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(71) Applicant and

(72) Inventor: **FROLOV, George** [US/US]; 23 Woodruff
Road, Farmington, CT 06032 (US).

(74) Agent: **YALE, Guy, D.**; Alix, Yale & Ristas, LLP, 750
Main Street, Suite 1400, Hartford, CT 06103-2721 (US).

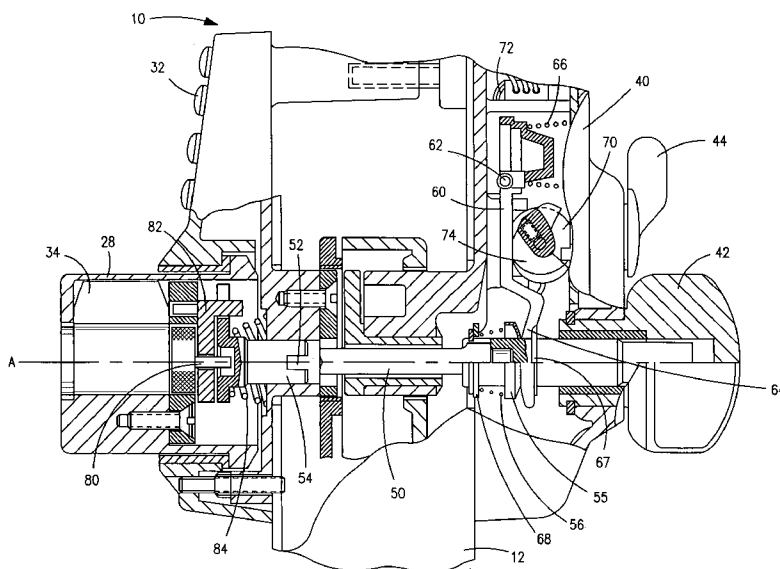
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(54) Title: UNIVERSAL ELECTRONIC LOCK AND TRIM ASSEMBLY



(57) Abstract: An electronic lock assembly comprises a first rotatable member and a second rotatable member disposed on opposite sides of a structure to be secured. A coupler is connectable for rotatable motion with the first rotatable member. The coupler and a spindle are selectively axially positionable for interlocking in a fixed rotatable movement and uncoupleable for independent relative rotatable movement. An electronic access input is disposed at one side. A motor is responsive to the access input and driveable to rotate a cam to pivot a lever arm about an axis generally transverse to the axis of the coupler and spindle to provide the locking and unlocking function. The electronic assembly may be employed with various selected panels to accommodate a wide range of dimensional configurations.

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UNIVERSAL ELECTRONIC LOCK AND TRIM ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the priority of U.S. Provisional Patent Application No. 60/873,677 filed December 8, 2006.

BACKGROUND OF THE TECHNOLOGY

[0002] The subject technology relates to electronically controlled latch and bolt assemblies for securing doorways and the like. More particularly, the subject technology relates to hardware and installation technologies for accommodating variations in dimensional standards for locks and latches.

SUMMARY

[0003] Briefly stated, an electronic lock assembly comprises a first rotatable operator and a second rotatable operator disposable at opposite sides of a door to be secured. A coupler is connectable for rotatable motion with the first rotatable operator. An axial spindle is rotatable for projecting and retracting a locking member. The coupler and spindle members are relatively axially positioned for interlocking fixed rotatable movement, and uncouplable for independent rotatable movement.

[0004] An electronic access input is disposed at the first side. A motor is responsive to the access input and driveable to rotate a cam to pivot a lever arm about an axis generally transversely to the axes of the coupler and the spindle. The cam is selectively engageable with the lever arm to force the spindle and coupler into rotatable engagement at a first position of the cam and to allow the spindle and coupler to disengage in a second position of the cam.

[0005] A mechanical key override assembly may be rotatable to engage the coupler and the spindle for fixed rotation thereof to provide retraction of the locking member. The key override assembly may comprise a transfer member having an internal spiral ramp to collapse a spring to engage

for axial engagement with the spindle. The key override assembly can accommodate different lock configurations.

[0006] A spring assembly is capable of accumulating energy in the event an obstacle is encountered and is capable of axially displacing the spindle to the second position upon removal of the obstacle. A panel, which for a given door standard has an opening dimensioned and positioned to accommodate the distance between the rotational axis of an operator and the key override assembly, is mounted against the door. A coupler defines a slot and the spindle selectively engages the slot. The coupler also has a spring assembly to accommodate a jamming condition. The lever arm has a fork with the slot received over the spindle and is engageable against a retainer. A spring is disposed between the retainer and a flange fixed to the spindle to permit the retainer to axially slide along the spindle. A spring assembly biases the lever arm to urge the spindle toward the secured position.

[0007] The electronic lock assembly may employ a mechanical key override assembly and an actuator for selectively operating in a first mode wherein the first and second cam positions are responsive to either the key override assembly or the electronic access input, or in a second mode wherein the first and second cam positions are only responsive to the key override assembly. A stud is positionable by means of the actuator to engage an edge portion of the cam to prevent the cam from rotating to selectively engage the lever arm to force the engagement of the spindle with the coupler. A stud projects from a bistable plate which is maintained in one of two positions by a spring.

[0008] A method for configuring the electronic lock assembly for a variety of installations for different standard distances between door operating hardware components comprises providing a series of panels, each having an opening positioned for a given distance. A panel is selected for a given installation, and the selected panel is installed with the lock assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Figure 1 is an edge view of a fragmentary door and associated hardware to which a universal electronic lock and trim assembly for a US mortise lock is installed;

[0010] Figure 1A is a front view of the installed lock and trim assembly of Figure 1;

[0011] Figure 1B is a rear view of the installed lock and trim assembly of Figure 1;

[0012] Figure 2 is an interior view, partially broken away, partially in phantom and partially in section, and viewed from the opposite side showing the latch of the lock assembly of Figure 1 and deadbolt in a locked position;

[0013] Figure 2A is a fragmentary view, partially in schematic of the secured side of the lock and trim assembly of Figure 2;

[0014] Figure 3 is an interior view, partially broken away and partially in section, showing the lock and trim assembly system of Figure 2 in an unlocked position;

[0015] Figure 3A is an interior view, partially broken away and partially in phantom, showing the lock trim assembly system of Figure 2 in a jammed condition;

[0016] Figure 4 is an interior view, partially broken away, partially in section and partially in phantom of the lock and trim assembly of Figure 2 and showing the lock system unlocked manually by means of a key;

[0017] Figure 4A is an interior view, partially broken away, partially in section and partly in phantom, of the lock and trim assembly of Figure in a jamming condition;

[0018] Figure 5 is a fragmentary sectional view of a trim assembly (for a mortise lock with a latch only) embodiment in a locked position from an interior side edge elevational view thereof;

[0019] Figure 6 is a second side fragmentary interior view of the trim assembly of Figure 5;

[0020] Figure 7 is a deadbolt cylindrical lock assembly with an electronic trim mounted to a portion of a door viewed from the edge thereof;

[0021] Figure 7A is an access side elevational view of the lock trim assembly of Figure 7;

[0022] Figure 7B is a secure side elevational view of the lock and trim assembly of Figure 7;

[0023] Figure 8 is an interior side view, partially broken away and partially in section, of the deadbolt cylindrical lock and trim assembly and door portion of Figure 7;

[0024] Figure 9 is a secured side interior view, partially in schematic, of the deadbolt cylindrical lock and trim assembly of Figure 8;

[0025] Figures 10 and 10A-D are a series of views, partially in schematic form, illustrating manually switching from electronic to mechanical access mode for a lock with a latch only, wherein Figures 10B1, 10B2 and 10C are sectional views taken along respective lines B1-B1, 10B2-10B2 and C-C of Figure 10 and Figure 10D is a side view taken from view D of Figure 10D;

[0026] Figure 11 is a side elevational view, partially broken away to show detail, of an electronic mortise lock trim assembly for a latch with a European profile cylinder;

[0027] Figure 11A is an access (left) side view for an emergency key override cylindrical lock portion of Figure 11;

[0028] Figure 12 is an elevational side view of a universal electronic lock assembly for a European mortise lock installed to a door, partially illustrated and viewed from the outer edge thereof;

[0029] Figure 13 is a fragmentary side elevational view, partially broken away, partially in schematic and partially in section, illustrating the universal European mortise lock assembly of Figure 12;

[0030] Figure 13A is a fragmentary cross-sectional view of the upper portion of the mortise lock assembly of Figure 13;

[0031] Figure 14 is an interior sectional view, partially broken away and partially in section, illustrating additional installation details of the European lock assembly of Figure 13;

[0032] Figure 15 is an access side elevational view, partially in schematic, illustrating a universal trim with a variable center distance for European style mortise locks for the electronic assembly of Figure 12; and

[0033] Figure 16 is a chart illustrating representative dimensional relationships for the various European mortise lock standards which may be accommodated by the universal electronic lock assembly of Figure 12.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0034] With reference to the drawings, wherein like numerals represent like parts throughout the several figures, an electronic lock assembly incorporates a selective spindle axis coupling system which is both electronically and mechanically operated. The electronic lock assembly is adapted for universal use in a multiplicity of latch and deadbolt configurations. The universal lock assembly mates with a wide range of trim suited for the specific door configurations. The locking mechanisms also are adapted to efficiently accommodate and relieve jamming conditions.

[0035] An electronic lock assembly for a mortise lock deadbolt assembly is designated generally by the numeral 10 in Figures 1-4. The lock assembly 10 is installed through the mortise of a door 12 and controls the position of a deadbolt 14 which projects through the latch plate 20 at the edge of the door. Handles 24 and 26, which may be of any conventional form and function, are disposed at the opposite access and secured sides 15, 17 of the door for rotatably operating a latch 16 to provide access and egress through the doorway. Naturally, the assembly 10 has application in connection with gates and other securement structures.

[0036] The electronic lock assembly 10 employs an exterior cover 30 which mounts a keypad 32 (or card reader or other input device) and mechanical key cylinder 34 which functions as a key operated mechanical override of the electronic lock controlled through the keypad 32. The cylinder 34 may be received in a knob 28. The knob 28 normally is free wheeling 360° when locked; when unlocked it engages with an internal mechanism to withdraw a latch and deadbolt. The unlocking is accomplished by electronic means - keypad, for instance, or by a mechanical key cylinder 34. The opposing secured side 17 of the lock assembly 10 includes a cover 40 installed at the interior of the door for housing the various components as will be further described. The cover mounts a thumb knob 42 which independent mechanically operates the deadbolt 14. The cover also mounts an actuator 44 for selecting either an electronic PIN and key access mode or a key only access mode (which disables the electronic entry).

[0037] With reference to Figures 2-4, an axially moveable spindle 50 selectively engages an axial slot 52 of a coupler 54 along axis A for

implementing an unlocked and locked position for the deadbolt. In the locked position, the coupling end of spindle 50 is axially withdrawn from the slot 52, as illustrated in Figure 2. A torque applied to the knob 28 will not rotate spindle 50. The spring 66 through the lever arm 60 always urges the spindle by means of flange 67 into the unlocked position (towards the secured side of the door). A lever arm 60 pivots about a pin 62 transverse to the spindle axis A. A motor 70, which electrically communicates via wires 72, is operated by a valid access signal from the keypad 32. The motor 70 has a shaft which drives a cam 74. The cam 74 is rotatable, and in a locked position, engages the pivot arm 60, as best illustrated in Figure 2. The end of the pivot arm includes a fork 64 with a slot which is received over the spindle 50 and engages the retainer 55. A spring 56 supports the retainer 55, which is slideable along the spindle 50. The other end of spring 56 engages flange 68 fixed to the spindle. A spring 66 biases against the opposite end of the lever arm 60 to urge the spindle to the right in Figures 2-4. The lever arm 60 pivots about the pin 62 transverse to the spindle axis A to axially move and define the axial position of the spindle 50.

