United States Patent [19]

Evans

[11] **3,835,680**

[45] **Sept. 17, 1974**

[54] **ELECTRONIC COMBINATION LOCK SELECTOR UNIT**

[75] Inventor: **Milton R. Evans,** Annapolis, Md.

[73] Assignee: **Halliburton Company,** Duncan, Okla.

[22] Filed: **Jan. 4, 1973**

[21] Appl. No.: **321,037**

[52] **U.S. Cl.** ..... **70/278,** 70/333 A, 70/432, 200/4, 200/167 A, 240/2.1

[51] **Int. Cl.** **E05b 49/00,** H01h 9/00

[58] **Field of Search** ..... 70/277, 278, 332, 333 A, 70/444, 44 S; 74/557; 200/4, 43, 167 A; 340/164 A

[56] **References Cited**

UNITED STATES PATENTS

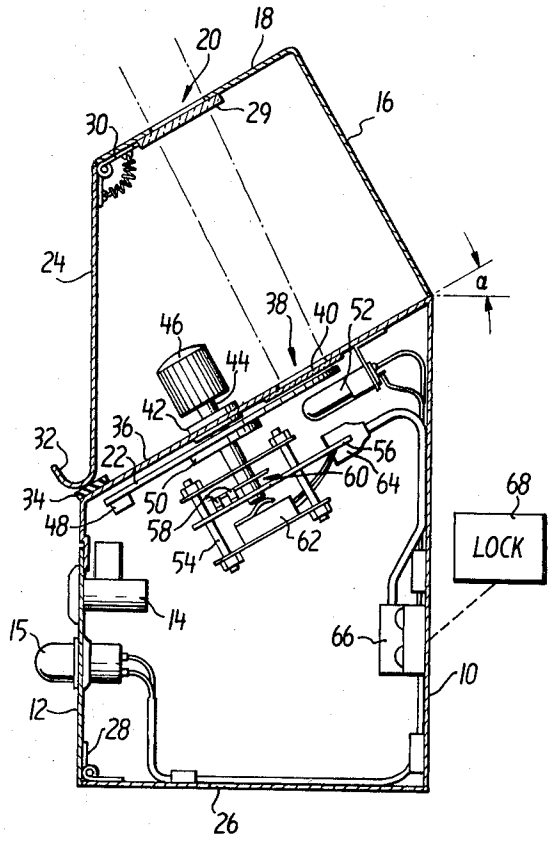
629,999	8/1899	Jacobs	74/557
1,435,992	11/1922	Strauss et al.	70/442
2,606,237	8/1952	Chase	317/123
2,668,200	2/1954	Glaze	200/1
3,184,557	5/1965	Clarey	200/4
3,702,070	11/1972	Gartner	70/278

Primary Examiner—Albert G. Craig, Jr.
Attorney, Agent, or Firm—Burns, Doane, Swecker & Mathis

[57] **ABSTRACT**

A selector unit for an electronic combination lock including a combination disc which may be selectively rotated to expose a selected digit and then depressed to provide an electrical signal indicative of that digit. The order of occurrence of the electrical signals is evaluated as the combination for lock operating purposes. The knob by which the disc is rotated and depressed is contained within an enclosure apertured to effectively shield the position of the disc from personnel other than the individual operating the lock. A hinge flap is provided for access to the knob and the enclosure effectively hides the movements of the individual's hand in rotating and depressing the disc.

