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Nicholson

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[54] **COMBINATION ELECTRIC LOCK**

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[51] **Int. Cl.** **E05b 49/00**

[58] **Field of Search** ..... 317/134; 307/10 AT, 307/10 BP

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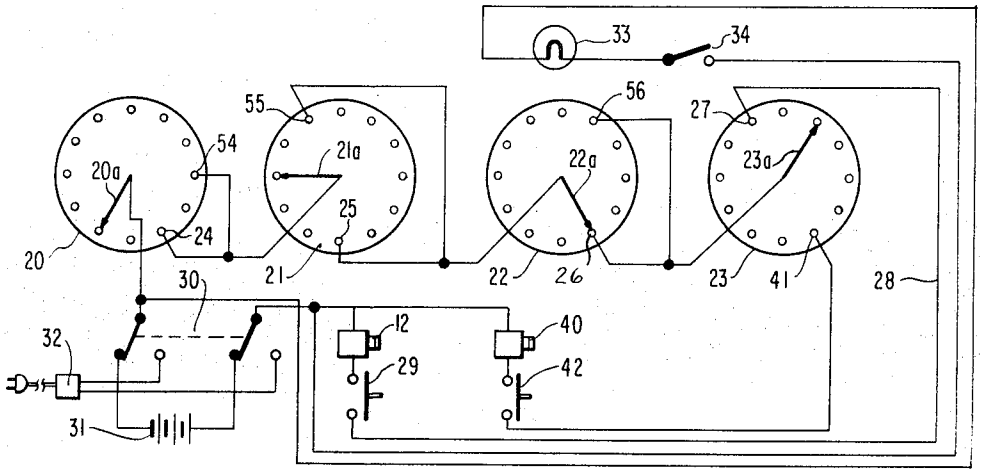
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[57] **ABSTRACT**

Electric lock apparatus including two or more multiple position electrical switches for completing a circuit to actuate an electric unlocking device. The electric unlocking apparatus is operable from a conventional AC power source and also is operable from a self-contained battery in the event of power failure. Provisions are made for using the same basic switching arrangement for providing separate unlocking combinations for controlling two or more locks. A simplified provision for changing the unlocking combinations is shown.

