

Oct. 13, 1936.

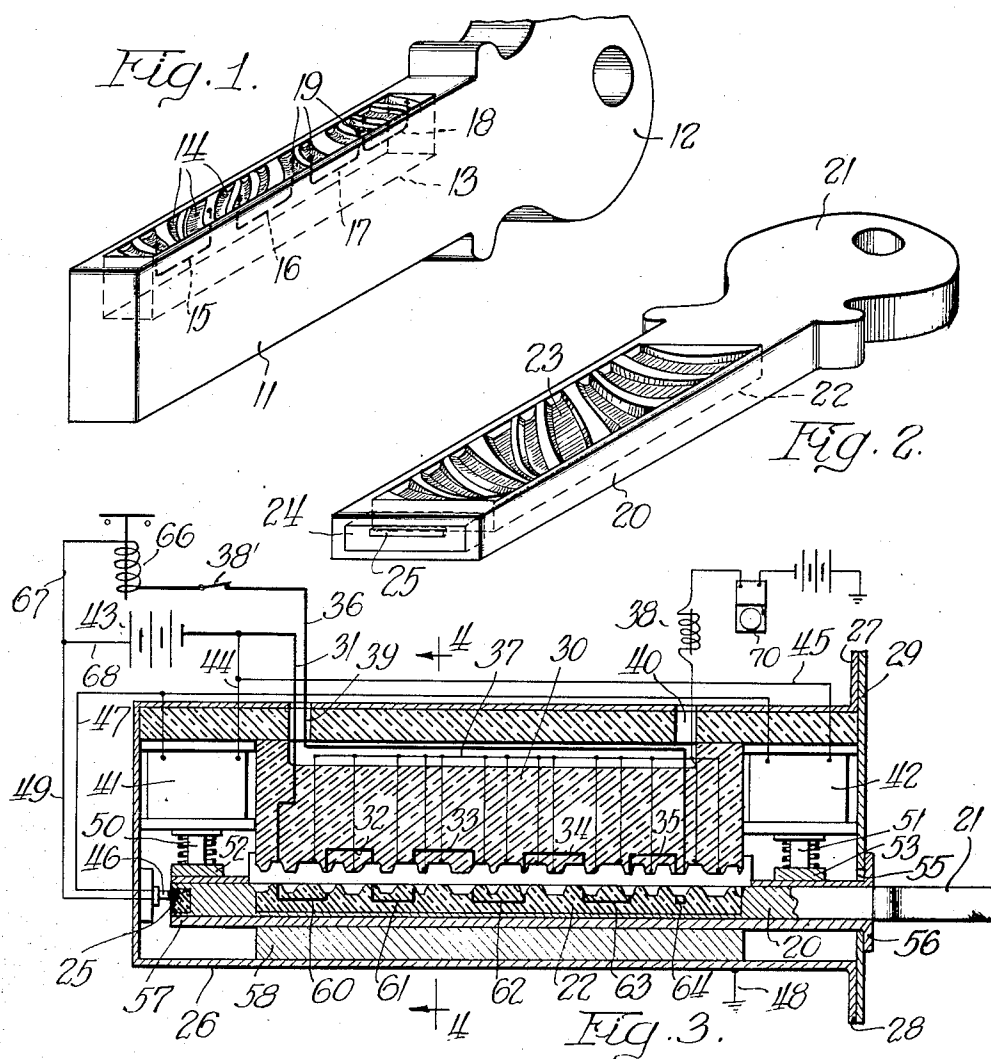
R. MACDONALD

2,057,532

SWITCH AND LOCK DEVICE

Filed Feb. 28, 1933

2 Sheets-Sheet 1



Inventor:
Robert Macdonald

By George Auer *Atty.*

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Fig. 5.

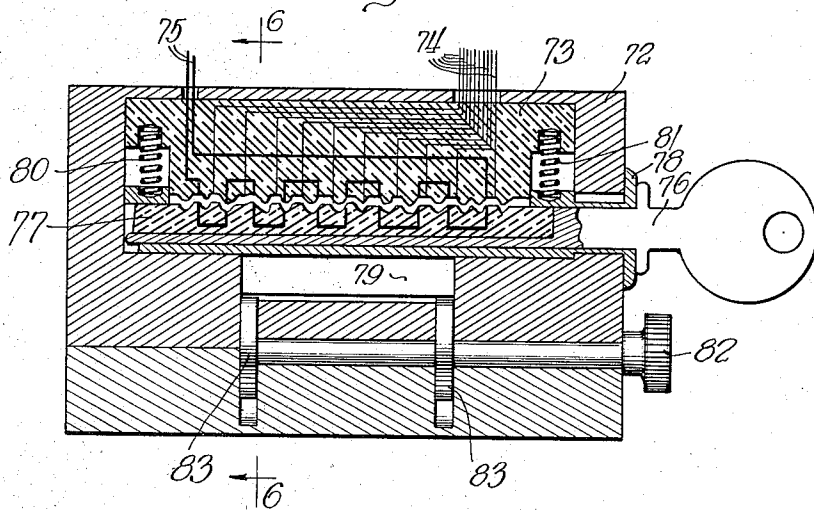


Fig. 6.

