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(71) Applicant: **Pentair Technical Solutions GmbH**
75334 Straubenhardt (DE)

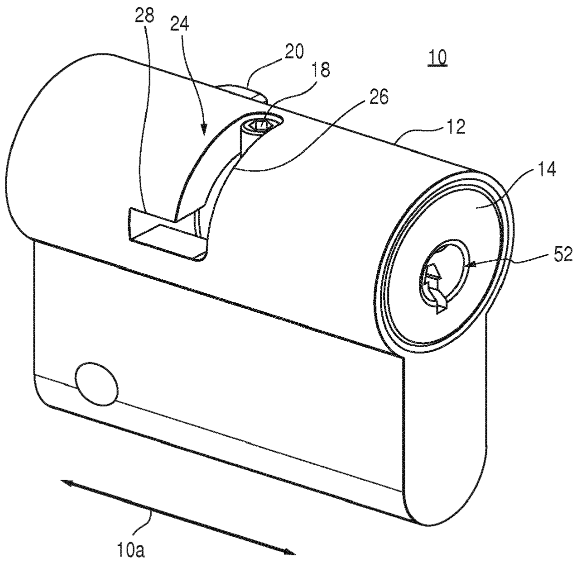
(72) Inventors:
- **MARCINKOWSKI, Christophe**
  67660 Betschdorf (FR)
- **THOMAS, Daniel**
  67160 Seebach (FR)

(74) Representative: **Barker Brettell LLP**
100 Hagley Road
Edgbaston
Birmingham B16 8QQ (GB)

(54) PUSH-BUTTON LOCK

(57) A push-button locking assembly (10, 100) includes a lock body (12) having an internal cavity (16) and a slot (24) that is open to the internal cavity. A lock cylinder (14) is received within the internal cavity. The lock cylinder is configured to be rotated between a locked orientation and an unlocked orientation and is configured to be axially pushed by a user to open the door, when in the unlocked orientation. A lock post (18) is coupled to the lock cylinder and can extend at least partly into the slot. The slot is configured to engage the lock post to prevent axial movement of the lock cylinder relative to the lock body when the lock cylinder is in the locked orientation. The slot is further configured to permit axial movement of the lock cylinder relative to the lock body when the lock cylinder is in the unlocked orientation.

FIG. 1



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Description

BACKGROUND

[0001] Locking mechanisms can be used in industrial workplaces and other contexts, including in order to limit access to potentially dangerous components, such as electrical equipment, machinery, and the like. Some locks used in these applications can be unlocked using a physical key, which is sized and shaped for insertion into a locking cylinder. In some arrangements, when an appropriate key is inserted into a locking cylinder, the locking cylinder can be rotated, which unlocks the lock.

SUMMARY

[0002] Some embodiments of the invention provide a push-button locking assembly for a door. A lock body can include an internal cavity and a slot that is open to the internal cavity. A lock cylinder can be received within the internal cavity of the lock body, the lock cylinder being configured to be rotated between a locked orientation and an unlocked orientation and configured to be axially pushed by a user to open the door, when in the unlocked orientation. A lock post can be coupled to the lock cylinder, the lock post extending at least partly into the slot in the lock body. The slot can be configured to engage the lock post to prevent axial movement of the lock cylinder relative to the lock body when the lock cylinder is in the locked orientation and to permit axial movement of the lock cylinder relative to the lock body when the lock cylinder is in the unlocked orientation.

[0003] Some embodiments of the invention provide a method of opening a door that is secured closed with a push-button locking assembly, the push-button locking assembly including a lock body with an internal cavity and a slot that is open to the internal cavity, a lock cylinder that is rotatably and slidably received in the internal cavity, and a lock post that is coupled to the lock cylinder and extends at least partly into the slot in the lock body. A key can be inserted into the lock cylinder. The key and the lock cylinder can be rotated relative to the lock body to dispose the lock cylinder in an unlocked orientation. The lock cylinder can be manually pushed axially into the internal cavity to release the push-button locking assembly so that the door can be opened.

DESCRIPTION OF THE DRAWINGS

[0004]

FIG. 1 is a front, left, top isometric view of a push-button locking assembly according to one embodiment of the invention, including a lock body, a lock cylinder, a lock target, and a lock post.

FIG. 2 is a front, right, top exploded isometric view of the push-button locking assembly of FIG. 1, including the lock body, the lock target, and the lock post of FIG. 1, and a spring.

FIG. 3A is a front, left, top exploded isometric view of the lock target of FIG. 1 and the spring of FIG. 2.

FIG. 3B is a front, left, top isometric view of the lock target of FIG. 1 and the spring of FIG. 2, in an assembled configuration.

FIG. 4A is a front, right, top isometric view of the lock body of FIG. 1, with the lock target of FIG. 1 and the spring of FIG. 2 disposed for assembly with the lock body.

FIG. 4B is an front, right, top isometric view of the lock body of FIG. 1, with the lock target of FIG. 1 and the spring of FIG. 2 installed therein.

FIG. 5A is a partly exploded front, left, top isometric view of the push-button locking assembly of FIG. 1, with the lock post disposed for assembly.

FIG. 5B is a front, left, top isometric view of the push-button locking assembly of FIG. 1.

FIG. 6A is a front, left, top isometric view of the push-button locking assembly of FIG. 1 in a locked configuration.

FIG. 6B is a front, left, top isometric view of the push-button locking assembly of FIG. 1 in an unlocked configuration.

FIG. 6C is an isometric, cross-sectional view of the lock target, the lock cylinder, and the lock post of FIG. 1, arranged as installed in the push-button locking assembly of FIG. 1.

FIG. 7A is a front, right, top isometric view of a handle assembly including the push-button locking assembly of FIG. 1, with a handle of the assembly in a locked configuration.

FIG. 7B is a front, right, top isometric view of the handle assembly of FIG. 7A, with the handle in an open configuration.

FIG. 7C is a rear, right, top isometric partial view of the handle assembly of 7A, including the push-button locking assembly of FIG. 1.

FIG. 8 is a front, top, right isometric view of an alternate embodiment of a push-button locking assembly according to the invention.

DETAILED DESCRIPTION

[0005] Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways. Also, it is to be understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including," "comprising," or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless specified or limited otherwise, the terms "mounted," "connected," "supported," and "coupled" and variations thereof are used broadly and encompass both direct and indirect mountings, connections, supports, and couplings. Further, "connected" and "coupled" are not restricted to physical or mechanical connections or couplings.

[0006] The following discussion is presented to enable a person skilled in the art to make and use embodiments of the invention. Various modifications to the illustrated embodiments will be readily apparent to those skilled in the art, and the generic principles herein can be applied to other embodiments and applications without departing from embodiments of the invention. Thus, embodiments of the invention are not intended to be limited to embodiments shown, but are to be accorded the widest scope consistent with the principles and features disclosed herein. The following detailed description is to be read with reference to the figures, in which like elements in different figures have like reference numerals. The figures, which are not necessarily to scale, depict selected embodiments and are not intended to limit the scope of embodiments of the invention. Skilled artisans will recognize the examples provided herein have many useful alternatives and fall within the scope of embodiments of the invention.

[0007] As also noted above, locking mechanisms with rotatable locking cylinders can be used in a variety of contexts. In some conventional designs, in order to decrease the likelihood of a lock failure and to add an additional layer of security, rotatable locks can include a push button. Generally, conventional arrangements use a dual-actuation configuration in which the push button serves as a second actuator, separate from the locking cylinder.

[0008] Dual-actuation locks have proven useful in many applications, but can exhibit certain drawbacks. For example, locks using a dual-actuation arrangement may need to be relatively large to accommodate all of the required components. Further, the general accessibility of conventional push buttons can allow actuation of a portion of the lock, even without use of an appropriate key. In some configurations, this can cause other component of the locking mechanism, such as a handle, to be at least partly released. This, in turn, can result in unnecessary and unwanted stress on certain components of the lock, which can lead to the failure of the components, or of the lock generally.

[0009] In this regard, for example, a need exists for a dual-actuation locking assembly that provides increased security by limiting access to actuation components. Similarly, a need exists to develop a dual-actuation locking assembly having a compact design that can be readily used on existing handles using cylinder locks.

[0010] Generally, embodiments of the invention can provide an improved locking assembly that provides both key-lock and push-button functionality. In this regard, for example, users can use a key to unlock (or lock) a locking assembly, then manually push a push-button of the unlocked locking assembly to unlatch or otherwise open an associated door. In some embodiments, a locking cylinder to be actuated by a key (e.g., a mechanical key) and a push button can be formed from one or more of the same components.

