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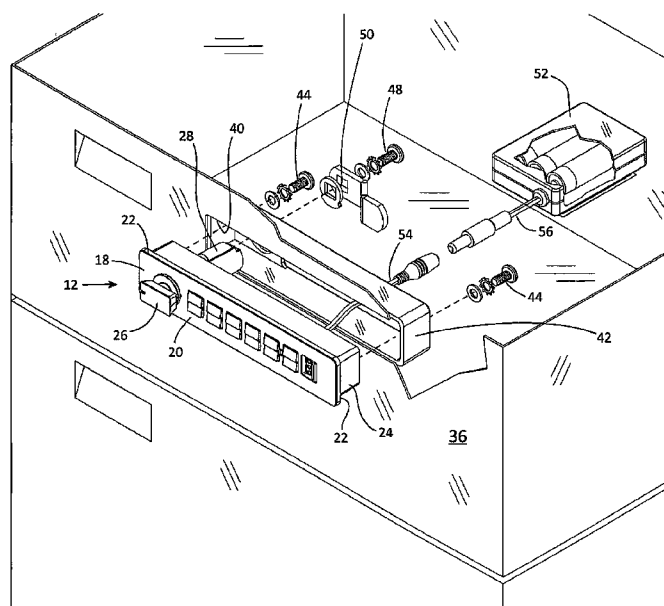


FIG-2

(57) Abstract: An electronic cam lock accessible either by PIN code or wirelessly transmitted code from a user's credential has a compact electronics housing that fits neatly and unobtrusively in office furniture, including metal or wood file cabinets. The housing has a rear-extending driver, which may be within a cylinder, preferably positioned where the driver of a cam lock of conventional keyed configuration would be located. One form of the lock is front-recess mounted. In another form the housing is inside-mounted, fitted within the usually one-inch top rail or vertical side rail of a file cabinet, with the electronic access terminal and a rotatable knob exposed for the user. The locks can be connected in a wired or wireless network for controlling access by time or by personnel, or for auditing entries.



ELECTRONIC LOCKS PARTICULARLY FOR OFFICE FURNITURE

S P E C I F I C A T I O N

Background of the Invention

This application is a continuation-in-part of application Serial No. 13/945,695, filed July 18, 2013, which was a continuation-in-part of application Serial No. 11/809,172, filed May 30, 2007, issued July 30, 2013 as U.S. Patent No. 8,495,898, and of application Serial No. 12/214,357, filed June 17, 2008, issued July 23, 2013 as U.S. Patent No. 8,490,443. All content of those two patents was incorporated in the copending parent application hereto, Serial No. 13/945,695. The disclosures of those two issued patents and of the copending application are all incorporated herein by reference in their entirety, including specifications and drawings.

This invention concerns locks for cabinets, lockers, drawers, access panels and similar situations. Specifically the invention embraces an electronic cam lock that fits office furniture, usually metal and wood file cabinets and other furniture units with doors, panels or drawers.

Metal and wood file cabinets, desk and cabinet drawers, locker doors, access panels and doors, mail boxes, dispensers and other secure situations often utilize relatively simple lock mechanisms known as cam locks. Such cam locks may or may not involve a camming action. In some cases they move other mechanisms that are engaged with the door or drawer of the cabinet or engaged with other mechanisms that are linked to

the door and drawer of the cabinet or multiple doors or drawers of the cabinet. In all cases except plungers, cam locks have a rotatable component at a back side. In one of the simplest forms, a cam lock on a cabinet door typically fits in a 3/4 inch diameter D-shaped or double D-shaped hole and, at the back side of the cam lock cylinder unit, has a metal blade or arm called a cam that rotates when the key is turned, from a position disengaged from surrounding cabinet hardware to a position of engagement in a slot or behind a ledge of the surrounding cabinet hardware. Other locks, such as those for desk drawers, commonly referred as cabinet locks, involve a camming type action as the key and plug are rotated, and these are also referred to as cam locks herein. The rotation causes a cam or nipple to move a deadbolt linearly to a locking or unlocking position, or in the case of a spring loaded latch or deadlatch, the rotation causes the cam or nipple to move a latch or deadlatch to unlocking position and removing the key keeps the latch or deadlatch in the extended locked position. The term cam lock excludes door entry locks on commercial or residential buildings. Such locks are heavier-duty and more secure than cam locks, which are typically small (3/4 inch hole receives them) and lighter-duty, as for office furniture.

Metal filing cabinets often utilize cam locks, but sometimes have a variation known as a plunger type lock in which a spring loaded plunger/lock cylinder located in the top horizontal margin of the cabinet, when pushed in, will lock all drawers. The use of a key releases the spring plunger to return to the outward position and unlock the drawers. These plunger locks are also referred to as cam locks herein, even though they have no rotatable member that locks and releases doors or drawers.

Locker and cabinet locks have included electronic locking devices, some of which utilized keypads and some of which utilized IButtons or other ID or non-volatile memory devices

which work on contact to release the lock. See, for example, U.S. Patents Nos. 5,894,277, 5,886,644, 6,655,180 and 6,791,450. The disclosures of all of these patents are incorporated herein by reference.

5 There is a need for a relatively simple, easily used, reliable and compact electronic lock, which may have a keypad but optionally operable by an electronic key or wireless device which may not require contact, or both, for situations in which typically cam, plunger and cabinet locks were
10 employed, and capable of fitting into a small space in the cabinet to produce a low-profile and aesthetic appearance. This is an objective of the current invention described below.

Summary of the Invention

15 The invention addresses these needs with a low profile and very compact electronic lock that, in one application, fits in the top one inch horizontal margin or "rail" of a steel file cabinet. The compact electronic locking device in one embodiment has a knob or handle that can rotate the cam lock cylinder plug or other rear-extending driver when such
20 manual rotation is permitted by the lock electronics. A keypad for entry of a code may be included, and if so, the code can be either permanently set to a reprogrammable code, or set in each case by a temporary user, who can then input the same code to lock and unlock the lock, this feature
25 depending on circumstances and function desired.

 In one preferred embodiment particularly adapted for a file cabinet, the locking device in one embodiment is less than one inch in height (about 7/8 to 31/32 inch), about five inches in length and roughly about 3/4 inch in depth or
30 thickness (or about 1/2 to 3/4 inch), as to the housing of the device. A cam locking device of this size will fit inside the horizontal top rail or vertical side rail, typically a space U-shaped in cross section, with the unit's keypad or access panel and the rotary knob extending through openings formed in

the top rail for this purpose. In another embodiment, an electronic lock of a similar size is configured for front-recess mounting. A collar or rim around the face of the housing engages against the face of the file cabinet and the
5 approximately 3/4 inch depth of the housing extends into the cabinet.

The housing may contain several battery cells, such as two or three AA batteries. From the back of the housing in one embodiment extends a cam lock cylinder unit which may be
10 of conventional cam lock size, and with a length to fit the application, i.e. the depth of material and configuration where mounted. In other embodiments a dummy plug can extend back from the housing unit, or simply a driver or spindle.

In the inside mount configuration described above, with
15 the lock housing fitting into the top rail of a metal file cabinet and inserted from the inside, the housing can have mounting flanges, one at each end, extending essentially coplanarly with the bottom side of the unit. These mounting flanges allow for screwing or riveting the housing into the
20 top rail from the bottom of the top rail. (References to "top", "bottom", etc. are for convenience in describing the locks as horizontally mounted, as in the top rail. These inside-mount locks can be vertically mounted in the vertical side rail as well; the directional wording is not meant to be
25 limiting.) For the front-recess mount form of the invention, the housing body is retained closely within a preferably rectangular hole in the file cabinet, with the rim that extends from the face bearing against the face of the file cabinet. This configuration includes a plastic or metal
30 receiver casing that is slipped over the body of the lock housing from the back, i.e. from the inside of the panel or drawer or door and which is then secured to the housing body by machine screws to firmly retain the lock and the casing in place. This casing may have a battery case at one end, or a
35 battery case can be separately retained within the file

cabinet and connected by wire or plug-in cable to the lock housing. The type of battery housing can be determined by space requirements.

The same front/recess mounted electronic lock can be used
5 for wood file cabinets or other office furniture having a thicker depth, e.g. 3/4 inch panels (as opposed to the thin panel of a steel cabinet). In this case the electronic lock includes different components at the back side of the door,
10 drawer or panel. The battery case is positioned essentially flush against the back surface of the drawer or panel and can be directly behind the recess-mounted electronics housing.

In all forms of the electronic lock of the invention, a keypad can be provided and/or a wireless terminal can be
15 provided, which can be RFID, or NFC (near field communication) allowing cell phone access or other wireless communication, all for security in accessing the lock and/or transferring data to or from the lock.

Importantly, the electronic lock device is compact and simple, at least as to mechanical elements, and without any
20 further electronics required to be connected to the lock at the back side of the door or panel. Essentially the only element extending from the lock unit at the back side of the panel is the rear-extending cam or cabinet lock cylinder unit or actuator, i.e. a latch or cam or driver positioned to
25 engage with a ledge or slot or bolt or latch lock unit or multiple-drawer locking rod or other hardware to retain the door(s), drawer(s) or panel locked.

In a preferred form the invention is embodied in a cam lock for a door, cabinet or drawer mountable from back of the
30 door, cabinet or drawer such that only the user interface and knob extend through the face of the door, etc. and includes a compact electronics housing with an electronic key receptacle and a keypad, RF reader or wireless reader or IButton reader for entry of a code, a driver unit extending from a back side
35 of the housing that matches the end of a cam lock or cam lock

plug of the typical mechanical lock for engaging with a strike
or other locking bars, cams or apparatus. The knob extends
from the housing for operating the cam lock manually when
permitted by the electronics. Note that the manual knob in
5 all forms of the invention can be spring-loaded to perform an
auto relock feature when applicable to the lock hardware.

In a variation of the invention, once the proper code has
been entered, the lock is opened not by a manual knob but by
an electromagnetic actuator (e.g. a solenoid or a miniature
10 motor) within the housing. Return to locked position can be
by an entry to the terminal (e.g. via a relock button or a re-
presentation of a credential to operate the motor or solenoid,
or by a spring return if a spring latch is involved); or it
can be via a sensor determining when the drawer, door or panel
15 is closed, using optical proximity, magnetic or mechanical
sensing.

In all forms of the invention the electronic lock devices
can be fitted with an RJ45 jack or another type of jack or
wireless antenna for network connectivity and external power.

20 It is therefore among the objects of the invention to
improve over prior cam and cabinet locks, particularly in
office furniture, with an electronic cam lock that can be
efficiently installed in doors, drawers, access panels, mail
boxes, etc., particularly office furniture. The device is
25 simple, compact, unobtrusive and provides a very clean and
integrated appearance. These and other objects, advantages
and features of the invention will be apparent from the
following description of preferred embodiments, considered
along with the accompanying drawings.

30 Description of the Drawings

Figure 1 is a perspective view showing an item of office
furniture, e.g. a file cabinet, and showing two different
forms of front recess mount electronic cam locks of the
invention, showing different access protocols and in both

cases with a rotatable knob or handle to release the lock when permitted.

Figure 2 is a perspective view showing a front recess mount lock as in Figure 1, the view being exploded to show components

as secured to the front and from the rear of the drawer, door or panel, including a battery case connected to the electronics housing.

Figure 3 is an exploded perspective view showing the lock assembly of Figure 2 and indicating assembly, but with the cabinet not shown.

Figure 4 is a perspective view showing the same electronic lock housing as in Figures 2 and 3 as installed in a drawer or panel of office furniture, but in this embodiment with a different form of battery case.

Figure 5 is an exploded view similar to Figure 4 but not showing the drawer or cabinet.

Figure 6 is a perspective exploded view similar to Figure 4 but showing a drawer or panel of thicker material, such as wood, approximately 3/4 inches thick, the electronic lock housing being the same as in previous figures but with different hardware at the back side of the drawer for retaining batteries.

Figure 7 is an exploded view similar to Figure 6 but not showing the drawer or panel.

Figure 8 is a perspective view showing the front of a file cabinet or other item of metal office furniture, with another embodiment of the electronic cam lock of the invention, fitted into the top rail of the cabinet.

Figure 9 is a view similar to Figure 8, but showing a keypad as the primary accessing feature of the electronic lock.

Figure 10 is a perspective view similar to Figure 9, but partially broken away and exploded, revealing the position of the electronic lock housing in the top rail of the cabinet and

showing cam and battery case features.

