

Jan. 12, 1960

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2,921,152

KEY DEVICE

Filed Dec. 29, 1958

2 Sheets-Sheet 1

FIG. 1

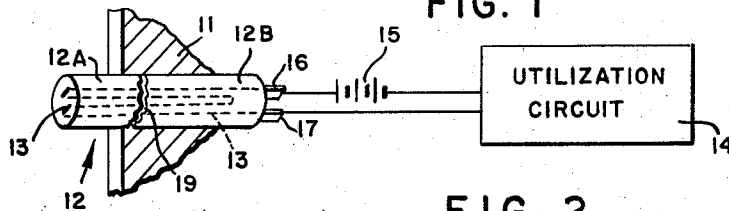


FIG. 2

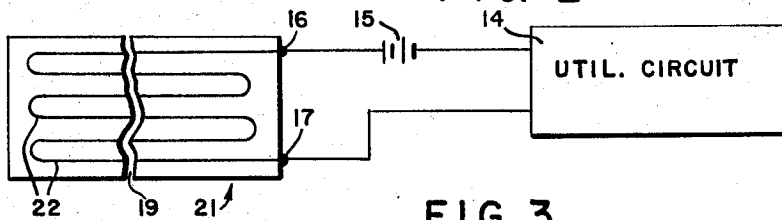


FIG. 3

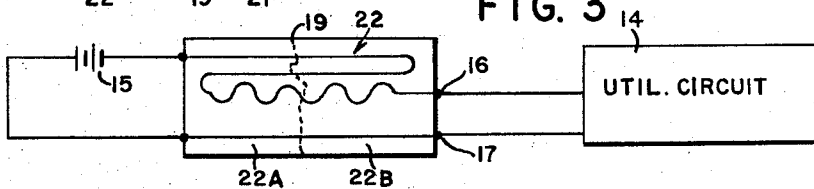


FIG. 4

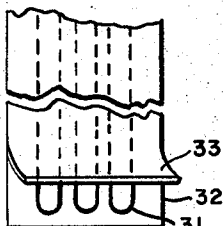


FIG. 5

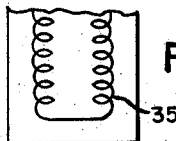
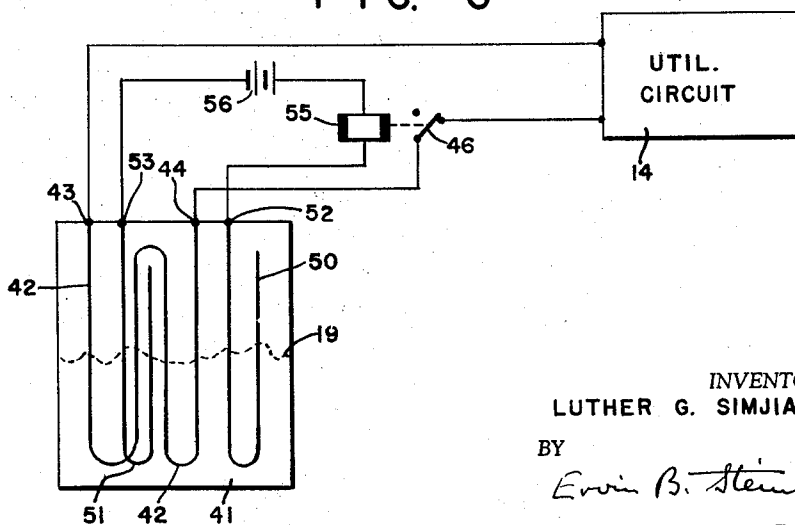