[0038] Upon the entry of a suitable input to the keypad 32, an electrical signal drives the motor 70 to rotate the cam 74, as best illustrated in Figure 3. The cam 74 forces the lever arm 60 to pivot. The lever arm 60 engages the retainer 55 to force the spindle to move axially (toward the left in Figure 3) to engage the slot 52 of the coupler 54. The slot 52 is preferably complementary in shape to the male end of the spindle which typically has flat surfaces. It should be noted that commonly the slot in the coupler 54 is not aligned with the male end of the spindle 50 and most likely the spindle will be jammed as it is shown in Figure 3A. However, the lever arm still takes the position as shown on Figures 3 and 3A and spring 56 allows that by being compressed and thus storing energy. When knob 28 is rotated, the slot of the coupler 54 aligns with the spindle 50 and the spring 56 pushes the spindle 50 into engagement with the coupler. Continued rotation of the knob 28 operates the lock set. Upon rotation of the exterior handle or knob 28, the spindle will rotate to thereby retract the bolt 14 and provide access (upon retraction of the latch) through the door. It will be appreciated that in the Figure 2 configuration, rotation of the handle 28 will fail to rotatably engage the spindle

and consequently will have no effect on the retraction of the deadbolt. The spindle operated throw assembly for the deadbolt is conventional.

[0039] With reference to Figures 3-4, the electronic lock assembly 10 also employs a key operated override feature which also acts along axis A. When a suitable key 11 is inserted in the lock cylinder 34, upon key rotation, lock driver 80 rotates transfer member 82. Member 82 has an internal spiral ramp which forces the coupler 54 axially (from the non-override position of Figure 3 to the right override position of Figure 4) to collapse spring 84, to thereby force the coupler 54 to axially engage and rotatably couple the spindle 50. Accordingly, upon further rotation of the handle or knob, the spindle 50 will accordingly rotate and also withdraw the deadbolt 14. It will be appreciated that the dual axial interaction of the spindle 50 and the coupler 54 provides a very efficient axial lock and unlock engagement for both electronic and mechanical mode operation. The spring 84 also functions to store energy in case of a jamming condition (Figure 4A) and to release the axial components upon removal of the jammed condition.

[0040] Additional embodiments and their corresponding components are designated in the drawings by three digit numerals with the hundredths or lead digit designating the specific embodiment. Figures 5 and 6 further illustrate the trim in a respective cross view and a front view of electronic lock assembly 110 for a latch only application without a deadbolt.

[0041] With reference to Figures 7-9, an electronic cylindrical deadbolt assembly which is especially adapted for U.S. type applications is generally designated by the numeral 210. The axial spindle 250/coupler 254 lock mechanism functions in substantially the same way as previously described for lock assembly 10. A reed switch 211 (Figure 8) connects with a magnet 213 for automatic relocking when the bolt is thrown out from inside or outside of the secured area. A thumb knob 242 for manually operating the deadbolt is positioned at the secure side 17. An actuator 244 is also operable on the secure side for selectively disabling the electronic entry (mechanical key only operation) or placing the lock in a PIN input or a mechanical key unlock mode.

[0042] With reference to Figures 10 and 10A-10D, the switching sequence is illustrated wherein actuator 144 selects between a mode where both a PIN input and a mechanical key will operate the latch to a mechanical

mode only where only a key will operate the latch (and the electronic portion of the assembly lock 110 is disabled). The operational mode is determined by an angularly positionable stud 186 projecting from a selector plate 188. The cam 174, which engages the pivot arm 160, is illustrated in the electronic PIN/key mode in Figure 10. The stud 186 engages a recessed edge portion 175 of the cam 174 member so that rotation by the motor allows the lever arm to force the axial movement of the spindle (in the clockwise direction as illustrated in Figure 10). Figure 10A shows the mechanism in the key only mode wherein the stud 186 engages against an edge portion 177 of the cam to prevent rotation and to prevent the cam from rotating to force the axial engagement of the spindle with the coupler (as described for lock assembly 10). Figure 10A illustrates the exterior view from A in Figure 10 showing how the PIN electronic/key mode and the key only mode may be selectively established. Figure 10B1 is a section view along line B1-B1 of Figure 10. The selector plate 188 which mounts the stud 186 is illustrated in one of a bi-stable position which is maintained by a spring 192. Figure 10B2 illustrates a section view along B2-B2 wherein the selector 188 is removed. Figure 10D shows the actuator 144 for selecting the PIN/key or the key only modes.

[0043] The electronic lock assembly in its various forms also has application for accommodating a wide variety of lock cylinder profiles and configurations as well as dimensional spacings between the latching and locking levers, knobs and handles as may, for example, be employed in the various countries in Europe. With reference to Figure 11, an electronic lock assembly 310 is adapted for European configurations. The key override lock cylinder is illustrated for a European profile cylinder 334 shown in Figure 11A. The illustrated embodiment shows the axial spindle 350/coupler 354 in sub-assembly for a mortise lock. The illustrated electronic lock assembly 310 functions to provide a locking for the latch for both a key only and a PIN/key access mode.

[0044] Figure 16 is a chart which describes the various standard lock dimensional and feature characteristics for each of the countries to further illustrate the variations required for installations from country to country in Europe. With reference to Figures 12 through 15, a universal electronic lock assembly 410 which is adaptable to accommodate the various European

requirements is further illustrated for a European mortise lock application for both deadbolt and latching functions.

[0045] A universal cover trim 430 is dimensioned for configuration to accommodate variable center distances between the rotatable exterior door hardware. All of the components, including the internal mechanical and electronic components, for trim 430 are the same, except for a national panel 440. For example, the lever opener 426 may rotate a spindle 427 having a rotational axis which varies from 110 millimeters to 55 millimeters from the rotational axis of the lock cylinder 434. These variations in the distances will require only a specific panel 440 for a given country. The panel frame adjacent the door has a sufficient dimension for opening 442 to accommodate all variations. These variations are schematically illustrated in Figure 13 and 15.

[0046] It will be appreciated that the lever arm 460 and cam 474 can be disposed below the spindle 450 as illustrated in Figure 13. It will be appreciated that the only significant structural feature that would require differentiation would be in terms of the panels 440 which would typically be trimmed and dimensioned to accommodate the variations between the rotational axes.

WHAT IS CLAIMED IS:

1. An electronic lock assembly comprising:

a first rotatable operator and a second rotatable operator disposable at opposite sides of a structure to be secured;

a coupler connectable for rotatable motion with said first rotatable operator;

an axial spindle rotatable for projecting and retracting a locking member, said coupler and spindle being relatively axially positionable for interlocking fixed rotatable movement and uncouplable for independent rotatable movement;

an electronic access input disposed at said first side;

a motor responsive to said access input and driveable to rotate a cam to pivot a lever arm about a axis generally transverse to said axes of said coupler and spindle, said cam selectively engageable with said lever arm to force said spindle and coupler into rotatable engagement at a first position of a cam and to allow said spindle and coupler to disengage in a second position of said cam.

2. The electronic lock assembly of claim 1 further comprising a mechanical key override assembly which is rotatable to engage said coupler and said spindle for fixed rotation thereof to provide retraction of said locking member.

3. The electronic lock assembly of claim 2 wherein said key override assembly comprises a transfer member having an internal spiral ramp to collapse a spring to engage the coupler into axial engagement with the spindle.

4. The electronic lock assembly of claim 1 wherein said key override assembly can accommodate different lock cylinder configurations.

5. The electronic lock assembly of claim 1 further comprising a spring assembly which is capable of accumulating energy in the event an obstacle is

encountered and is capable of axially displacing the spindle to a second position upon removal of the obstacle.

6. The electronic lock assembly of claim 2 further comprising a panel which has an opening dimensioned and positioned to accommodate the distance between the rotational axis of an operator and the key override assembly.

7. The electronic lock assembly of claim 1 wherein said coupler has planar walls which define a slot and an axial end of said spindle has a shape generally complementary to the slot and engageable against said walls.

8. The electronic lock assembly of claim 1 wherein said lever arm has a fork with a slot received over the spindle and is engageable against a retainer.

9. The electronic lock assembly of claim 8 wherein a spring is disposed between the retainer and a flange fixed to the spindle to permit the retainer to axially slide along the spindle.

10. The electronic lock assembly of claim 1 further comprising a spring assembly which biases said lever arm to urge said spindle toward the secured position.

11. The electronic lock assembly of claim 1 further comprising a mechanical key override assembly and an actuator for selectively operating in a first mode wherein said first and second positions are responsive to either said key override assembly or said electronic access input or in a second mode wherein said first and second positions are only responsive to said key override assembly.

12. The electronic lock assembly of claim 10 wherein a stud is positionable by a means of the actuator to engage an edge portion of the cam to prevent the cam from rotating to selectively engage the lever arm to force the engagement of the spindle with the coupler.

13. The electronic lock assembly of claim 1 wherein said stud projects from a bi-stable plate which is maintained in one of two positions by a spring.

14. A method of configuring an electronic lock assembly for a variety of installations with different standard distances between door operating hardware components comprising:

providing a series of panels each having an opening positioned for a given distance;

selecting a panel for a given installation; and

installing the selected panel with the lock assembly.

15. The method of claim 14 wherein the electronic lock assembly comprises:

a first rotatable operator and a second rotatable operator disposable at opposite sides of a structure to be secured;

a coupler connectable for rotatable motion with said first rotatable operator; and

an axial spindle rotatable for projecting and retracting a locking member, said coupler and spindle being relatively axially positionable for interlocking fixed rotatable movement and uncouplable for independent rotatable movement.

16. The method of claim 15 wherein the electronic lock assembly comprises:

an electronic access input disposed at said first side; and

a motor responsive to said access input and driveable to rotate a cam to pivot a lever arm about a axis generally transverse to said axes of said coupler and spindle, said cam selectively engageable with said lever arm to force said spindle and coupler into rotatable engagement at a first position of a cam and to allow said spindle and coupler to disengage in a second position of said cam.