Figure 11 is a side elevational section view showing the lock installation of Figures 8, 9 and 10.

Figure 12 is a perspective, exploded view showing the lock assembly of Figures 8-11 but without the cabinet.

Figure 13 is a rear perspective view showing the invention with a power over Ethernet connector for data and power connection.

Figures 14 and 15 show different extensions for a driver.

Figures 16 and 17 show the invention as a plunger lock.

Figure 18 is a sectional view similar to Figure 11 but showing a modification.

Description of Preferred Embodiments

Figure 1 shows in perspective a file cabinet 10, which in this example is a metal file cabinet with multiple drawers. The drawing illustrates two different types of electronic cam lock according to the invention, installed in this item of office furniture. The lower drawer shows an electronic cam lock 12 having a keypad 14, while the upper drawer has a very similar electronic cam lock 12a but without a keypad, and instead with a wireless electronic access device 16. The two locks can in other respects be identical. The electronic access 16 can be an RFID communicating device for use with an RFID credential carried by a user, or it can be any other proximity or wireless, touch-free communication device, including NFC (allowing cell phone access). It could use infrared or encrypted bar code (QR code). Reference herein to entry of a code or access code includes PIN code for keypad locks and also other forms of wireless input, including those mentioned above, i.e. electronically-transmitted codes.

The electronic lock 12 or 12a is shown front recess mounted in Figures 1-5 and also Figure 6 and 7. The lock comprises a housing 18 which has a front face 20 with a rim 22 that extends outwardly (both length and width) slightly more

than a body 24 of the housing behind the face plate 20 (see Figures 2 et seq. for body). For example, the rim can extend about 1/16 inch to 1/8 inch out from the body.

Figure 1 also shows that the lock includes a manually rotatable knob or lever 26 which can be rotated by a user once access has been authorized, rotating the cam lock plug or driver within a cylinder 28 and an attached cam or latch device directly behind the knob 26 to release the lock and allow opening of the drawer or panel. The term "cylinder" or "cylinder unit" as used herein is intended to mean at least a collar extending part way back from the housing, not necessarily as deep as the driver which imports rotation to the cam or other device, the driver being within the collar and rotatable within the collar. In addition, a contact terminal 30 is shown on the lock, for accepting a manager's or supervisor's utility or programming "key" device to supply power to the lock when power (e.g. battery) has failed or when an access device or PIN code has been lost, or both. This can operate in the same way as described in Patent No. 7,336,150, and the disclosure of that patent is incorporated herein by reference in its entirety. Note that reference to a cylinder with a driver extending back from the housing is intended to include any rotatable element operated by the knob 26 and connected to a cam or latch device, whether an actual cylinder shell is present or not.

As seen in Figure 1 on the lock device 12a, a push-button 32 can be included to wake up the lock device as a power saving measure, followed up by introduction of the credential. Until the button 32 is pushed, the lock is in sleep mode and after it is pushed it looks for a credential. The button 32 is also used in programming functions; for example, after pushing the button for 5 seconds it puts the lock in the programming mode, allowing the insertion of the utility or programming key to be touched, followed by introduction of the credentials that allow opening of the lock. Similarly, the

keypad 14 of the lock device 12 (shown on the lower drawer in Figure 1) has two additional push-button keys 34 beyond the ten numeral keys (e.g. marked "c" and with a key symbol), for instructions to the electronics. For example, the lock
5 electronics might require one of these buttons to be pushed prior to entering a four-digit PIN, and the other of the two buttons to be pushed when the code has been completed. Additionally the lock can be put into the programming mode by pressing C + key symbol + 55 + key, for example.

10 Figure 2 shows the lock 12 in a drawer or panel 36 of metal office furniture. This could also be a door or other type of lockable panel. The description of Figures 2-5, as well as Figures 6 and 7, applies equally to the non-keypad lock 12a shown in Figure 1.

15 The front recess mount lock 12 is received a rectangular hole 40 formed in the panel 36 at the appropriate location. The panel is assumed to be sheet metal, usually steel, and typically about 12 to 20 gauge. When the lock housing 18 is inserted into the rectangular opening 40, the housing body 24,
20 only slightly smaller than the opening, slips through the opening and the rim 22 around the face plate engages against the surface of the panel 36 surrounding the opening. The cam lock cylinder 28 or other rotatable driver extends back through the opening 40, as does nearly all the depth of the
25 lock housing body 24, which may be about 3/4 inch in depth. In this embodiment of the invention, a plastic or metal rear housing or casing 42 is assembled over the back of the housing body 24 from the inside of the drawer or other item of office furniture. The lock cylinder 28 passes through the back of
30 the plastic casing 42 (hole 43), and the casing 42 and lock housing 18 are secured together to firmly hold the lock assembly in place. This can be using machine screws 44 as indicated in the assembly drawings of Figures 2 and 3. These views also show a cam 46 of typical configuration being
35 secured onto the rotating element at back of the cam lock

cylinder 28, by another machine screw 48, such that the cam 46 rotates with the rotation of the manually-turned knob 26 to lock or unlock the panel. As is typical, a specifically shaped (square) opening 50 in the cam secures it for rotation with the back of the cylinder driver or cylinder plug of the cylinder 28.

The exploded views of Figures 2 and 3 show that in this embodiment, a battery case 52 is separate from the lock housing and from the rear plastic case 42, connected by cables 54 and 56 and appropriate connectors to supply power to the lock housing. The battery casing or housing 52, which preferably is rectangular, can be secured in any convenient and efficient way to the interior of the cabinet or other office furniture. For example, it could be secured to any inside surface of the drawer shown in Figure 2, such as by VELCRO hook and loop fastener material, as illustrated below in connection with another embodiment of the invention.

Figures 4 and 5 show another preferred embodiment, a variation of the lock assembly shown in Figures 2 and 3 in regard to battery location. The exploded views of Figures 4 and 5 are the same in many respects as Figures 2 and 3, but a plastic lock body-receiving casing 42a is integral with the battery case 52a. As these drawings indicate, the battery case 52a (which may hold three AA battery cells) preferably is integrally formed with the body-receiving casing 42a, with a battery-engaging holder 58 secured in the casing 52a and a battery cover 60 that snaps together with the battery case 52a. AA batteries are shown at 62. Again, the body-receiving case 42a has a hole 43 through which the cam lock cylinder or driver 28 extends, and this casing may be secured to the electronic lock housing 18 by machine screws 44 assembled from the rear. The integral device comprising 42a and 52a of the battery-receiving components and cover may be called a rear cover and power unit of the lock assembly. The rear cover/battery power unit of Figures 4 and 5 can be used when

space permits at the back of the drawer or panel.

Figures 6 and 7 show another variation, again with the identical electronic lock housing 12 (or 12a), in a front recess mount, as in the drawings discussed above. In this case the lock housing 12 and lock assembly are fitted into a drawer or panel 36a of thicker dimension, such as a wood desk drawer or wood cabinet drawer, having a thickness t of approximately $3/4$ inch. The broken away, exploded view of Figure 6 indicates that the body 24 of the front recess mounted lock housing is fitted again into a rectangular hole slightly larger than the body 24, but the rear of the body 24 will be approximately flush with the back side of the panel 36a when fully inserted with the housing rim 22 engaged against the panel 36a surface. In this case a rear plate 64, preferably of metal, is assembled from the rear to the electronics housing, preferably using machine screws 44 as described above. This tightly sandwiches the panel structure 36a between the lock housing rim 22 and the rear plate 64. For this purpose the housing body 24 preferably is slightly less than $3/4$ inch thick to allow for some variation in thickness of the panel 36a. The plate should not "bottom out" against the back of the housing body 24 but should be pulled toward a housing body by the screws 44 to make a tight engagement with the panel structure. The plate is flat since there is no need to receive any portion of the lock body 24, which does not protrude through the back of the thick panel 36a. The metal plate 64 has attached to it (by fasteners – pem nuts are shown at 66, fixed to the metal plate to allow a screw to be received) several plastic components as shown at 68 and 70, the latter being a battery contacting holder. A hollow battery cover 72 is shown for securing to the plate 66 or connected structure to close the battery compartment. A power cable is shown at 74, with connectors, for electrically connecting the electronic housing 18 to the power supply, i.e. batteries, the cable extending through a hole in the plate

shown at 76. As an alternative, fixed male and female connectors could be positioned on the back of the housing body 24 and on the battery holder 70, exposed through the hole 76, so that connection is made without wires when the plate 64 is secured to the electronics housing when the lock is assembled to a panel. The use of an electric cable gives more versatility since the drawer or panel can vary in thickness.

Figures 8 through 13 show another form of electronic cam lock and lock installation according to the invention, again in office furniture, specifically a metal cabinet or other metal office furniture 80 having a top rail 82. Figure 8 shows a wireless non-keypad electronic cam lock 84a with access feature such as shown in the lock 12a in Figure 1, but configured differently for inside mount. Figure 9 shows an electronic cam lock 84 which is identical in all respects to the lock 84a but with a keypad 14. The locks 84 and 84a have functions similar to those described above. All discussion of the lock 84, as regards installation of securing within the top rail 82 of the cabinet, as well as battery treatment and location, apply to the lock 84a as well. Also, all such discussion is intended to apply to a file cabinet vertical side rail as well.

Figures 9 through 12 should be viewed together regarding the description of this lock and installation.

Figure 12 shows the electronic cam lock assembly 84, without the cabinet. The assembly includes an electronic lock housing 86 with the secure accessing feature 14, the housing being of limited height so as to fit into the top rail of metal office furniture. Typically the top rail of a metal file cabinet is generally U-shaped in cross section (see Figure 11) and has an inside clearance of about 1 inch. The lock housing 86 preferably has a height of about 15/16 inch or about 31/32 inch, so as to fit within this top rail space. The access feature 14 defines a rectangular protrusion 88, i.e. a portion of the housing face 90 protruding slightly (no

more than about 1/16 inch) from the face of the housing, that face 90 bearing against the inside surface of the front piece 92 of the top rail. The protrusion 88 is defined by a peripheral rim 88a, seen best in Figure 12. Thus, the
5 accessing feature 14 (here, keypad and emergency access terminal 30) fit closely within a rectangular cutout provided for this purpose in the front top rail piece 92, with the rim 88a very closely fitted in the cutout, providing a neat and unobtrusive, built-in appearance as can be seen in Figures 8
10 and 9.

In addition to the access terminal, a knob or lever 26 must also be positioned at the outside of the top rail. A second opening, preferably circular, can be provided in the rail for this purpose as indicated in Figure 9. As indicated
15 in Figures 10 and 12, the knob or handle 26 is assembled onto the electronics housing 86 after installation of the housing in the top rail. This can be, as shown in Figures 10 and 12, by a machine screw 92 (covered by a snap-in obscuring insert 93), and with the knob having a shank 94 of specific shape,
20 such as a D shape, so as to fit in an oriented position in a similar-shaped socket 96 of the electronic cam lock housing. This rotatable socket 96 then operates the cam lock, turning the rotatable member 29 of the cam lock cylinder when permitted by entry of a proper access code. Note that a
25 single opening could be provided through the front rail piece 92 to accommodate the access feature 14 and the knob together, preferably with a relieved rim surrounding both and fitting closely within the cutout opening.

Although the inside-mount electronic cam housing 86 could
30 be secured to the top rail front piece 82, as by machine screws or rivets, in this preferred embodiment the attachment is all internal and not exposed, via side-protruding horizontal flanges 98 integral with the housing 86 and extending generally planarly along the bottom of the housing.
35 This allows securing to the bottom piece 100 of the top rail

82 of the cabinet, by machine screws or rivets 102 as shown in the exploded and partially cut away view of Figure 10. The assembled lock is also well illustrated in Figure 11, a sectional side elevation view showing the lock housing 86
5 secured to the bottom flange or section 100 of the top rail 82, with the electronic access panel 14 and knob or handle 26 extending outside the top rail. Again, the lock housing 86 could be inside-mounted in a vertical side rail of a file cabinet.

10 Figure 10 shows the cam lock assembly 84 fitted with a type of cam 104 that raises and lowers a rod (not shown) for simultaneously locking or unlocking a series of file cabinet drawers, which is an important application for this inside-
15 mount, rail-contained form of cam lock. This is the same hardware used with conventional cam locks that simply rotate with a key, and the electronic lock 84 substitutes for the conventional device, in the same location in the cabinet. In fact all locks herein are located with lock cylinder at the
20 same location as for conventional cam locks, so that the same internal hardware of a manufacturer can be used. Figure 11 shows the electronic cam lock 84 with a typical offset cam 46 as the locking element, similar to what is shown in Figures 2-7.

