal axis, with the outer handle further including a compartment extending from the outer end towards but spaced from the inner end of the outer handle, with the compartment including an inner periphery having a groove, with the outer handle further including an axial hole extending from the inner end of the outer handle and intercommunicating with the compartment, and with the outer handle coupled to and jointly pivotable with the outer spindle;

a mounting member rotatably mounted in the compartment of the outer handle, with the mounting member including a first end face and a second end face spaced from the first end face along the longitudinal axis, with the mounting member further including a first hole extending from the first end face through the second end face and aligned with the axial hole of the outer handle, with the mounting member further including a second hole extending from the first end face through the second end face, and with the second hole located on a side of and intercommunicated with the first hole;

a positioning member movably received in the groove of the outer handle, with the positioning member permitting the mounting member to pivot about the pivotal axis, and with the positioning member preventing the mounting member from moving relative to the outer handle along the longitudinal axis; and

a lock core including a first portion and a second portion adjoining and extending parallel to the first portion, with the lock core detachably engaged with the mounting member,

with the lock core engaged with the mounting member, the first portion of the lock core is received in the first hole of the mounting member, and the second portion of the lock core is received in the second hole of the

mounting member, preventing the mounting member from pivoting about the pivotal axis relative to the outer handle, and

with the lock core disengaged from the mounting member, the mounting member is pivotable about the pivotal axis relative to the outer handle to change a positional relationship between the first and second holes of the mounting member.

2. The door lock as claimed in claim **1**, with the mounting member further including an outer periphery extending between the first and second end faces of the mounting member, with the mounting member further including a through-hole extending from an inner periphery of the second hole in a radial direction perpendicular to the pivotal axis through the outer periphery of the mounting member, with the through-hole aligned with the groove of the outer handle, and with the positioning member including a first end securely received in the through-hole and a second end slideably received in the groove of the outer handle.

3. The door lock as claimed in claim **1**, with the mounting member further including an outer periphery extending between the first and second end faces of the mounting member, with an annular groove defined in the outer periphery of the mounting member, with the mounting member further including a through-hole extending from an inner periphery of the second hole in a radial direction perpendicular to the pivotal axis to the annular groove, with the through-hole aligned with the annular groove of the mounting member and the groove of the outer handle, and with the positioning member moving through the through-hole into a space formed by the annular groove of the mounting member and the groove of the outer handle.

4. The door lock as claimed in claim **3**, with each of the first and second holes having a central axis, with the central axes of the first and second holes spaced from each other in a spacing direction, and with the through-hole having a central axis at a non-parallel angle to the spacing direction.

5. The door lock as claimed in claim **1**, with the lock core including a positioning sleeve configured to be unlocked and pivoted by a key, and with the positioning sleeve including a lug formed on an outer periphery thereof, wherein the key is operable to pivot the lug between an extended, engagement position and a retracted, detachment position,

with the lug in the extended, engagement position, the lug abuts the second end face of the mounting member to prevent the lock core from disengaging from the mounting member along the longitudinal axis, thereby positioning the lock core, and

with the lug in the retracted, detachment position, the lug is spaced from the second end face of the mounting member to permit the lock core to move relative to the mounting member along the longitudinal axis, disengaging the lock core from the mounting member.

6. The door lock as claimed in claim **5**, with the outer spindle further including a first insertion groove and a second insertion groove spaced from the first insertion groove by 180° in a circumferential direction about the pivotal axis,

with the lug in the extended, engagement position, the lug abuts an inner wall of one of the first and second insertion grooves to prevent the lock core from disengaging from the mounting member along the longitudinal axis, thereby positioning the lock core, and

with the lug in the retracted, detachment position, the lug is spaced from the inner walls of the first and second insertion grooves to permit the lock core to move relative to the mounting member along the longitudinal axis, disengaging the lock core from the mounting member and the outer spindle.

7. A door lock comprising:

a driving device including an outer spindle pivotable about a pivotal axis, with the driving device adapted to be mounted to a door having a first end face and a second end face opposite to the first end face, with the door further including a first side extending between the first and the second end faces, and with the outer spindle having a distal end located on an outer end of the first side of the door;

a latch device operably connected to the driving device, with the latch device including a latch, with pivotal movement of the outer spindle causing movement of the latch between a latching position and an unlatching position, and with the latch device configured to be mounted to one of the first and second end faces of the door;

an outer handle including an outer end and an inner end spaced from the outer end along a longitudinal axis of the outer spindle, with the outer handle further including a compartment extending from the outer end towards but spaced from the inner end of the outer handle, with the compartment including an inner periphery having a groove, with the outer handle further including an axial hole extending from the inner end of the outer handle and intercommunicating with the compartment, and with the outer handle coupled to and jointly pivotable with the outer spindle;