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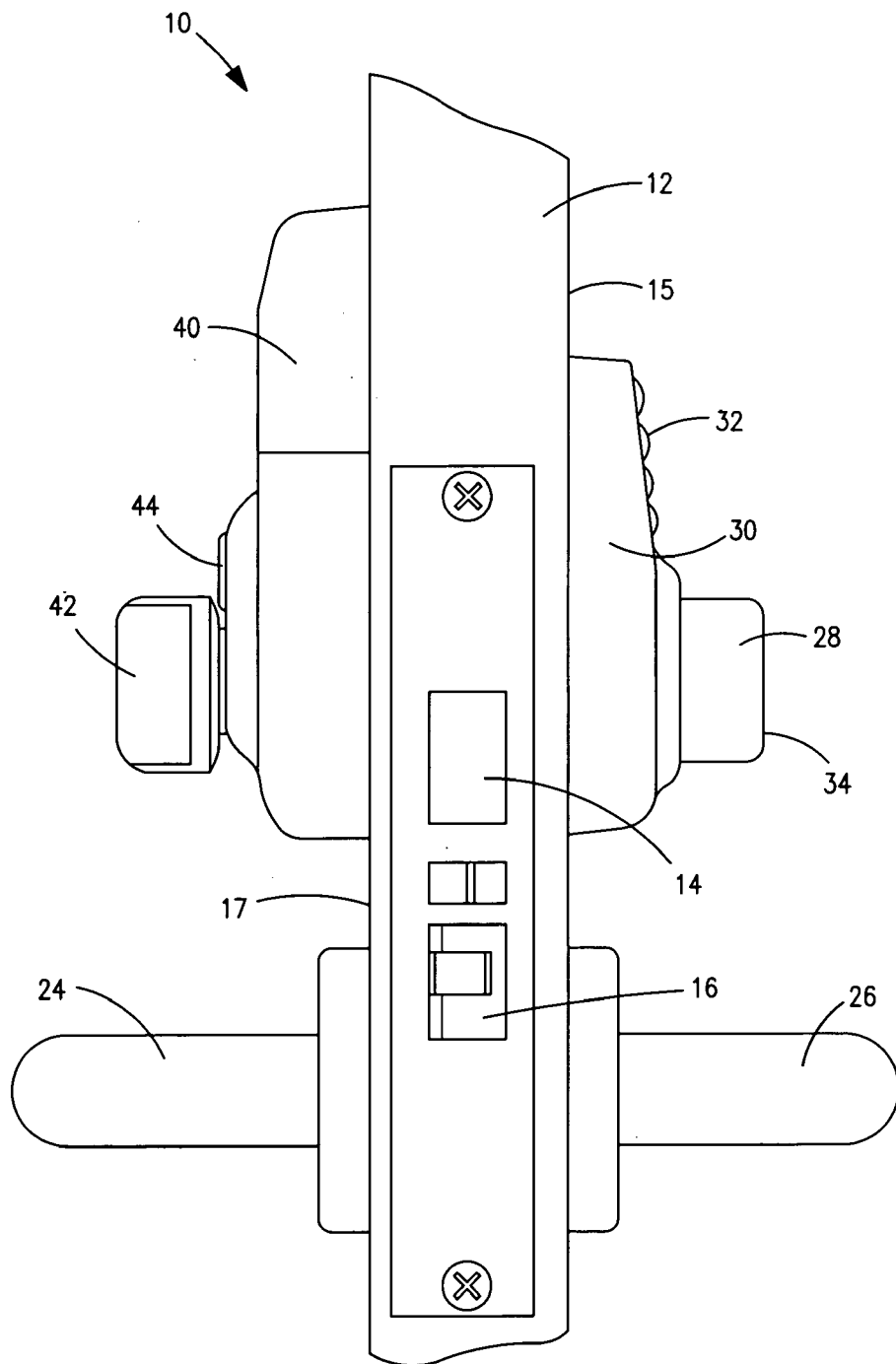


FIG. 1

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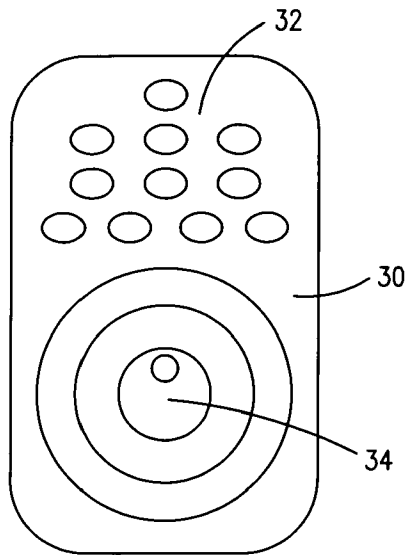


FIG. 1A

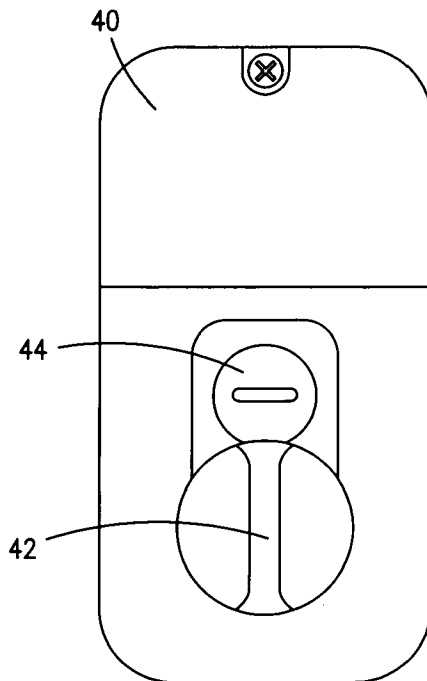


FIG. 1B

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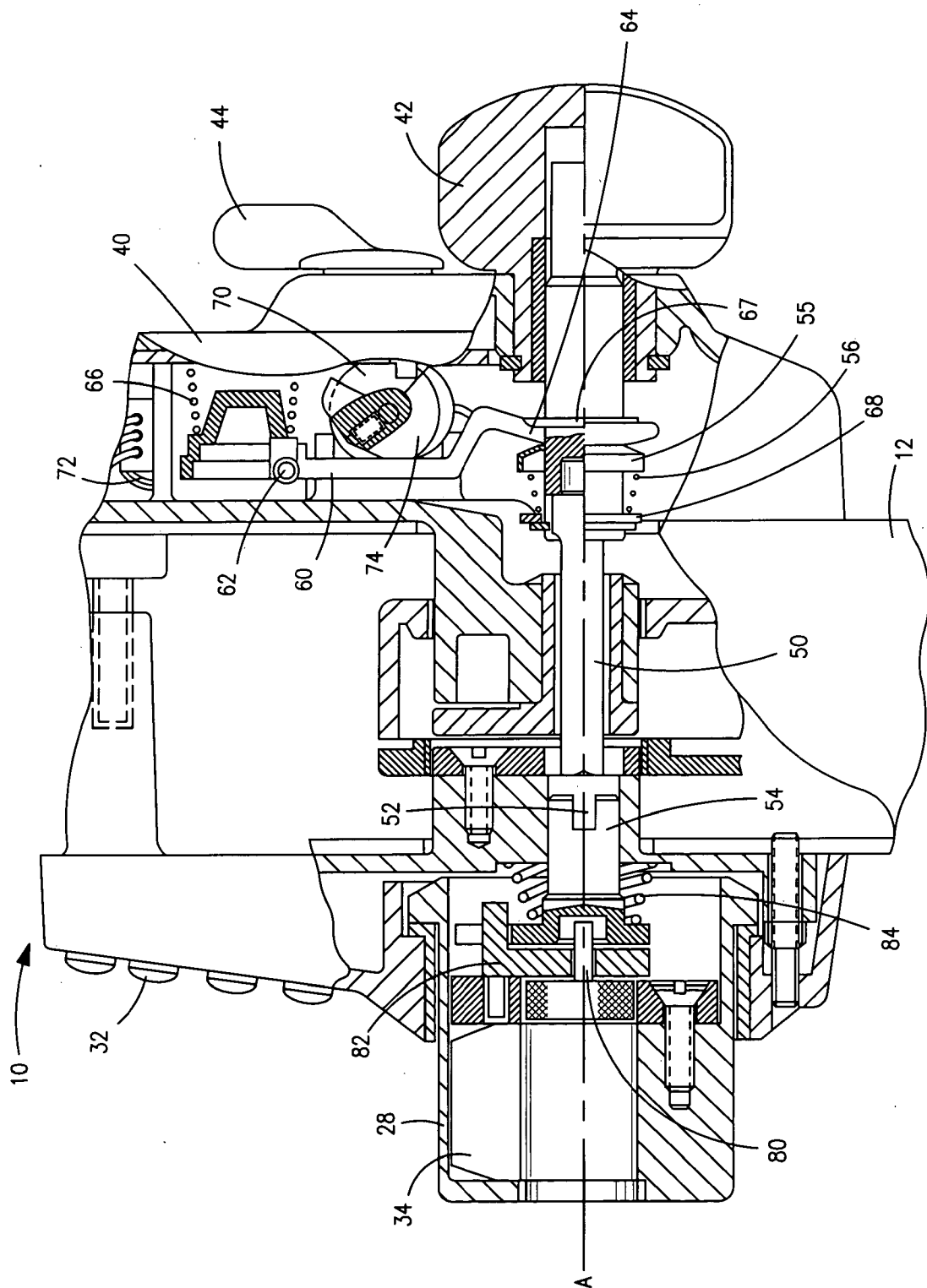


FIG. 2

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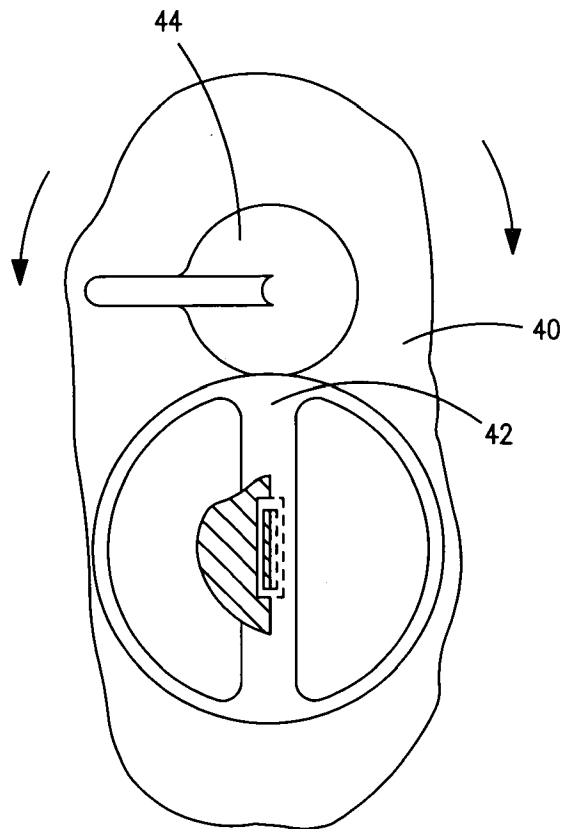


FIG. 2A

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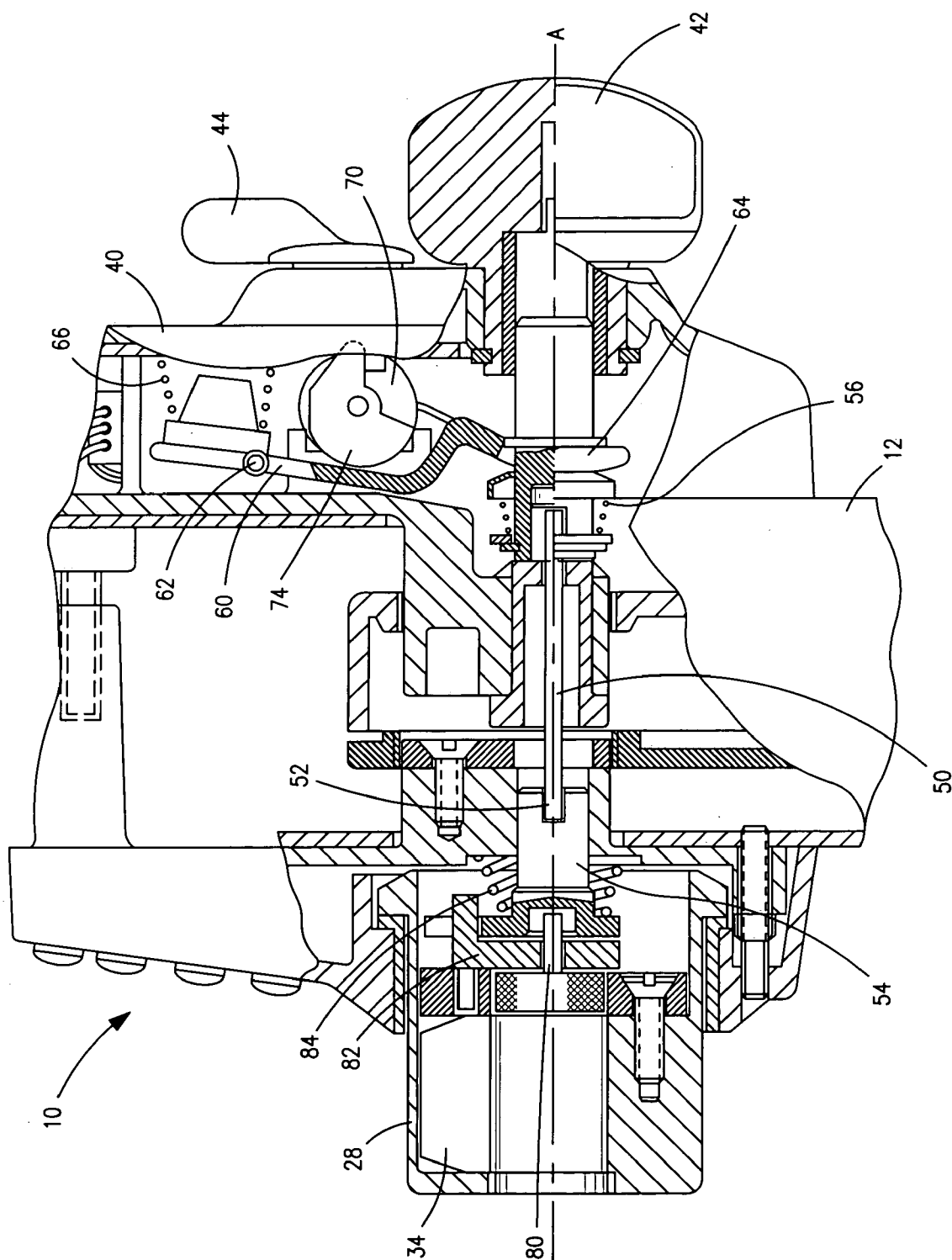