[0011] In some embodiments, a lock body can include a slot that is configured to inhibit or permit operation of a push button, depending on whether the assembly is in a locked configuration or an unlocked configuration. For example, a lock body can be provided with a slot that includes a blocking portion and an opening portion. Further, the lock body can be configured to rotatably and slidably receive a lock cylinder that is also configured as a push button. A lock post, such as a screw, can be secured to the lock cylinder to extend into the slot when the lock cylinder is received in the lock body.

[0012] With the lock cylinder in a locked orientation, the lock post can be engaged by the blocking portion of the slot so that axial movement of the lock cylinder is prevented. With the lock cylinder in an unlocked orientation (e.g., rotated 90 degrees from the locked orientation), the lock post can be aligned with the opening portion of the slot so that axial movement of the lock cylinder is permitted. In this way, for example, the slot and the lock post can cooperate to selectively allow or inhibit operation of lock cylinder as a push button.

[0013] In some embodiments, a lock slot can be an L-shaped slot. In other embodiments, other configurations are possible.

[0014] FIGS. 1 and 2 illustrate a push-button locking assembly 10 according to one embodiment of the invention. In the embodiment illustrated, the locking assembly 10 includes a lock body 12 and a lock cylinder 14.

[0015] In different embodiments, a lock body can be configured to exhibit any number of standardized or other profiles, as appropriate for particular installations. In the embodiment illustrated, the lock body 12 is configured to comply with one or more standards and requirements, such as Deutsches Institut für Normung e.V. ("DIN") standard 18252, which details the dimensions and requirements for profile cylinders for door locks.

[0016] Generally, the lock cylinder 14 is configured to fit within an internal cavity 16 of the lock body 12, for sliding and rotating movement therein, as also described below. Further, to be rotated within the lock body 12, the lock cylinder 14 is configured to require insertion of a mechanical key (not shown) with a specific configuration.

[0017] In the embodiment illustrated, the locking assembly 10 further includes a lock post 18, a lock target 20, and a resilient member 22 (see FIG. 2). The lock post 18, the lock target 20, and the resilient member 22 can all be configured to be received at least partially within a portion of the lock body 12. As also described below, the lock cylinder 14, the lock body 12, the lock post 18, the lock target 20, and the resilient member 22 can together allow for push-button operation of the locking assembly 10, such that the locking assembly 10 can operate as a dual-actuation keyed and push-button lock.

[0018] In the embodiment illustrated, the lock post 18 is configured as a lock screw, and the resilient member 22 is configured as a coil spring. In other embodiments, other configurations are possible.

[0019] As illustrated in FIG. 1 in particular, the lock body 12 also includes a lock slot 24, which is open to the internal cavity 16 and is configured to receive at least part of the lock post 18. As also discussed below, the lock slot 24 is generally configured to cooperate with the lock post 18 to selectively permit or restrict movement of the lock cylinder 14. Correspondingly, in the embodiment illustrated, the lock slot 24 includes a circumferential portion 26 and an axial portion 28, such that the lock slot 24 generally forms an L-shape in the lock body 12.

[0020] In the illustrated embodiment, the circumferential portion 26 of the lock slot 24 spans an arc of about 90°, such that up to a 90° rotation of the lock cylinder 14 and the lock post 18 may be required before the lock post 18 is aligned with the axial portion 28. In some embodiments, the circumferential portion 26 of the lock slot 24 can span larger or smaller arc sizes, such as arcs between about 15° and about 270° or more.

[0021] In some embodiments, a lock target and an associated resilient member can be formed as distinct components that can assembled together and then secured to a larger locking assembly. As illustrated in FIGS. 3A and 3B, for example, the lock target 20 includes a spring support 30, which is sized and configured to receive the resilient member 22. In particular, in the embodiment illustrated, the spring support 30 is configured as a post 32 that can serve as a guide for appropriately aligned movement of the resilient member 22. To help secure the resilient member 22 to the lock target, an annular recess 34 that surrounds the post 32 is configured to receive one or more spring coils of a resilient member 22. In other embodiments, other configurations are possible.

[0022] As appropriate, the resilient member 22 can be adhesively coupled to the spring support 30, can be adhesively coupled to a different portion of the lock target 20, or can be otherwise coupled to the lock target 20. For example, in some embodiments, the resilient member 22 can be placed around post 32 of the spring support 30 and a crimping force can be applied to create an interference fit between the interior coils of the resilient member 22 and the post 32. Alternatively (or additionally), the resilient member 22 can exhibit a resting coil diameter that allows the resilient member 22 to be press fit onto the post 32 or into the recess 34. In other embodiments, other techniques can be used to couple the resilient member 22 to the spring support 30 or to lock target 20 generally.

[0023] In some embodiments, the spring support 30 may serve as a guide to position the resilient member 22 relative to the lock target 20, but may not be necessarily configured to secure the resilient member 22 to the lock target 20. In some embodiments, resilient member 22 may not require an adhesive or compressive fit to features of the lock target 20 in order to operate appropriately as part of the locking assembly 10. For example, in some embodiments, the resilient member 22 can sit loosely on the post 32 or nest loosely within the recess 34.

[0024] In the embodiment illustrated, the resilient member 22 is a helical compression spring having a longitudinal axis 22a that extends generally through the center of the coils of the resilient member 22. Accordingly, as also discussed below, compression of the resilient member 22 can correspond with the lock target 20 travelling along the longitudinal axis 22a of the resilient member 22, with the lock target 20 generally moving further into the lock body 12. Similarly, when the resilient member 22 is released, the elastic response of the spring can cause the lock target 20 to travel in the opposite direction along the longitudinal axis 22a, with the lock target 20 moving generally outwardly relative to the lock body 12.

[0025] While the resilient member 22 is illustrated as a compression spring, other resilient members can be used in locking assemblies according to the invention (e.g., the locking assembly 10). For example, in some embodiments, other structures formed from elastomeric materials could be used in place of the compression resilient member 22.

[0026] Generally, the lock target 20 can exhibit an exterior shape that is configured to guide movement of the lock target 20 into and out of a lock body (e.g., the lock body 12) in response to the application of particular forces. In the embodiment illustrated, for example, the lock target 20 has a substantially rectangular block shape, which can correspond to an opening on the lock body 12 (as also discussed below).

[0027] In some aspects, however, the lock target 20 can deviate from a fully rectangular block shape. For example, in the embodiment illustrated, the lock target 20 includes a sloped surface 36. As also discussed below, for example, the sloped surface 36 can cause automatic translation of the lock target 20 in response to particular forces, as may be useful to ensure that the locking assembly 10 automatically actuates upon a door being closed and then resets into a latching configuration (see, e.g., FIG. 4B). In some embodiments, the sloped surface

36 can be provided with a low friction coating or formed from materials with relatively low coefficients of friction.

[0028] In general, a lock target can be configured to translate axial movement of a push-button into appropriate non-axial (or other) locking or unlocking movement. In the embodiment illustrated, for example, and as a further deviation from the generally rectangular block shape, the lock target 20 includes an engagement cavity 38.

[0029] As also discussed below, an engagement cavity can be configured to convert axial movement of a push button (e.g., the lock cylinder 14, as also described below) into a generally perpendicular movement of a lock target. In the embodiment illustrated, for example, the engagement cavity 38 is sized to accommodate an actuator, such as a cylindrical inner end 14a of the lock cylinder 14 (see FIG. 2) and further includes a drive section 40 and a stopping section 42.

[0030] In the embodiment illustrated, the drive section 40 of the engagement cavity 38 is shaped with an angled surface, relative to an axial direction 10a of the assembly 10 (see FIG. 1). In this regard, for example, the drive section 40 is configured to cause the lock target 20 to convert a received axial force (e.g., along the axial direction 10a) translate into a force that urges movement in an approximately perpendicularly direction. Generally, the drive section 40 can be configured to exhibit an angle of between about 15° and 75° with the axial direction 10a, and preferably an angle of between about 30° and about 60°. In some embodiments, the drive section 40 can form an angle of about 45° with the axial direction 10a. In some embodiments, other angles can also be formed by the drive section 40 relative to the axial direction 10a.

[0031] In some embodiments, the drive section 40 can be formed to exhibit a relatively low coefficient of friction, in order to more readily translate axial forces into generally perpendicular movement of the lock target 20. In some embodiments, a low friction coating can be added to the interior of the engagement cavity 38. In some embodiments, the drive section 40 or the stopping section 42 can be provided with a concave or otherwise curved shape that is configured to receive the inner end 14a of the lock cylinder 14 and limit movement of the lock cylinder 14 in unwanted directions.

