L. GARRISON.

ELECTRICAL COMBINATION LOCK.

APPLICATION FILED SEPT. 20, 1920.

1,433,543.

Patented Oct. 31, 1922.

2 SHEETS—SHEET 1.

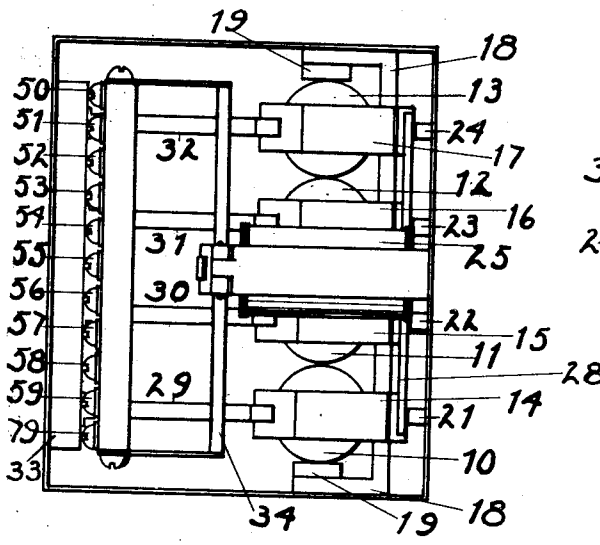


Fig. 1

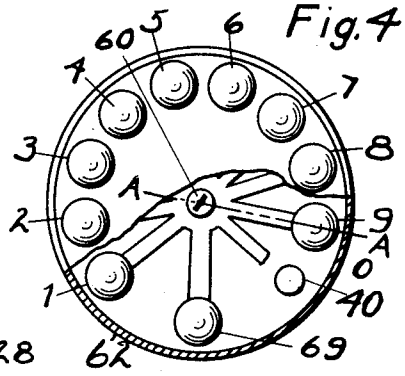


Fig. 4

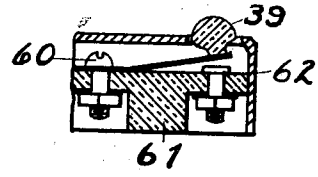


Fig. 5

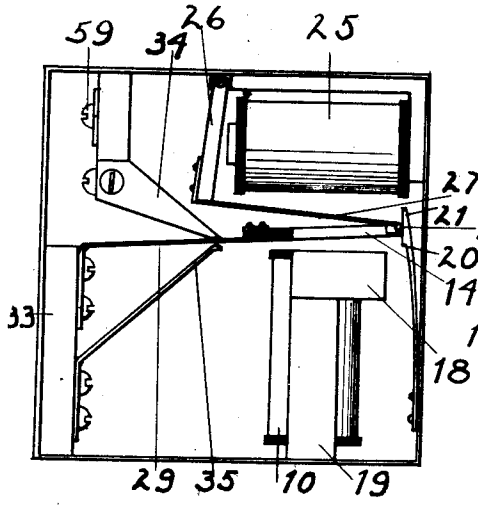


Fig. 2

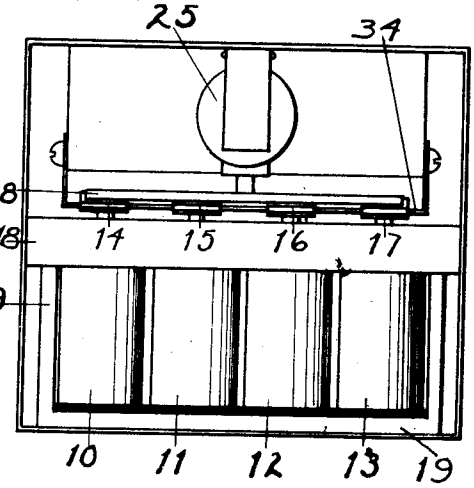


Fig. 3

WITNESSES

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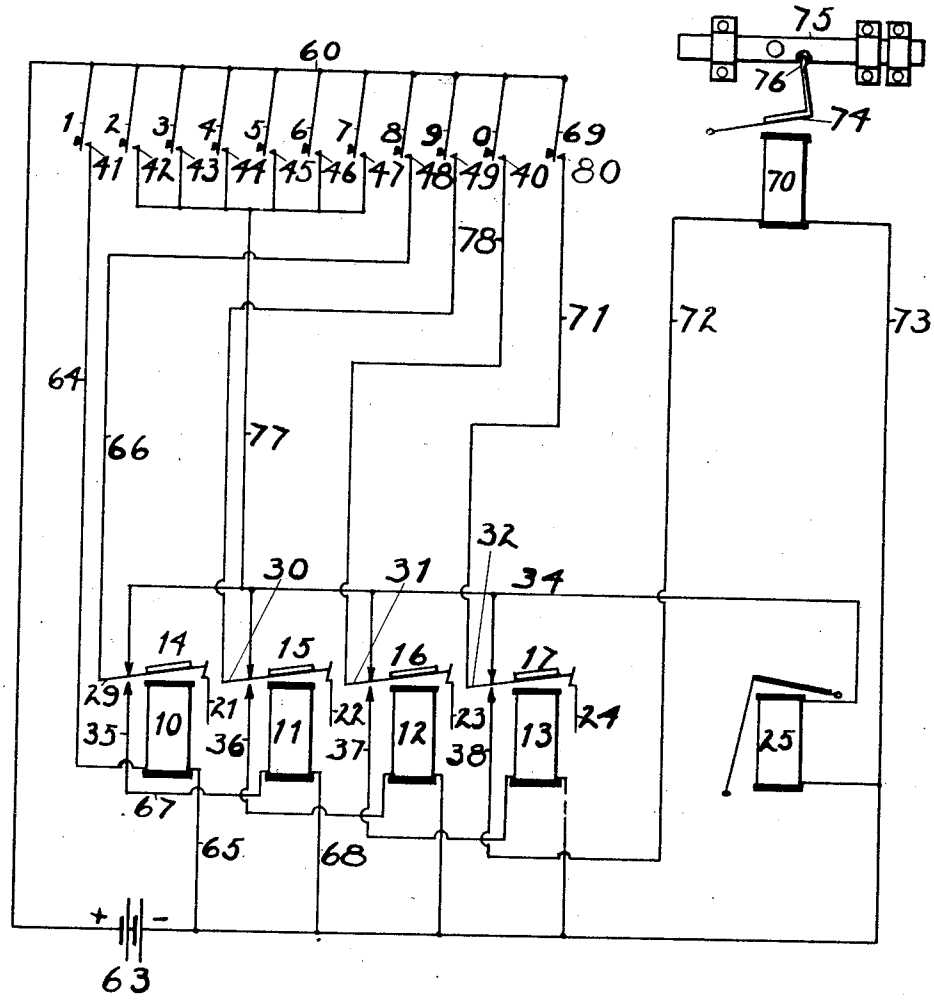


Fig. 6

WITNESSES

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Patented Oct. 31, 1922. 1,433,543

UNITED STATES PATENT OFFICE.

LLOYD GARRISON, OF SALT LAKE CITY, UTAH.

ELECTRICAL COMBINATION LOCK.

Application filed September 20, 1920. Serial No. 411,517.

To all whom it may concern:

Be it known that I, LLOYD GARRISON, a citizen of the United States, residing at Salt Lake City, in the county of Salt Lake and State of Utah, have invented a new and useful Improvement in Electrical Combination Locks, of which the following is a specification.

The object of my invention is to provide an electrically operated combination lock for safes, vaults, houses, and other compartments, entrance to which is ordinarily prevented by some lock device.

Devices of this type as they are now constructed use either a motor actuated combination lock or a multiplicity of coils and contacts which require considerable space and are not dependable because of their liability to get out of order. Also, the ordinary mechanical form of safe lock has a small knob projecting from the door which renders it more or less vulnerable to the operations of safe robbers. The purpose of my device is to provide a simple, compact, and reliable means of operating the lock mechanism from the inside of the locked compartment, thus eliminating the combination knob and removing the unreliable features of previous forms of electrical devices used for this purpose.

In the accompanying drawings,

Fig. 1 is a top view of the step by step mechanism.

Fig. 2 is a side view of the same.

Fig. 3 is a left elevation of Fig. 2.

In Figs. 1, 2 and 3 the corresponding sides of the case containing the mechanism are shown removed.

Fig. 4 is a top view of the keyboard, a portion of the cover being cut away.

Fig. 5 is section A—A of Fig. 4.

Fig. 6 is a wiring diagram of the apparatus as a whole.

The same numbers in all figures represent the same parts.