FIG. 3

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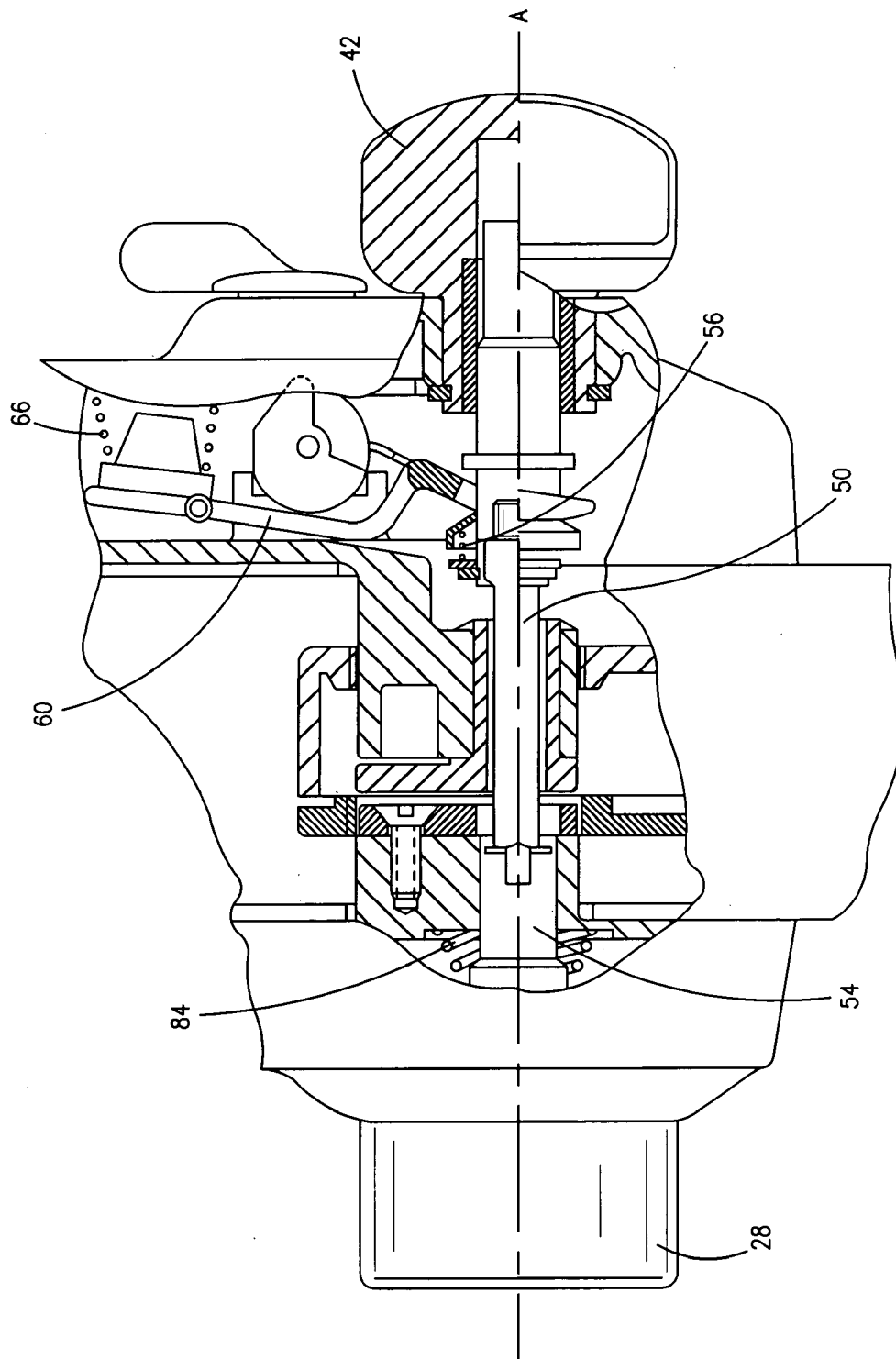


FIG. 3A

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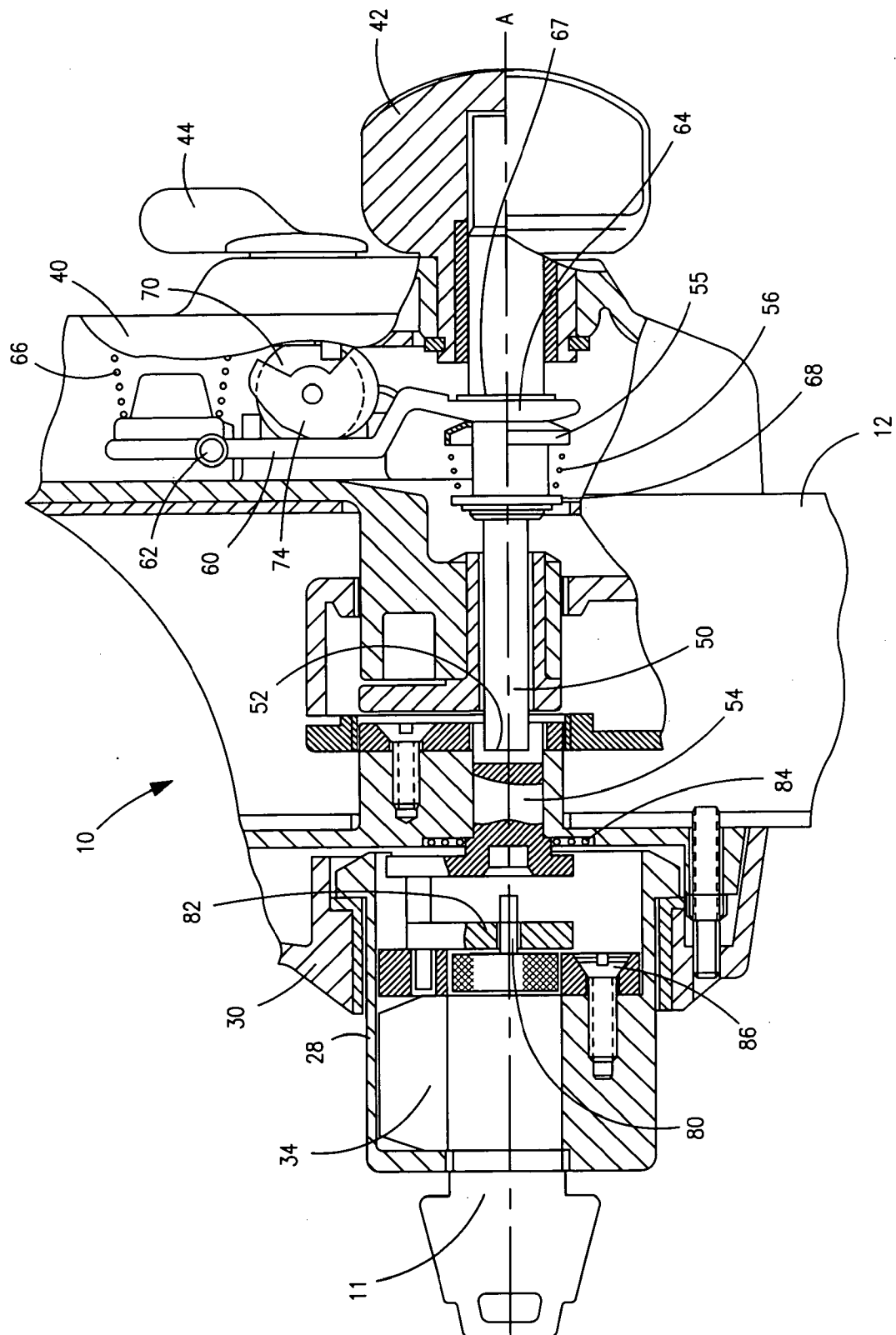


FIG. 4

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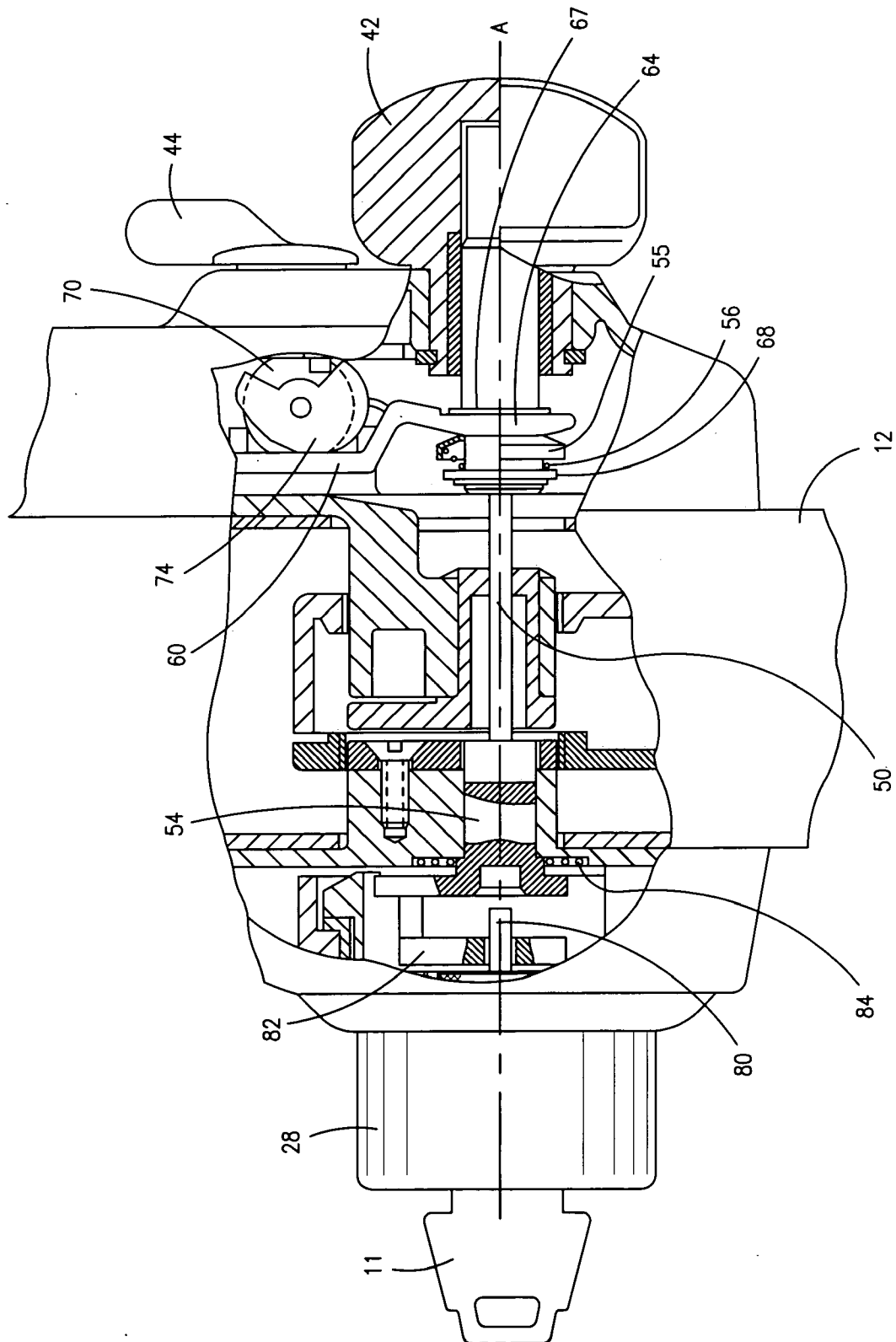