[0032] With reference now to FIGS. 4A and 4B, the lock target 20 and the resilient member 22 are configured to be inserted into a target cavity 44 formed in the lock body 12 to provide a movable latch for operation of the locking assembly 10. Generally, the lengths of the resilient member 22 and the lock target 20 can be chosen so that, when the lock target 20 is operationally received within the lock body 12, only a portion of the lock target 20 extends outside of the lock body 12 (see FIG. 4B). In some embodiments, the lock target 20 can be configured to move inwardly, to be received entirely within the lock body 12, when the locking assembly 10 is fully assembled and sufficient force (e.g., from contact with a door frame) is applied to the sloped surface 36.

[0033] In some embodiments, the shape of the lock target 20 or the target cavity 44 can be selected to provide a relatively narrow clearance between the lock target 20 and side walls of the target cavity 20. For example, by providing the lock target 20 with a rectangular (or other) cross-section similar in size to the target cavity 44, the walls of the target cavity 44 can help to guide movement of the lock target 20 into and out of the lock body 12, while generally restricting movement in other directions.

[0034] In some embodiments, an internal surface of the lock body 12 (e.g., within the internal cavity 16) can include a structure (not shown), such as a structure similar to the spring support 30 (see FIG. 3A)) that can receive and secure, and help to guide movement of, the resilient member 22. In some embodiments, the resilient member 22 can be adhesively secured to such a structure or can be otherwise coupled to the lock body 12 (e.g., along an interior surface of the lock body 12). In some embodiments, the resilient member 22 can be disposed to be solely in compressive contact with the interior of the lock body 12.

[0035] Once the lock target 20 and the resilient member 22 have been installed, the lock cylinder 14 can be axially inserted into the internal cavity 16, so that the inner end 14a of the lock cylinder 14 extends into the engagement cavity 38 of the lock target 20 (see, e.g., FIG. 6C). In some embodiments, as illustrated in FIGS. 5A and 5B, for example, the lock cylinder 14 can be configured to sit flush with a front surface of the lock body 12 once installed for operation. This can be useful, for example, in order to minimize an overall profile of the locking assembly 10, as well as to protect the lock cylinder 14 from accidental contacts.

[0036] In some embodiments, the lock target 20 and resilient member 22 can be fully compressed within the lock body 12 when the lock cylinder 14 is installed. This can, for example, help to ensure appropriate alignment of a post of the lock cylinder 14 (e.g., the inner end 14a of the lock cylinder 14, as shown in FIG. 6C) with the engagement cavity 38. In these embodiments, once the lock cylinder 14 is appropriately installed within the hollow cavity 16 of the lock body 12, the lock target 20 can be released, which can cause the resilient member 22 to expand towards its original (or other) length. Further, with the inner end 14a of the lock cylinder 14 disposed within the engagement cavity 38, the resilient member 22 can be prevented from fully returning to its relaxed state, so that the resilient member 22 is constantly maintained under a compressive load while installed within the locking assembly 10.

[0037] With the lock cylinder 14 installed into the lock body 12, as shown in FIG. 5A, the lock post 18, can be coupled to the lock cylinder 14. As also noted above, the lock post 18 is generally adapted, once installed, to cooperate with the lock slot 24 to selectively restrict movement of the lock cylinder 14.

[0038] In the embodiment illustrated, the lock post 18 is configured to be received in a corresponding post support 46 on the lock cylinder 14 (see FIG. 5A). This may be useful, for example, in order to allow the lock post 18 to be installed within the lock slot 24 after the lock cylinder 14 has been installed in the interior cavity 16. This can allow for a closed configuration of the lock slot 24 (as shown), which can contribute to a relatively strong configuration of the lock body 12 as well as allowing the lock post 18 to help to generally secure the lock cylinder 14 in place within the lock body 12. In this regard, for example, in order to appropriately install the lock post 18, the lock cylinder 14 can be disposed at a depth in the lock body 12 that aligns the post support 46 with the lock slot 24. The lock post 18 can then be inserted through the lock slot 24 into engagement with the post support 46.

[0039] In the embodiment illustrated, the lock post 18 is configured as a lock screw with a head 48 and a threaded coupling section 50. Correspondingly, the post support 46 is configured as a threaded hole, into which the coupling section 50 can be threaded. In some embodiments, the head 48 can be shaped to accommodate a particular tool, such as a hex key. In other embodiments, other configurations are possible.

[0040] In some embodiments, the coupling section 50 can extend only partly along the lock post 18, or can include a select number of thread pitches. This can be useful, for example, in order to allow the lock post 18 to be threaded only a particular distance into the post support 46 and thereby to provide an appropriate final height of the head 48 of the lock post 18 relative to the lock slot 24. In the embodiment illustrated, for example, the coupling section 50 is configured to secure the lock post 18 with the head 48 flush with or slightly inside of the outer surface of the lock body 12. Usefully, for example, this can allow the entire lock assembly 10, excluding a portion of the lock target 20, to be contained within the exterior shape of the lock body 12. In other embodiments, other configurations are possible.

[0041] In other embodiments, other configurations for a lock post are possible. For example, in some embodiments, a lock post can be a spring-loaded (or otherwise movable) component relative to a lock cylinder. In such embodiments, for example, the lock post can be initially depressed when the lock cylinder is inserted into a lock body, so that the lock post does not prevent the lock cylinder from being advanced into an internal cavity of the lock body. When the lock cylinder has been properly disposed within the lock body, with the lock post appropriately aligned with a lock slot, the lock post can then spring (or otherwise move) outwardly into engagement with the lock slot.

[0042] In some embodiments, the lock post 18 can be secured to the lock cylinder 14 with a non-threaded engagement, such as with adhesive or non-threaded mechanical couplings. In some embodiments, for example, the lock post 18 can be configured as a spiral (or other) pin and the post support 46 may be configured as a non-threaded hole that is sized to form compressive engagement with the pin. In some embodiments, the lock post 18 and the lock cylinder 14 can be coupled together with a keyed connection.

[0043] Turning now to FIGS. 6A through 6C, aspects of the operation of the fully assembled push-button locking assembly 10 are illustrated. With specific reference to FIG. 6A, the locking assembly 10 is shown in a "locked" configuration. In this configuration, the alignment of the lock post 18 with the circumferential portion 26 of the lock slot 24 generally prevents the lock cylinder 14 from moving axially in either direction. Accordingly, the lock cylinder 14 cannot be pushed to release an associated door and cannot be moved in an opposite direction to be removed from the lock body 12. Further, without a proper key to engage the associated locking mechanism, the lock cylinder 14 cannot be rotated in order to move the lock post 18 clear of the circumferential portion 26 of the lock slot 24.

[0044] With specific reference to FIG. 6B, an appropriate key (not shown) can be used to rotate the lock cylinder 14 to an unlocked orientation. In particular, once an appropriate key is inserted into a keyway 52 of the locking mechanism, the key can be used to rotate the lock cylinder 14. With sufficient rotation, as illustrated in FIG. 6B, the lock post 18 can be moved circumferentially along the circumferential portion 26 of the lock slot 24 into alignment with the axial portion 28 of the lock slot 24. Accordingly, the lock post 18 and the lock slot 24 may no longer impede axial movement of the lock cylinder 14, and a user can push the lock cylinder 14 into the lock body 12 (e.g., in order to release an associated door).

[0045] In some embodiments, the rotational range of the lock cylinder 14 can correspond to (e.g., be dictated by) the shape and orientation of the lock slot 24. For example, the rotational range of the lock cylinder 14 in FIG. 6B may be limited by the arcuate dimensions of the circumferential portion 26 of the lock slot 24. In other embodiments, other configurations are possible.

[0046] As illustrated in FIG. 6C in particular, and as also noted above, an inner end 14a of the lock cylinder 14 supports (e.g., integrally includes) an actuator that can be configured to actuate the lock target 20. In particular, when the lock cylinder 14 is in a resting state (e.g., as shown in FIG. 6A), the actuator provided by the inner end 14a of the lock cylinder 14 is generally aligned within the drive section 40 of the engagement cavity 38. Accordingly, as the lock cylinder 14 is pushed axially into the lock body 12, the inner end 14a of the lock cylinder 14 can bear on the drive section 40 of the engagement cavity 38. As also discussed above, the drive section 40 exhibits an angled surface that is configured to convert axial force provided by the inner end 14a of the lock cylinder 14 into a force having a perpendicular component to the force provided by the inner end 14a of the lock cylinder 14. This perpendicular force component can move the lock target 20, against the bias of the resilient member 22, perpendicularly to the movement of the inner end 14a of the lock cylinder 14 and generally further into the target cavity 44 of the lock body 12 (see, e.g., FIGS.

