



(11) **EP 4 269 731 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
01.11.2023 Bulletin 2023/44

(51) International Patent Classification (IPC):
E05B 47/06^(2006.01) E05B 1/00^(2006.01)

(21) Application number: **23170428.9**

(52) Cooperative Patent Classification (CPC):
E05B 47/0611; E05B 1/0007; E05B 1/0069

(22) Date of filing: **27.04.2023**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

- **CRUMPTON, Tony**
Maghull
Liverpool
L31 2HD (GB)
- **FALKINGHAM, David**
Thornton Cleveleys
Lancashire
FY5 2ZG (GB)

(30) Priority: **29.04.2022 GB 202206316**

(74) Representative: **Prichard, Leslie Stephen**
Culverstons
20 Dawlish Road
Wirral, Merseyside CH61 2XP (GB)

(71) Applicant: **Anti-Ligature Shop Ltd**
Warrington WA2 7UW (GB)

(72) Inventors:

- **NEED, Carl**
Widnes
Cheshire
WA8 9AZ (GB)

(54) **ANTI-LIGATURE KEYLESS ACCESS CONTROL DEVICE**

(57) The present invention relates to an anti-ligature keyless access control device for securing a door being pivotally mounted in a frame, the locking and unlocking of the door being controlled by a door lock, the keyless access control device comprising:
a keyless entry cylinder comprising:
an electronic cylinder housing that can be inserted into the lock case,
a locking cam that is rotatably mounted with respect to the housing for actuating locking devices of the door lock,

an electronics receiver module which verifies authorisation of a person requesting access, and
a rotatable knob which projects from the door lock for actuating the locking cam when access authorisation has been determined, and

an anti-ligature turn pull and base surrounding the rotatable knob which resists or inhibits ligatures from being attached thereon

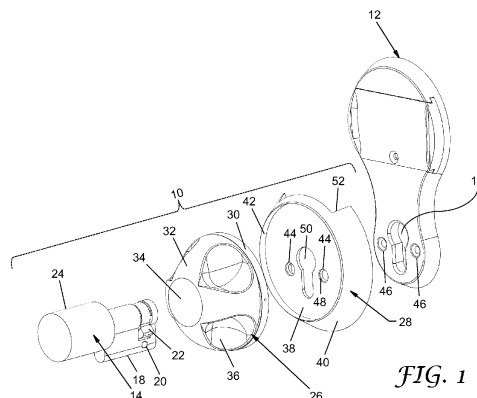


FIG. 1

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] This invention relates to an anti-ligature keyless access control device. In particular, this invention relates to an anti-ligature keyless access control device that can be used on new or existing mental health mechanical locksets, or retrofitted to existing mental health mechanical locksets. The invention replaces the mechanical key cylinder lock within the existing lock case with an electronic keyless entry cylinder with an anti-ligature turn pull handle along with various adaptor bases.

BACKGROUND

[0002] Mental health treatment settings or environments generally provide residential care for individuals in crisis who are often referred to as either patients or service users. Most residential mental health treatment settings are designed to be comfortable, and to promote different levels of self-autonomy within each person's recovery journey. A service user is usually assigned their own room for privacy. It has been known for many years to utilise mechanical key cylinder locks to lock, and unlock, doors within mental health treatment environments. Because of the risk of barricade, the mechanical key cylinder locks controlling access to an individual service user's room, often incorporate a secondary override system which prevents a service user from holding or jamming the turn and pull handle on one side of the door to prevent staff entry. These override methods can also directly turn the spindle, allowing entry even if the keyway of the mechanical key cylinder lock is blocked with moistened paper or chewing gum.

[0003] Whilst these mental health locksets having a secondary override function have proven popular since they ensure service user safety, there is now a general shift in mental health treatment environments to empower service users, giving them more autonomy and control. At the moment, if a service user wishes to enter their own room during the course of the day, for example, they have to attract the attention of the staff, or other keyholder, to be let into their room. This can be both frustrating and time-consuming for service users and staff, and blocking the keyway of a mechanical key cylinder lock with a foreign object is a common way in which this frustration can manifest itself.

[0004] In recent years, keyless or wireless locking cylinders that have the same form factor as a mechanical cylinder lock have been utilised in various access control applications. With these keyless entry cylinders, the locking cylinder can be replaced by a linkage that has a turning knob on the inside and/or outside of the door. The linkage includes a cam that actuates the lock, like a mechanical cylinder lock. The cam is however coupled to the turning knob on the inside and/or outside of the door via an electromagnetically-actuated clutch. An electron-

ics receiver module within the keyless entry cylinder controls the clutch in such a manner that it only establishes a rotary connection with the turning knob to open the door if a high-frequency transponder (often a fob or credit card-sized transmitter) is held in proximity to, and communicates with, the receiver. The access rights of the transponder being performed in a previous programming process.

[0005] However, the take-up of keyless or wireless access control devices and systems in mental health settings have hitherto not proven popular. There are a number of reasons for this.

[0006] The main reason is the proliferation of mechanical locksets having a secondary override function already in mental health treatment settings or environments. These mental health settings have already made a significant capital investment in terms of these locksets, which, despite their disadvantages, still provide a critical lifesaving role. In common with many organisations, budgets are increasingly under pressure, but with the current philosophy of empowering service users there is a tension to allow service users to have keyless access to specific doors.