FIG. 6



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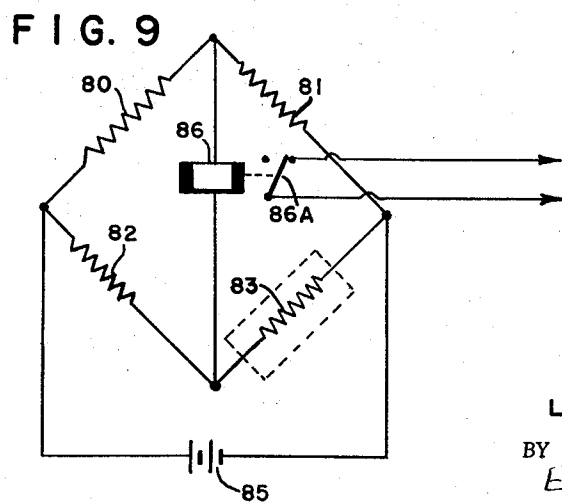
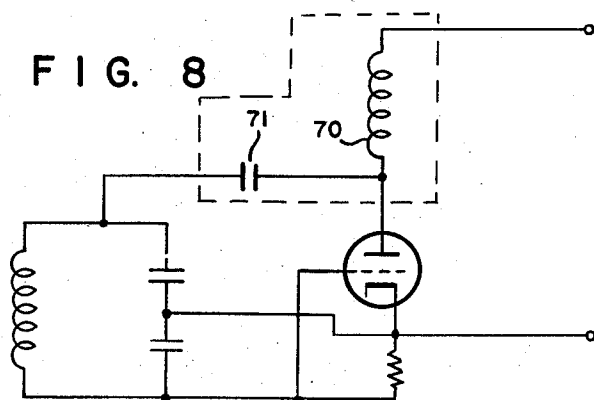
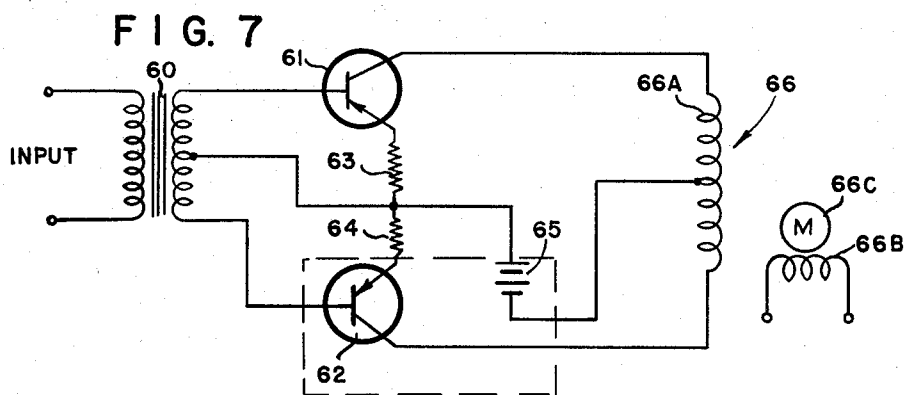
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2 Sheets-Sheet 2



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KEY DEVICE

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8 Claims. (Cl. 200—42)

This invention is related in general to a key device and has particular reference to a key means employing electrical circuit means for rendering a utilization circuit operative.

More specifically, the invention has reference to a combined structural and electrical means acting as a key device for rendering a normally locked utilization circuit operative.

Various locks have been designed to prevent unauthorized personnel from gaining access to such devices and instrumentalities as cabinets, safes, doors, intelligence transmitters, code machines, depository devices, check signing and issuing apparatus and many others. Yet it is well known that in spite of concentrated efforts over many decades, most present day locks can be picked by certain persons skilled in the art, regardless whether the locks are of complicated tumbler design or of the complex permutation type.

The instant invention describes a means wherein not only an utmost precise mechanical fit must be achieved to accomplish unlocking, but wherein, in addition, an electrical circuit simultaneously must be completed before unlocking takes place and this circuit being inherently associated with the mechanical fit.

Since the two traits, that is mechanical fit and electrical circuit are arranged so as to form an integral part, picking of the lock poses almost an impossible task.

One of the objects of this invention therefore is the provision of an improved locking device avoiding one or more of the disadvantages and limitations of prior art devices.

Another object of this invention is the provision of an improved key means for rendering a normally locked utilization circuit operative.

Another object of this invention is the provision of a key means employing structural and electrical means for rendering a utilization circuit operative.

A further object of this invention is to provide a key means which cannot readily be duplicated by unauthorized personnel or if desired, cannot be duplicated at all.

Another and further object of this invention is the provision of key means which requires perfect match between fragments having irregular borders.

Another and still further object of this invention is to provide key means which require complete mechanical and electrical match between fragments in order to render a utilization circuit operative.

Still another and further object of this invention is the provision of a unitary mechanical-electrical instrumentality which is severed into fragments whereby at least one of the fragments when mating with one or more of the remaining fragments serves as a key.

In one form of its embodiments the invention comprises structural means which are provided with means constituting a part in an electrical circuit. These structural means are severable to effect a plurality of fragments whereby each fragment carries a portion of the

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means constituting a part in said circuit. When these fragments are rejoined along their severance, the totality of the means constituting a part in said circuit is restored thereby rendering an utilization circuit operative.

Other forms of this invention and still other objects thereof will be apparent from the following description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a view, partly in perspective, of a typical embodiment of the present invention;

Figure 2 is a plan view of another embodiment;

Figure 3 is a plan view illustrating a further embodiment;

Figure 4 is a plan view indicating still another embodiment of the instant invention;

Figure 5 is a plan view of a fragment which serves as a key;

Figure 6 is a plan view of one type of the present invention and includes certain protective features shown in conjunction with a schematic electrical circuit diagram;

Figure 7 is a schematic electrical circuit diagram in which the instant invention may be embodied;

Figure 8 is another illustration of a schematic electrical circuit in which the keying device may be incorporated, and

Figure 9 is still another schematic electrical circuit diagram which may be combined with the present invention.