FIG. 4A

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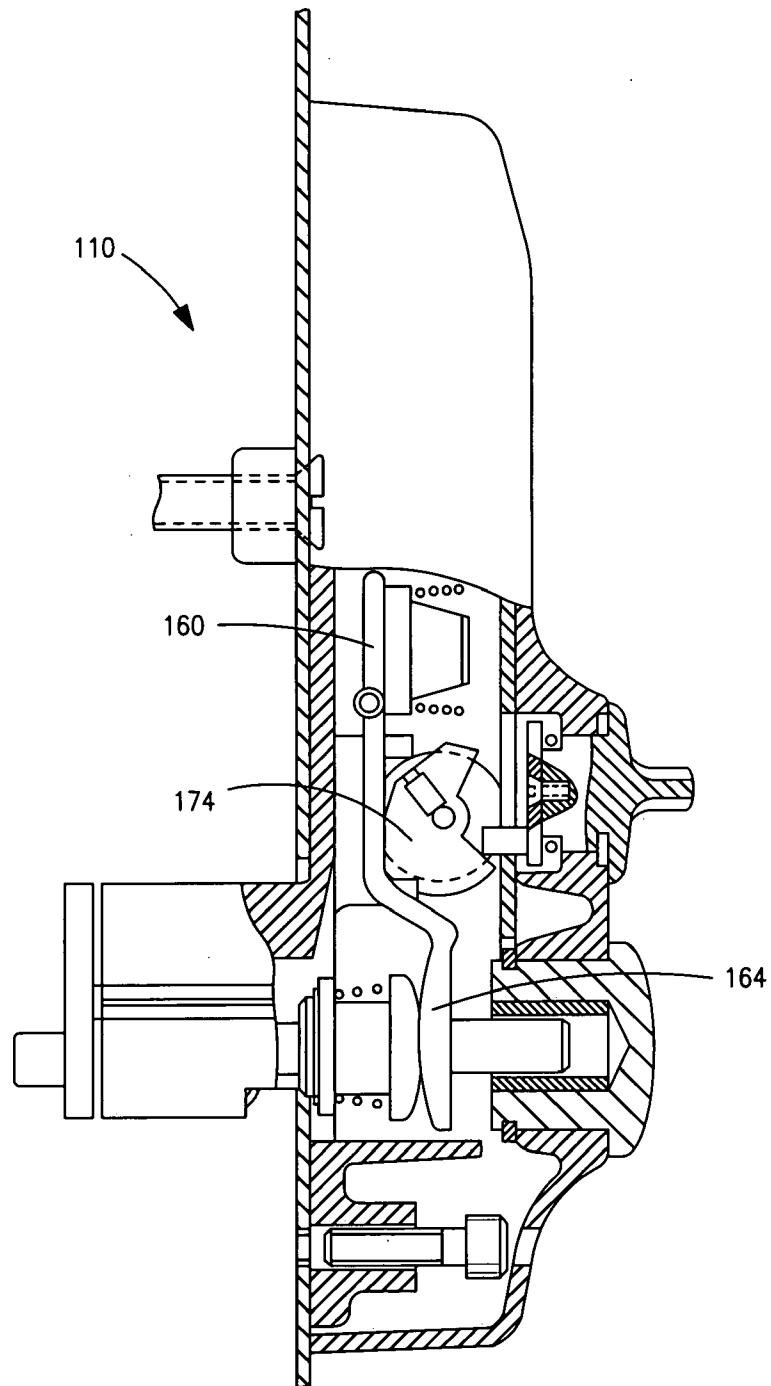


FIG. 5

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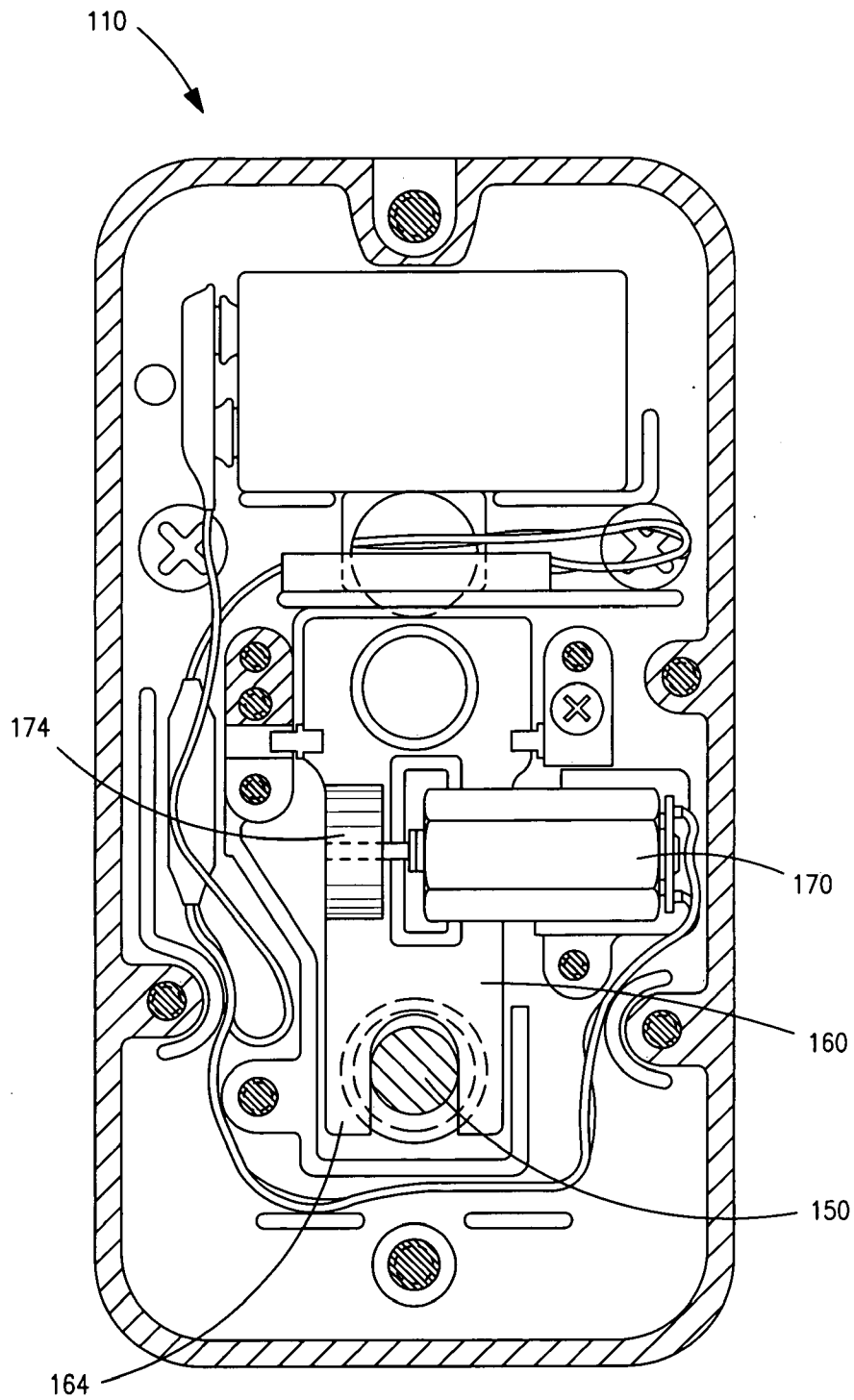
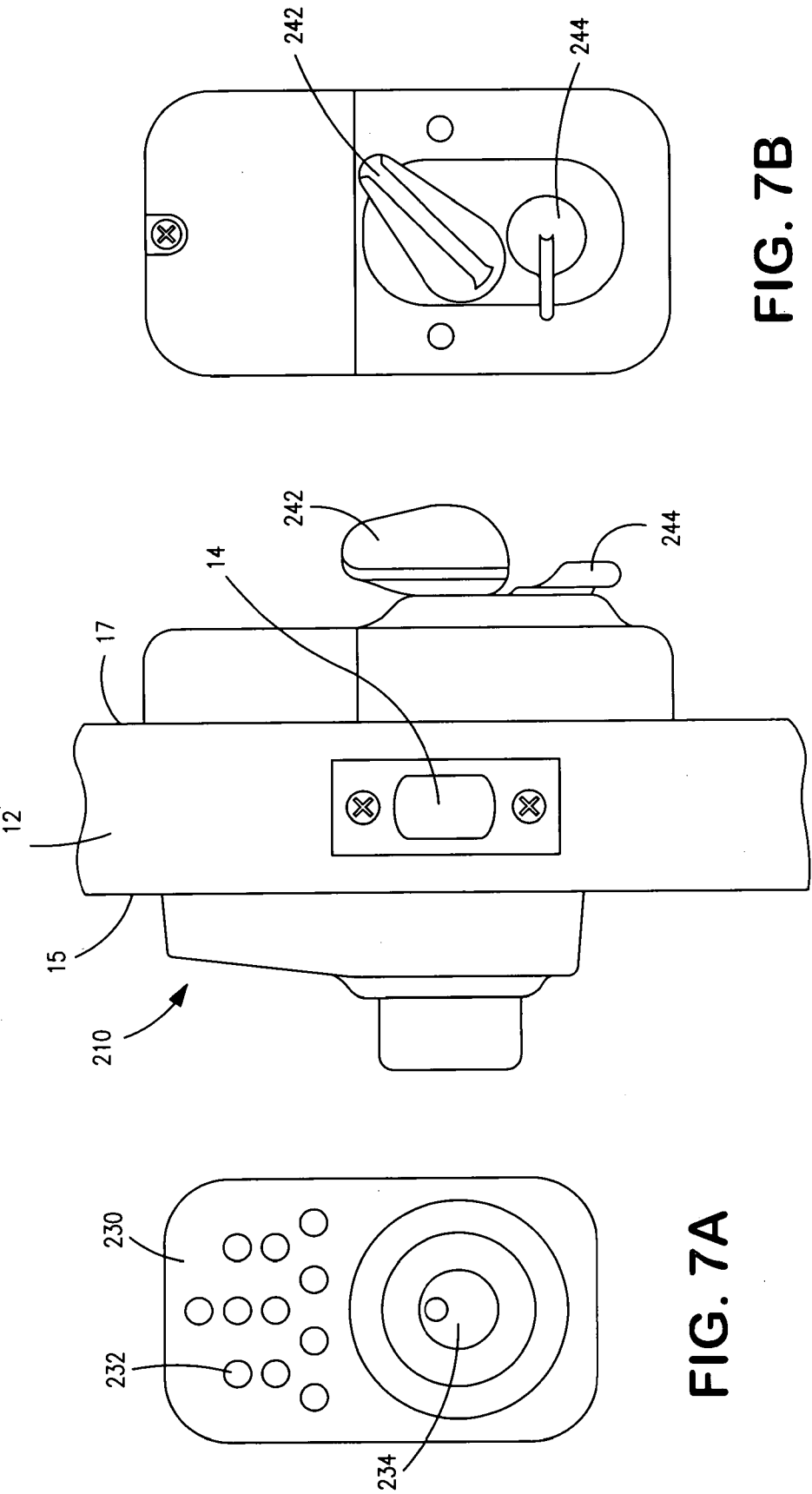