[0007] Whilst there are keyless anti-ligature access control devices on the market, they require significant alterations or modifications to the existing door, which, if the integrity of the fire rating of the door is not maintained would also require a new door to be fitted. These kinds of installation works can be both disruptive and time-consuming, as well as costly.

[0008] Accordingly, there is a need for an anti-ligature keyless access control device that uses the existing lock aperture and which requires no alteration to the existing door, and therefore the door fire rating will remain intact. It is also desirable for there to be an anti-ligature keyless access control device that utilises a keyless entry cylinder with an anti-ligature turn pull and boss, so that the lock can be adapted at each door in a matter of minutes, to minimise disruption at the mental health treatment setting. It is also desirable for there to be an anti-ligature keyless access control device that promotes upcycling, by re-using the majority of the existing door and lock infrastructure to minimise waste, time and money, and enabling service users to have keyless access to specific doors as part of the current treatment philosophy of empowering service users, yet keeping them safe.

[0009] Accordingly, an object of the present invention is to provide an anti-ligature keyless access control device that uses the existing lock aperture and which requires no alteration to the existing door, and therefore the door fire rating will remain intact. It is a further object of the present invention to provide an anti-ligature keyless access control device that utilises a keyless entry cylinder with an anti-ligature turn pull and boss, so that the lock can be adapted at each door in a matter of minutes, to minimise disruption at the mental health treatment setting. It is a further object of the present invention to provide an anti-ligature keyless access control device

that promotes upcycling, by re-using the majority of the existing door and lock infrastructure to minimise waste, time and money, and enabling service users to have keyless access to specific doors as part of the current treatment philosophy of empowering service users, yet keeping them safe.

SUMMARY OF THE INVENTION

[0010] The present invention is described herein and in the claims.

[0011] According to the present invention there is provided an anti-ligature keyless access control device for securing a door being pivotally mounted in a frame, the locking and unlocking of the door being controlled by a door lock, the keyless access control device comprising:

a keyless entry cylinder comprising:

- an electronic cylinder housing that can be inserted into the lock case,
- a locking cam that is rotatably mounted with respect to the housing for actuating locking devices of the door lock,
- an electronics receiver module which verifies authorisation of a person requesting access, and
- a rotatable knob which projects from the door lock for actuating the locking cam when access authorisation has been determined, and

an anti-ligature turn pull and base surrounding the rotatable knob which resists or inhibits ligatures from being attached thereon

[0012] An advantage of the present invention is that it can use the existing lock aperture of a mechanical key cylinder lock already fitted to the door which can be replaced with a keyless entry cylinder with an anti-ligature turn pull and base, and which requires no alteration to the existing door, or door lock, to enable the improvement to be carried out quickly and economically.

[0013] Preferably, the electronics receiver module being arranged inside the rotatable knob.

[0014] Further preferably, the rotatable knob is coupled to the locking cam via a clutch controlled by the electronics receiver module.

[0015] In use, the electronics receiver module which verifies authorisation of the person requesting access may energise an electromagnet which actuates the clutch such that the rotatable knob is rotatably coupled with the locking cam.

[0016] Preferably, the electronics receiver module undergoes a data exchange with a transponder when the transponder is positioned wirelessly in proximity to the electronics receiver module.

[0017] Further preferably, the turn pull and base extends the length of the rotatable knob projecting from the

door lock.

[0018] In use, the turn pull may be a unitary body with a circular base from which a generally hemispherical dome shape projects, and an axial cylindrical bore running completely therethrough from the base to the apex of hemispherical dome

[0019] Preferably, the knob is received in the axial cylindrical bore of the turn pull and abuts to form a close or interference fit therebetween.

[0020] Further preferably, the turn pull comprises a plurality of finger grips disposed equidistantly around the axial cylindrical bore.

[0021] In use, each of the finger grips may be teardrop-shaped.

[0022] Preferably, the base being a planar body comprising a generally flat base, a circumferential side wall which tapers from the base, the distal edge of side wall forming a lip which receives and nests the circular base of the turn pull.

[0023] Further preferably, the circumferential side wall includes a cut-out such that the base wall sits flush with the outer cover of the door lock.

[0024] In use, the electronic cylinder housing may replace the existing mechanical cylinder in the existing lock case.

[0025] Further according to the present invention there is provided an anti-ligature turn pull and base being locatable on the outer circumference of the knob of a keyless entry cylinder comprising a cylinder housing that can be inserted into a door lock, the turn pull and base resists or inhibits ligatures from attachment thereon.

[0026] Preferably, the anti-ligature turn pull has a generally hemispherical dome shape and the base has a tapered profile.

[0027] Further preferably, the turn pull can be co-moulded with the outer circumference of the knob.

[0028] In use, the turn pull and base may be formed via injection moulding and/or blow moulding and/or vacuum forming and/or rotational moulding and/or compression moulding and/or rim moulding and/or powder impression moulding and/or additive manufacturing and/or 3D printing.