25 With this top rail installation, a battery case 106 that generally is not secured at the back of the electronics housing 86. The battery case 106 can conveniently be secured to the electronics housing by cables 54, 56 and connectors 54a, 56a, and with the casing secured to the underside of the top panel 107 of the file cabinet such as using self-stick
30 VELCRO hook and loop fastener material 108. This is shown in Figures 10, 11 and 12. Other positions for the battery case are also possible, but retaining it within the height of the top rail 82 assures there will be no interference with action of the top drawer.

35 Figure 13 shows the electronic cam lock housing unit 18

from the back side, as in Figures 1-7, showing the rearwardly protruding housing body 24, the laterally protruding mounting rim 22 and the cam lock cylinder 28 and rotating driver 29, and also revealing the optional inclusion of an RJ 45 receptacle, at 110. A cable 112 with an RJ 45 connector 114 is shown in position to be plugged into the receptacle. As mentioned above, the cable 112 can power the lock with line power in lieu of batteries, and also hook up to a data network simultaneously. Such a data network is useful in a network of office furniture, such as file cabinets, to provide a record of entries to the cabinets and also, when desired, to control who may gain access to which file cabinets at specific dates and times. With a network, this access control can be set up and monitored from a secure central location.

If the electronic cam locks of the invention are wired for networking, this could be either individually or in groups. The wiring can be done as part of a bus system where the locks can be wired for data, with the same cable also providing power. This can allow the units to be wired and receive data such as access data. Even without wiring, a data network can be established using a WiFi for a group of locks, and access and/or audit data can be transmitted to and from the locks from a central location, via the WiFi or Internet connection. The information can be distributed to all locks in the system either individually or as a whole, but with data coded for particular locks as needed.

This is a power over Ethernet arrangement when both power and data are carried by the cable 112. Note that connectors other than RJ 45 could be used.

Figures 14 and 15 demonstrate that an electronic cam lock according to the invention, including any of the embodiments, can be fitted with any desired length of extension of the rotatable cylinder shaft or driver. These drawings show extensions 115 and 116 of different lengths. The initial shaft from the cylinder 28 is relatively short, but the shaft

or driver can be extended to any desired length to achieve the correct length required for the application. The extension is secured to the shaft or driver via a machine screw 118 of appropriate length.

5 Figures 16 and 17 show a plunger lock 120 constructed according to the invention, with a keypad 14 or a wireless access 16 such as shown in other embodiments. The lock 120 is shown as having a front-recess mounting housing, as in Figures 1-7, but it could be an inside-mount as well, as shown in
10 Figures 8 et seq. With this type of lock 120, the plunger 122 is spring-biased outwardly to the position shown in Figure 16, which is the unlocking position. For the locked position shown in Figure 17, the user pushes inward on the plunger with sufficient force to overcome the strain and mechanical
15 resistance, and at that point the plunger latches inwardly at the position shown in Figure 17. The mechanism behind the lock is the same as in conventional plunger lock operation, and is not shown here, but the movement of the plunger actuates an internal mechanism, as in a file cabinet, to
20 effect locking of all drawers. With the invention, the proper entry of a PIN code or a wirelessly-transmitted electronic code will cause the movement of a small blocking pin or other restraint device inside the lock when in the position shown in Figure 17, to release the restraint and allow the internal
25 spring to pop the plunger back out, granting access.

 Figure 18, a cross section in elevation similar to Figure 11, shows that in a variation of the invention, the knob or handle is eliminated. An internal electromagnetic actuator, e.g. a solenoid or motor M, rotates the driving element or
30 plug that moves the cam 46 (or latch or other mechanical latching device). Unlatching occurs when the proper code or ID is received in the terminal 14. Re-latching can occur by sensing when the door or drawer is closed (optical, mechanical, magnetic, etc.), or by the user's touching a
35 button on the terminal or again presenting an automatically

read credential, or it can occur after a short delay if a spring latch is present.

As noted above, the entire disclosures of Patents Nos. 8,495,898 and 8,490,443, as well as Patent No. 7,336,150, and
5 copending application No. 13/945,695 are incorporated herein by reference. All disclosure regarding drivers, networking, antennas, different types of wireless access reader protocol, emergency access or power loss, and other features can be applied to the locks disclosed herein.

10 The above described preferred embodiments are intended to illustrate the principles of the invention, but not to limit its scope. Other embodiments and variations to these preferred embodiments will be apparent to those skilled in the art and may be made without departing from the spirit and
15 scope of the invention as defined in the following claims.

I CLAIM:

1. An electronic cam lock on a door, cabinet, panel or drawer in a cabinet or furniture that provides ingress and no ingress, without a mechanical key, comprising:

5 a compact housing containing electronics and having an access terminal enabling entry of a code by a user, such code when properly entered causing the electronics to permit access, the housing being affixed to a panel of said door or drawer or other structure of said cabinet or furniture, and
10 the housing having a housing body and a face fixed at the front of the housing body, the face having a peripheral rim that extends outward laterally beyond the housing body, and the housing being front-recess mounted in an opening in the panel which is sized to closely receive the body of the
15 housing and not the rim, such that the rim of the housing is positioned against the front of the panel,

a cam lock cylinder unit extending from a back side of the housing, with a lock driver in the cylinder unit engaged with a cam or latch device at the inside of the panel of the cabinet or furniture, and including a knob or handle on the
5 housing for operating the lock manually without a mechanical key to rotate the lock driver and the cam or latch device when permitted by the electronics, and

a power source connected to power the electronics.

2. The electronic cam lock of claim 1, wherein the
10 housing and the opening to the panel are generally rectangular in shape.

3. The electronic cam lock of claim 1, wherein the panel is of sheet metal, about 12 to 20 gauge, such that the housing body protrudes inwardly into the cabinet or furniture, and

including a rear casing at the inside of the panel, covering the housing body from the back, and wherein the housing and rear casing are secured to the panel by fasteners extending through the rear casing and engaged with the housing body.

5 4. The electronic cam lock of claim 3, wherein the rear casing has a back panel with an opening through which the cam lock cylinder unit extends.

10 5. The electronic cam lock of claim 3, wherein the power source comprises a battery pack, the battery pack being secured on the inside of the cabinet or furniture and connected by electrical cable through the rear casing and to the housing.

15 6. The electronic cam lock of claim 3, wherein the rear casing is a part of a combined rear casing and battery power unit, including a battery casing serving as said power source and integrally formed laterally at one end of the rear casing, containing batteries and being connected electrically to the housing.

20 7. The electronic cam lock of claim 1, wherein the panel of the cabinet or furniture has a thickness of about 5/8 inch to 3/4 inch, and wherein the housing body extends into the opening of the panel such that a back side of the housing body is approximately flush with an inside surface of the panel, and wherein a plate is included inside the cabinet or
25 furniture, immediately behind the housing, and the plate and housing being retained on the panel by fasteners extending through the plate and engaged with the housing so that both the plate and the rim of the housing bear against the panel.

30 8. The electronic cam lock of claim 7, wherein the plate has an opening through which the cam lock cylinder unit

extends.

9. The electronic cam lock of claim 8, wherein the power source comprises a battery casing secured to the back side of the plate, containing batteries, and the batteries being
5 connected to power the electronics of the housing.

10. The electronic cam lock of claim 1, wherein the power source is a cable feeding line power to the housing.

11. The electronic cam lock of claim 1, wherein the electronic cam lock is part of a network of similar locks,
10 with a data port on the housing connected by a cable to the network.

12. The electronic cam lock of claim 1, wherein the access terminal includes an RFID reader for a user credential carrying an RFID tag.

13. An electronic cam lock on a door, cabinet, panel or drawer in a metal cabinet or furniture that provides ingress and no ingress, without a mechanical key, comprising:

a compact housing containing electronics and having an access terminal enabling entry of a code by a user, such code
20 when properly entered causing the electronics to permit access, the housing being affixed in a generally U-shaped top rail or vertical side rail of said cabinet or furniture, and the housing having a face at the front of the housing, the housing being inside-mounted, fitted within the top rail or
25 side rail such that a portion of the housing face having the access terminal is exposed through an opening in a front rail piece of the top rail or side rail, and the housing being secured to the inside of the top rail or side rail,

a cam lock cylinder unit extending from a back side of
30 the housing, with a lock driver in the cylinder unit engaged

with a cam or latch device at the inside of the panel of the cabinet or furniture, and including a knob or handle secured to the front of the housing through an opening in the front rail piece, for operating the lock manually without a
5 mechanical key to rotate the lock driver and the cam or latch device when permitted by the electronics, and
a power source connected to power the electronics.

14. The electronic cam lock of claim 13, wherein the housing and the opening in the front rail piece are generally
10 rectangular in shape.

15. The electronic cam lock of claim 13, wherein the metal cabinet or furniture is a file cabinet and the power source comprises a battery pack, the battery pack being secured on the inside of the file cabinet and connected by
15 electrical cable to the housing.

16. The electronic cam lock of claim 15, wherein the battery pack is secured against an inside surface of a file cabinet panel forming a part of said top rail or side rail using hook and loop fastener material.

17. The electronic cam lock of claim 13, wherein said opening in the front rail piece for the access terminal is separate from said opening in the front rail piece through which the knob or handle is secured to the housing.
20

18. The electronic cam lock of claim 13, wherein said portion of the housing face having the access terminal is slightly relieved outwardly from the remainder of the housing face, with a relieved peripheral rim around said portion of the housing face, the rim fitting closely within said opening in the front rail piece.
25

19. The electronic cam lock of claim 13, wherein the housing includes mounting flanges extending laterally and integrally from the housing, the housing being secured to the inside of the top rail or side rail by fasteners engaged with said mounting flanges.

20. The electronic cam lock of claim 13, wherein the cabinet is a file cabinet and said cam or latch is a lifter cam operating multiple drawers of the file cabinet.

21. The electronic cam lock of claim 13, wherein the U-shaped top rail or vertical side rail in which the housing is positioned has a clearance of about one inch, the housing having a corresponding dimension about 1/16 inch to 1/32 inch less.

22. The electronic cam lock of claim 13, wherein the power source comprises line power wired to the housing.

23. The electronic cam lock of claim 13, wherein the electronic cam lock is part of a network of similar locks, with a data port on the housing connected by a cable to the network.

24. The electronic cam lock of claim 23, wherein the data port also receives line power via the cable, the line power serving as said power source.

25. The electronic cam lock of claim 13, further including an antenna connected to the electronics for network connection with a series of similar locks.

26. The electronic cam lock of claim 13, wherein the access terminal includes an RFID reader for a user credential carrying an RFID tag.

27. The electronic cam lock of claim 13, wherein the access terminal has electrical contacts, and further including a portable key device with a battery and with contacts adapted to fit with the terminal and to make contact with the electrical contacts of the terminal.

28. An electronic cam lock on a door, cabinet, panel or drawer in a cabinet or furniture that provides ingress and no ingress, without a mechanical key, comprising:

a compact housing containing electronics and having an access terminal enabling entry of a code by a user, such code when properly entered causing the electronics to permit access, the housing being affixed to a panel of said door or drawer or other structure of said cabinet or furniture, and the housing having a housing body and a face with said access terminal, the face being fixed at the front of the housing body, the housing being mounted to the panel such that the access terminal is exposed for entry of a code by a user,

a cam lock cylinder unit extending from a back side of the housing, with a lock driver in the cylinder unit engaged with a cam or latch device at the inside of the panel of the cabinet or furniture, and including an electromagnetic actuator in the housing for operating the lock without a mechanical key to rotate the lock driver and a cam or latch device when permitted by the electronics, and

a power source connected to power the lock.

29. The electronic cam lock of claim 28, wherein the face on the housing has a peripheral rim that extends outward laterally beyond the housing body, and the housing being front-recess mounted in an opening in the panel which is sized to closely receive the body of the housing and not the rim, such that the rim of the housing is positioned against the front of the panel.

30. The electronic cam lock of claim 28, wherein the housing is affixed in a generally U-shaped top rail or vertical side rail of said cabinet or furniture, and the housing having a face at the front of the housing, the housing being inside-mounted, fitted within the top rail or side rail such that a portion of the housing face having the access terminal is exposed through an opening in a front rail piece of the top rail or side rail, and the housing being secured to the inside of the top rail or side rail.