In use the keyboard is placed at any desired place, such as outside of a house for operating a door lock or near the desk of some officer of a bank when used to operate the lock of the vault. The step by step mechanism, comprising the electromagnetic switches with their retaining and releasing mechanism, is placed within the compartment locked and is connected to the keyboard by a cable having the requisite number of wires. This cable is small and can be led into the locked compartment at the most inaccessible and safest place, such as through the bottom of the safe. It is thus of little or no value to burglars who might desire to use its point of entrance as a means of introducing explosive.

In Fig. 6, and Figs. 1, 2, and 3, numbers 10, 11, 12, and 13 represent small similar electromagnets which, when energized attract the armatures 14, 15, 16, and 17, respectively. For compactness and simplicity the electromagnets are all mounted on the iron strap 19 and the magnetic circuit of each is closed through the corresponding armature and the strap 18. When any armature is attracted by its electromagnet its outer end is engaged by the notch 20 of the corresponding spring, numbered 21, 22, 23 and 24, respectively, and held in the attracted position until released by the action of the release electromagnet 25. The latter, when energized, attracts armature 26, which through arm 27 presses bar 28 against springs 21, 22, 23, and 24, and releases their hold on armatures 14, 15, 16, and 17, permitting the latter to return to their normal positions, shown in the drawings. Springs 29, 30, 31, and 32, which support armatures 14, 15, 16 and 17, respectively, are fastened to the insulating support 33 and are normally in contact with bus 34. When any armature, as 14, is attracted, its corresponding spring, as 29, is brought into contact with another spring, as 35, the springs corresponding to the four armatures being numbered 35, 36, 37, and 38, respectively, and when contact is made with any one of the latter springs, contact with bus 34 is broken.

The key board shown in Figs. 4 and 5 has ten keys 0 to 9 inclusive, adapted to touch ten contacts 40 to 49 inclusive, when pressed down. All keys are fitted with insulating knobs, as 39, and are fashioned from one piece of metal. The latter is fastened at the center of the circle containing the ten contacts by the screw 60, which is in turn fastened to one terminal of the battery. Each one of the ten contacts, 40 to 49 inclusive, is connected to a corresponding terminal 50 to 59 inclusive, of the step by step mechanism, Fig. 1, and from these terminals

any combination desired is obtained by connecting the terminals corresponding to the combination to the four springs 29, 30, 31, and 32 in the order of the numbers of the combination. The remainder of terminals 50 to 59 are connected to bus 34. The keyboard consists of an insulating body 61, a cap 62, and the various keys and contacts. Each contact is provided with a smooth surface on the top for reception of the key and with a nut at its lower extremity for fastening the wire connecting it to the step by step mechanism. A key 69 and contact 80, which is connected to terminal 79, are also provided to control the lock mechanism.

In the event it is desired to enclose the keyboard as well as the step by step mechanism within the locked compartment, the keys 0 to 9 may be replaced by a rotating key connected as to screw 60. This rotating key is fastened on the inner end of a shaft passing through the wall of the compartment and on the outer end of the shaft is a pointer. Encircling the shaft on the outside is a dial numbered to correspond to contacts 40 to 49. By moving the pointer to any number and then pressing it contact is made in the same manner as heretofore shown.

The action of the apparatus, Fig. 6 is as follows: The combination is shown as 1890. When key 1 is pressed the current flows from the positive terminal of the battery 63 to screw 60, key 1, contact 41, wire 64, electromagnet 10, wire 65, to the negative terminal of the battery. Armature 14 is then attracted by electromagnet 10 and engaged by spring 21. At the same time spring 29 comes into contact with spring 35 and breaks contact with bus 34. When key 8 is pressed current flows from battery as before to the key, wire 66, spring 29, spring 35, wire 67, electromagnet 11, and wire 68 to battery. Electromagnet 11 is then energized and completes connection between springs 30 and 36 for key 9 and electromagnet 12 in precisely the same manner as shown in the case of electromagnet 10 which completed the connection for key 8 and electromagnet 11. Similarly electromagnet 12 completes the circuit for key 0 and electromagnet 13 through springs 31 and 37, and electromagnet 13 completes the circuit for key 69 and electromagnet 70 through springs 32 and 38. When the latter two springs are brought into contact and key 69 is pressed, current flows to wire 71, spring 32, spring 38, wire 72, electromagnet 70, and wire 73 to battery. Armature 74 is then attracted and releases lock bar 75 by withdrawing catch 76. If it is desired, the lock bar and catch may be replaced by an ordinary electromagnetic door lock or equivalent device and the lock operated directly by pressing key 69. This eliminates entirely manual operation of the lock itself, and if used in connection with a safe or vault enables the entire mechanism of the lock to be placed within the locked compartment. The only necessary projection on the outside of the door is then one for pulling it open.