Referring now to the figures and Figure 1 in particular, numeral 11 identifies an enclosure such as a vault door which is adapted to receive the key means 12. The key means comprises essentially structural material, depicted as a bar 12 which carries a plurality of folded and embedded electrical conductors 13, all connected in series. These conductors form a part in an electrical circuit which comprises utilization circuit 14 energized via a source of electrical energy 15 and connected to the key means at terminals 16 and 17, the latter being a part of the key means.

The key means 12 depicted in Figure 1 may be constructed in many ways and for example, may comprise a bar made of plastic material having embedded therein electrical conductors 13, for instance copper wire, iron, graphite, tungsten or similar electrical conductive material. The entire assembly can readily be fabricated by well known molding techniques.

The bar then is fractured either manually or by means of an appliance to effect a plurality of fragments 12A and 12B respectively, each fragment having an irregular but mating disjunction 19. Subsequently, fragment 12B is secured within the retaining means 11 while fragment 12A becomes the "key."

For rendering utilization circuit 14 operative, it is necessary to insert fragment 12A into enclosure 11 and effect a perfect match between fragments 12A and 12B along their severance 19. When a perfect match is attained, conductors 13 are reunited, thereby establishing continuity between battery 15 and utilization circuit 14 via conductors 13 and terminals 16 and 17.

Utilization circuit 14 may be an electrically operated door opener, a starting device for a code machine, a solenoid actuated lock for a vault or similar instrumentality to be rendered operative only by an authorized person.

Since structural element 12 when constructed from fairly brittle material when severed will break in a random fashion, duplication of fragment 12A poses almost an impossibility. In this manner the combination of key means 12A and 12B provides maximum security.

Figure 2 is an alternate design showing a flat structural element, plate 21, carrying conductors 22. The

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plate may be a printed circuit board comprising a phenolic base material and "printed" conductors as are well known in the electrical art. The conductors may be etched copper lines or conductive ink adhering to the base. Again, severance 19 may be effected by manual means or by a shearing or breaking implement to effect a random disjunction. Utilization circuit 14 will be rendered operative only upon perfect mechanical and electrical alignment between both fragments along severance 19.

Figure 3 illustrates another alternate design wherein conductors 22 are applied to a plate like structure. The conductors are shown partly as straight and partly of flat corrugated shape. Obviously, other configurations may be used. In this embodiment, the source of electrical energy is a part of key fragment 22A and may be physically mounted, if desired, on fragment 22A. Again, operation of circuit 14 is possible only if the fragments match and if the external power source 15 is of proper value. Additionally, the foregoing arrangement may be rendered still more complex by designing the circuit in such a fashion that external source 15 must provide a definite number and spaced electrical impulses for acceptance by circuit 14 before activation can take place.

Figure 4 illustrates an arrangement wherein conductors 31 are concealed by being laminated between opaque layers 32 and 33. In this way the conductors are not visible to the user and if necessary, the key means can be constructed so that when layers 32 and 33 are being pried apart mutilation of conductive element 31 occurs.

In Figure 5 the conductive element 35 is constructed to be of helical shape to form, if desired, an inductive circuit. It will readily be apparent that a capacitive circuit, a filter network or other electrical circuit elements or combinations of elements may be used without deviating from the principles disclosed heretofore.

The arrangement depicted in Figure 6 illustrates another typical form of a protective feature which conveniently may be built into the instant key device. Plate 41 is provided with a plurality of series connected conductors 42 terminating at terminals 43 and 44. Terminal 43 is connected directly to utilization circuit 14 while terminal 44 is connected to this circuit via a closed relay contact 46. The plate may be severed at an area indicated by dashed line 19.

Another set of conductors 50 and 51 is connected to terminals 52 and 53 respectively. Each conductor is formed and embedded in plate 41 in such a manner as to be similar in appearance. Actually, conductors 50 and 51 are discontinuous with respect to one another and are provided to sense tampering with the device, particularly to render circuit 14 inoperative when an attempt is made to establish a short-circuit across severance 19. When this procedure is employed, conductors 50 and 51 become connected via the shorting means, for instance a saline solution or mercury, thereby causing continuity between terminals 52 and 53 via electromagnetic relay coil 55 and source of energy 56. This connection energizes relay coil 55 thereby moving contact 46 to the open circuit position and thus, interrupting the connection to circuit 14. In this manner circuit 14 cannot be rendered operative and the efforts of the intruder are spoiled.