10

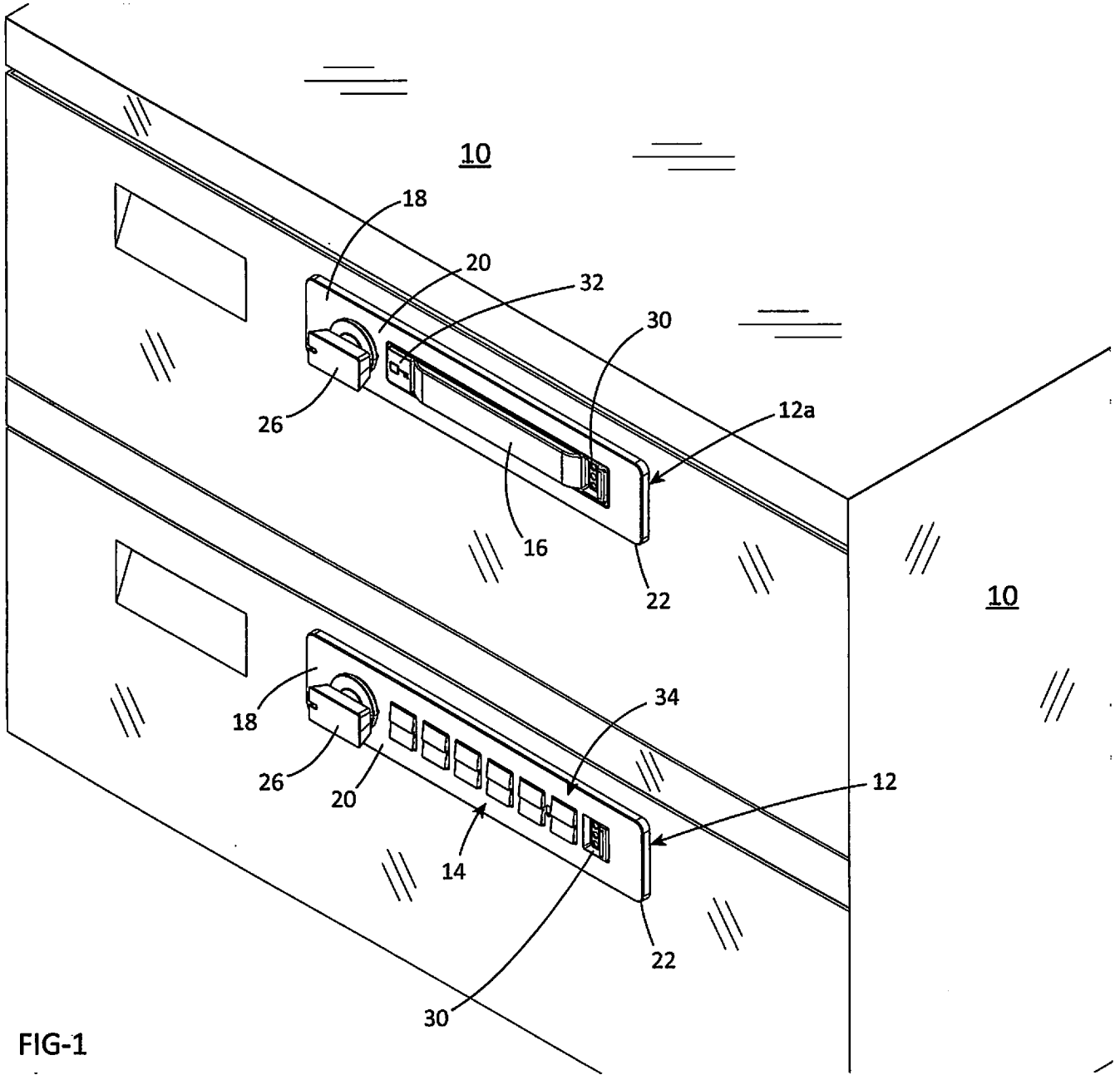


FIG-1

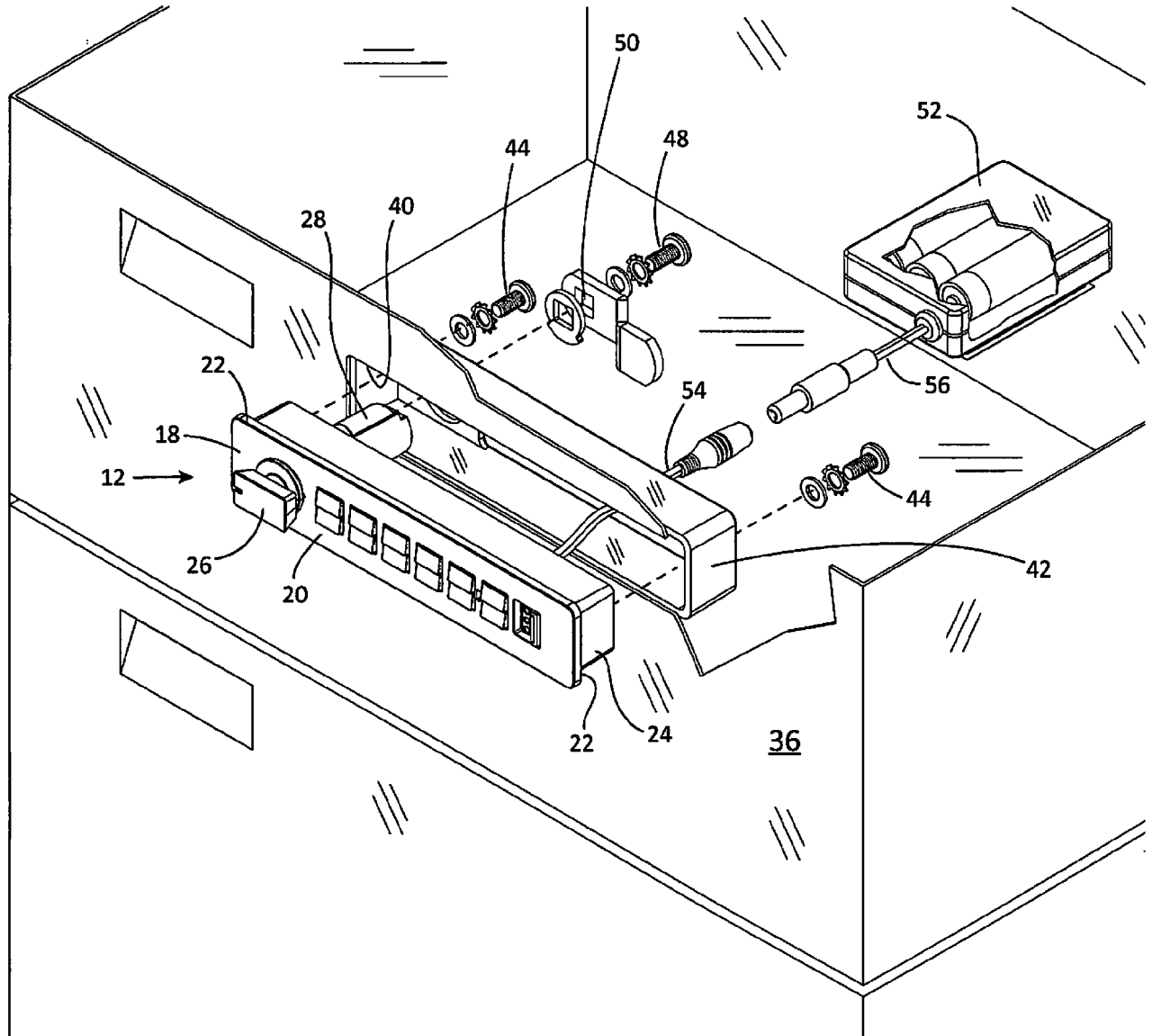


FIG-2

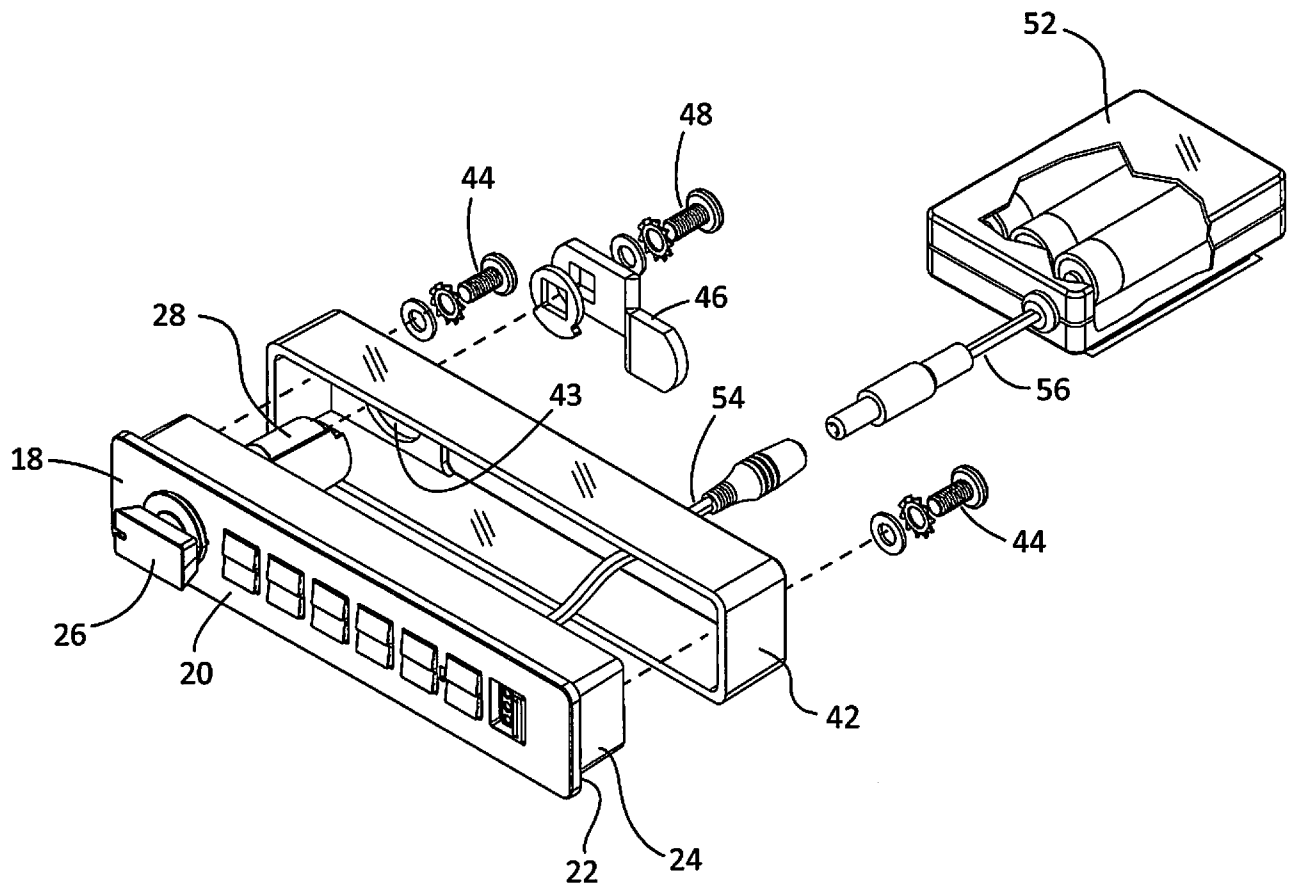


FIG-3

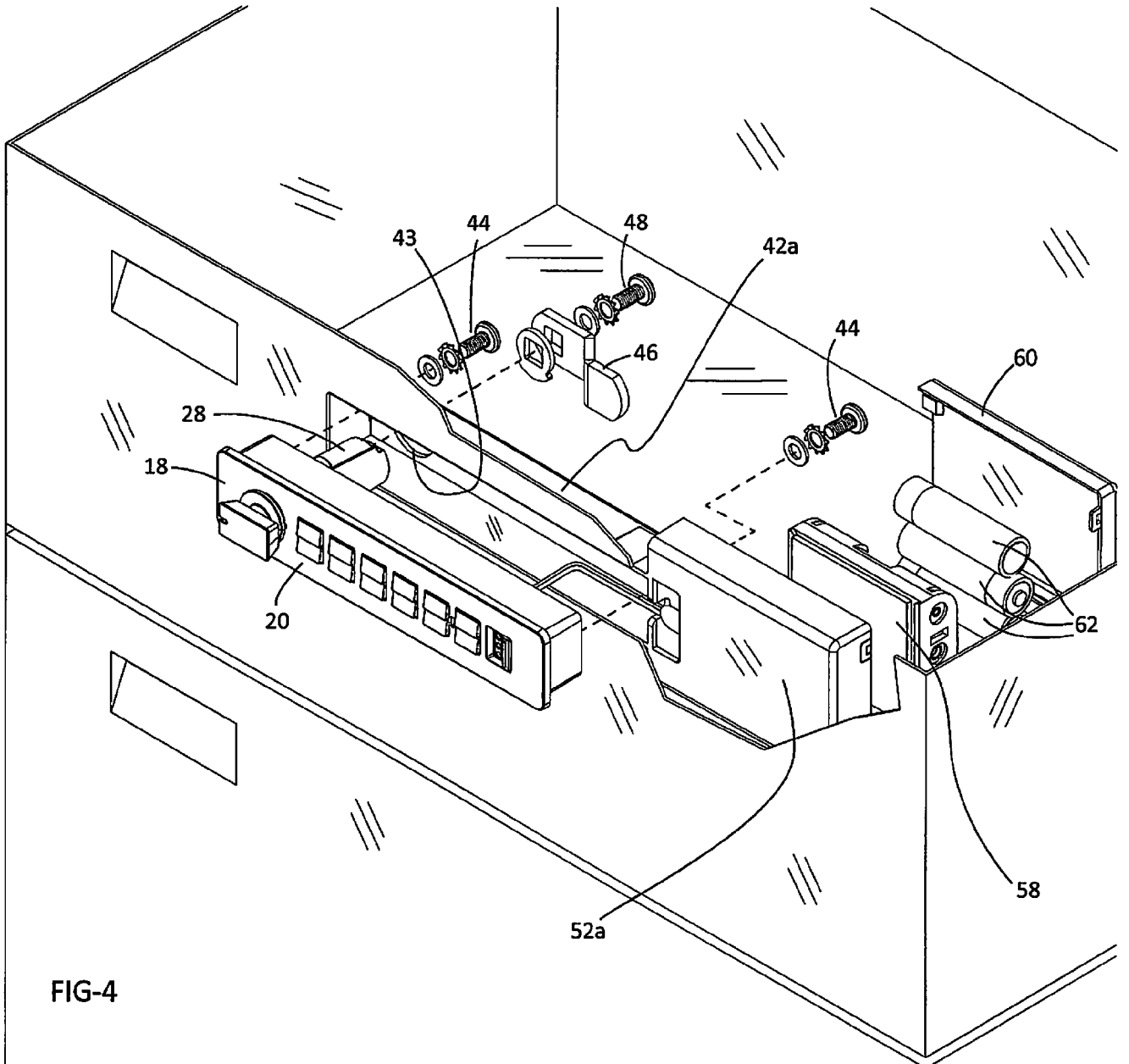


FIG-4

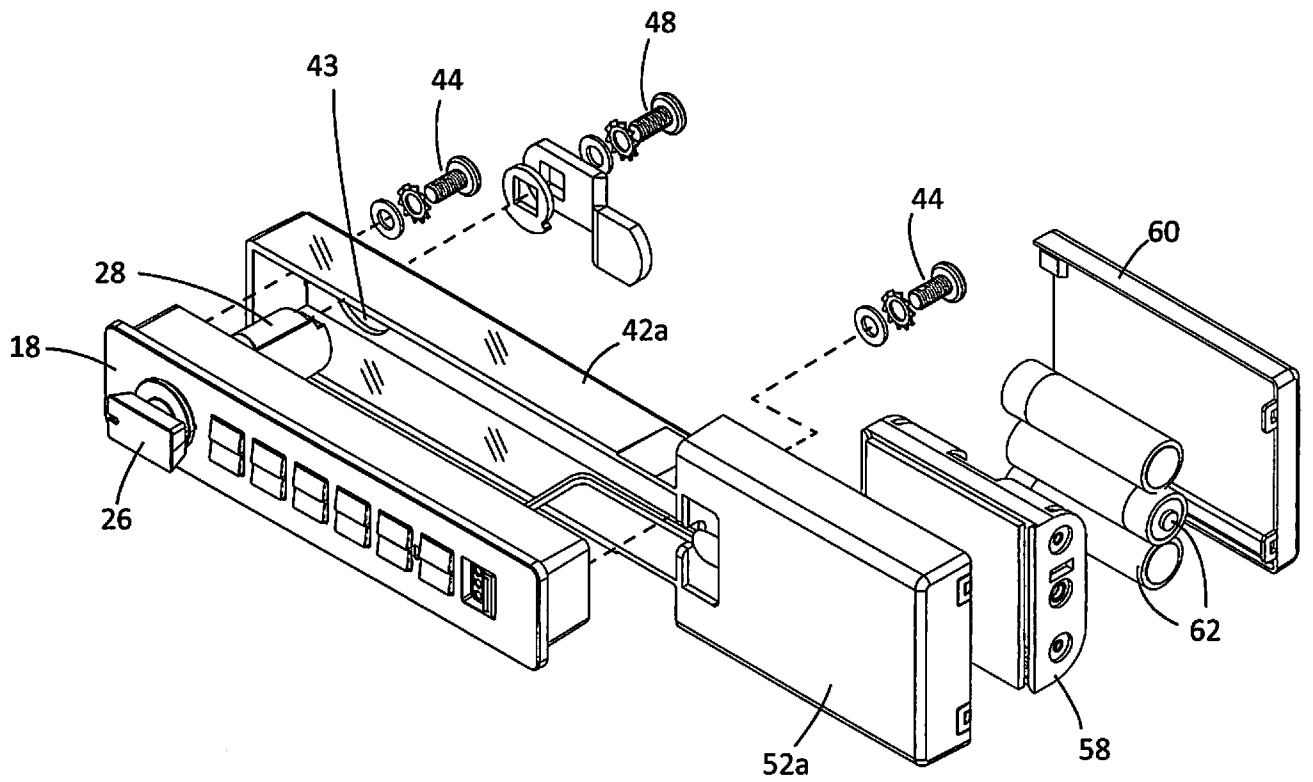


FIG-5

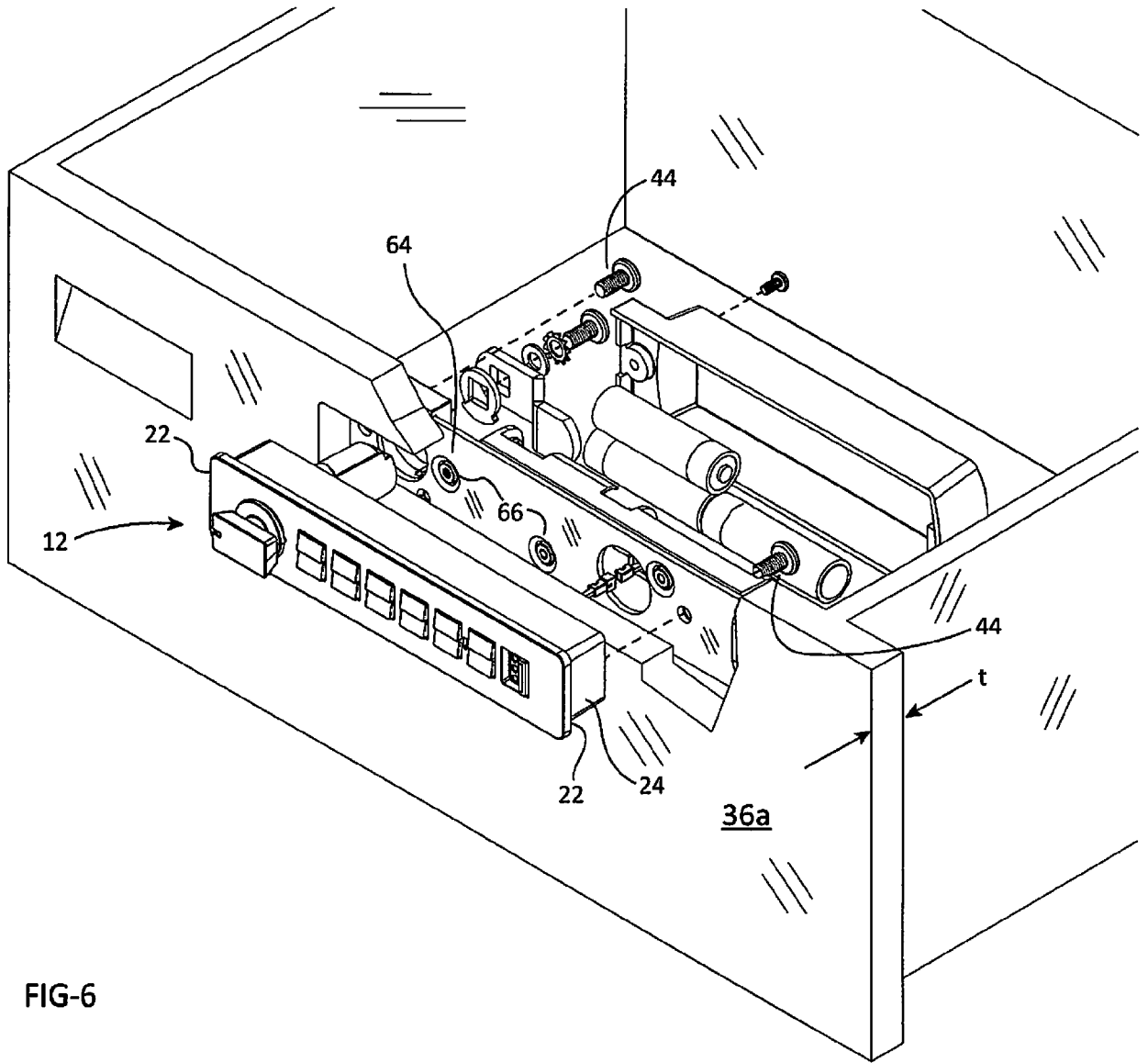


FIG-6

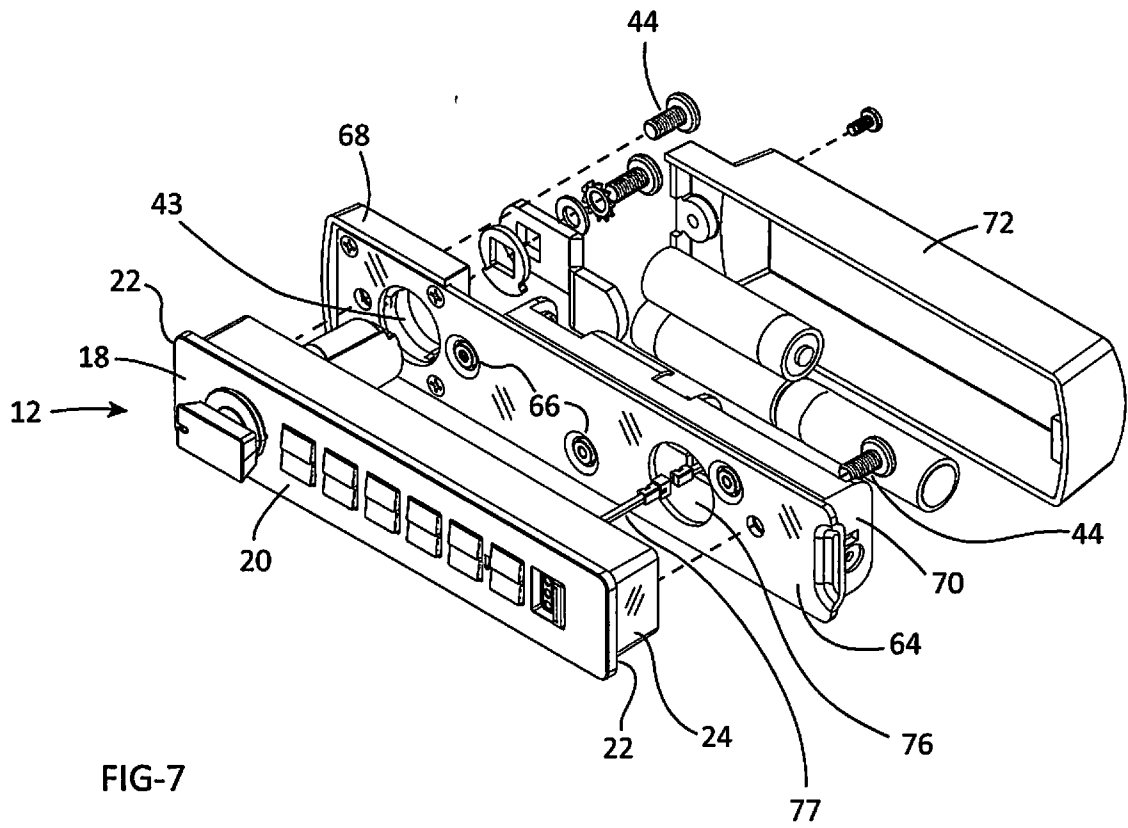


FIG-7

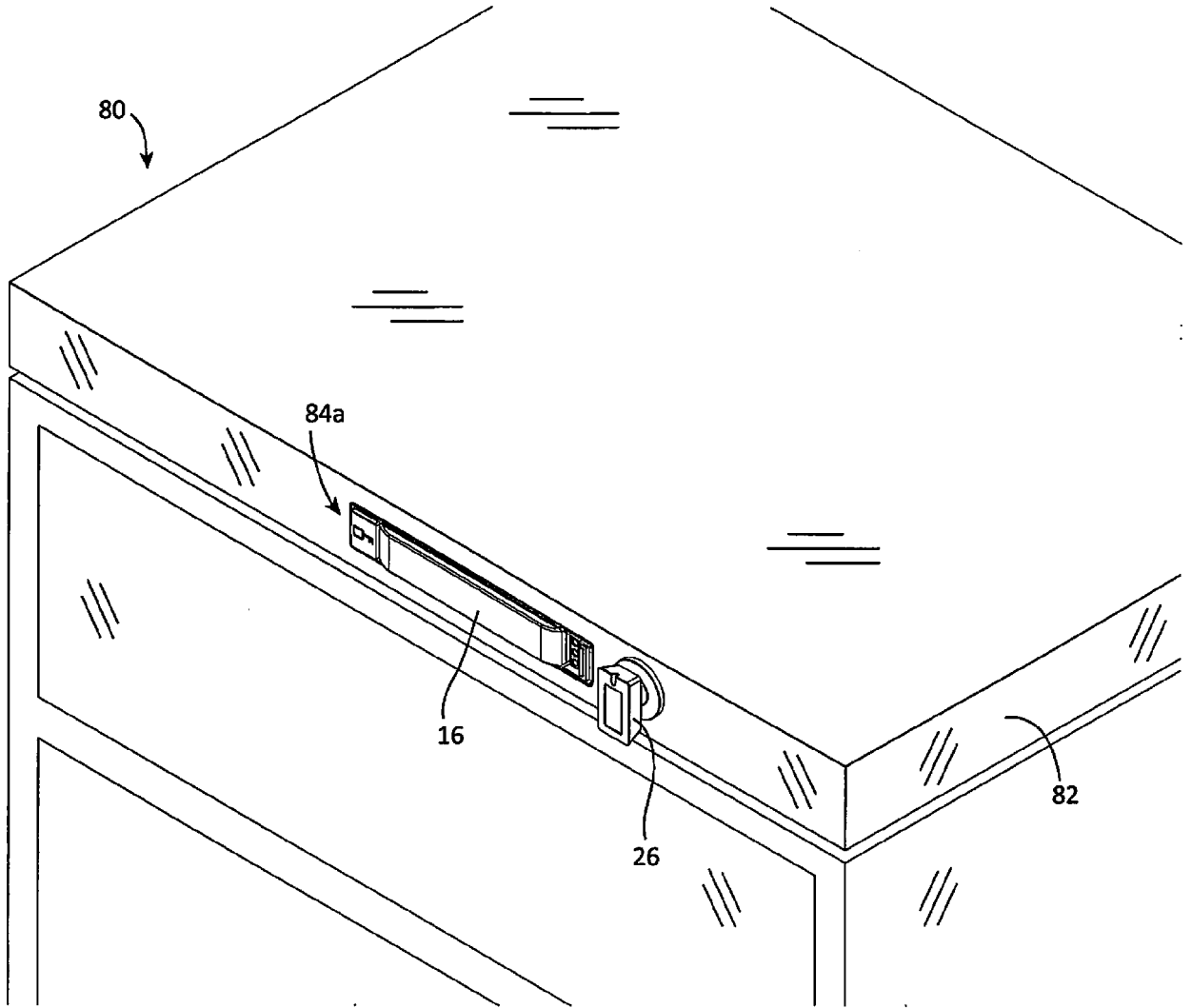


FIG-8

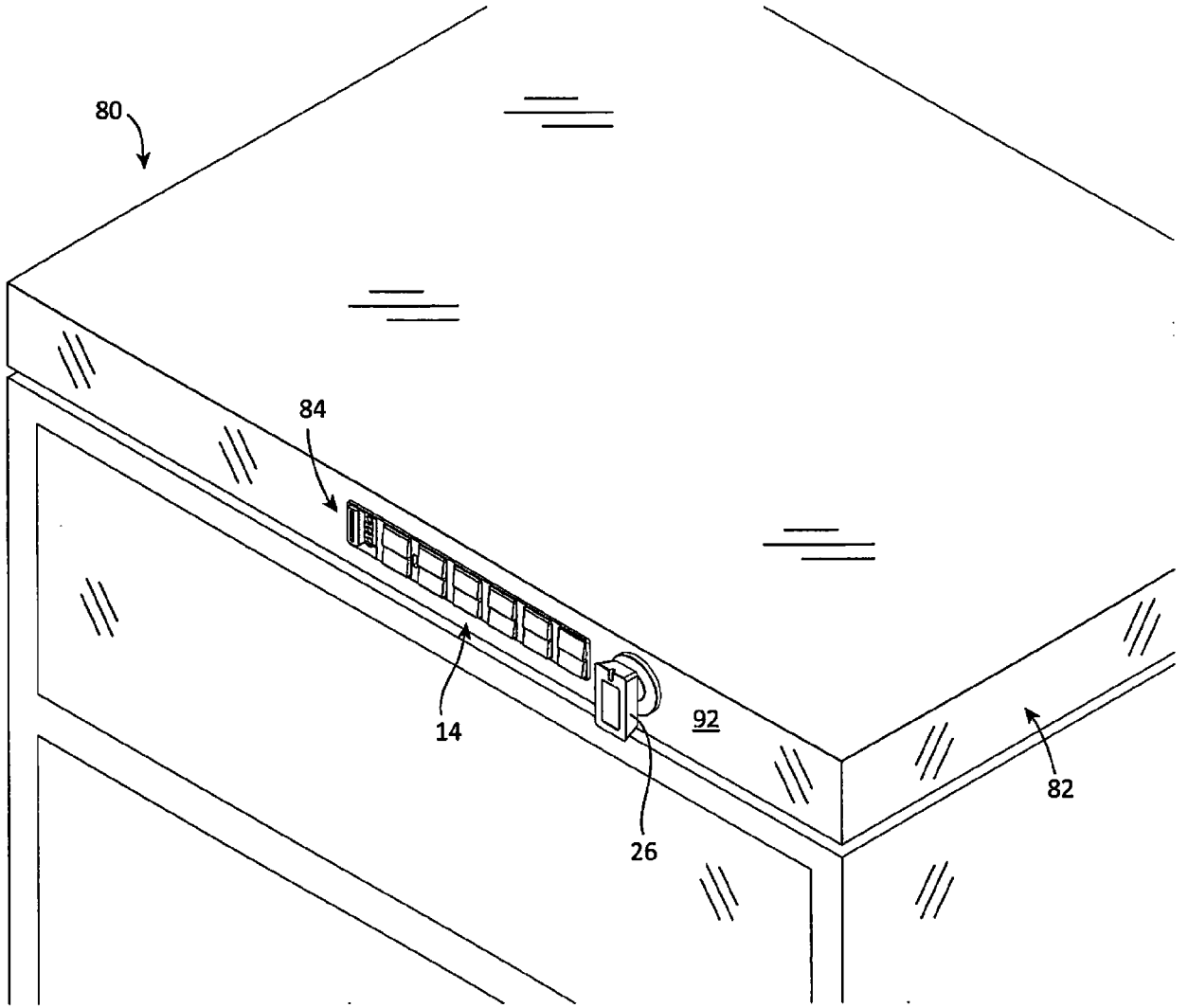


FIG-9

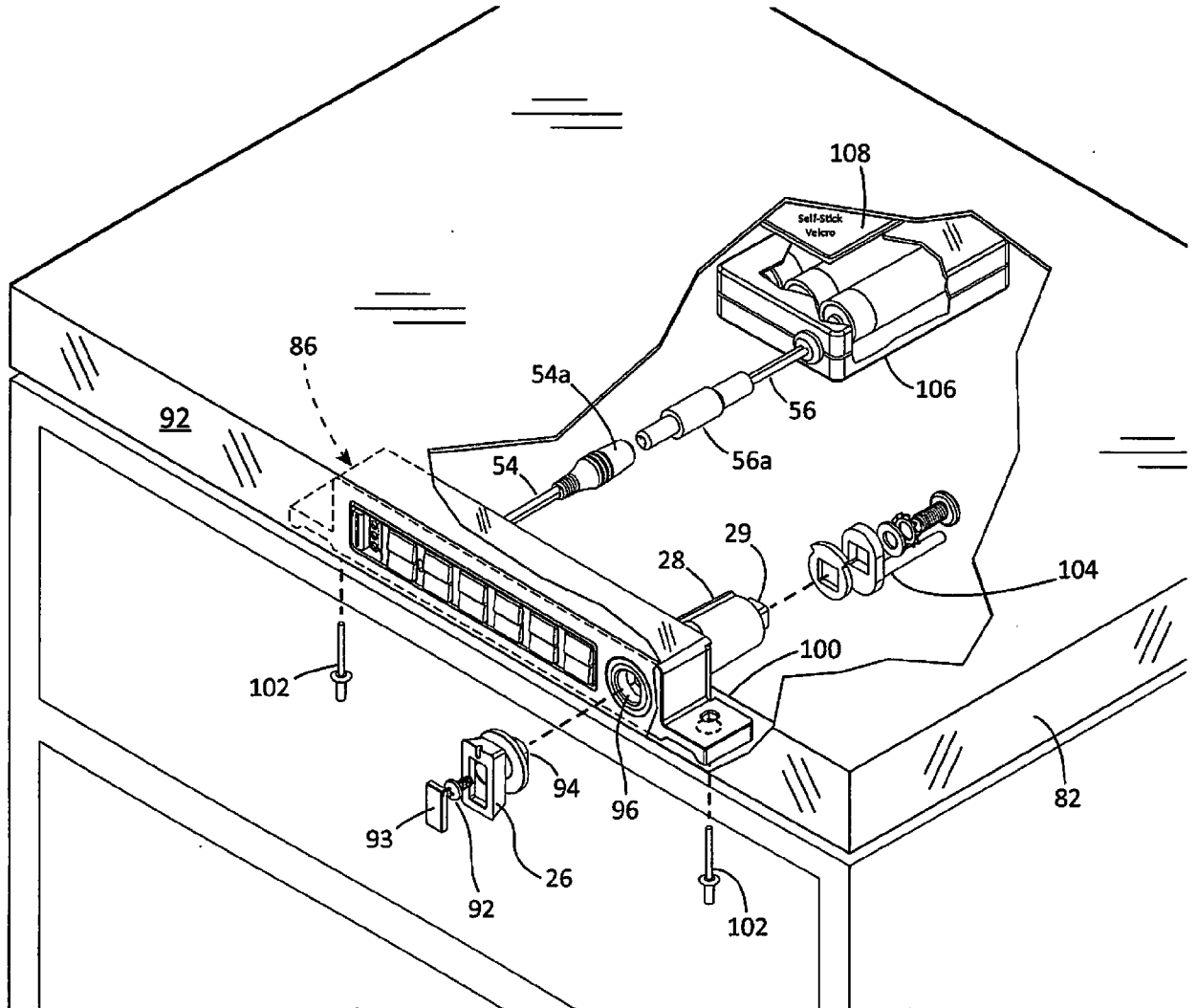


FIG-10

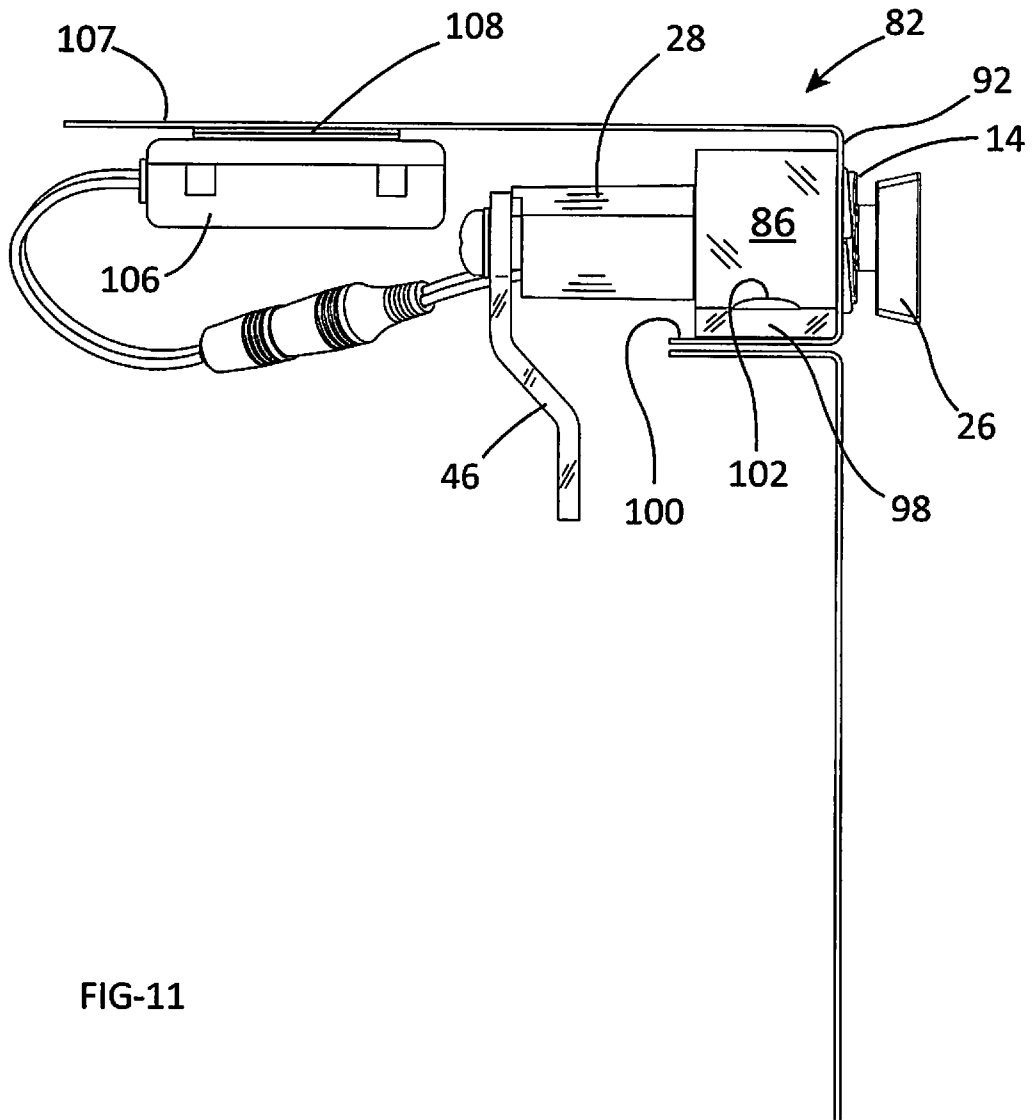


FIG-11

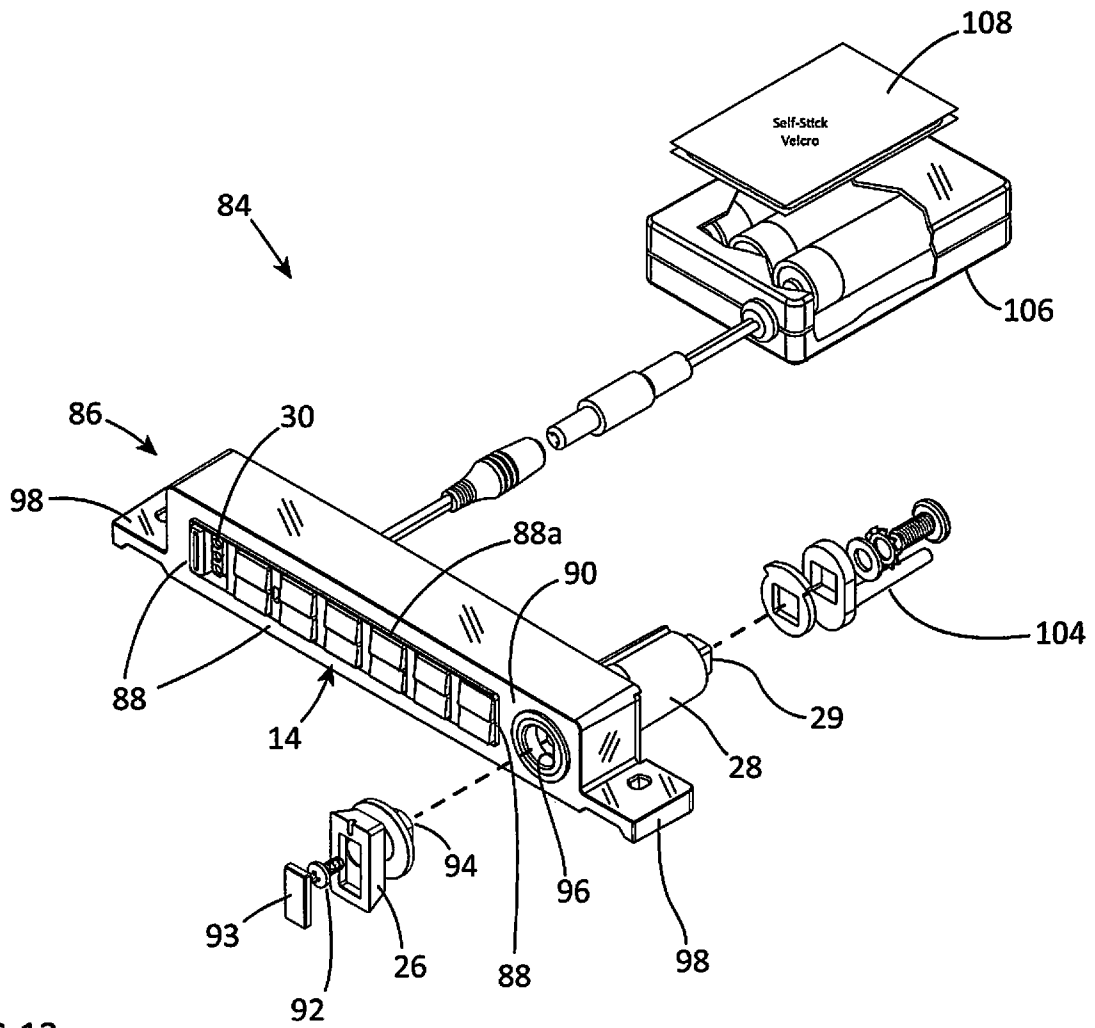


FIG-12

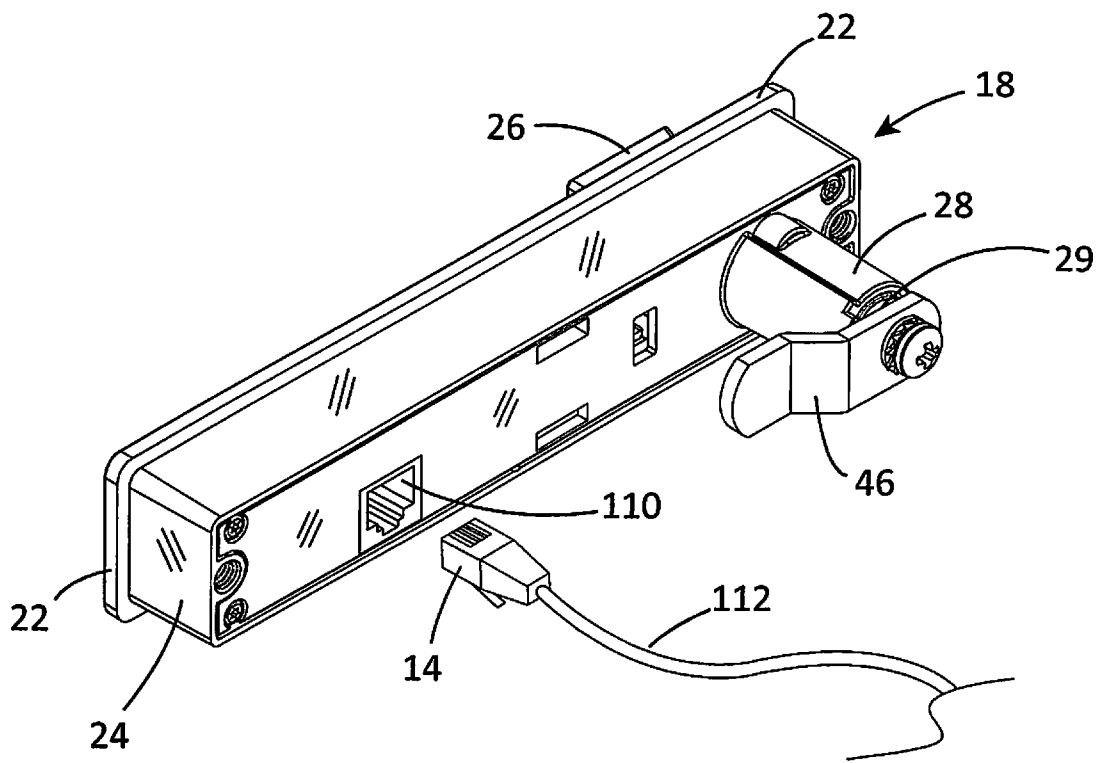


FIG-13

14/16

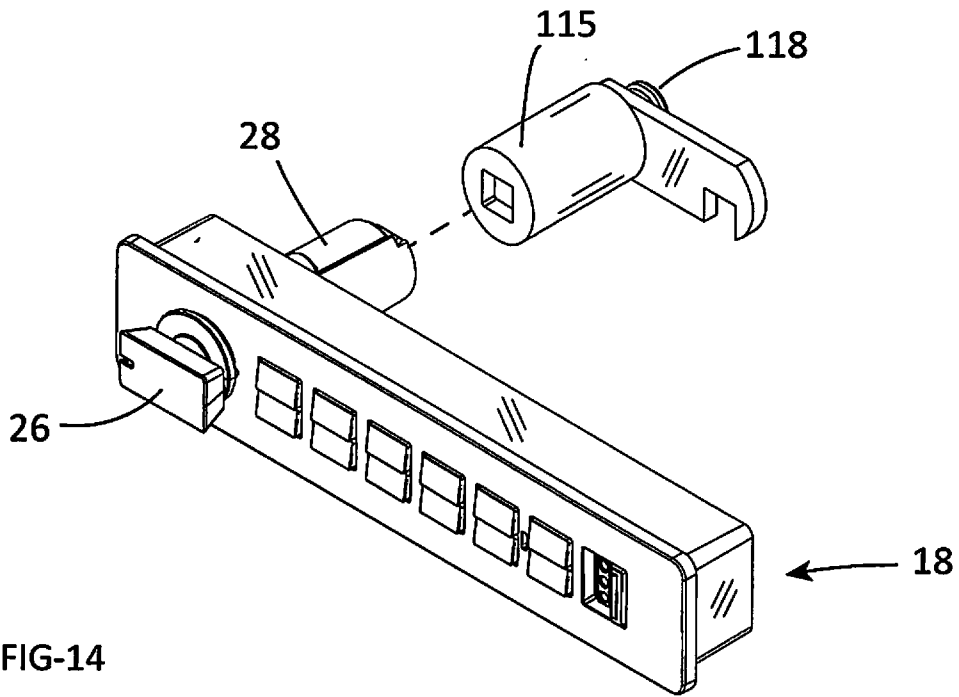


FIG-14

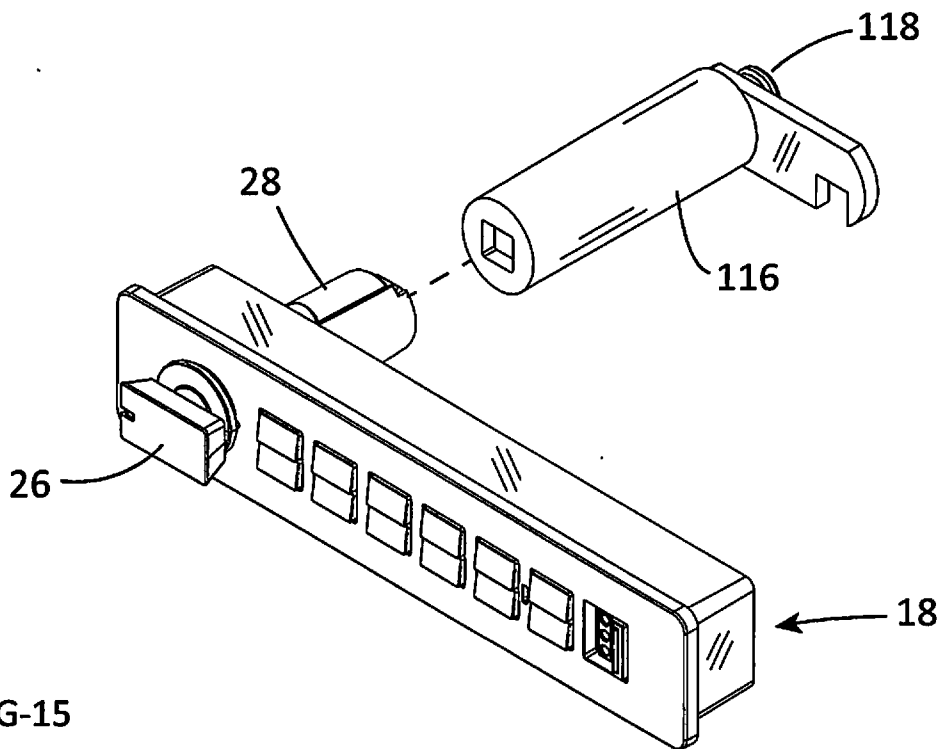


FIG-15

15/16

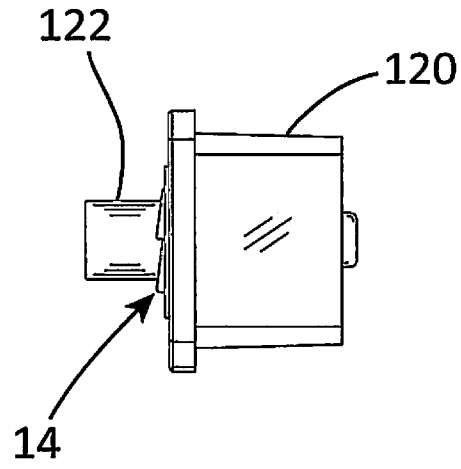


FIG-16

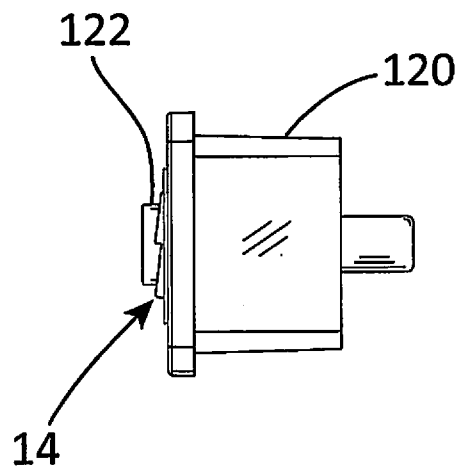


FIG-17

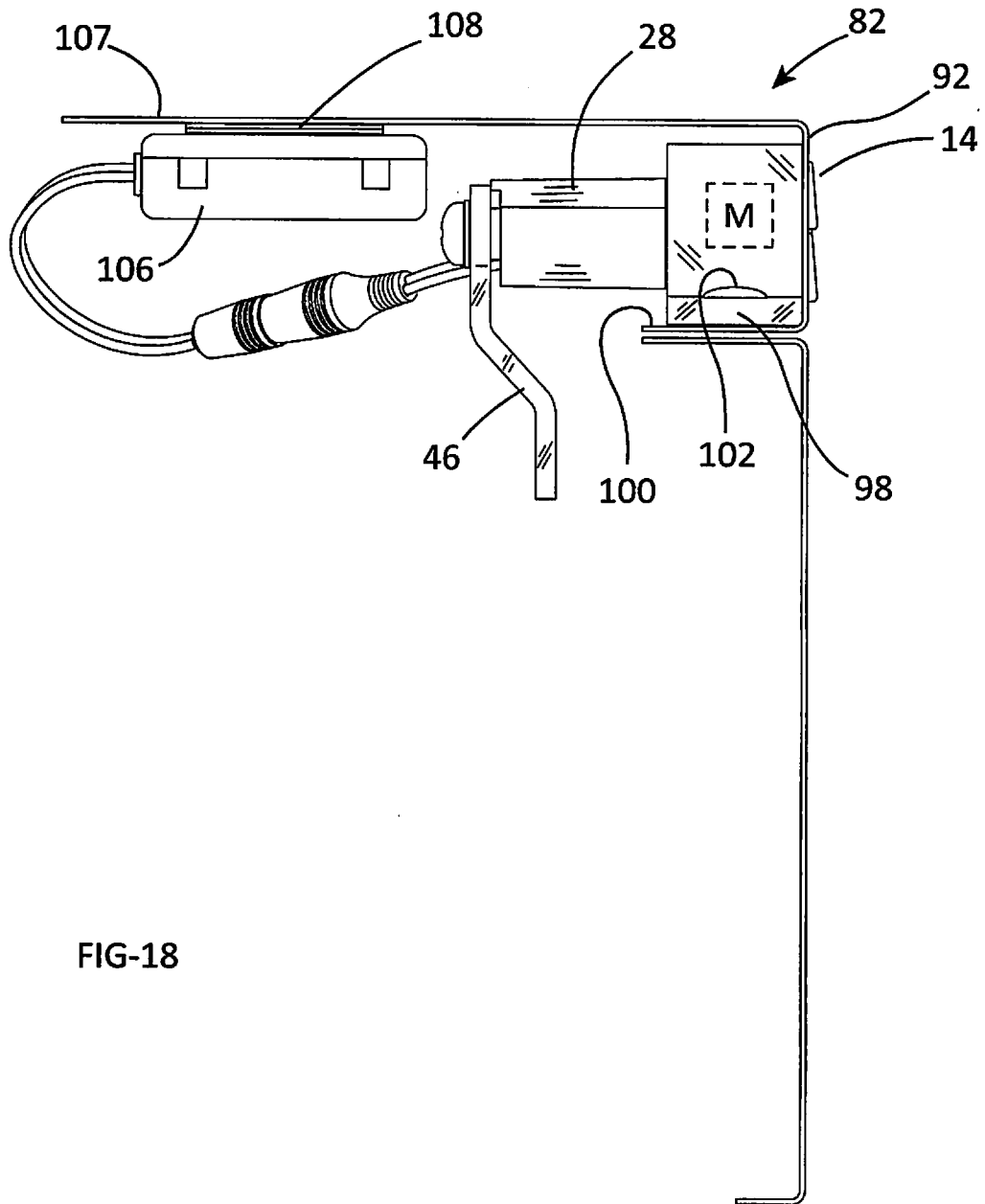


FIG-18

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US14/47167

A. CLASSIFICATION OF SUBJECT MATTER
 IPC(8) - E05B 49/02, 65/44 (2014.01)
 CPC - E05B 47/0001, 65/0075, 65/44
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
 Minimum documentation searched (classification system followed by classification symbols)
 IPC(8): E05B 49/02, 65/44 (2014.01)
 CPC: E05B 47/0001, 65/0075, 65/44 USPC:70/278.1; 340/5/54

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 MicroPatent (US Granted, US Applications, EP-A, EP-B, WO, JP, DE-G, DE-A, DE-T, DE-U, GB-A, FR-A); Google; Google Scholar; ProQuest; Lock*, Electronic*, Cam, cams, cammed, latch*, Keypad*, Wireless, Rfid*, Radio ADJ frequency, infrared