3A-3B)

[0047] As illustrated in FIG. 6C, the lock cylinder 14 has been pressed fully into the lock body 12 (not shown in FIG. 6C), which has moved the stopping section 42 of the engagement cavity 38 into contact with the inner end 14a of the lock cylinder 14. Correspondingly, further movement of the lock target 20 into the lock body 12 is generally prevented, as is further axial movement of the lock cylinder 14 toward the lock target 20.

[0048] In some embodiments, the configuration illustrated in FIG. 6C can correspond to the lock target 20 being fully withdrawn into the lock body 12 so as not to protrude from the target cavity 44 (see, e.g., FIG. 4B). Further, with the lock cylinder 14 thus actuated, the resilient member 22 may be relatively highly compressed. Accordingly, releasing the axial force from to the lock cylinder 14 can allow the resilient member 22 to return the lock target 20, and thereby the lock cylinder 14, to the respective resting positions (e.g., extending radially out of the lock body 12, and sitting flush with the front surface of the lock body 12, respectively).

[0049] In some embodiments, the lock slot 24 can be configured to complement or to determine certain states of the lock target 20 and the lock cylinder 14. For example, the lock slot 24 can be configured so that the lock target 20 is entirely received within the lock body 12, when the lock post 18 comes into contact with the end of the axial portion 28 that is opposite the circumferential portion 26. Similarly, the lock slot 24 can be configured so that the lock cylinder 14 is generally flush with the front surface of the lock body 12, when the lock post 18 comes into contact with the circumferential portion 26 of the lock slot 24, such that the circumferential portion 26 prevents further axial movement of the lock cylinder 14 out of the lock body 12.

[0050] In some embodiments, including as illustrated in FIG. 6C, the inner end 14a (or other actuator) of the lock cylinder 14 can exhibit a cylindrical shape with a generally hemispherical tip. This can be useful, for example, in order to provide an actuator with a surface that can readily contact and transmit forces to a drive section (e.g., the drive section 40), while providing minimal surface contact to reduce the potential of sticking within an engagement cavity (e.g., the engagement cavity 38).

[0051] Similarly, in some embodiments, a generally cylindrical shape with a generally hemispherical tip can allow an actuator on a lock cylinder to maintain an approximately constant space requirement within an engagement cavity, including during rotation of the relevant lock cylinder during locking and unlocking operations. In the illustrated embodiment, for example, this can allow the engagement cavity 38 to be optimized in size and shape. This, in turn, can help to provide a relatively close fit with the inner end 14a of the lock cylinder 14 and thereby prevent unwanted movement of the inner end 14a of the lock cylinder 14 within the engagement cavity 38.

[0052] In some embodiments, the drive section 40 or and the stopping section 42 can exhibit a concave surface with an effective curvature (or other geometry) that is generally similar to the radius of curvature (or other geometry) of the inner end 14a of the lock cylinder 14. In this way, for example, the motion of the inner end 14a of the lock cylinder 14 can be efficiently directed along the drive section 40 and stopping section 42.

[0053] In other embodiments, other configurations are possible. For example, the inner end 14a of the lock cylinder 14 can be provided with other geometric configurations, such as fully cylindrical, pointed, square, or other profiles.

[0054] Generally, the lock cylinder 14 can be pushed axially into the lock body 12 to move the lock target 20 using a variety of techniques. In some embodiments, for example, after unlocking the locking assembly 10 with a key, a user can axially push a portion of the key that protrudes outwardly from the keyway 52, so that the entire cylinder 14 and part of the key are urged axially into the lock body 12. Correspondingly, in some such embodiments, it may be advantageous to provide a key with a bow that is sized to be contained within the hollow cavity 16 of the lock body 12. This can, for example, allow the key to move with the lock cylinder 14 relatively far into the lock body 12, such that the push button portion of the lock can be more fully actuated.

[0055] In some embodiments, locking assemblies according to the invention can be actuated even after a key has been removed. For example, once the lock cylinder 14 has been unlocked, the relevant key can be removed before the lock cylinder 14 is pushed into the lock body 12. For example, a user can unlock the lock cylinder 14, remove the key, and then push on the face of the lock cylinder 14 with a finger or other mechanical engagement to urge the lock cylinder 14 axially into the lock body 12. Generally, allowing a key to be removed when a locking assembly is in an unlocked configuration can allow the user to have a greater access to the face of the lock cylinder 14. In some configurations, this can usefully provide more surface area to be engaged to push the lock cylinder 14 into the lock body 12, as well as help to avoid accidental breakage of the key.

[0056] In some embodiments, to allow a key to be removed from the locking assembly 10 whether the lock cylinder 14 is unlocked (e.g., as illustrated in FIG. 6A) or locked (e.g., as illustrated in FIG. 6B), the hollow cavity 16 of the lock body 12 can be configured with a particular interior profile. In particular, as partially illustrated in FIG. 4B, the cavity 16 can include a plurality of (e.g., four) recessed channels 16a that extend axially along the cavity 16, each separated from its adjacent neighbors by approximately 90°. In some embodiments, the channels 16a (or other similar features) can provide clearance for movement locking pins (not shown) or other components, so that a key can be inserted into and removed from the lock cylinder 14 at a plurality of different orientations (e.g., as aligned with any one of the channels 16a). Accordingly, for example, a key can be inserted into and removed from the lock cylinder 14 in both a locked and an unlocked orientation.

[0057] In some embodiments, the fixed aspect of the lock body 12 and the movable aspect of the lock cylinder 14 can provide particular benefits. For example, in some embodiments, including as illustrated, a push-button lock cylinder can be configured to be fully contained by a lock body in both a resting state (see, e.g., FIG. 6A) and actuated state (see, e.g., FIG. 6B). This can, for example, allow for a relatively low profile assembly that can be used in a variety of settings, with a convenience that may not be possible for conventional designs.

[0058] Although the locking mechanism of the lock cylinder 14 has been described with reference to a mechanically operated key, similar operability in some embodiments can be achieved using non-mechanical keys, including via active or passive RFID, Bluetooth®, Wi-Fi, passcode entry, Near Field Communication (NFC), or other methods. In some embodiments, when the locking mechanism receives a signal that an electronic key is within communication range, the lock can automatically actuate the lock cylinder 14 to rotate the lock post 18 into alignment with the axial portion 28 of the lock slot 24.

[0059] In some embodiments, a locking assembly such as the locking assembly 10 can be included in a door handle. As illustrated in FIGS. 7A through 7C, for example, a handle assembly 100 for a door can be configured to include the locking assembly 10. In the embodiment illustrated, the handle assembly 100 includes an elongate handle 110 and a base 120, with the handle 110 being lockable to the base 120, in a closed position (see FIG. 7A), using the locking assembly 10. In some configurations, the handle assembly 100 may be particularly well suited for use with electrical enclosures, although other uses are also possible.

[0060] In some embodiments, including as illustrated in FIGS. 7A through 7C, the locking assembly 10 can be positioned at about the middle to the handle 110, with respect to an elongate dimension of the handle 110. This can provide a number of advantages. For example, with the locking assembly 10 positioned near the middle of the handle 110, a relatively greater area is provided for a user to grip the handle 110, as compared to conventional designs. This can, for example, allow for a more ergonomic handle design and increase ease of operation. Further, the extended length of the handle, in combination with location of the locking assembly 10 in the middle of the handle 110, can allow users to relatively easily apply relatively high torque to the handle assembly 100. For example, because the length of the lever arm is generally increased over conventional handles, and because the central location of the lock assembly 10 provides significant area for manual engagement towards a free end of the handle 110, a user can apply rotational force to the handle 110 at a relatively large distance from a pivot point between the handle 110 the base 120.

[0061] As can be seen in FIG. 7B, in which the handle 110 is shown unlocked from the base 120, a locking-assembly cavity 130 extends into the base 120. Generally, the locking-assembly cavity 130 can be sized to receive at least a portion of the locking assembly 10, when the handle 110 is in the closed position. In some embodiments, as shown in FIG. 7A, the handle 110 and base 120 are configured so that the locking assembly 10 is entirely received within the handle 110 and the base 120, when the handle assembly is in a closed position.

[0062] In some embodiments, the base 120 and locking-assembly cavity 130 can be configured so that the locking assembly 10 does not extend beyond the mounting surface of the base 120. In some embodiments, the locking assembly 10 and the locking-assembly cavity 130 can be configured so that the locking assembly 10 locks the handle 110 to the base 120. Accordingly, for example, the locking assembly 10 can be used to prevent rotation of the handle 110 relative to the base 120, rather than locking the handle 110 directly to a relevant door or directly locking the relevant door to a relevant enclosure structure.