[0029] Preferably, the turn pull and base are formed from a lathe machined and/or welded construction and/or pressed and/or cast and/or forged from a suitable metal material and alloys thereof.

[0030] Also according to the present invention there is provided a method of manufacturing an anti-ligature turn pull and base being as hereinbefore described, comprising the steps of:

supplying a polymer or alloy into a moulding tool; and ejecting the moulded parts from the moulding tool.

[0031] Preferably, the polymer is selected from the group consisting, but not limited to, any of the following: High-Density Polyethylene (HDPE), Polypropylene (PP), Low-Density Polyethylene (LDPE), Polyethylene

Terephthalate (PET), Polyvinyl Chloride (PVC) or Acrylonitrile Butadiene Styrene (ABS) or a biobased polymer or blends thereof.

[0032] Further preferably, the method of manufacturing further comprising a step of admixing an antimicrobial additive with the polymer.

[0033] In use, the antimicrobial additive may comprise an active ingredient based on silver ions.

[0034] Preferably, the method of manufacturing further comprising a step of admixing one or more dyes or pigment with the polymer.

[0035] Also further according to the present invention there is provided a kit of parts for an anti-ligature keyless access control device being as hereinbefore described or the anti-ligature turn pull and base being as hereinbefore described.

[0036] It is believed that an anti-ligature keyless access control device, an anti-ligature turn pull and base, its method of manufacture and a kit of parts in accordance with the present invention at least addresses the problems outlined above.

[0037] It will be obvious to those skilled in the art that variations of the present invention are possible and it is intended that the present invention may be used other than as specifically described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038] The present invention will now be described by way of example only, and with reference to the accompanying drawings, in which:

Figure 1 is a side perspective view of an exploded anti-ligature keyless access control device in accordance with the present invention;

Figure 2 illustrates a side perspective view of an assembled anti-ligature keyless access control device in accordance with the present invention; and

Figure 3 shows a side perspective view of an alternative boss configuration in accordance with a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0039] The present invention has adopted the approach of utilising an anti-ligature keyless access control device that can be used on new mental health mechanical locksets, or retrofitted to existing mental health mechanical locksets, and which replaces the mechanical key cylinder lock with a keyless entry cylinder with an anti-ligature turn pull and boss. Advantageously, the present invention provides an anti-ligature keyless access control device that uses the existing lock aperture and which requires no alteration to the existing door, and therefore the door fire rating will remain intact. Further advanta-

geously, the present invention also provides an anti-ligature keyless access control device that utilises a keyless entry cylinder with an anti-ligature turn pull and boss, so that the lock can be adapted at each door in a matter of minutes, to minimise disruption at the mental health treatment setting. Further advantageously, the present invention also provides an anti-ligature keyless access control device that promotes upcycling, by re-using the majority of the existing door and lock infrastructure to minimise waste, time and money, and enabling service users to have keyless access to specific doors as part of the current treatment philosophy of empowering service users, yet keeping them safe.

[0040] Referring now to the drawings, an anti-ligature keyless access control device 10 according to the present invention is illustrated in Figure 1. Specifically, the keyless access control device 10 is for securing a door (not shown) that is mounted in a frame (not shown). The locking and unlocking of the door being controlled by an access control lockset that can have a secondary override system. In Figure 1, the outer cover 12 of such an access control lockset is shown, which, in use, would be secured to a first side of the door.

[0041] In the present invention, the keyless access control device 10 replaces a mechanical key cylinder lock of the access control lockset with a keyless entry cylinder 14 which is received in the existing lock aperture 16 in the outer cover 12 of the access control lockset, and which therefore requires no alteration whatsoever to the door. The skilled person will understand that the keyless access control device 10 can be retrofitted to a previously installed access control lockset, or be part of a new installation.

[0042] The keyless entry cylinder 14 of the present invention is one that is known in the art and comprises a cylinder housing 18 that can be received in the lock aperture 16. The cylinder housing 18 also includes a threaded aperture 20 through which the housing 18 can be secured using a threaded fastener (not shown). A locking cam 22 is rotatably mounted with respect to the housing 18 for actuating the locking device of the lockset.

[0043] A turning knob 24 is mounted at the opposite end of the cylinder housing 18 for actuating the cam 22 when access authorisation has been determined by an electronics receiver module (not shown) which verifies authorisation of a person requesting access. The electronics receiver module is usually positioned inside the knob 24. As would be known to someone skilled in the art, the electronics receiver module controls an electromagnet, which actuates a clutch, which can transmit any rotation of the knob 24 to turn the cam driver 22.

[0044] A service user who wishes to open (or close) a door is issued with, or assigned, a high-frequency transponder, which can be a fob or credit card-sized transmitter (not shown), and which can be held in proximity to, and communicates with, the electronics receiver module in the keyless entry cylinder 14. When the transponder is held within the range of wireless communication to the

electronics receiver module, both exchange data according to a predefined access control protocol, which enables the electronics receiver module to determine the identity of the transponder and to verify whether it grants access authorisation to the room secured by the keyless access control device 10 in question.