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2009/0115196 A1 (STANGO JC) 07 May 2009 figures 39-65; paragraphs [0093] - [0111]	1-4, 6-9, 12 --- 5
X --- Y	US 2009/0249846 A1 (GOKCEBAY AT) 08 October 2009 figures 1, 2, ,15, and 16; paragraphs [0034] -[0051], claim 1	1, 10, 11 --- 5
A	US 5,894,277 A (KESKIN YK et al.) 13 April 1999 entire document	1-12

Further documents are listed in the continuation of Box C.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 09 December 2014 (09.12.2014)	Date of mailing of the international search report 16 DEC 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US14/47167

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

- 1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

- 2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

- 3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

----Please See Supplemental Page----

- 1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
- 2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
- 3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

- 4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-12

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

-Continued from Box No. III: Observations where unity of invention is lacking-

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: claims 1-12 are directed toward an electronic cam lock comprising a housing having a peripheral rim that extends outward laterally beyond the housing body.

Group II: claims 13-27 are directed toward an electronic cam lock comprising a housing being affixed in a generally U-shaped top rail or vertical side rail of said cabinet or furniture.

Group III: claims 28-30 are directed toward an electronic cam lock comprising housing being mounted to the panel such that the access terminal is exposed for entry of a code by a user.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons.

The special technical features of Group I include the housing being affixed to a panel of said door or drawer or other structure of said cabinet or furniture (which is not present in Group II); the face having a peripheral rim that extends outward laterally beyond the housing body, and the housing being front-recess mounted in an opening in the panel which is sized to closely receive the body of the housing and not the rim, such that the rim of the housing is positioned against the front of the panel (which is not present in Groups II, III); and including a knob or handle on the housing (which is not present in Group III).

The special technical features of Group II include the housing being affixed in a generally U-shaped top rail or vertical side rail of said cabinet or furniture, and the housing having a face at the front of the housing, the housing being inside-mounted, fitted within the top rail or side rail such that a portion of the housing face having the access terminal is exposed through an opening in a front rail piece of the top rail or side rail, and the housing being secured to the inside of the top rail or side rail (which is not present in Groups I, III) and including a knob or handle secured to the front of the housing (which is not present in Group III) through an opening in the front rail piece (which is not present in Groups I, III).