[0063] In some embodiments, accordingly, the locking-assembly cavity 130 can provided with an interior geometry that is configured to be securely engaged by the locking assembly 10 to lock the handle 110 to the base 120. For example, as illustrated in FIG. 7C, the locking-assembly cavity 130 includes an interior ledge 132 that configured to engage the lock target 20 when the lock target 20 extends fully out of the lock body 12. Accordingly, with the handle 110 closed and the lock target 20 extending from the lock body 12, contact between the lock target 20 and the interior ledge 132 prevents the handle 110 from being released from the base 120, and the relevant door (not shown) cannot be opened.

[0064] In order to release the handle 110 from the base 120, the lock cylinder 14 can unlocked and then pushed into the lock body 12, as also described above. For example, as also discussed with regard to FIGS. 6A through 6C, an appropriate key (not shown) can be used to rotate the lock cylinder 14, then a user can push the lock cylinder 14 axially into the lock body 12 to move the lock target 20 inwardly relative to the lock body 12. With sufficient actuation of the lock cylinder 14, the lock target 20 can be moved clear of the interior ledge 132, thereby releasing the handle 110 and locking assembly 10 from the base 120 so that the handle 110 can be further actuated by a user.

[0065] In order to re-secure the handle 110 to the base 120 of the handle assembly 100, the handle 110 can be moved to align the locking assembly 10 with the base 120 and then pushed to urge the locking assembly 10 into the locking-assembly cavity 130. The sloped surface 36 of the lock target 20 can thus be moved into contact with one or more features within the locking-assembly cavity 130, with the resulting force on sloped surface 36 causing the lock target 20 to move inwardly into the lock body 12. As the handle 110 continues to be urged into the closed position, the lock target 20 can be moved fully past the interior ledge 132 of the locking-assembly cavity 130, at which point the resilient member 22 of the lock assembly 10 (see, e.g., FIG. 3B) can move the lock target 20 laterally outwardly into engagement with the interior ledge 132 (see, e.g., FIG. 7C). As desired, the locking assembly10 can then be locked (e.g., with a mechanical key) to lock the handle 110 in the closed position.

[0066] In other embodiments, other configurations are possible. For example, FIG. 8 illustrates an alternative embodiment configured as a locking assembly 200 with a lock body 210. Generally, the locking assembly 220 is configured similarly to the locking assembly 10. However, the lock body 210 is formed from relatively less material than the lock body 12 (see, e.g., FIG. 1), in order to generally decrease both the weight and the manufacturing costs of the locking assembly 200.

[0067] In different embodiments, different types of locks and cylinders may be suitable for use in with the disclosed push-button arrangement. For example, although the cylinder shown in each of the illustrative figures is a DIN cylinder, embodiments of the invention can effectively use cam locks, mortise locks, or other locking systems that unlock using rotational movement. Similarly, while examples of the disclosed locking assembly generally address handle assemblies, as may be useful for enclosure doors, the locking assemblies disclosed herein may be readily adapted for use in other applications. For example, locking assemblies according to the invention can be used with filing cabinets, sliding doors, or display cases, or in a variety of other contexts that may require additional security.

[0068] Thus, embodiments of the invention can provide improved locking assemblies. For example, some embodiments of the invention can provide a push-button locking assembly in which a push button and a locking cylinder are formed from one or more shared components. This can result in a locking assembly with relatively simple operation and relatively small size, as well as avoiding other issues of conventional dual-actuation locks (e.g., as discussed above).

[0069] It will be appreciated by those skilled in the art that while the invention has been described above in connection with particular embodiments and examples, the invention is not necessarily so limited, and that numerous other embodiments, examples, uses, modifications and departures from the embodiments, examples and uses are intended to be encompassed by the claims attached hereto. The entire disclosure of each patent and publication cited herein is incorporated by reference, as if each such patent or publication were individually incorporated by reference herein. Various features and advantages of the invention are set forth in the following claims.

Claims

1. A push-button locking assembly (10) for a door, the push-button locking assembly comprising:

    a lock body (12) with an internal cavity (16) and a slot (24) that is open to the internal cavity (16);
    a lock cylinder (14) that is received within the internal cavity (16) of the lock body (12), the lock cylinder (14) being configured to be rotated between a locked orientation and an unlocked orientation and configured to be axially pushed by a user to open the door, when in the unlocked orientation; and
    a lock post (18) coupled to the lock cylinder (14), the lock post (18) extending at least partly into the slot (24) in the lock body (12);
    the slot (24) being configured to:

        engage the lock post (18) to prevent axial movement of the lock cylinder (14) relative to the lock body (12) when the lock cylinder (14) is in the locked orientation; and
        permit axial movement of the lock cylinder (14) relative to the lock body (12) when the lock cylinder (14) is in the unlocked orientation.

2. The push-button locking assembly (10, 100) of claim 1, wherein the slot (24) includes an circumferential portion (26) and an axial portion (28); and
    wherein, with the lock cylinder (14) in the locked orientation, the lock post (18) is disposed in the circumferential portion (26) of the slot (24) and the circumferential portion (26) of the slot (24) blocks axial movement of the lock post (18) to prevent the axial movement of the lock cylinder (14) relative to the lock body (12).

3. The push-button locking assembly (10, 100) of claim 2, wherein rotation of the lock cylinder (14) to the unlocked orientation moves the lock post (18) from the circumferential portion (26) of the slot (24) into alignment with the axial portion (28) of the slot (24).

4. The push-button locking assembly (10, 100) of any of the preceding claims, further comprising:

    a lock target (20) that is at least partially received within the lock body (12) and is configured to be moved to an open orientation by an inner end of the lock cylinder (14) when the lock cylinder (14) is pushed axially.

5. The push-button locking assembly (10, 100) of claim 4, wherein the lock target (20) is coupled to a resilient member (22) having a longitudinal axis (22a);
    wherein the resilient member (22) biases the lock target (20) away from the open orientation; and
    wherein the lock target (20) is configured to move in parallel with the longitudinal axis (22a) of the resilient member (22) when moved by the inner end of the lock cylinder (14).

6. The push-button locking assembly (10, 100) of claim 5, wherein the lock target (20) includes an engagement cavity (38) with a drive section (40) and a stopping section (42); and
wherein the drive section (40) of the engagement cavity (38) includes an angled surface configured to cause the lock target (20) to move in parallel with the longitudinal axis (22a) of the resilient member (22) in response to an axial force applied to the drive section (40) by axial movement of the lock cylinder (14).

7. The push-button locking assembly (10, 100) of either of claims 5 or 6, wherein the longitudinal axis (22a) of the resilient member (22) is substantially perpendicular to the axial movement of the lock cylinder (14).

8. The push-button locking assembly (10, 100) of any of the preceding claims, further comprising:

a handle assembly (100) that includes a handle (110) and a base (120);
wherein the lock body (12) is coupled to the handle (110);
wherein the base (120) is coupled to the handle (110); and
wherein the base (120) includes a locking assembly cavity (130) that is configured to receive a lock target (20) that is at least partially received within the lock body (12), to lock the handle (110) to the base (120).

9. The push-button locking assembly (10, 100) of claim 8, wherein the handle (110) includes an elongate handle body; and
wherein the locking body is coupled to the elongate handle body at about the middle of the elongate handle body in the elongate direction.

10. The push-button locking assembly (10, 100) of either of claims 8 or 9, wherein the locking assembly cavity (130) includes an interior ledge (132) that is configured to engage a portion of the lock target (20) to restrict motion of the handle (110) relative to the base (120).

11. A method of opening a door that is secured closed with a push-button locking assembly (10, 100), the push-button locking assembly (10, 100) including a lock body (12) with an internal cavity (16) and a slot (24) that is open to the internal cavity (16), a lock cylinder (14) that is rotatably and slidably received in the internal cavity (16), and a lock post (18) that is coupled to the lock cylinder (14) and extends at least partly into the slot (24) in the lock body (12), the method comprising:

inserting a key into the lock cylinder (14);
rotating the key and the lock cylinder (14) relative to the lock body (12) to dispose the lock cylinder (14) in an unlocked orientation; and
manually pushing the lock cylinder (14) axially into the internal cavity (16) to release the push-button locking assembly (10, 100) so that the door can be opened.