FIG. 6



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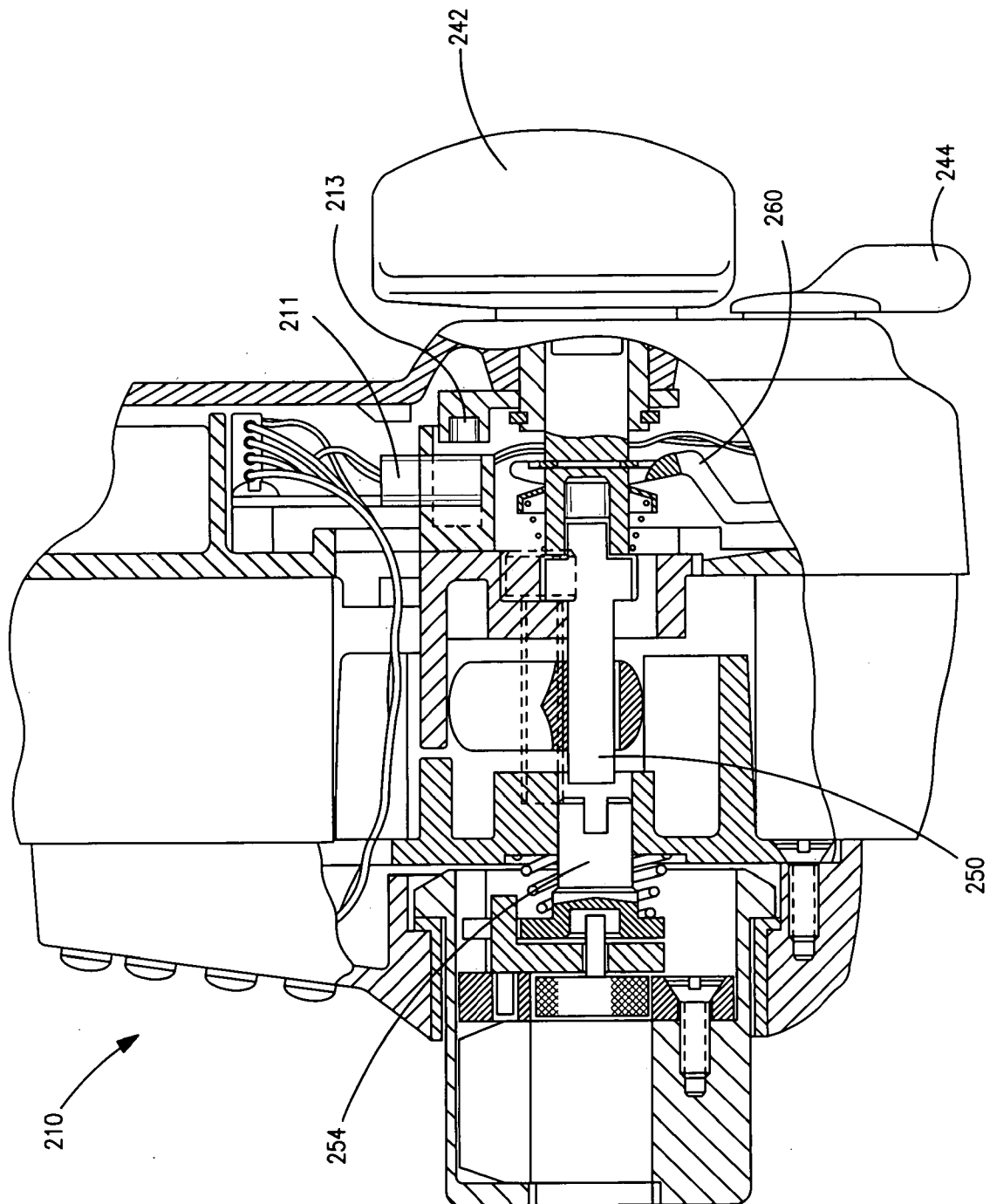


FIG. 8

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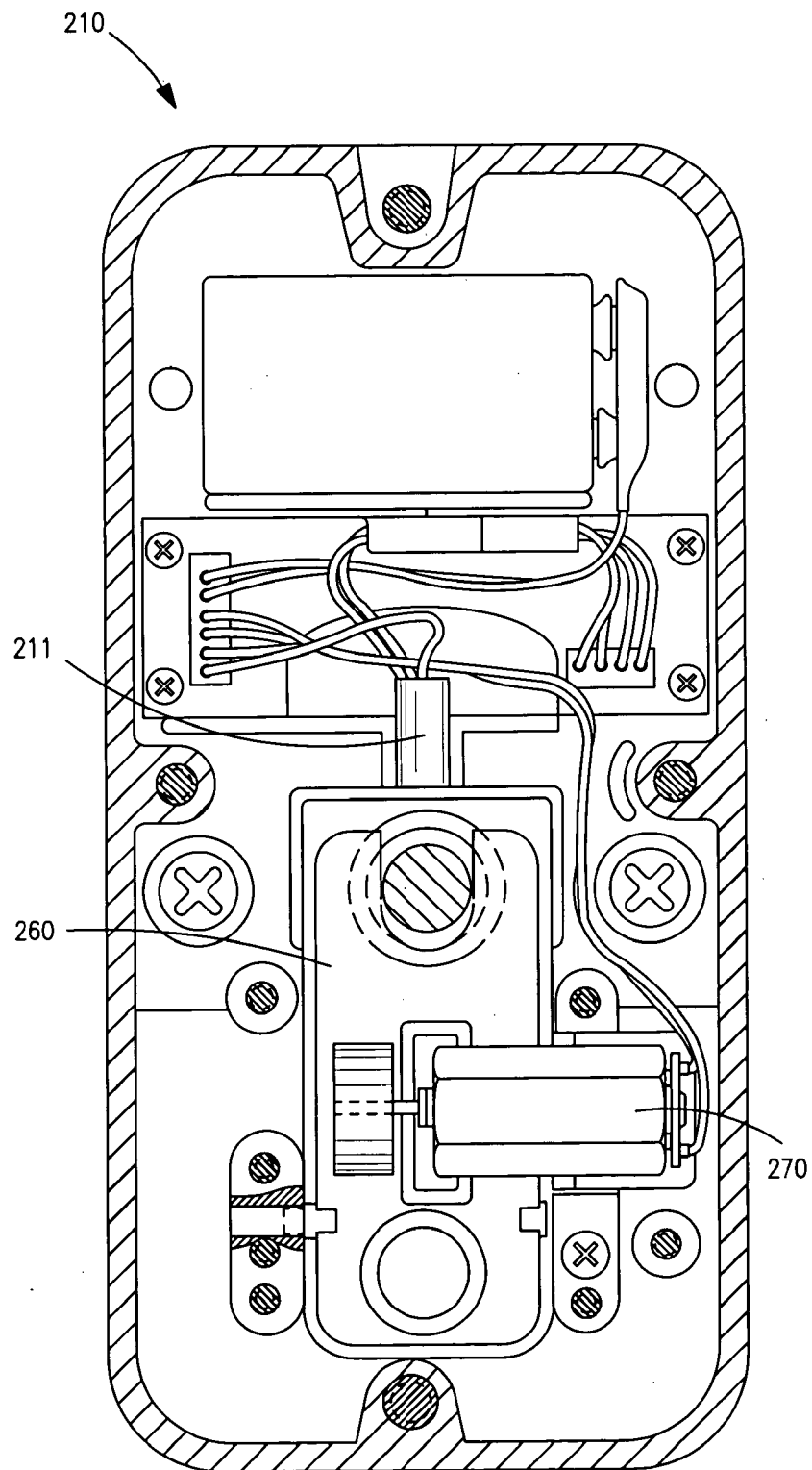


FIG. 9

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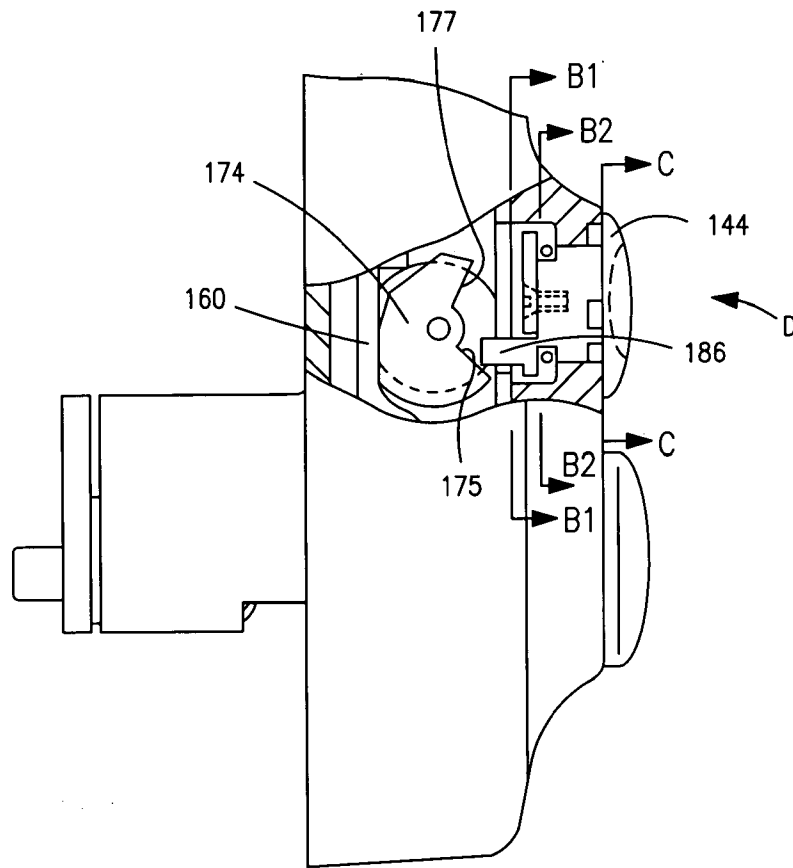
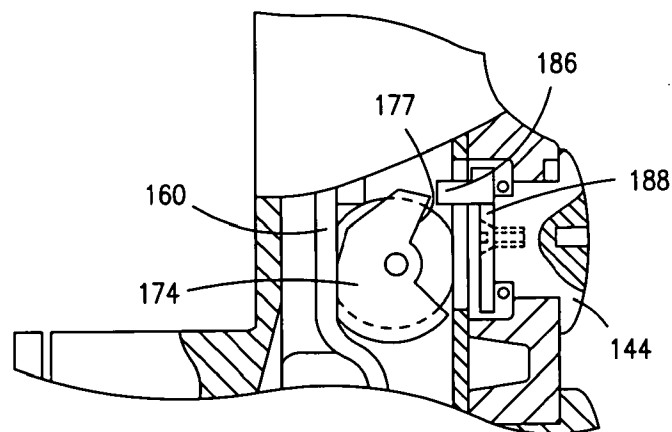


FIG. 10



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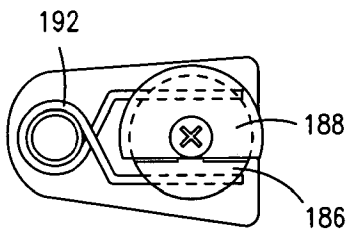