The special technical features of Group III include the housing being affixed to a panel of said door or drawer or other structure of said cabinet or furniture (which is not present in Group II), and housing having a housing body and a face with said access terminal, the face being fixed at the front of the housing body, the housing being mounted to the panel such that the access terminal is exposed for entry of a code by a user, and including an electromagnetic actuator in the housing (which is not present in Group I).

The common technical features of Groups I-III include an electronic cam lock on a door, cabinet, panel or drawer in a cabinet or furniture that provides ingress and no ingress, without a mechanical key, comprising: a compact housing containing electronics and having an access terminal enabling entry of a code by a user, such code when properly entered causing the electronics to permit access, the housing being affixed to a panel of said door or drawer or other structure of said cabinet or furniture, and the housing having a housing body and a face fixed at the front of the housing body, a cam lock cylinder unit extending from a back side of the housing, with a lock driver in the cylinder unit engaged with a cam or latch device at the inside of the panel of the cabinet or furniture, and including a knob or handle on the housing for operating the lock manually without a mechanical key to rotate the lock driver and the cam or latch device when permitted by the electronics, and a power source connected to power the electronics.

These common technical features are disclosed by US 2009/0115196 A1 (STANGO): an electronic cam lock on a door, cabinet, panel or drawer in a cabinet or furniture that provides ingress and no ingress, without a mechanical key, comprising: a compact housing (224; figures 51 and 54H) containing electronics (242, 230, collectively; figure 49; paragraph [0095]) and having an access terminal (256) enabling entry of a code by a user (via electronic key; paragraph [0095]), such code when properly entered causing the electronics to permit access (enabling movement to the open position; paragraph [0095]), the housing being affixed to a panel (e.g. front panel of drawer 202; figure 51) of said door or drawer (202) or other structure of said cabinet or furniture (204; figure 42), and the housing (224) having a housing body and a face fixed at the front of the housing body (as shown; figure 49); a cam lock cylinder unit (228; figure 49) extending from a back side of the housing (as shown; figure 49), with a lock driver (226; figure 49) in the cylinder unit engaged with a cam or latch device (210; paragraph [0099]) at the inside of the panel of the cabinet or furniture (as shown; figure 51), and including a knob or handle (216) on the housing for operating the lock (200) manually without a mechanical key (manual operation is enabled by the electronic key; paragraph [0095]) to rotate the lock driver (226) and the cam or latch device (210) when permitted by the electronics (242, 230, collectively; paragraph [0095]), and a power source (248; figure 50) connected to power the electronics (242, 230, collectively; paragraph [0103]).

Because the common technical features are disclosed by Stango, the inventions are not so linked as to form a single general inventive concept. Therefore, Groups I-III lack unity.