8 Claims, 4 Drawing Figures



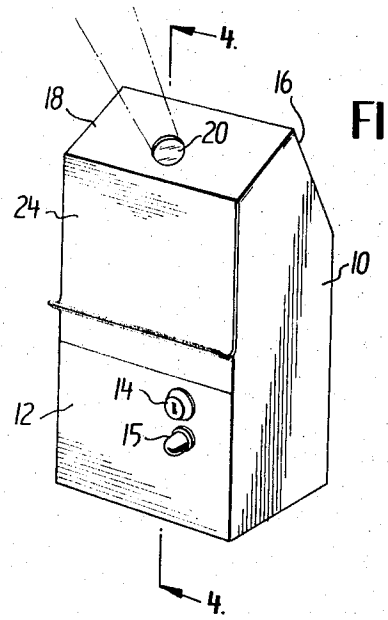


FIG. 1

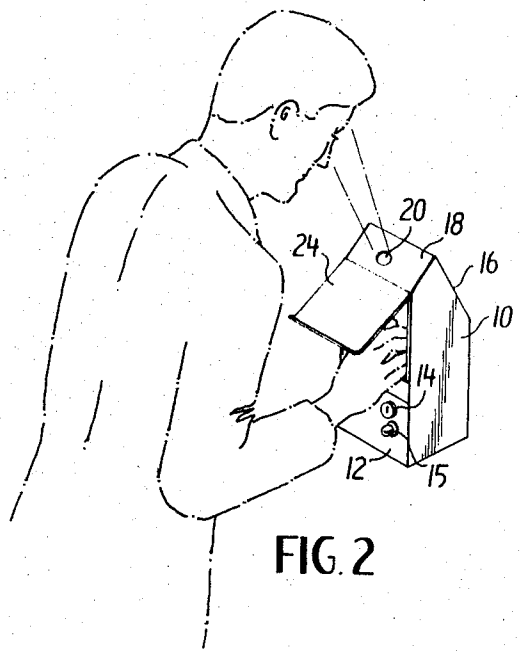


FIG. 2

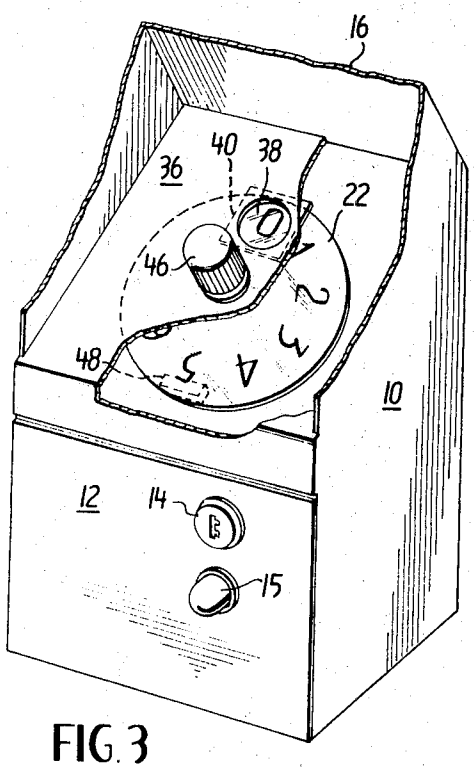


FIG. 3

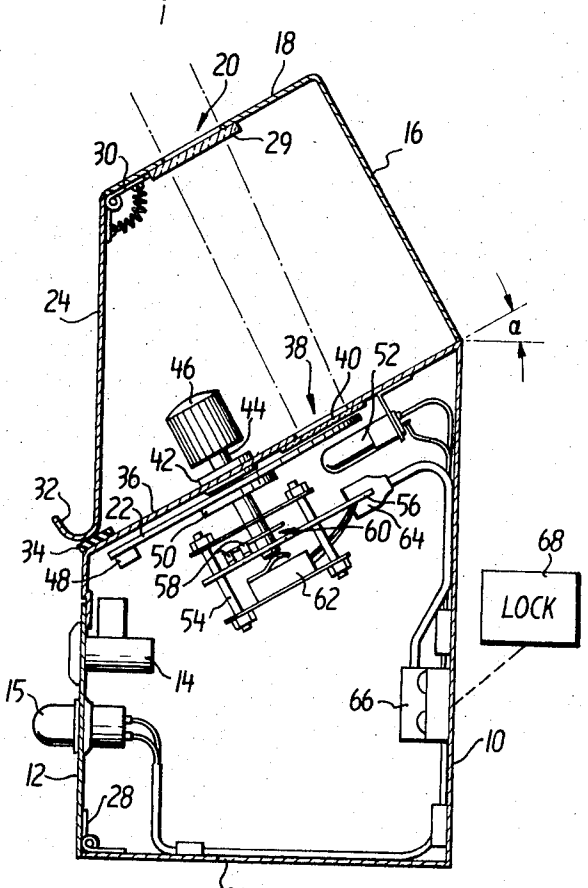


FIG. 4

ELECTRONIC COMBINATION LOCK SELECTOR UNIT

BACKGROUND OF THE INVENTION

The present invention relates to a selector unit for an electronic combination lock. Electronic combination locks are well known and may include a keyboard having a number of indicia bearing push buttons therein to enter the combination into an appropriate decoder circuit which controls the operation of the lock. Systems of this type suffer from several material disadvantages.

For example, the view of the keyboard is generally relatively unobscured and the movement of the fingers of operating personnel may be observed by unauthorized personnel in the general area of the lock. In addition, the push buttons themselves may disclose through wear, or otherwise through the physical condition and/or appearance thereof, the digits of the combination from which the combination of the lock may be ascertained by a relatively simple trial and error procedure once the possible permutations are thus materially reduced. For example, the temperature of the push buttons when measured by a sensitive instrument may disclose not only the buttons pushed but the order thereof and thus the combination.

Another problem associated with many of the generally known selector units is the use of mechanical detents which may produce audible sounds detectable from some distance by a sensitive directional microphone or in the immediate proximity by unauthorized personnel.

Still another problem with generally known selector units is the lack of a positive indication that the individual element of the combination has been entered. For example, the individual depressing a push button typically receives no feedback as to the successful operation of the switch contacts associated with that button.

It is accordingly an object of the present invention to provide a novel method and combination lock selector unit obviating these and other disadvantages of the prior art.

It is another object of the present invention to provide a novel electronic combination lock selector unit in which the view of the individual combination elements is restricted to the personnel operating the lock.

It is still another object of the present invention to provide a novel electronic combination lock selector unit in which the movement of the hand operating the lock is obscured from unauthorized personnel.