3 Claims, 4 Drawing Figures



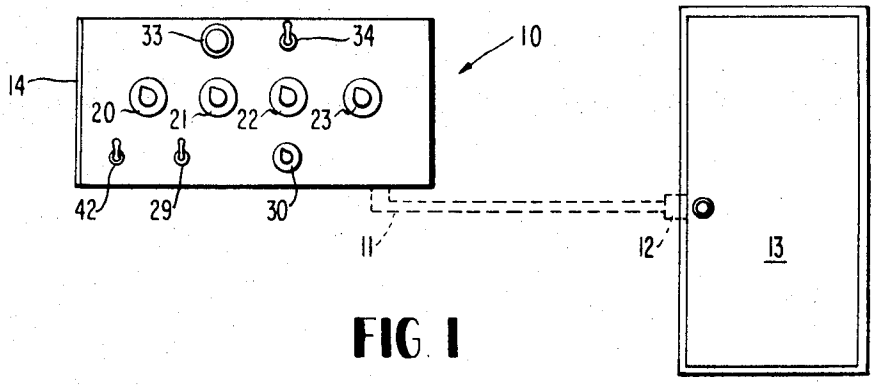


FIG. 1

FIG. 2

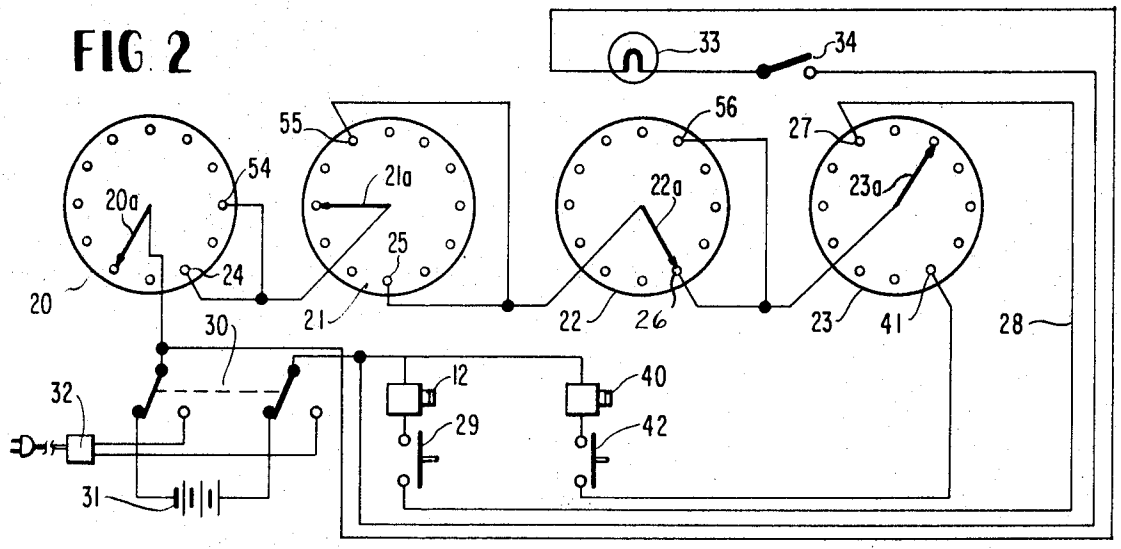


FIG. 3

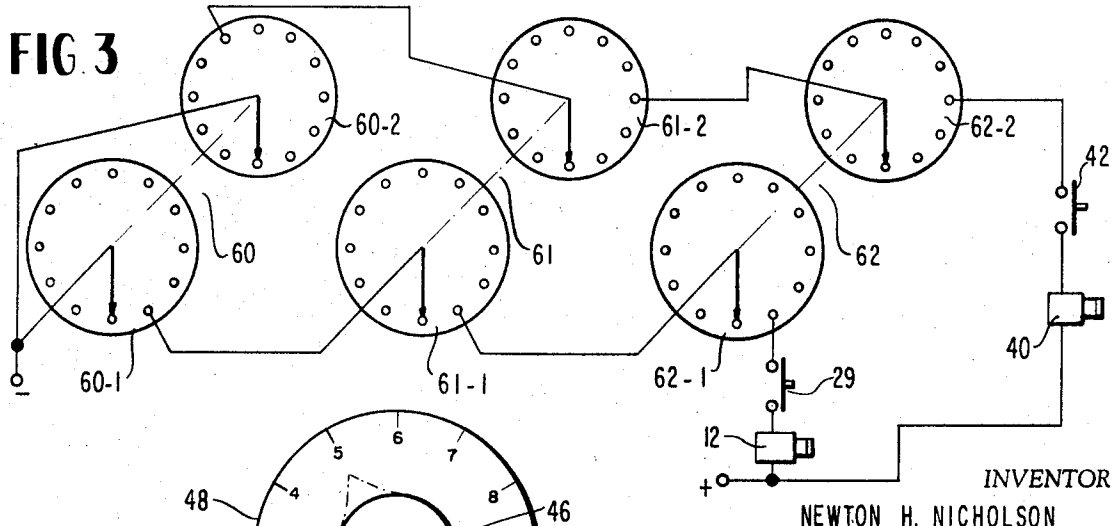
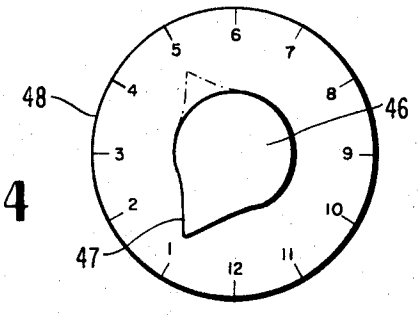


FIG. 4



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COMBINATION ELECTRIC LOCK

This invention relates in general to locking devices and in particular to a locking apparatus which is electrically actuated for unlocking only after a predetermined combination number is set in the apparatus.

The need to secure doors and other portals with a lock which is readily openable by authorized persons but yet which is secure against unauthorized entry has been a continuing problem. While the art is replete with various types of latches, locks, and locking systems, these devices generally fall into one of two categories: key-type locks, wherein a uniquely shaped or otherwise coded key must be used to open the lock; and keyless locks, wherein a particular predetermined combination of numbers or other variables must be set into the lock by the operator to unlock the lock. The key-type locks, while generally being self-contained and operable independently of external power sources, require that each and every person authorized to open the lock must carry or otherwise have access to his own key. This gives rise to the hazard that a person who loses a key or who temporarily leaves the key in the custody of another may find that his key has been used or duplicated so as to permit unauthorized opening of an otherwise locked door. Where a number of individuals are permitted keys for opening a particular lock, moreover, this proliferation of keys makes even more likely the probability that at least one of the keys will become lost or misappropriated. While most modern locks of the bin-tumbler type, for example, have locking elements which can be changed by a qualified locksmith to require a different key for operation, this changing entails a certain amount of expense.