FIG. 10B1

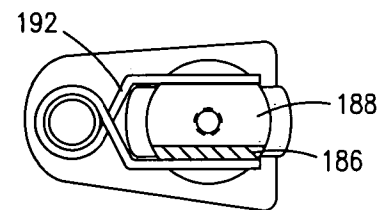


FIG. 10B2

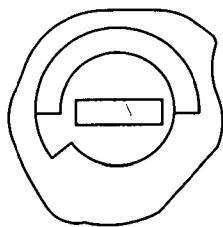


FIG. 10C

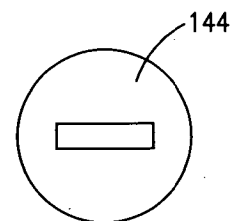
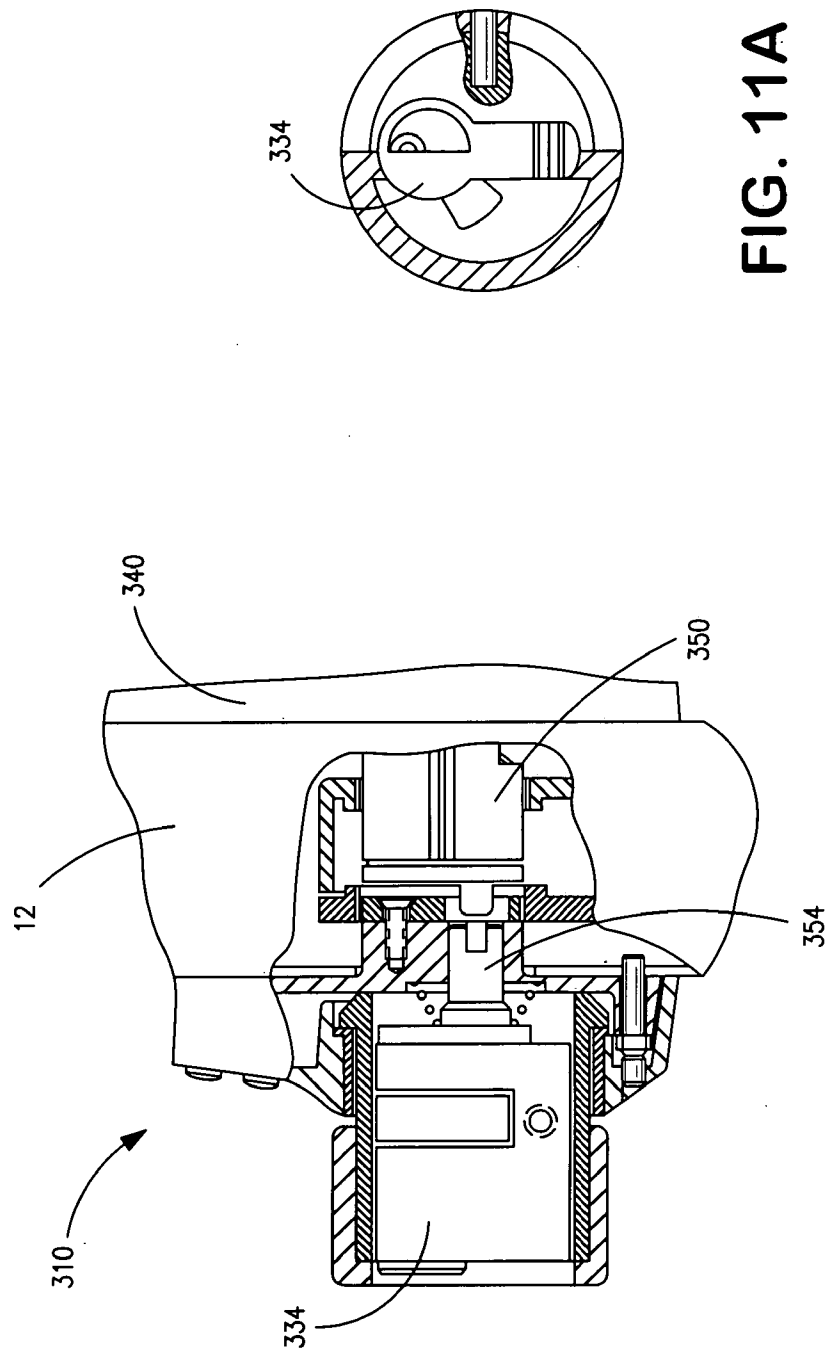


FIG. 10D

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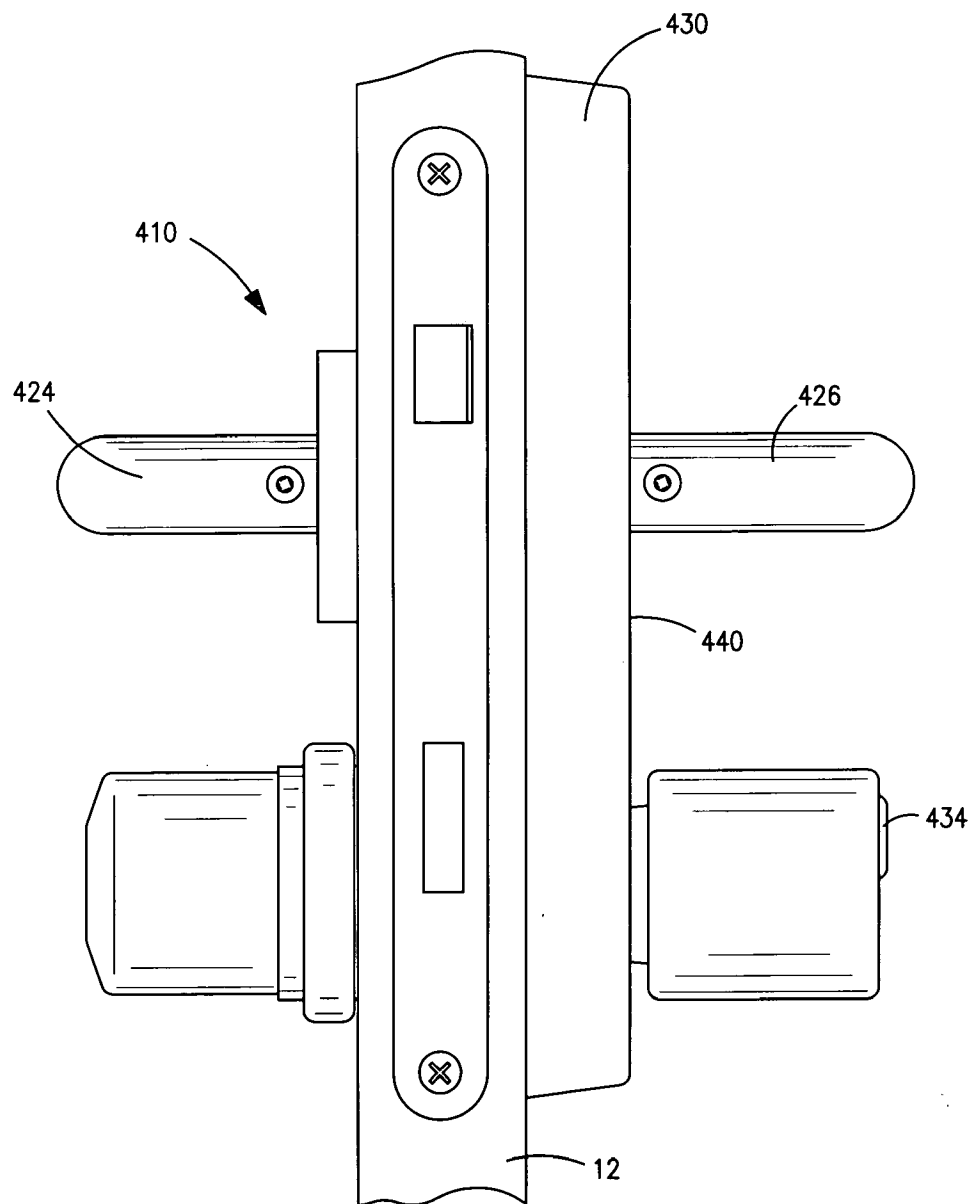


FIG. 12

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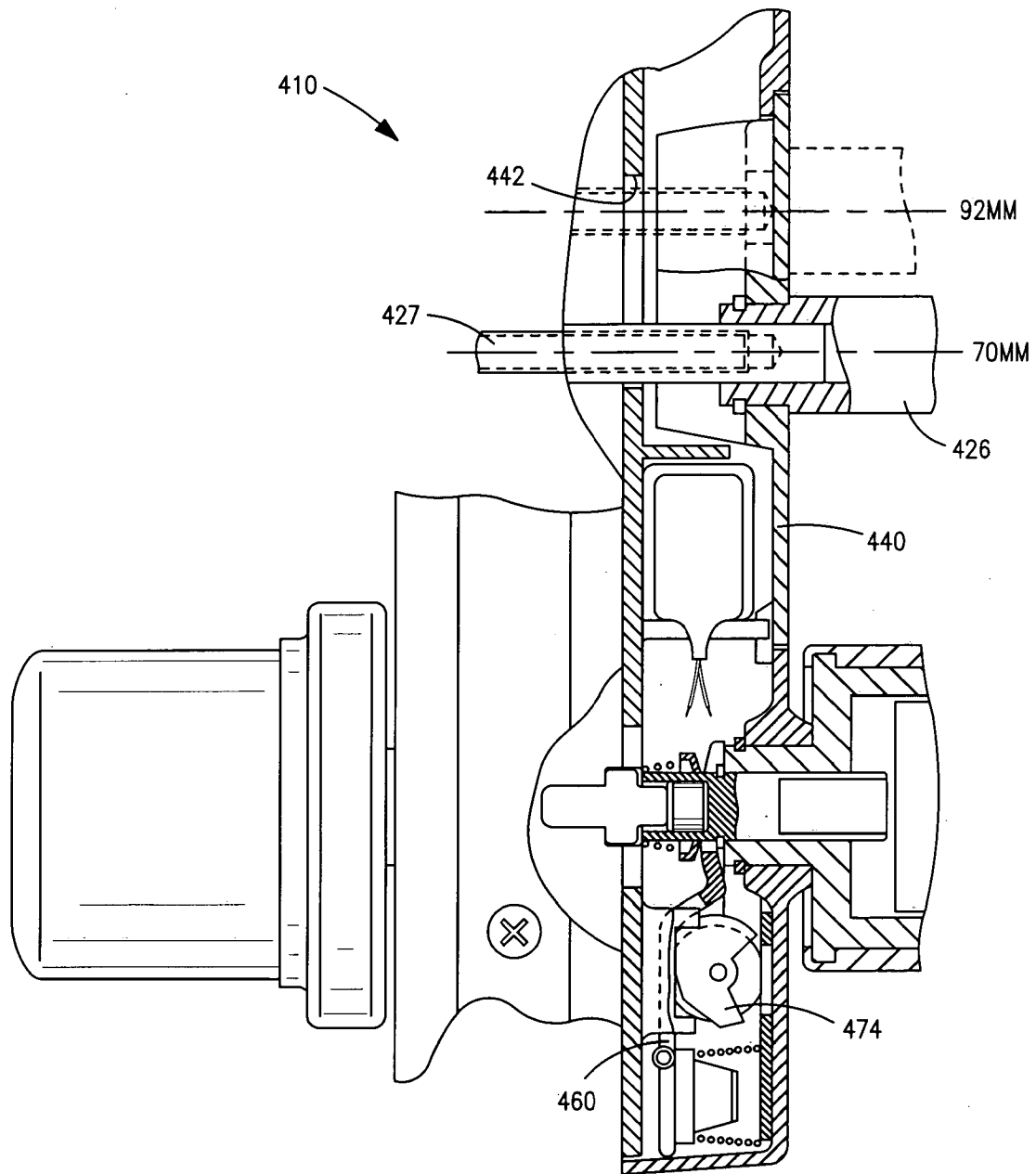