It is yet another object of the present invention to provide a novel electronic combination lock selector unit in which the combination disc is biased to a predetermined neutral position to obviate inadvertent disclosure of the last digit of the combination.

A further object of the present invention is to provide a novel electronic combination lock selector unit in which the individual elements of the combination are selected and then entered into the evaluation circuit by the operation of one hand.

Yet a further object of the present invention is to provide a novel electronic combination lock selector unit which is completely weatherproof even during the operation thereof.

A still further object of the present invention is to provide a novel selector unit which produces no audible sounds indicative of the combination.

Yet still a further object of the present invention is to provide a novel electronic lock selector unit in which positive feedback to operating personnel is provided regarding the entry of each individual element of the combination.

These and many other objects and advantages of the present invention will be readily apparent from the claims and from the following detailed description when read in conjunction with the appended drawings.

THE DRAWINGS

FIG. **1** is a pictorial view of a preferred embodiment of the selector unit for an electronic combination lock of the present invention;

FIG. **2** is a pictorial view of the lock of FIG. **1** illustrating the operation thereof;

FIG. **3** is a pictorial view of the selector unit of FIGS. **1** and **2** with the enclosure removed and with the surface partially cut away to expose a portion of the combination disc; and,

FIG. **4** is an elevation taken through lines **4—4** of FIG. **1.**

THE DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

With reference now to FIG. **1,** the selector unit of the present invention may include a metallic housing of the desired strength with a front door **12** hingedly secured to the bottom of the housing **10** and opened through the operation of a suitable conventional lock **14.** Secured to the housing **10** may be a shield **16** having an upstanding side and end walls and an upper surface **18** provided with a window **20** through which the combination disc **22** of FIGS. **3** and **4** may be viewed by the personnel operating the lock. The enclosure **16** may be provided with a flap **24** hingedly secured to the upper surface **18** of the enclosure by which, as illustrated in FIG. **2,** access may be had to the knob of the combination disc for the operation of the lock.