Various types of mechanical and electrical combination locks have been proposed in the prior art. While combination locks do away with the need for every authorized person to carry or otherwise have access to a key for opening a particular lock, prior art combination locks generally have proven to be complex and expensive in construction if such locks are to provide a satisfactory number of possible combinations necessary to render very low the probability that an unauthorized person can open the lock by trial-and-error settings of random combinations. Changing the predetermined combination of prior art electrically actuated combination locks has generally required either rewiring of selector switches or other circuit elements, or else has required a separate set of switches for combination changing purposes. In either event, such electrical combination locks have been expensive to obtain or have required the services of an electrician to change the predetermined combination, and such factors have made electrical combination locks of the prior art unavailable for the average homeowner, apartment renter, and other typical users of locks. Accordingly, it is an object of the present invention to provide an improved electric combination lock.

It is another object of the present invention to provide an electric combination lock in which the predetermined unlocking combination can be readily and inexpensively changed.

It is still another object of the present invention to provide an electric combination lock which can be assembled from readily available and relatively inexpensive components.

It is a further object of the present invention to provide an electric combination lock in which a single set of combination selector switches can be used to provide separate and different combinations for unlocking more than one lock.

Other objects as well as many of the attendant advantages of the present invention will become more readily apparent from the following description and drawing of an embodiment of the invention in which:

FIG. **1** shows a pictorial view of the control panel of a lock according to an embodiment of the present invention;

FIG. **2** shows a schematic wiring diagram of the embodiment depicted in FIG. **1**;

FIG. **3** shows a schematic diagram of a modified embodiment of the present invention; and

FIG. **4** shows a pictorial view of a control knob for a combination selector switch used in the disclosed embodiments of the present invention.

Stated generally, the present embodiment includes an electric combination lock apparatus wherein an electric unlatching circuit is completed by properly positioning a plurality of multiple position selector switches to complete a prewired series circuit including the aforementioned switches. Each switch position corresponds to a particular switch position number, and the numerical position corresponding to a particular switch position can be changed by changing the position of the knob or other actuating device associated with the switch. The switches can be wired to provide multiple series paths, with each series path corresponding to an unlatching circuit for a separate locking device.

More particularly, and with reference taken to FIGS. **1** and **2**, there is shown an embodiment of the present invention including a control panel indicated generally at **10** connected by wires **11** to selectively apply electric power to a latching device **12** which functions to control the operation of the door **13**. The latching device **12** may be a conventional device such as a solenoid-operated latch or the like, in which the door **13** including a conventional lock striker bolt may be closed and engaged with the latching device **12** and in which application of power to the latching device withdraws a latching member to permit the door **13** to be opened. The control panel **10**, which typically but not necessarily is installed adjacent the door **13** to be controlled, includes a cover door **14** which is openable to reveal a number of control switches the identity and purpose of which will become apparent below.

Turning next to FIG. **2**, there is shown a schematic diagram of an embodiment of the present invention including four multiple-position switches **20, 21, 22,** and **23**. While these switches are depicted as 12-position rotary switches of the type wherein a common terminal is selectively connectable to each switch position, it will be understood that switches having a greater or lesser number of positions may be used. It will also be understood that more or fewer switches than four may be used in the present invention, with a corresponding increase or decrease in the available number of locking combinations.

The multiple positions switches **20–23** are interconnected so that at least one of the 12 switching contacts such as the contact designated **24**, of the switch **20** is connected to the common terminal **21***a* of the multiple position switch **21**. In a similar manner, at least one of

the contacts of the multiple switch **21**, such as contact **25**, is connected to the common terminal **22***a* of switch **22**, and at least one of the contacts, such as **26**, of the multiple position switch **22** is connected to the common terminal **23***a* of the multiple position switch **23**. The basic circuit further includes an electrical connection from one of the multiple position switch **23** contacts such as the contact indicated at **27**, extending through a conductor **28** to a momentary-on switch **29** and the aforementioned latching device **12**. The circuit is completed through a power source selection switch **30**, which may be a conventional DTDT switch, enabling either a battery power source **31** of an AC converter power source **32** to be applied to the locking circuit of this embodiment. The power source selected by the switch **30** is also connectable to a lamp **33** operated through a switch **34**, the lamp and its associated switch being positioned as shown in FIG. **1** to cast illumination on the multiple position contact switches of the control panel.