[0045] When access authorisation is given, the electronics receiver module momentarily energises an electromagnet, which actuates a clutch in such a way that the knob 24 is rotatably coupled with the cam 22, and the door can be unlocked (or locked). After short time period, of the order of several seconds, the electronics receiver module de-energises the electromagnet and the clutch separates the rotatable connection, so that the knob 24 simply rotates freely without driving the cam 22.

[0046] The knob 24 of the keyless entry cylinder 14 also receives an anti-ligature turn pull 26 and boss or base 28 which resists the insertion of a ligature on, or around, the knob 24 or connection to the outer cover 12 of a pre-existing mechanical lockset. As best shown in Figure 1, the turn pull 26 has a circular base 30 from which a generally hemispherical dome shape 32 projects. The turn pull 26 includes an axial cylindrical bore 34 running completely therethrough from the base 30 to the apex of the rounded or hemispherical dome 32. The knob 24 and turn pull 26 are capable of being brought together and aligned through the bore 34 to form a close or interference fit therebetween. In addition, the turn pull 26 can be held in place using a threaded fastener, such as a grub screw (not shown) or the like.

[0047] In an alternative embodiment of the invention, it is envisaged that the turn pull 26 and the rotary knob 24 can have a unitary structure.

[0048] The turn pull 26 also includes a plurality of finger grips 36 that enable a service user to grasp and rotate the turn pull 26, and hence rotate and pull the knob 24 to open and close the door, as required. In the embodiment shown in Figure 1, each of these finger grips 36 is teardrop-shaped, and the number of teardrop-shaped indentations or grips 36 disposed around the turn pull 26 is four. This is in no way intended to be limiting or exhaustive.

[0049] In use, the turn pull 26 is seated upon a boss 28. The boss 28 is formed as a largely planar body, and having a generally flat base 38 which supports the circular base 30 of the turn pull 26 and allows it to rotate therein. Around the periphery of the flat base 38 is a side wall 40 which extends both upwardly and downwardly from the base 38 through an angle α (as illustrated, for reasons of clarity in Figure 3). The distal edge of side wall 40 forms a rim or lip 42 that is in a plane substantially perpendicular to the base 38. The rim or lip 42 receives and nests the circular base 30 of the turn pull 26.

[0050] The side wall 40 projects upwardly and downwardly from the base 38 at an angle α such that it cannot support the formation of a ligature on-or-around the boss 28, as best shown in Figure 2. In use, the boss 28 is secured to the outer cover 12 of the access control lock-

set through screw holes 44 and threaded fasteners (not shown) which meet with complementary screw holes 46 on the outer cover 12 of the access control lockset. The screw holes 44 on the boss 28 are typically countersunk 48 which provides space for the threaded fasteners (not shown) to sit flush, or below, the base wall 38. The boss 28 also includes a lock aperture 50 which can receive the cylinder housing 18. The side wall 40 also includes a cut-out 52, or is otherwise segmented, so that base wall 38 sits flush with the outer cover 12 of the access control lockset.

[0051] Figure 2 shows an assembled anti-ligature keyless access control device 10 in accordance with the present invention. It is clear to the skilled person that both the turn pull 26 and boss 28 at all time resists the formation, or insertion, or tying of a ligature on-or-around the rotary knob 24.

[0052] Figure 3 shows a second embodiment of the keyless access control device 10 of the present invention. The construction of the second embodiment is very similar to that of the first embodiment and corresponding features have been given the same reference numerals.

[0053] The second embodiment differs from the first embodiment in that the boss 28 can be configured without a cut-out 52 provided around the side wall 40, so that the boss 28 can seat against a wide range of mental health access control locksets which have a secondary override system. The thickness of the base wall 38 can also be increased.

[0054] In a preferred embodiment, the turn pull 26 and boss 28 is formed from a polymer such as High-Density Polyethylene (HDPE). Alternatively, the turn pull 26 and boss 28 can be formed from a polymer such as Polypropylene (PP), Low-Density Polyethylene (LDPE), Polyethylene Terephthalate (PET), Polyvinyl Chloride (PVC) or Acrylonitrile Butadiene Styrene (ABS) or blends thereof. Equally, the skilled person will appreciate that the turn pull 26 and boss 28 can be formed from any number of synthetic plastics, such as a thermoplastic or thermoset material. The above list is no way intended to be limiting or exhaustive.

[0055] The turn pull 26 and boss 28 can be manufactured using techniques such as injection moulding, blow moulding, vacuum forming, rotational moulding, compression moulding, rim moulding, powder impression moulding or any other form of plastics or rubber manufacture, as additive manufacturing or 3D printing.

[0056] The turn pull 26 and boss 28 can be supplied in a number of different colours.

[0057] The turn pull 26 and boss 28 may also contain silver ion technology. In order to diminish the risk of the build-up or transfer of germs or bacteria, an antimicrobial additive, such as silver ions, could be admixed with the polymer forming the turn pull 26 and boss 28. Impregnating the turn pull 26 and boss 28 with an antimicrobial additive will prevent against methicillin-resistant *Staphylococcus aureus* (MRSA), *Escherichia coli* (E. coli), *Legionella*, *Salmonella*, *Campylobacter*, *Listeria* and *Pseu-*

domonas. Such antimicrobial additives are also proven effective against a wide range of microbes including bacteria, mould and fungi, even multi-drug resistant bacteria and the H1N1 or Covid-19 virus. The above list is in no way intended to be limiting and exhaustive.