12. The method of claim 11, with the slot (24) including a circumferential portion (26) and an axial portion (28), and with the circumferential portion (26) of the slot (24) being configured to engage the lock post (18) to block axial movement of the lock cylinder (14) relative to the lock body (12), wherein rotating the key and the lock cylinder (14) moves the lock post (18) into alignment with the axial portion (28) of the slot (24).

13. The method of either of claims 11 or 12, with the push-button locking assembly (10, 100) further including a lock target (20), wherein manually pushing the lock cylinder (14) axially into the internal cavity (16) moves the lock target (20) to an open orientation.

14. The method of claim 13, with the push-button locking assembly (10, 100) further including a resilient member (22) configured to bias the lock target (20) away from the open orientation, wherein manually pushing the lock cylinder (14) axially into the internal cavity (16) moves the lock target (20) against the bias of the resilient member (22).

15. The method of any of claims 11 through 14, further comprising:
before manually pushing the lock cylinder (14), removing the key from the lock cylinder (14).

FIG. 1

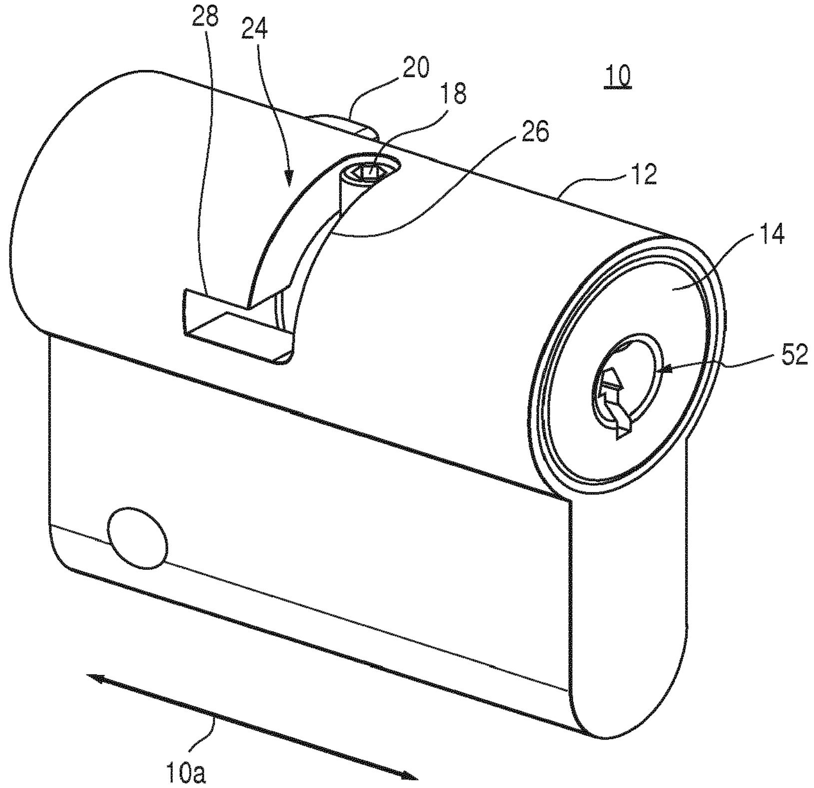


FIG. 2

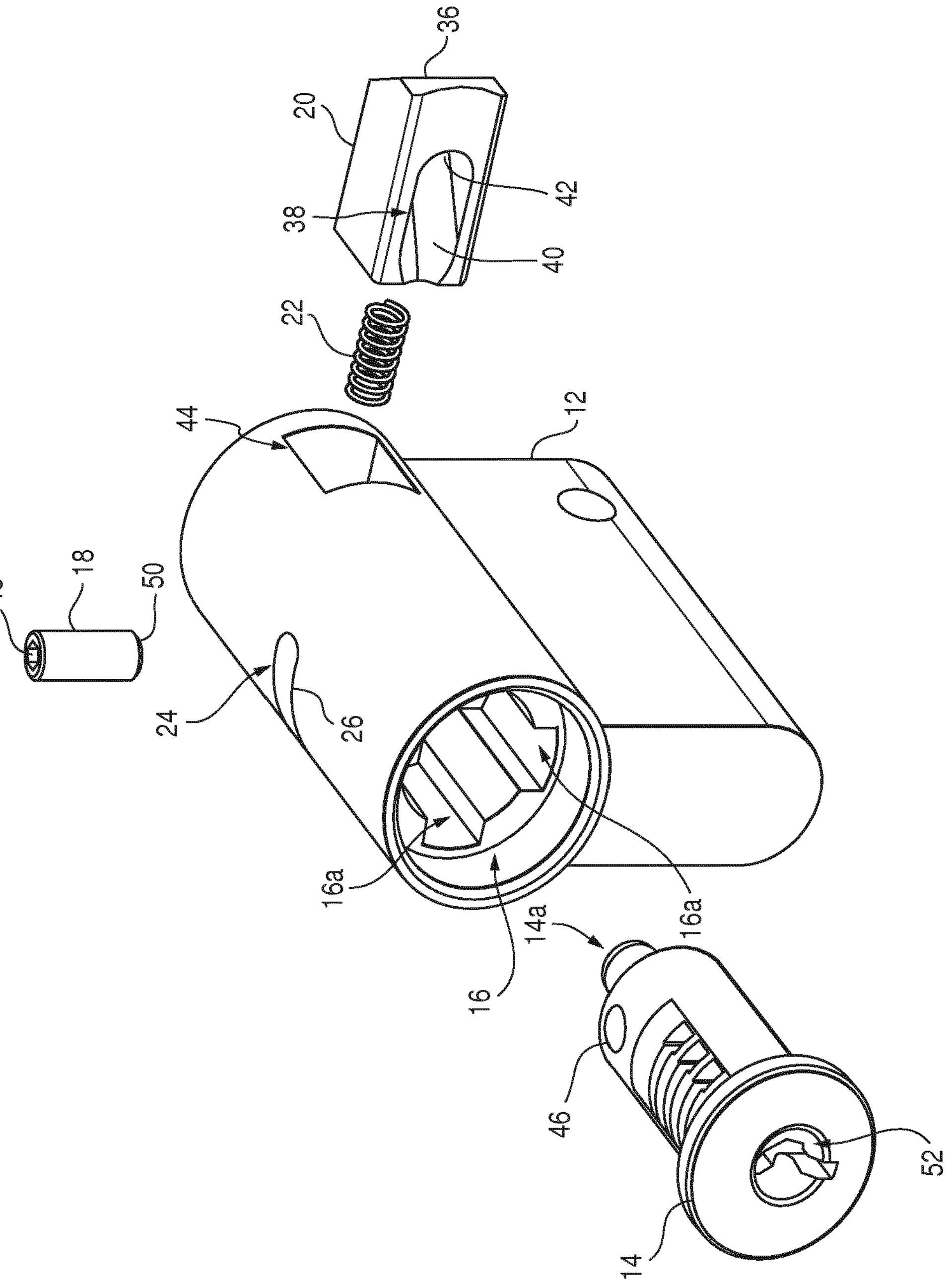


FIG. 3A

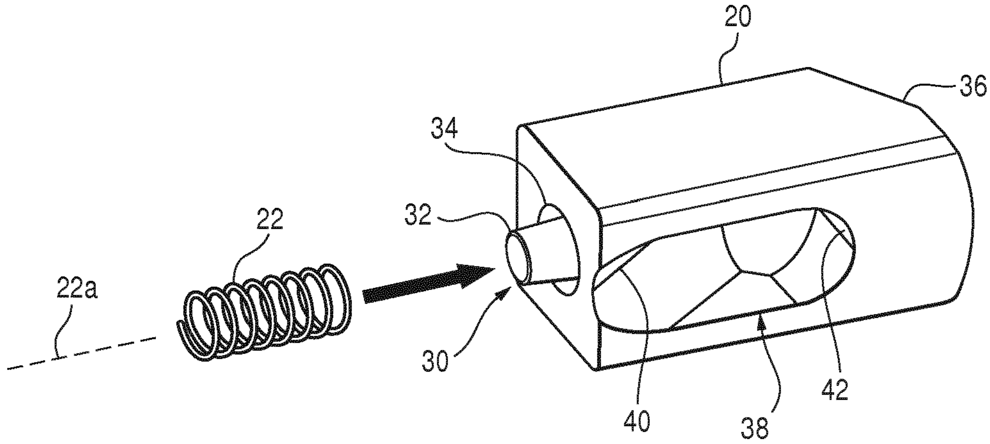


FIG. 3B

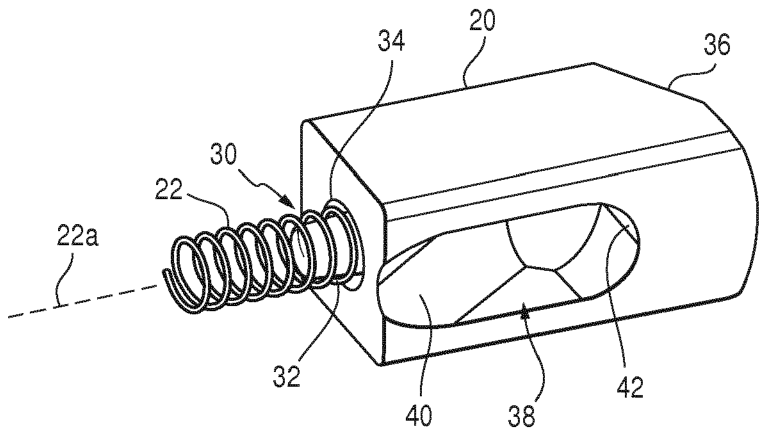


FIG. 4A

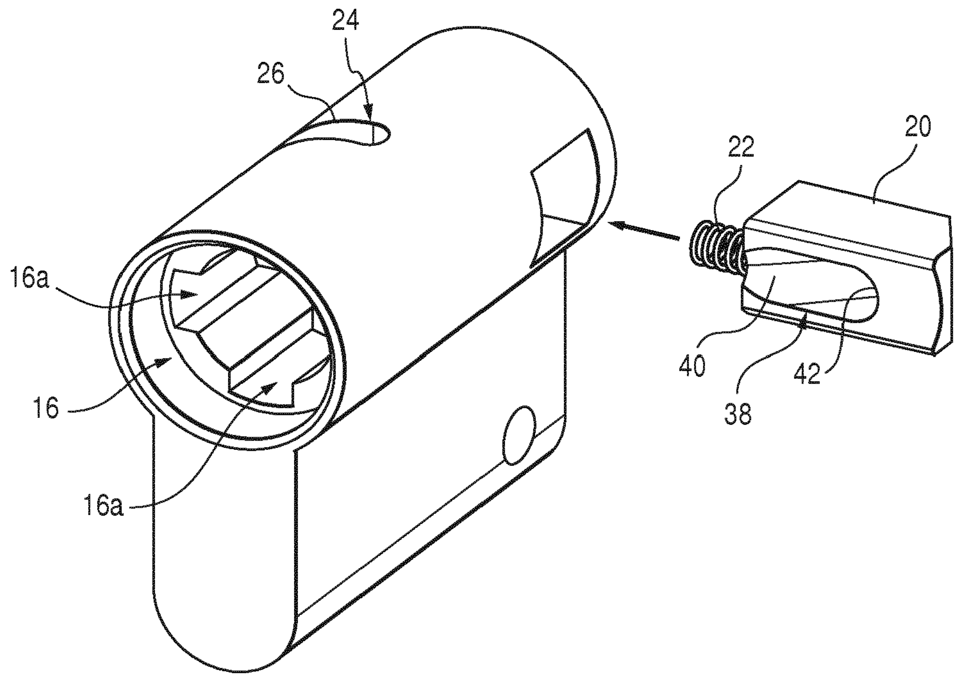


FIG. 4B