In operation of the lock, if at any time the wrong key, as 4, is pressed, the current passes from the key to wire 77, bus 34, release electromagnet 25, and back to battery. Electromagnet 25, when energized, immediately disengages any one or all of armatures 14, 15, 16, and 17 from springs 21, 22, 23, and 24, and allows the armatures to return to their normal positions as before described. Similarly, if any succeeding number of the combination is pressed out of order, as 0 before 9 in the combination shown, current flows from key 0 to wire 78, spring 31, bus 34, release electromagnet 25, and back to battery, causing the release of armatures 14 and 15 which had been attracted by the previous operation of keys 1 and 8 in the combination.

It will be observed that after any number of the combination has been used in its proper order it ceases to have any further use, either to again be used in the combination or to operate the release mechanism until its corresponding armature is released by some other action. This fact results in a reduction of the number of combinations that it is possible to obtain when the same number can be used twice, and a step by step mechanism can be constructed to allow the same number to be used more than once. However, the complications introduced overbalance the gain and I prefer to use the simple mechanism herein outlined. The number of combinations possible with the apparatus shown is 5040, while if any number could be used twice the number of combinations would be 10,000. However, if another key should be added to the keyboard as it is herein shown the total number of possible combinations would be 7920, and if two keys should be added, the total number of combinations would be 11,880. Similarly if an additional electromagnet were added in the step by step mechanism and a corresponding number to the combination of the apparatus herein shown, the total possible number of combinations would be 30,240. The method of multiplying the total number of possible combinations with the apparatus is, therefore, very simple, and provides an apparatus which is considerably more rugged and simple than one which enables the same number to be used more than once in the combination.

In order to prevent the various numbers of the combination being determined by electrical tests the electromagnets 10, 11, 12, 13, and 25 are made with the same electrical characteristics as regards resistance and re-

actance, and the moving parts actuated by the armatures are so designed as to have the same electrical effect in all cases.

What I claim as my invention is:

1. In an electrical device of the type described, the combination of a keyboard having a number of keys, a source of electrical energy, a step by step mechanism, a release mechanism for re-setting the step by step mechanism, an electromagnetic lock device, connections from the source of electrical energy to the keyboard, step by step mechanism, release mechanism, and electromagnetic lock device, such connections within the step by step mechanism that when certain predetermined keys of the keyboard are pressed in a certain predetermined order the electromagnetic lock device is connected by the step by step mechanism to the source of electrical energy, and such other connections within the step by step mechanism that when any other than said certain keys are pressed, and when the said certain keys are pressed in any other than the certain predetermined order, the release mechanism resets the step by step mechanism to its original position.

2. The combination of a keyboard having a number of keys with a source of electrical energy, a series of electromagnets, electric switches operated by the electromagnets, retaining catches for said switches, an electromagnetic release acting to release said catches, an electromagnetic lock device, such connections between the keyboard, the source of electrical energy, the electromagnets, the electric switches, the electromagnetic release, and the electromagnetic lock device that when a certain combination of keys on the keyboard is operated the electromagnetic lock device is connected to the source of electrical energy, but when any other than said combination of keys is operated the electromagnetic release acts to release the retaining catches of the switches.

3. In a device of the type described the combination of a number of electromagnetic switches, catches to retain said switches when acted upon by the electromagnets operating them, a number of keys, a source of electrical energy, a release electromagnet, an electromagnetic lock device, such electrical connections that when a certain combination of keys is operated said electromagnetic switches are successively operated and the electromagnetic lock device is connected to the source of electrical energy, and such other connections that when any of the said keys is operated except in accordance with said combination the electromagnetic release disengages the catches from the electromagnetic switches and allows them to return to their original position.

In witness whereof, I have set my hand this 16th day of September, 1920.

LLOYD GARRISON.

Witnesses:

W. N. GUNDRY,

GEORGE A. FRANKE.