[0058] The construction of the turn pull 26 and boss 28, or parts thereof, can also be via any suitable form of metal fabrication, e.g., machined, pressed, cast or forged from a suitable metal, such as aluminium, brass, stainless-steel and combinations and alloys thereof. The turn pull 26 and the rotary knob 24 can be formed having a unitary structure.

[0059] Therefore, the keyless access control device 10 according to the present invention can be used on new mental health mechanical locksets, or retrofitted to existing mental health mechanical locksets, and which replaces the mechanical key cylinder lock with a keyless entry cylinder with an anti-ligature turn pull 26 and boss 28. The skilled person will also understand that the keyless access control device 10 according to the present invention can also be used on in conjunction with locksets that do not incorporate or include a secondary override function.

[0060] When used in this specification and claims, the terms "comprises" and "comprising" and variations thereof mean that the specified features, steps or integers are included. The terms are not to be interpreted to exclude the presence of other features, steps or components. The singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "includes" and/or "including" when used herein, specify the presence of stated features, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, steps, operations, elements, components, and/or groups thereof.

[0061] The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, separately, or in any combination of such features, can be utilised for realising the invention in diverse forms thereof.

[0062] The invention is not intended to be limited to the details of the embodiments described herein, which are described by way of example only. It will be understood that features described in relation to any particular embodiment can be featured in combination with other embodiments.

[0063] It is contemplated by the inventor that various substitutions, alterations and modifications may be made to the invention without departing from the spirit and scope of the invention as defined by the claims.

CLAUSES

[0064] The following clauses define preferred embodiments of the invention.

1. An anti-ligature keyless access control device for securing a door being pivotally mounted in a frame, the locking and unlocking of the door being controlled by a door lock, the keyless access control device comprising:

a keyless entry cylinder comprising:

an electronic cylinder housing that can be inserted into the lock case,
a locking cam that is rotatably mounted with respect to the housing for actuating locking devices of the door lock,
an electronics receiver module which verifies authorisation of a person requesting access, and
a rotatable knob which projects from the door lock for actuating the locking cam when access authorisation has been determined, and

an anti-ligature turn pull and base surrounding the rotatable knob which resists or inhibits ligatures from being attached thereon.

2. The anti-ligature keyless access control device according to clause 1, wherein the electronics receiver module being arranged inside the rotatable knob.

3. The anti-ligature keyless access control device according to clauses 1 or 2, wherein the rotatable knob is coupled to the locking cam via a clutch controlled by the electronics receiver module.

4. The anti-ligature keyless access control device according to clause 3, wherein the electronics receiver module which verifies authorisation of the person requesting access energises an electromagnet which actuates the clutch such that the rotatable knob is rotatably coupled with the locking cam.

5. The anti-ligature keyless access control device according to any of the preceding clauses, wherein the electronics receiver module undergoes a data exchange with a transponder when the transponder is positioned wirelessly in proximity to the electronics receiver module.

6. The anti-ligature keyless access control device according to any of the preceding clauses, wherein the turn pull and base extends the length of the rotatable knob projecting from the door lock.

7. The anti-ligature keyless access control device according to any of the preceding clauses, wherein the turn pull being a unitary body with a circular base from which a generally hemispherical dome shape projects, and an axial cylindrical bore running completely therethrough from the base to the apex of hemispherical dome

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8. The anti-ligature keyless access control device according to clause 7, wherein the knob is received in the axial cylindrical bore of the turn pull and abuts to form a close or interference fit therebetween.

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9. The anti-ligature keyless access control device according to clause 8, wherein the turn pull comprises a plurality of finger grips disposed equidistantly around the axial cylindrical bore.

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10. The anti-ligature keyless access control device according to clause 9, wherein each of the finger grips is teardrop-shaped.

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11. The anti-ligature keyless access control device according to any of clauses 6 to 10, wherein the base being a planar body comprising a generally flat base, a circumferential side wall which tapers from the base, the distal edge of side wall forming a lip which receives and nests the circular base of the turn pull.

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12. The anti-ligature keyless access control device according to clause 11, wherein the circumferential side wall includes a cut-out such that the base wall sits flush with the outer cover of the door lock.

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13. The anti-ligature keyless access control device according to clause 1, wherein the electronic cylinder housing can replace the existing mechanical cylinder in the existing lock case.

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14. An anti-ligature turn pull and base being locatable on the outer circumference of the knob of a keyless entry cylinder comprising a cylinder housing that can be inserted into a door lock case, the turn pull and base resists or inhibits ligatures from being attachment thereon.

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15. The anti-ligature turn pull and base according to clause 14, wherein the anti-ligature turn pull has a generally hemispherical dome shape and the base has a tapered profile.

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16. The anti-ligature turn pull and base according to clause 14, wherein the turn pull can be co-moulded with the outer circumference of the knob.

17. The anti-ligature turn pull and base according to any of the preceding clauses, wherein the turn pull and base are formed via injection moulding and/or

blow moulding and/or vacuum forming and/or rotational moulding and/or compression moulding and/or rim moulding and/or powder impression moulding and/or additive manufacturing and/or 3D printing.