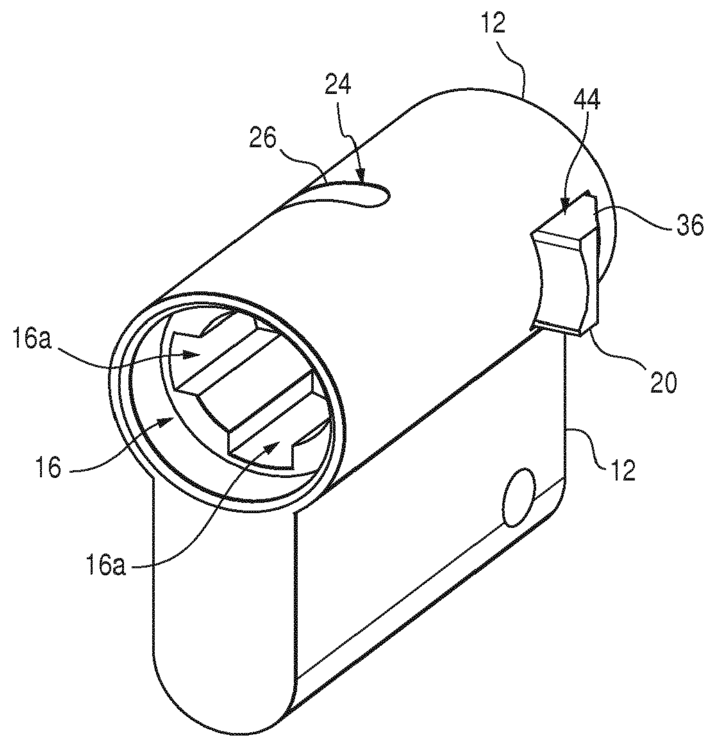


FIG. 5A

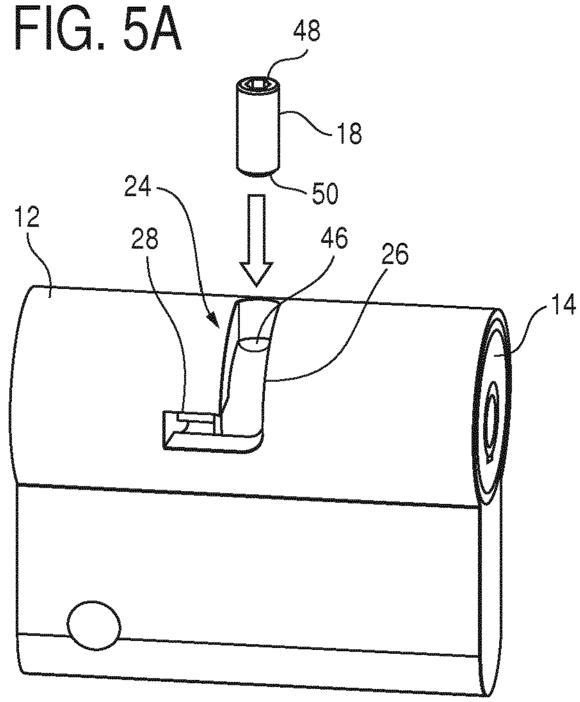


FIG. 5B

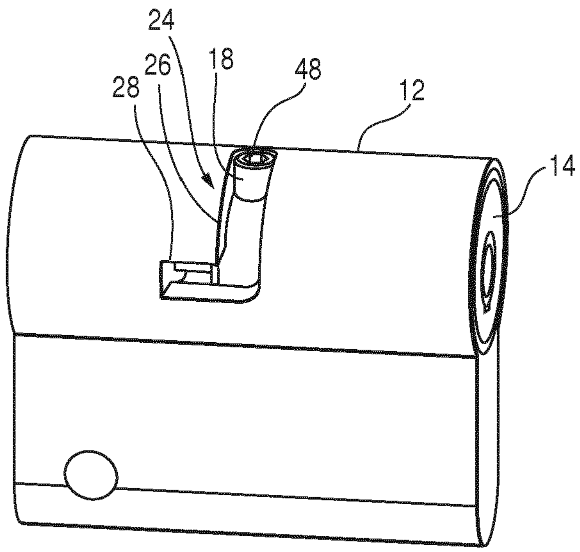


FIG. 6A

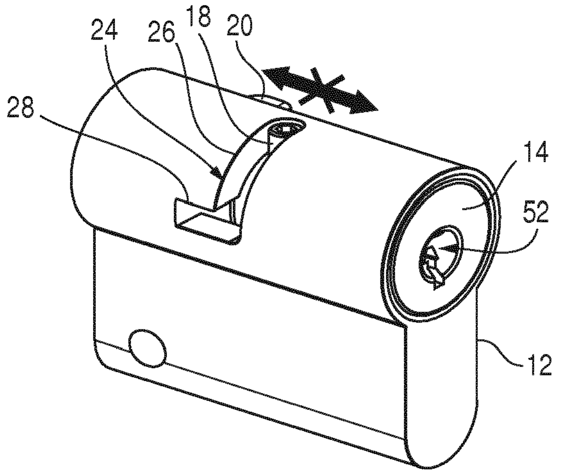


FIG. 6B

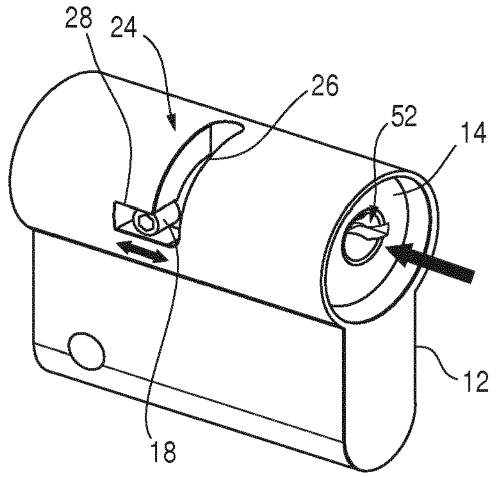


FIG. 6C

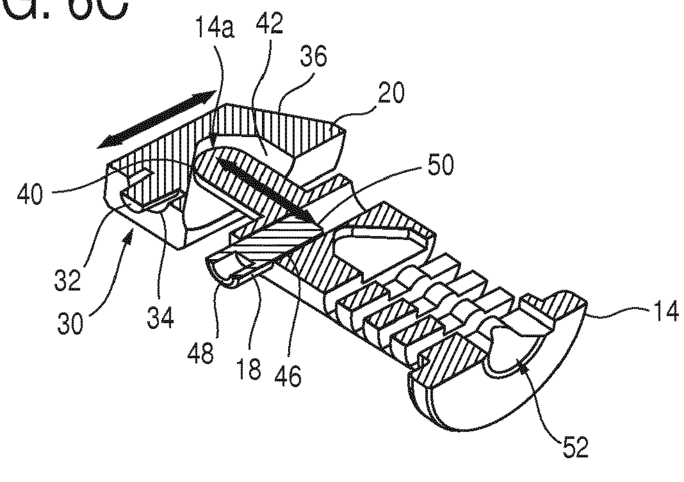


FIG. 7A

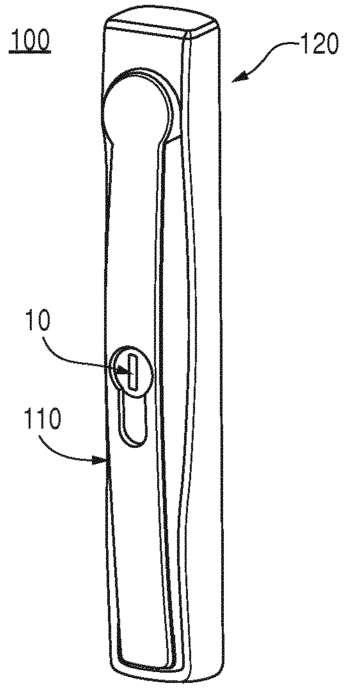


FIG. 7B

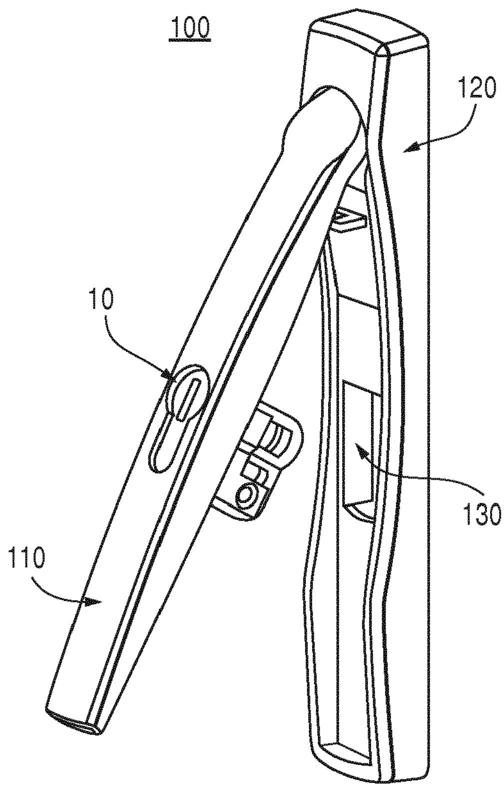


FIG. 7C

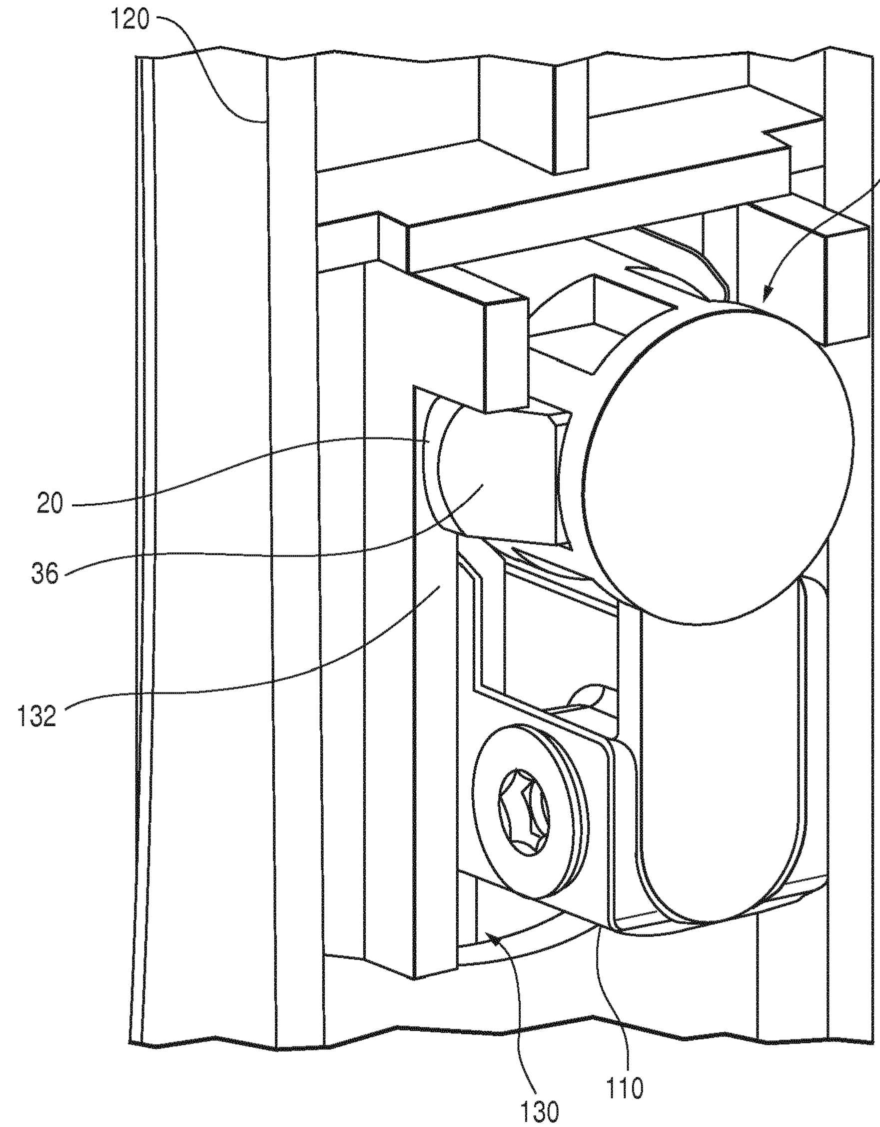
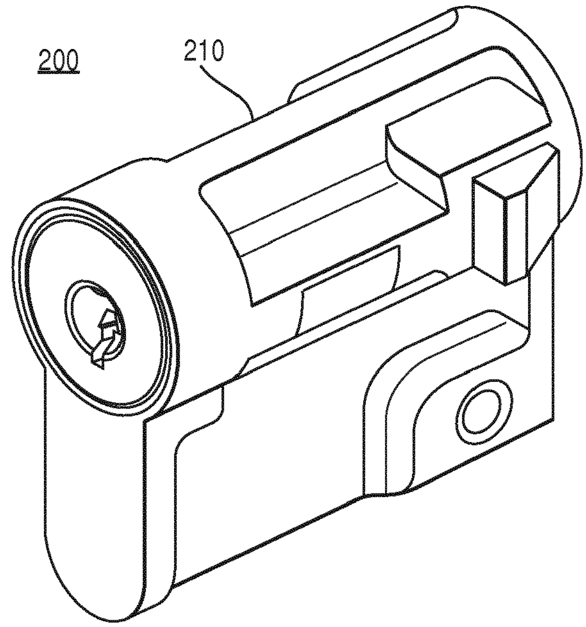


FIG. 8



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EUROPEAN SEARCH REPORT

Application Number
EP 18 17 7678

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	15 October 2018	Van Beurden, Jason

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