As illustrated in FIG. **2,** the movements of the hand and arm within the enclosure **16** are obscured thereby and the visibility of the element of the combination being introduced into the electronic circuit is materially restricted by the size of the window **20** in the upper surface **18** of the enclosure **16** and by the relative position thereof with respect to the housing **10** as is shown more clearly in FIG. **4.** Once the lock has been operated by the sequential introduction in an appropriate order of the individual elements of the combination, a signal may be returned from the locking mechanism to effect illumination of a suitable indicator such as the visual indicator **15.**

With reference now to FIGS. **3** and **4,** the housing **10** may be provided with apertures (not shown) in the rear wall or bottom thereof to facilitate the egress of electrical wiring. As shown in more detail in FIG. **4,** the front door **12** may be pivotably secured to the bottom **26** of the housing **10** by means of suitable conventional hinges **28** so that operation of the lock **14** may permit the downward and forward movement of the door **12** to permit access to the housing **10.**

The enclosure **16** may be rigidly secured to the housing **10** and may be provided with an upper surface **18**

having a window **20** therein to which a small pane of glass or other transparent material **28** may be secured for watertight integrity. The front flap **24** of the housing **16** may be secured to the upper surface **18** thereof by suitable conventional hinges **30** and the lower portion **32** of the flap **24** may abut a suitable gasket **34** for watertight integrity. It is desirable, but not necessary, that the hinge **30** be appropriately biased to maintain the front flap **24** in the closed position illustrated in FIG. **4.**

With continued reference to FIGS. **3** and **4,** the housing **10** may be provided with a surface **36** having a window **38** therein. As with the window **20,** the window **38** may be provided with a pane **40** of glass or other transparent material to further the watertight integrity of the housing **10.**

The surface **36** may also be apertured to receive, through a suitable conventional gasket **42,** a shaft **44** upon which a knob **46** may be mounted to facilitate the rotation and axial movement of the shaft **44.** It is desirable that the shaft **44** be rotatable in either direction through more than one revolution without mechanical detents.

Fixedly secured to the shaft **44** beneath the surface **36** may be a combination disc **22** carrying the desired combination indicia such as the numerals illustrated in FIG. **3.** The combination disc **22** may be provided with a weight **48** to bias, by the effects of gravity, the disc **22** to a predetermined position with respect to the window **38.** Alternatively, the biasing of the combination disc **22** may be achieved by a suitable spring member **50** connected to the housing **10** and the shaft **44.** A spring coiled around the shaft **44** and attached at opposite ends to the shaft **44** and the housing **10** has been found suitable for this purpose. The coil spring should, of course, be loosely coiled to permit rotation of the disc in either direction.

Immediately beneath the window **38** and in line with the window **20** may be disposed a suitable conventional illuminating means such as a small incandescent lamp **52** whereby the indicia of the combination disc **22** may be made visible through the windows **38** and **20.**

With continued reference to FIG. **4,** a frame **54** may be mounted by any suitable conventional means within the housing **10** so as to position the combination switch contacts in operable position with respect to the shaft **44.** In the illustrated embodiment, a mounting pad **56** may be proficded with a plurality of discrete contacts **58** spaced circumferentially about the shaft **44.** A wiper arm **60** may be carried by the shaft **44** to contact one of the contacts **58** in accordance with the position of the combination disc **22** relative to the window **38.** Disposed axially beneath the shaft **44** may be the contacts of a push button switch **62.** The contacts of the switch **62,** as well as the individual contacts **58,** may be connected by way of a cable **64** to a terminal board **66.** The terminal board may in turn be operably connected to any suitable conventional decoding and locking mechanism **68** which, when operated, may provide a return signal to the terminal board **66** for application to the indicator light **15.**

The shaft **44,** as earlier explained, is desirably mounted for axial movement and, in the embodiment illustrated, the position of the flexible arm **60** with respect to the individual contacts **58** is not entered or "read" into the decoder until such time as the contacts of the switch **62** are closed by the axial movement of the shaft **44.**

The switch **62** may also be utilized to extinguish the lamp **52** and thus the indication of the combination indicia. In this way, the operating personnel receives positive feedback regarding the entry of each combination element into the decoding system.