18. The anti-ligature turn pull and base according to any of the preceding clauses, wherein the turn pull and base are formed from a lathe machined and/or welded construction and/or pressed and/or cast and/or forged from a suitable metal material and alloys thereof.

19. A method of manufacturing an anti-ligature turn pull and base according to any of clauses 14 to 18, comprising the steps of:

supplying a polymer or alloy into a moulding tool; and
ejecting the moulded parts from the moulding tool.

20. The method of manufacturing an anti-ligature turn pull and base according to clause 19, wherein the polymer is selected from the group consisting, but not limited to, any of the following: High-Density Polyethylene (HDPE), Polypropylene (PP), Low-Density Polyethylene (LDPE), Polyethylene Terephthalate (PET), Polyvinyl Chloride (PVC) or Acrylonitrile Butadiene Styrene (ABS) or a biobased polymer or blends thereof.

21. The method of manufacturing an anti-ligature turn pull and base according to clauses 19 or 20, further comprising a step of admixing an antimicrobial additive with the polymer.

22. The method of manufacturing an anti-ligature turn pull and base according to clause 21, wherein the antimicrobial additive comprises an active ingredient based on silver ions.

23. The method of manufacturing an anti-ligature turn pull and base according to any of clauses 19 to 22, further comprising a step of admixing one or more dyes or pigment with the polymer.

24. A kit of parts for an anti-ligature keyless access control device being according to any of clauses 1 to 13 or the anti-ligature turn pull and base being according to any of clauses 14 to 18.

Claims

1. An anti-ligature keyless access control device for securing a door being pivotally mounted in a frame, the locking and unlocking of the door being controlled by a door lock, the keyless access control device

comprising:

a keyless entry cylinder comprising:

an electronic cylinder housing that can be inserted into the lock case,
 a locking cam that is rotatably mounted with respect to the housing for actuating locking devices of the door lock,
 an electronics receiver module which verifies authorisation of a person requesting access, and
 a rotatable knob which projects from the door lock for actuating the locking cam when access authorisation has been determined, and

an anti-ligature turn pull and base surrounding the rotatable knob which resists or inhibits ligatures from being attached thereon.

2. The anti-ligature keyless access control device as claimed in claim 1, wherein the electronics receiver module being arranged inside the rotatable knob.
3. The anti-ligature keyless access control device as claimed in claims 1 or 2, wherein the rotatable knob is coupled to the locking cam via a clutch controlled by the electronics receiver module; and/or optionally, wherein the electronics receiver module which verifies authorisation of the person requesting access energises an electromagnet which actuates the clutch such that the rotatable knob is rotatably coupled with the locking cam.
4. The anti-ligature keyless access control device as claimed in any of the preceding claims, wherein the electronics receiver module undergoes a data exchange with a transponder when the transponder is positioned wirelessly in proximity to the electronics receiver module ; and/or optionally, wherein the turn pull and base extends the length of the rotatable knob projecting from the door lock.
5. The anti-ligature keyless access control device as claimed in any of the preceding claims, wherein the turn pull being a unitary body with a circular base from which a generally hemispherical dome shape projects, and an axial cylindrical bore running completely therethrough from the base to the apex of hemispherical dome,
 wherein the knob is received in the axial cylindrical bore of the turn pull and abuts to form a close or interference fit therebetween.
6. The anti-ligature keyless access control device as claimed in claim 5, wherein the turn pull comprises a plurality of finger grips disposed equidistantly

around the axial cylindrical bore,
 wherein each of the finger grips is teardrop-shaped.

7. The anti-ligature keyless access control device as claimed in claims 4 or 5, wherein the base being a planar body comprising a generally flat base, a circumferential side wall which tapers from the base, the distal edge of side wall forming a lip which receives and nests the circular base of the turn pull, wherein the circumferential side wall includes a cut-out such that the base wall sits flush with the outer cover of the door lock.
8. The anti-ligature keyless access control device as claimed in claim 1, wherein the electronic cylinder housing can replace the existing mechanical cylinder in the existing lock case.
9. An anti-ligature turn pull and base being locatable on the outer circumference of the knob of a keyless entry cylinder comprising a cylinder housing that can be inserted into a door lock case, the turn pull and base resists or inhibits ligatures from being attachment thereon.
10. The anti-ligature turn pull and base as claimed in claim 9, wherein the anti-ligature turn pull has a generally hemispherical dome shape and the base has a tapered profile, and/or optionally, wherein the turn pull can be co-moulded with the outer circumference of the knob.
11. The anti-ligature turn pull and base as claimed in any of the preceding claims, wherein the turn pull and base are formed via injection moulding and/or blow moulding and/or vacuum forming and/or rotational moulding and/or compression moulding and/or rim moulding and/or powder impression moulding and/or additive manufacturing and/or 3D printing, and/or optionally, wherein the turn pull and base are formed from a lathe machined and/or welded construction and/or pressed and/or cast and/or forged from a suitable metal material and alloys thereof.
12. A method of manufacturing an anti-ligature turn pull and base as claimed in any of claims 9 to 11, comprising the steps of:
 - supplying a polymer or alloy into a moulding tool; and
 - ejecting the moulded parts from the moulding tool.
13. The method of manufacturing an anti-ligature turn pull and base as claimed in claim 12, wherein the polymer is selected from the group consisting, but not limited to, any of the following: High-Density Pol-

yethylene (HDPE), Polypropylene (PP), Low-Density Polyethylene (LDPE), Polyethylene Terephthalate (PET), Polyvinyl Chloride (PVC) or Acrylonitrile Butadiene Styrene (ABS) or a biobased polymer or blends thereof.