a mounting member rotatably mounted in the compartment of the outer handle, with the mounting member including a first end face and a second end face spaced from the first end face along the longitudinal axis, with the mounting member further including a first hole extending from the first end face through the second end face and aligned with the axial hole of the outer handle, with the mounting member further including a second hole extending from the first end face through the second end face, and with the second hole located on a side of and intercommunicated with the first hole;

a positioning member movably received in the groove of the outer handle, with the positioning member permitting the mounting member to pivot about the pivotal axis and preventing the mounting member from moving relative to the outer handle along the longitudinal axis; and

a lock core including a first portion and a second portion adjoining and extending parallel to the first portion, with the lock core detachably engaged with the mounting member,

with the lock core engaged with the mounting member, the first portion of the lock core is received in the first hole of the mounting member, and the second portion of the lock core is received in the second hole of the mounting member, preventing the mounting member from pivoting about the pivotal axis relative to the outer handle to change a positional relationship between the first and second holes of the mounting member,

with the lock core disengaged from the mounting member, the mounting member is pivotable about the pivotal axis relative to the outer handle,

with the latch device mounted to the first end face of the door, the second portion of the lock core is located right below the first portion of the lock core in a vertical direction perpendicular to the pivotal axis, and

with the latch device mounted to the second end face of the door, the second portion of the lock core is located

right below the first portion of the lock core in a vertical direction perpendicular to the pivotal axis.

8. The door lock as claimed in claim **7**, with the mounting member further including an outer periphery extending between the first and second end faces of the mounting member, with the mounting member further including a through-hole extending from an inner periphery of the second hole in a radial direction perpendicular to the pivotal axis through the outer periphery of the mounting member, with the through-hole aligned with the groove of the outer handle, and with the positioning member including a first end securely received in the through-hole and a second end slideably received in the groove of the outer handle.

9. The door lock as claimed in claim **7**, with the mounting member further including an outer periphery extending between the first and second end faces of the mounting member, with an annular groove defined in the outer periphery of the mounting member, with the mounting member further including a through-hole extending from an inner periphery of the second hole in a radial direction perpendicular to the pivotal axis to the annular groove, with the through-hole aligned with the annular groove of the mounting member and the groove of the outer handle, and with the positioning member moving through the through-hole into a space formed by the annular groove of the mounting member and the groove of the outer handle.

10. The door lock as claimed in claim **9**, with each of the first and second holes having a central axis, with the central axes of the first and second holes spaced from each other in a spacing direction, and with the through-hole having a central axis at a non-parallel angle to the spacing direction.

11. The door lock as claimed in claim **7**, with the lock core including a positioning sleeve configured to be unlocked and pivoted by a key, and with the positioning sleeve including a lug formed on an outer periphery thereof, wherein the key is operable to pivot the lug between an extended, engagement position and a retracted, detachment position,

with the lug in the extended, engagement position, the lug abuts the second end face of the mounting member to prevent the lock core from disengaging from the mounting member along the longitudinal axis, thereby positioning the lock core, and

with the lug in the retracted, detachment position, the lug is spaced from the second end face of the mounting member to permit the lock core to move relative to the mounting member along the longitudinal axis, disengaging the lock core from the mounting member.

12. The door lock as claimed in claim **11**, with the outer spindle further including a first insertion groove and a second insertion groove spaced from the first insertion groove by 180° in a circumferential direction about the pivotal axis,

with the lug in the extended, engagement position and with the latch device mounted to the first end face of the door, the lug abuts an inner wall of the first insertion groove to prevent the lock core from disengaging from the mounting member along the longitudinal axis, thereby positioning the lock core,

with the lug in the extended, engagement position and with the latch device mounted to the second end face of the door, the lug abuts an inner wall of the second insertion groove to prevent the lock core from disengaging from the mounting member along the longitudinal axis, thereby positioning the lock core,

with the lug in the retracted, detachment position and with the latch device mounted to the first end face of the door, the lug is spaced from the inner wall of the first insertion groove to permit the lock core to move relative to the mounting member along the longitudinal axis, disengaging the lock core from the mounting member and the outer spindle,

with the lug in the retracted, detachment position and with the latch device mounted to the second end face of the door, the lug is spaced from the inner wall of the second insertion groove to permit the lock core to move relative to the mounting member along the longitudinal axis, disengaging the lock core from the mounting member and the outer spindle.

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