In considering the operation of the combination electric lock described thus far, assume that each of the common terminals **20***a*, **21***a*, **22***a*, and **23***a* of the corresponding multiple position switches is positioned to establish contact with corresponding contacts **24, 25, 26,** and **27**. If this is done, it can be seen that actuation of the switch **29** completes an electric circuit through the several multiple position switches, the latching device **12** and the power source selected by the switch **30** thus causing the latching device to operate and unlock the door **13**. Once the door is unlocked, of course, the momentary-on switch **29** can be released.

If the same control panel shown generally at **10** and in detail in FIG. **2** is desired to operate a second latching device **40**, an additional contact on one of the multiple position switches such as the contact **41** of the switch **23**, is connected in circuit with the second latching device **40** and another momentary-on switch **42**. It can be seen, accordingly, that with the common terminals of the multiple position switches **20, 21** and **22** respectively connected to contacts **24, 25,** and **26,** and with the common terminal **23***a* of the **23** connected to the contact **41** instead of the contact **27**, a circuit has been energized which upon closure of the switch **42** causes the second latching device **40** to be actuated. The setting of the multiple position switch **23** determines which of the latching devices **12** or **40** has been selected for possible unlatching, provided that the other multiple position switches also have been properly set.

If it is desired to provide a completely different combination of multiple position switch settings for controlling the second latching device **40**, a second series of multiple position switch contacts **54, 55** and **56** on the corresponding switches **20, 21** and **22** can be provided with a connection to the respective common terminals **21***a*, **22***a* and **23***a* of the multiple position switches. In this way a first four-digit number corresponding to switch contacts **24, 25, 26** and **27** can be assigned to control unlatching of the latching device **12**, and a second completely different four-digit number corresponding to contacts **54, 55, 56** and **41** can be assigned to control unlatching of the latching device **40**. It will be understood, of course, that additional contacts of the switch **23** can be assigned to control still other latching devices; moreover, it will be understood that the circuit for the second latching device **40**, for example, instead of being associated with the contact **41** of the switch **23** could instead be associated with an available contact of one of the remaining multiple position switches, such as switch **22**, thereby giving a three-position combination number for the control of the second latching device **40** and further confusing a would-be unauthorized use of the present combination electric lock.

The provision of plural power sources in combination with the power selector switch **30** enables the latching device to be normally operated from conventionally available AC line power while permitting battery power to be selected for emergency operation of the lock in the event of power failure. The battery **31** may be one or more conventional dry cells connected to provide the appropriate latch operating voltage or may alternatively be a suitable rechargeable battery which may be floated across a suitable charging voltage so that the battery is normally maintained in a fully-charged condition.

Each of the multiple position switches **20–23** may be advantageously of the type depicted in FIG. **4** and including a manual actuation knob **46** which mounts on a switch shaft connected for positioning the respective common terminal of the switch as is known to those skilled in the art. Such switch knobs typically are affixed to the switch shaft either by means of coacting splines on the shaft and the knob interior, or by means of a suitable setscrew which is contained in the knob for engaging the switch shaft. If it is assumed that for each switch position of a given multiple position switch **20**, for example, there is a numerical designation such as "position 1", "position 2" and the like through "position 12" (in the case of a 12-position switch), then the numerical designation of a particular switch position in which the common terminal **20a** is connected to the contact **24**, for example, can be any one of the aforementioned 12 positions simply by appropriately positioning the knob on the switch shaft. For example, the pointer **47** of the knob **46** can be made to point to "1" or to "5" on the numerical indicator dial **48** by changing the position of the knob relative to the shaft of the switch. Thus a control panel **10** including four multiple-position switches prewired as shown in FIG. **2** to have one set (or more) of switching positions to establish a corresponding number of series paths through the four-switch chain, can have a numerical combination selected or changed at will by the simple expedient of changing the positions of one or more of the knobs corresponding to the several multiple positions switches. It is preferable to use multiple position switches that permit continuous rotation, so that a person tampering with the lock will not be advised by the existence of a rotation stop following the twelfth switch contact, for example, that the position of the switch knob may not correspond to the position of the common terminal of that switch.

The modified embodiment depicted in FIG. **3** shows still another arrangement of the present invention wherein a given number of multiple positions switches can be used to provide completely separate combinations for unlatching two (or more) latching devices **12** and **40**. The embodiment of FIG. **3** uses three separate two-deck multiple position switches **60, 61** and **62**, it being understood that a similar arrangement could be employed using a different number of multiple deck switches, such as the four-switch arrangement of FIG.