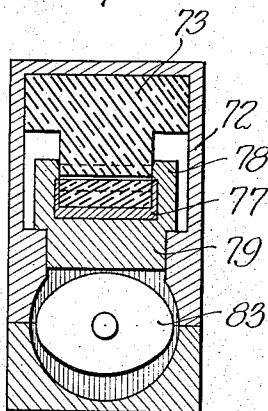
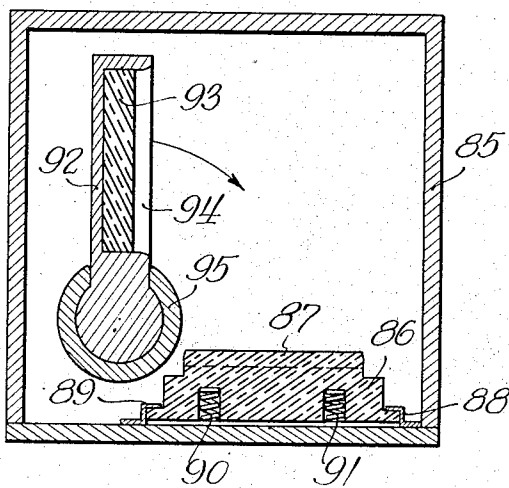


Fig. 7.



Inventor:
Robert Macdonald
By *Jerry Auer*
Att'y.

UNITED STATES PATENT OFFICE

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SWITCH AND LOCK DEVICE

Robert Macdonald, Chicago, Ill.

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4 Claims. (Cl. 200-43)

My invention relates, generally speaking, to switch and lock mechanisms and devices, and is particularly concerned with improvements aiming at increased safety and reliability of operation, and at simplifying the structure and operation, and thereby cutting down on the cost of production and also decreasing the need for maintenance. The nature of my improvements is such that it will also enlarge the field of application of such devices and mechanisms.

It will be shown presently that the invention introduces a number of improvements applicable to switches and to locks for a great variety of purposes. However, for convenience of explanation, the invention will be discussed in connection with switches and locks such, for example, as are provided for doors, or for ignition or starter circuits on engines, or, finally, for signalling devices, as in the case of alarm boxes and the like.

The switch mechanism of such devices is usually enclosed and is operable by key or key-like actuating members. The key has a bit made in accordance with a predetermined pattern. It is inserted into the switch or lock and rotated against a stationary ward of a corresponding pattern. In the case of the simplest structures, the correspondence of the patterns of the bit and the ward determines the function of the mechanism. In more evolved structures the bit of the key may actuate plungers or tongues which in turn operate locking levers and the like. There are also devices known in which the actuation of the plungers or tongues closes certain electrical circuits.

The bit of the key and the formation of the ward are devised according to predetermined patterns or code schemes. It is apparent that within a given pattern or code scheme there is a definite number of possible variations or combinations of bit and ward formations. In other words, the possible number of combinations is limited.

For the purpose of conveniently describing my invention I will retain the terminology employed in the case of known structures as briefly intimated above. Accordingly, I will use the terms "bit" and "key" for my operating member and the term "ward" for that part of the relatively stationary enclosed member which cooperates with the key. However, it will be shown presently that these structures as used in my novel devices, have in some cases, little actual resemblance to the well-known keys and wards employed in orthodox mechanisms of this character.

One of the objects of my invention resides in choosing a novel principle for determining the pattern of the key bit and of the corresponding ward in order to increase the number of possible combinations of the structures. I employ the finger print principle, that is to say, I provide on a carrier at least part of a finger print, on a suitably enlarged scale, either in a faithful reproduction or adapted or distorted according to a predetermined scheme or code. This carrier may represent the bit of the key. The ward of the switch or lock cooperating with this key is represented by a similar counter-replica of the same finger print or its portion. The switching function is preferably electrical and takes place when the two finger print replicas are brought into engagement.

It will be seen at once that the application of the finger print principle renders the production of a key and lock independent of any artificial, and, therefore limited pattern. Nature, which does not duplicate a finger print, renders infinite variety of combinations possible. Such a key, in addition to being individual represents also a means of identification. The owner bears the code of his key just as much as he bears the complex of his tangible and intangible personality.

My invention may be realized, in one of its simplest forms, by taking certain characteristic points from a finger print, transposing these points on the edge of a key blank, and cutting the same in the well known manner. The result will be a pattern which corresponds to the points of the finger print selected. This key may cooperate with a suitably and correspondingly constructed ward. The operation of the mechanism may conform in all other respects, to the usual operation according to any known and suitable lock and key mechanism. The advantages will be present in the value of the key as a novel means of identification, and in the possibility of infinite combinations of bit and ward formations. It may also be mentioned at this point that my invention dispenses with the necessity of keeping in stock or file any issued key formations. The saving to the key industries, in this respect, will be appreciated.