FIG. 13

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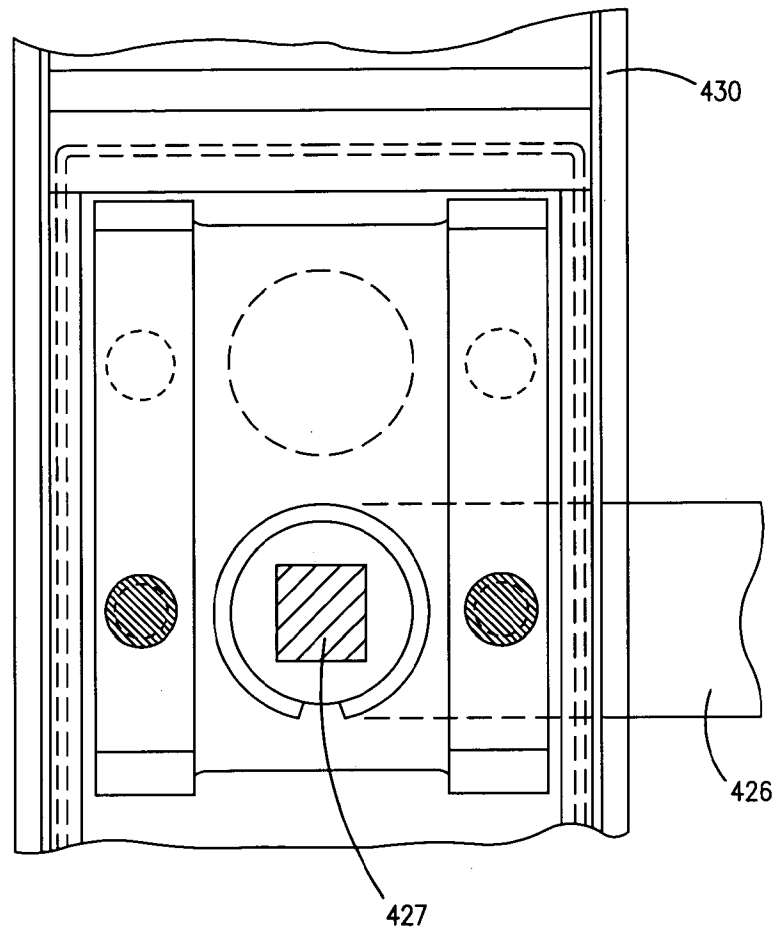


FIG. 13A

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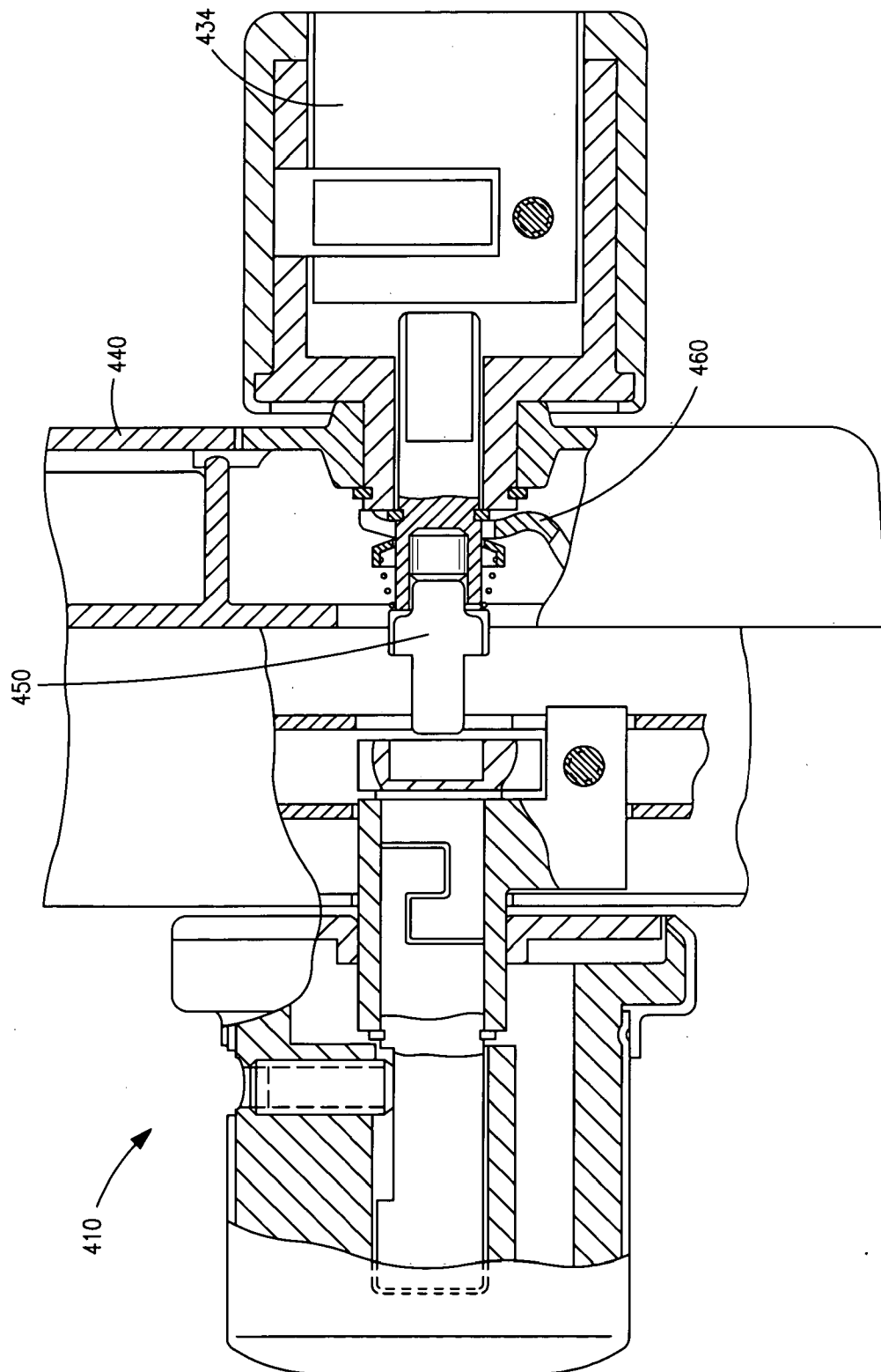
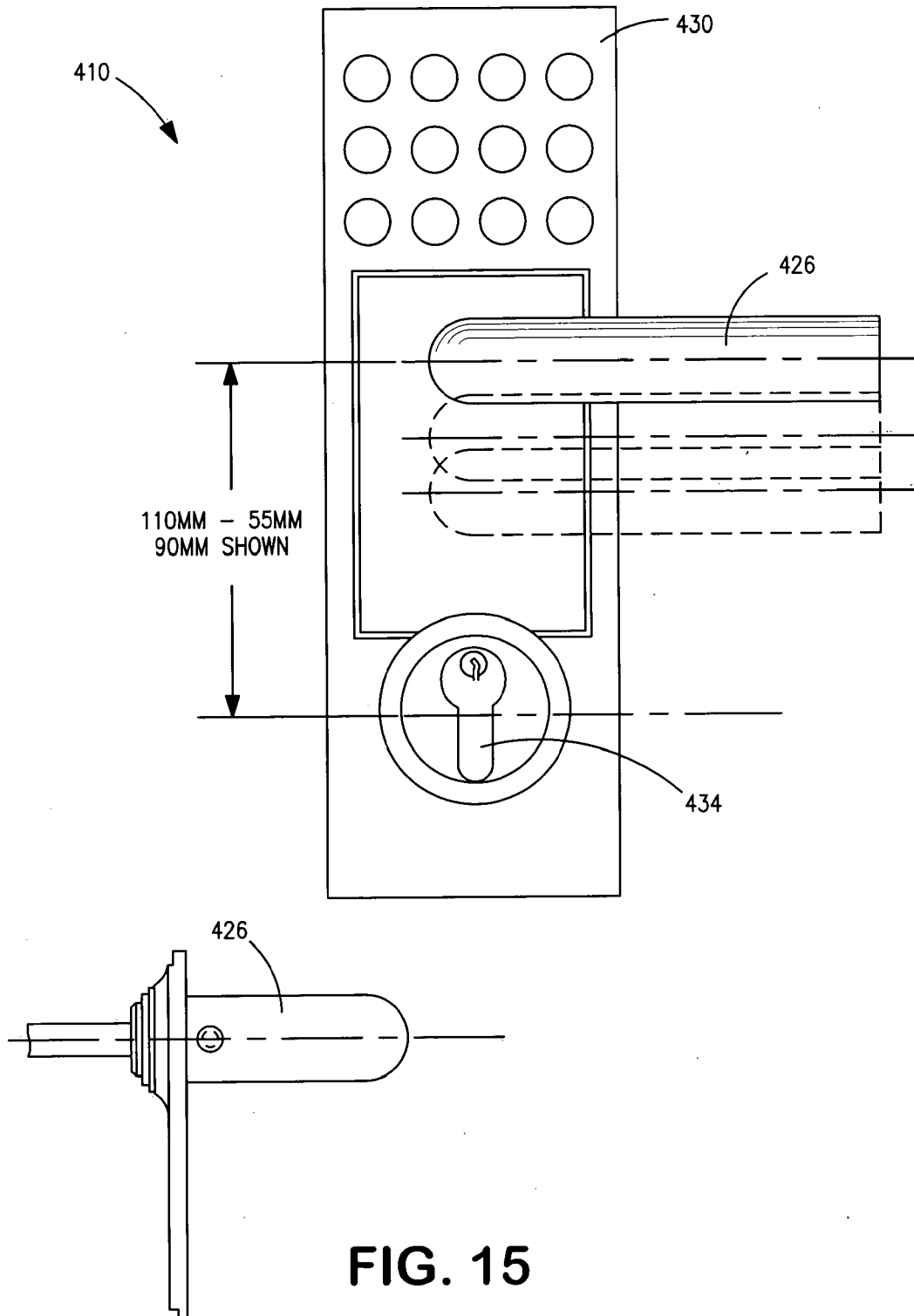


FIG. 14

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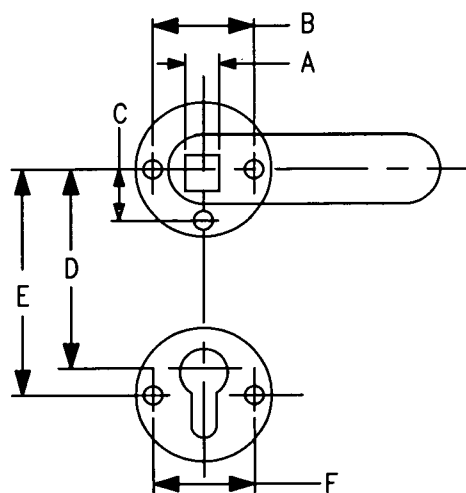


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European Standard Locks with Profile Cylinder

A = Spindle size
 B = Horizontal screw distance
 C = Vertical screw distance
 D = Lock center
 E = Vertical screw distance
 F = Horizontal screw distance

ID = Internal door
 ED = External door
 FD = Fire door



Country	Germany			France	Great Britain	Italy	Spain
Dimensions mm	ID	ED	FD				
A	8	10	9	7	8	8	8
B	38	38	38	—	—	—	40/50
C	21.5	21.5	21.5	—	—	—	—
D	72	92	72	70	57	90	70/85
E	80	100	80	—	—	—	—
F	38	38	38	—	—	—	—

FIG. 16