2. The actuating circuit for the latching device **12** is provided through a series connection established by the first decks **60–1, 61–1,** and **62–1** of the three multiple position switches, while the circuit for the second latching device **40** is provided through the second decks **60–2, 61–2,** and **62–2** of such switches. The interconnections between the common terminals and switch contacts of the first decks **60–1, 61–1,** and **62–1** preferably are at contact positions different from the corresponding interconnections between the second decks **60–2, 61–2,** and **62–2** so that a particular numerical setting which permits the latching device **12** to be actuated, for example, will not enable the second latching device **40** to be actuated.

The combination of the FIG. **3** embodiment can be readily changed as described above by repositioning the knobs which operate the multiple position switches, and it will be apparent that such repositioning of the switch knobs will automatically change the combinations for both latching devices **12** and **40.** It will be further understood that although the multiple power sources and the lamp depicted in FIG. **2** have been omitted from FIG. **3,** these additional features could as well be included in the FIG. **3** embodiment.

Although the foregoing embodiments of the present invention have been shown for operating a solenoid-type latching device, it will be understood that the combination electric lock of the present invention can as well be used to complete an electric circuit through any appropriate device such as a relay for controlling the operation of some other apparatus. For example, the control panel **10** can be mounted on a post or another suitable location adjacent the driveway of a house and the multiple position switches can be used to complete a circuit through a control relay, rather than a latching device, which in turn actuates a garage door opener. Moreover, a combination electric lock according to the present invention is effective as a circuit control apparatus in motor vehicle ignition circuits, for example, either to replace the conventional key ignition lock or to provide an additional locking stage in the ignition circuit. Many other uses and applications of the present invention will become apparent to those skilled in the art.

It should be understood, of course, that the foregoing relates only to preferred embodiments of the invention and that numerous modifications or alterations may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. A combination electric lock comprising:

at least two electrical switching means each of which has a common terminal selectively engageable in circuit with one of a plurality of switch contacts;

circuit means establishing electrical circuit between the common terminal of one of said switching means and a first switching contact of the other of said switching means;

a first control circuit establishing electrical circuit between the common terminal of said other switching means and a first switching contact of said one switching means, said control circuit being connected to receive a source of electrical power and including an electrically actuated means;

said electrically actuated means comprising an electrically actuated lock device connected in said first control circuit;

first control switch means operatively connected in said first control circuit and selectively operable to complete a circuit connecting said lock device with the power source when said common terminal of said one switching means is in circuit communication with said first switching contact of said one switching means;

said one switching means comprising a multiple contact rotary switch means having a common terminal capable of continuous rotation for selective engagement in circuit with any one of said plurality of switch contacts;

switch operating means operatively connected to rotate said common terminal;

an indicium disposed for rotation with said switch operating means;

position indication means fixedly mounted relative to said switch operating means for indication coaction with said indicium; and

means adjustably interconnecting said switch operating means for selective continuous rotation relative to said rotatable common terminal to selectively vary the indication coaction between said indicium and said position indication means without changing the switch contact actually selectively engaged by said common terminal.

2. A combination electric lock comprising:

at least two electrical switching means each of which has a common terminal selectively engageable in circuit with one of a plurality of switch contacts;

circuit means establishing electrical circuit between the common terminal of one of said switching means and a first switching contact of the other of said switching means;

a first control circuit establishing electrical circuit between the common terminal of said other switching means and a first switching contact of said one switching means, said control circuit being connected to receive a source of electrical power and including an electrically actuated means;

said electrically actuated means comprising a first electrically actuated lock device connected in said first control circuit;

first control switch means operatively connected in said first control circuit and selectively operable to complete a circuit connecting said common terminal of said other switching means with said first switching contact of said one switching means, the power source, and the first lock device;

a second electrically actuated lock device;

a second control circuit including the common terminal of said other switching means and a second switching contact of said one switching means;

said second control circuit being connected to receive a source of electrical power and including said second lock device; and

second control switch means operatively connected in said second control circuit and selectively operable to complete a circuit connecting said common terminal of said other switching means with said second switching contact of said one switching means, the power source, and said second lock device.

3. Apparatus as in claim **2,** further comprising:

second circuit means establishing electrical circuit between said common terminal of said one switching means and a second switching contact of the other of said switching means.

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