ADVANTAGES AND SCOPE OF THE INVENTION

From the foregoing, it is apparent that the selector unit of the present invention may be operated without disclosing to unauthorized personnel in the area the movements of the fingers in rotating the combination wheel to the desired position or the depressing of the knob **46** to provide an electrical signal to the decoding mechanism. The rotatability of the knob **46** in either direction through more than one revolution further masks the combination and positive feedback is provided regarding the entry of the individual combination element by extinguishing or otherwise removing from view the combination indicia.

The front flap of the enclosure is spring loaded to contribute to both the watertight integrity and the secrecy of operation. The biasing of the combination wheels to a predetermined neutral position eliminates any possibility that the last digit of the combination may be ascertained from a subsequent inspection of the lock, and the use of a single knob for all of the combination elements eliminates any possibility of ascertaining from the physical appearance of the knob the digits of the combination. The elimination of mechanical detents enhances further the security of operation in that audible sounds are substantially eliminated.

As illustrated by the angle α in FIG. **4,** the orientation of the upper surface **36** of the housing **10** may be modified as desired to change the angle from which the indicia of the combination wheel **22** may be viewed and great flexibility is thus afforded in the location of the combination mechanism. The selector unit of the present invention may be mounted such that individuals of almost any height can view the combination indicia. The size of the windows and the spacing therebetween may be adjusted so that the head of the operating personnel completely fills the area from which the indicia may be viewed thereby eliminating any possibility of a surreptitious over-the-shoulder inspection. In this manner the need for a raised platform or other special mounting means immediately in front of the selector unit to restrict the view of the individual operating the combination is thus obviated.

The present invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The presently disclosed embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed is:

1. A selector unit for an electronic combination lock comprising:

a first generally planar surface having a window therein;

a shaft extending through said surface at a point spaced from said window, said shaft being rotatable about the axis thereof in either direction and axially displaceable relative to said surface;

a disc fixedly carried by said shaft beneath said surface, said disc having indicia spaced around the periphery thereof in position to be viewed through said window from a point above said surface;

means for biasing said shaft to a predetermined axial position relative to said surface and for rotatably biasing said shaft to position the indicia of said disc into a predetermined position relative to said window, said rotatably biasing means including spring means in contact with said shaft and said surface;

control means adapted to be manually engaged and carried by said shaft above said surface for rotating selected indicia into view through said window from a point above said surface and for axially displacing said shaft relative to said surface;

shield means above said surface for significantly limiting the points above said surface from which the indicia of said disc may be viewed through said window; and,

switch means beneath said surface responsive to axial displacement of said shaft a predetermined distance from said surface for providing an electrical signal representative of the indicia of said disc then in view through said window from a point above said surface.

2. The selector unit of claim **1** wherein said shield limits the points above said surface from which the indicia of said disc may be viewed through said window to an arc between about **8** degrees to about 14°.

3. A selector unit for an electronic combination lock comprising:

a first generally planar surface having a window therein;

a shaft extending through said surface at a point spaced from said window, said shaft being rotatable about the axis thereof and axially displaceable relative to said surface;

4. The selector unit of claim **3** including means for rotatably biasing said shaft to position the indicia of said disc into a predetermined position relative to said window.

5. The selector unit of claim **4** including means for indicating the operation of the lock.

6. The selector unit of claim **4** including illuminating means disposed beneath said disc to illuminate the indicia in view through said window.

7. The selector unit of claim **6** wherein said illumination means is responsive to the axial displacement of said shaft to provide an indication of the operation of said switch means.

8. The selector unit of claim **3** wherein said shaft is rotatable in either direction and without mechanical detents.

* * * * *