Further embodiments of this invention are indicated in Figures 7, 8 and 9. Figure 7 shows the schematic circuit of a servo motor control device which comprises input transformer 60, a pair of transistors 61 and 62, two resistors 63 and 64, a source of bias supply 65 and a two-phase servo motor 66 having as its main elements winding 66A, rotor 66C and reference voltage winding 66B. This circuit is of conventional design as is well known in the art.

The removable fragment may be provided for instance, with bias supply 65 and transistor 62 as indicated by the dashed severance line. Only by restoring the missing

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circuit elements and connecting them in their exact position can motor 66 be rendered operative.

Figure 8 depicts a conventional oscillatory circuit. As an example, inductor 70 and coupling capacitor 71 may be mounted on the removable fragment. The circuit will be inoperative that is, will not oscillate, until the missing portions are replaced physically as well as in their appropriate magnitude.

A similar condition prevails in Figure 9 wherein a Wheatstone bridge circuit is depicted comprising a network of four equal resistors 80, 81, 82 and 83. Resistor 83 is mounted on the removable fragment (numeral 22A of Figure 3). When voltage is applied by battery 85 to this resistive network relay coil 86 will not be energized and relay contact 86A establishes connection to the utilization circuit. When resistor 83 is removed from the network or if a resistor of improper magnitude is used, relay coil 86 becomes energized thereby changing the position of contact 86A and interrupting the circuit to the utilization circuit.

It will be apparent to those skilled in the art that the above described examples are but a few of the almost infinite number of variations and combinations which may be devised. In all instances, the fragments must match along their severance to produce the desired end result.

Another important advantage of the instant invention resides in the fact that no mechanical skill is required to produce the key device disclosed. The circuits may be prefabricated and the key device can then be created by the person directly concerned with security thereby obviating the need of a third or outside person, for instance attendance of a locksmith. Moreover, as required with permutation locks, neither a record of the combination nor the memorizing of numbers and sequences is needed. The key combination may be changed daily with utmost facility and dispatch. Old or used fragments are useless and in addition may be mutilated readily.

Instead of providing a pair of fragments as illustrated hereinbefore it will readily be apparent, that three or more fragments may be provided, each fragment being in the custody of a different party. Only by reuniting the various fragments supplied by the respective parties can utilization circuit 14 or 66 respectively be rendered operative.

While there have been described certain embodiments of the present invention, it will be apparent to those skilled in the art that various other modifications and changes may be made therein without deviating from the intent and spirit of the invention, which shall be limited only by the scope of the appended claims.

What is claimed is:

1. A key device for rendering a utilization circuit operative comprising: structural means provided with means constituting a part in an electrical circuit; said means being severable to effect a plurality of fragments, each carrying a portion of said means constituting a part in said circuit, and said fragments when rejoined along their severance restoring the totality of the means constituting a part in said circuit thereby rendering the utilization circuit operative.

2. A key device for rendering a utilization circuit operative comprising: structural means provided with electrical circuit means; said structural means being severable to effect a plurality of fragments, each carrying a part of said circuit means, and said fragments when rejoined along their severance restoring the totality of said electrical circuit means thereby being adapted to render the utilization circuit operative.

3. A key device for rendering a utilization circuit operative comprising: structural means provided with electrical conductive means; said structural means being severable to effect a plurality of fragments, each carrying a part of said conductive means, and said fragments when rejoined long their severance restoring the totality of

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said electrical circuit means thereby being adapted to become an element in an electrical circuit which renders a utilization circuit operative.

4. A key device for rendering a utilization circuit operative comprising: structural means provided with electrical conductive means; said structural means being severable to effect a plurality of fragments, each carrying a part of said conductive means, and said fragments when rejoined along their severance restoring the unity of said electrical circuit means thereby being adapted to become an element in an electrical circuit which renders the utilization circuit operative.

5. A key device for rendering a utilization circuit operative comprising: structural means provided with electrical circuit transmitting means; said structural means being severable to effect a plurality of fragments, each carrying a part of said transmitting means, and said fragments when rejoined along their severance restoring the completeness of said electrical transmitting means thereby being adapted to become an element in an electrical circuit transmitting electrical energy between a source of electrical energy and said utilization circuit so as to render the latter circuit operative.

6. A key device for rendering a utilization circuit operative comprising: structural means provided with elec-

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trical circuit transmitting means, said structural means being severable to effect a plurality of fragments having an irregular border with respect to one another and each fragment carrying a part of said transmitting means, and said fragments when rejoined along said irregular border restoring the completeness of said electrical circuit transmitting means thereby being adapted to become an element in an electrical circuit for rendering said utilization circuit operative.

7. A key device for rendering a utilization circuit operative as set forth in claim 6 wherein the electrical circuit transmitting means are embedded in the structural material.

8. A key device for rendering a utilization circuit operative as set forth in claim 6 wherein the electrical circuit means are concealed.

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