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- 14.** The method of manufacturing an anti-ligature turn pull and base as claimed in claims 12 or 13, further comprising a step of admixing an antimicrobial additive with the polymer,

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wherein the antimicrobial additive comprises an active ingredient based on silver ions; and/or optionally,

further comprising a step of admixing one or more dyes or pigment with the polymer.

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- 15.** A kit of parts for an anti-ligature keyless access control device being as claimed in any of claims 1 to 8 or the anti-ligature turn pull and base being as claimed in any of claims 9 to 11.

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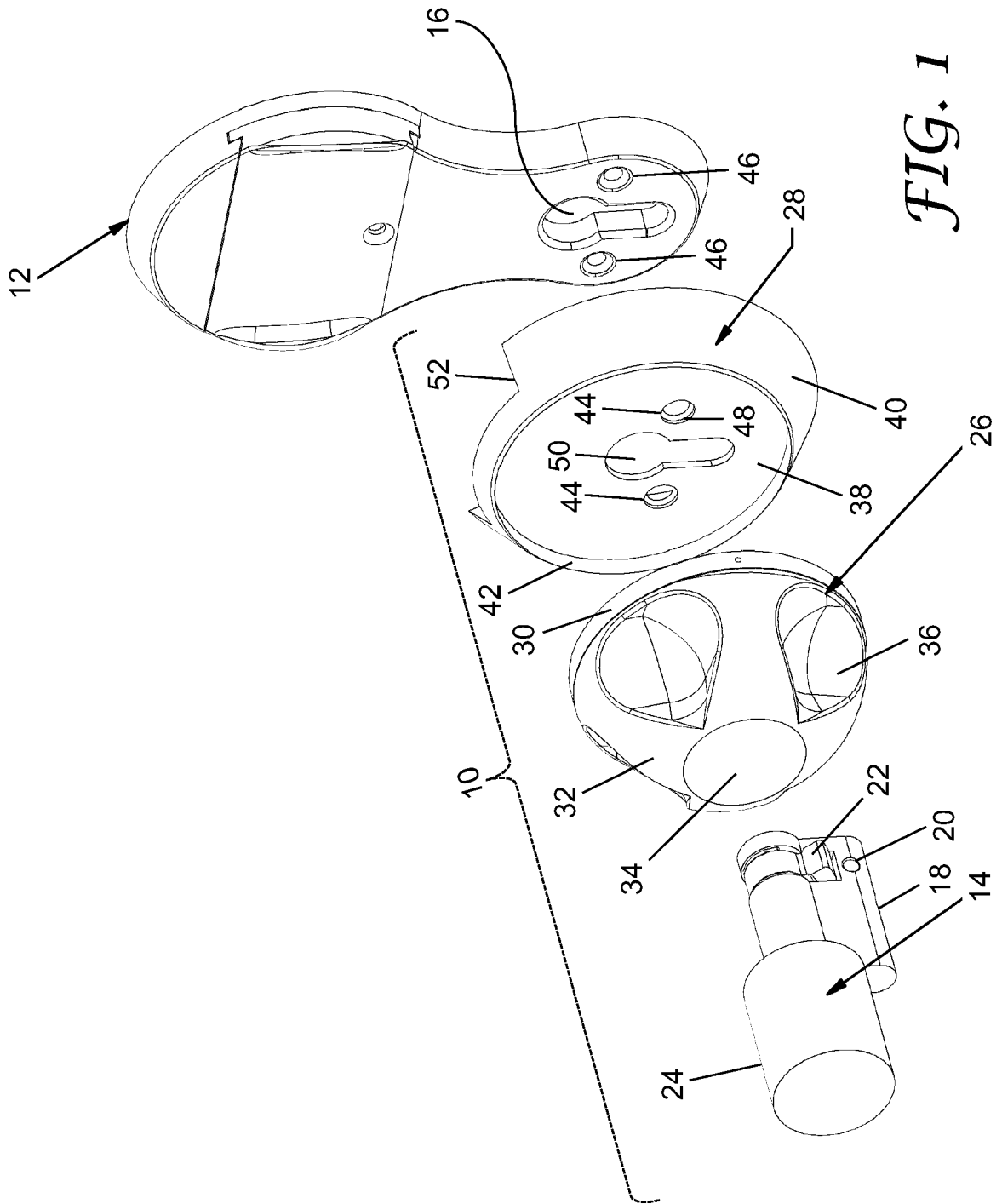


FIG. 1

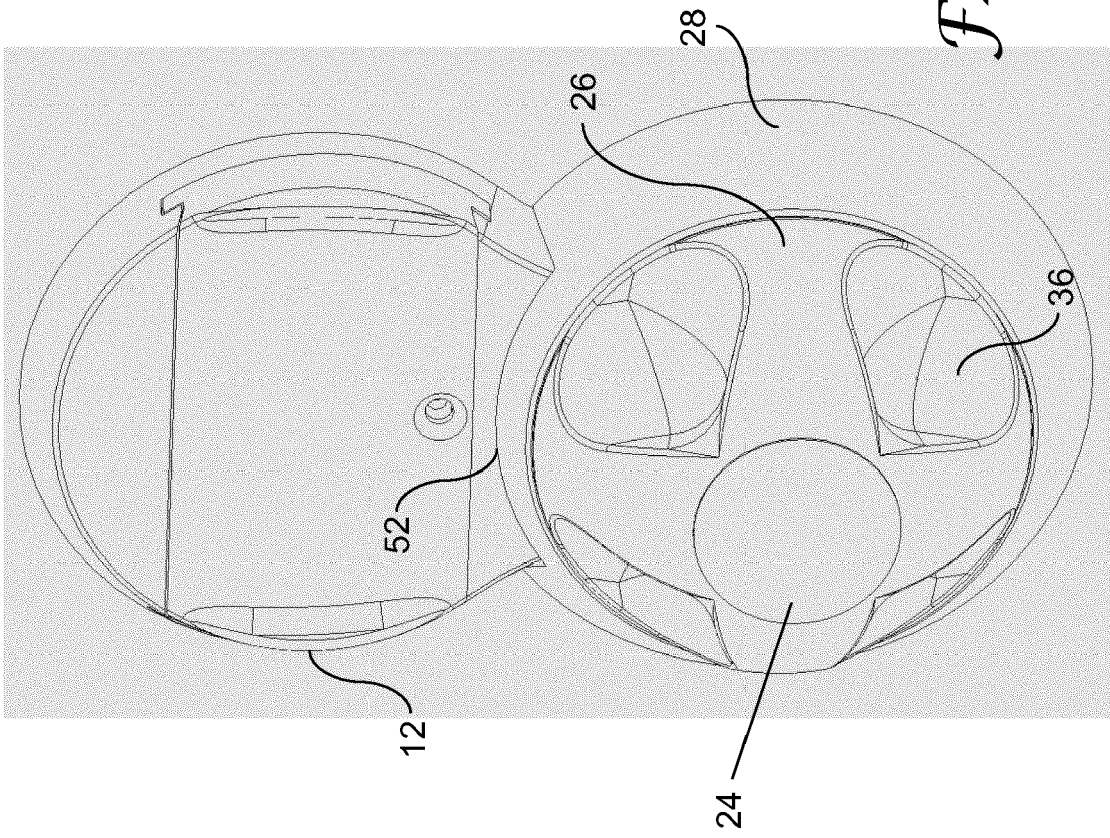
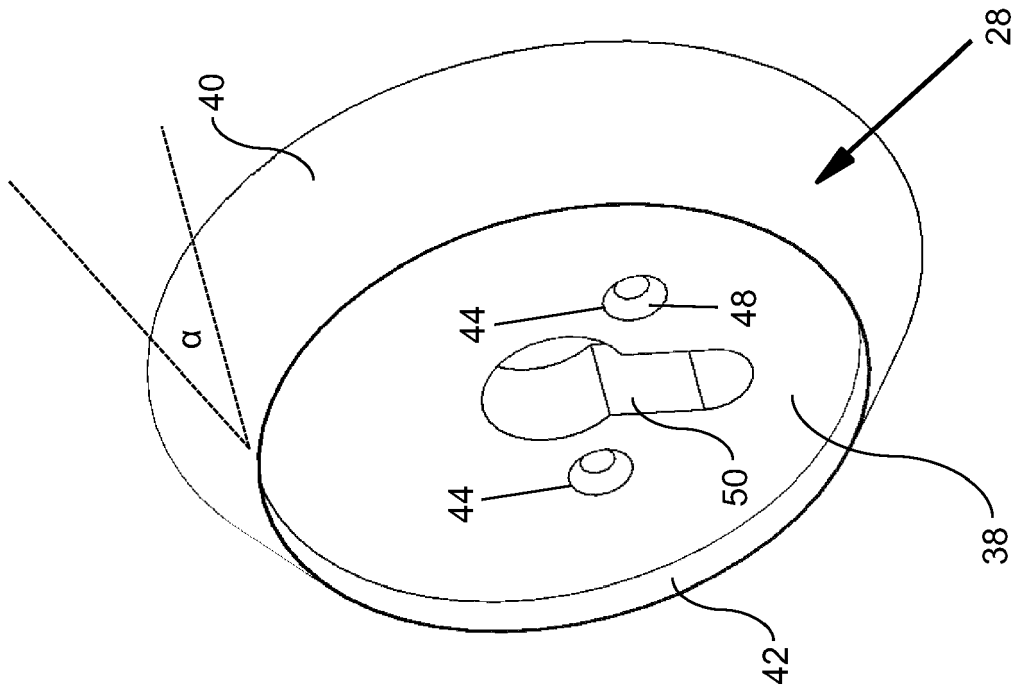


FIG. 2

FIG. 3





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