A preferred embodiment of my invention comprises a relatively stationary, enclosed ward, represented by a replica of at least part of a finger print on an insulating member, and carrying contacts at predetermined points. The key is provided with an insulating member also carrying a replica of the same finger print or section thereof,

adapted to mesh with the serrations or grooves of the above mentioned insulating member. Contact points are embedded in the insulating member of the key. The key is inserted into the switch or lock through a suitable slot, and then pressed against and into registry with the stationary ward, thus closing the circuit for the actuation of a solenoid or relay for operating the switch or lock mechanism. Hazard wires and contacts are provided in the insulating block of the ward. These contacts and hazard wires may be used for cutting out the operating circuit and, if desired, for actuating an alarm in the case of unauthorized tampering with the device. The operation of pressing the key against the ward may be accomplished manually or automatically.

The invention will be better understood from the following detailed description of the embodiments shown in the drawings, in which

Fig. 1 shows an operating member in elevation, having a finger print bit on its edge;

Fig. 2 illustrates an operating member in elevation, having a finger print reproduction on one side;

Fig. 3 represents one embodiment of a switch lock in longitudinal section, with a key or operating member such for example as shown in Fig. 2, inserted therein;

Fig. 4 is a section of the device shown in Fig. 3, the section being taken on lines 4—4 looking in the direction of the arrows;

Fig. 5 shows a modified switch lock in longitudinal section;

Fig. 6 is a transverse section of the device shown in Fig. 5, the view being taken on lines 6—6; and

Fig. 7 shows another embodiment of the invention, illustrating essential parts.

Referring now to the drawings, in Fig. 1 is shown a key or operating member having a metal casing 11 and the usual handle part 12. This metal casing may be stamped out or pressed from a metal sheet according to well known processes. On one edge of the operating member 11 is provided a recess and in this recess is disposed an insulating member 13. This insulating member carries grooves such as indicated at 14. The grooves correspond to a part of a finger print. These grooves may be produced by transposing certain points of a part of the finger print, preferably on an enlarged scale, upon the surface of the insulating member 13 and cutting or etching the grooves as shown. Contact wires such as 15, 16, 17, and 18 are embedded in an insulating member 13 and form contact points on the serrated surface of the bit as indicated by numeral 19. It will be observed that this bit is completely enclosed within the housing of the metal member 11. This is desirable in order to provide a protection for the bit itself and also a guide when the key is inserted into the corresponding lock.

In Fig. 2 is shown another embodiment of a key having a metal casing 20 provided with a handle part 21. An insulating member 22 is carried in the casing 20 having a surface 23 which is serrated in accordance with a certain section of a finger print. The forward end of the key is provided with a projecting insulating member 24 carrying a metal contact 25. It is understood, that the insulating member 24 may be a continuation of the insulating bit member 22, carrying at its end the contact point 25. The purpose of the contact at the forward end of the key or operating member will be explained later on.

I have shown in the above described Figs. 1 and 2 operating members each having a bit pro-

vided with serrations which correspond to predetermined points of a finger print or to a certain characteristic section of the finger print on an enlarged or suitably adapted scale. These serrations or grooves may represent a faithful reproduction of the finger print or only certain characteristic lines within a certain portion of a finger print. The rules to be followed will depend on the bit structure which it is desired to form.

The switch lock shown in Fig. 3 may be operated by a key such as the one shown in Fig. 2. The switch lock comprises a casing 26 having flanges 27 and 28 and a cover plate 29. The device may be embedded in a door or suitably mounted wherever it is needed. An insulating block indicated by the numeral 30 is contained within the casing. The surface of this insulating block is provided with grooves corresponding to a section of a finger print or to certain characteristic points of a finger print as previously discussed. Wires such as indicated at 31, 32, 33, 34, 35, and 36 are embedded within the insulating block 30 as shown forming contact points on the serrated surface thereof. These contact points and wires are part of an operating circuit presently to be explained. Hazard wires are embedded in the insulating block 30 and form contact points intermediate of the contact points of the operating circuit. These hazard wires are all connected to conductor 37 terminating in the relay 38. The free portions of the main operating circuit conductors 31 and 36 and the conductor 37 are disposed within suitably arranged recesses in the insulating block 30 as shown, and are conducted to the various control apparatus through openings such as 39 and 40.

On either side of the insulating block 30 is disposed a solenoid indicated by the reference numerals 41 and 42, respectively. One terminal of each of these solenoids is connected to the battery 43 by means of the conductors 44 and 45. The other terminal of each of the solenoids is connected to contacts 46 disposed at the forward end of the device inside of the casing 26, the connection being established by means of the conductor 47. The casing 26 may be grounded at 48, and a conductor 49 may be connected to the other pole of the battery 43 as shown. Each of the solenoids 41 and 42 is adapted to actuate a plunger as indicated at 50 and 51, respectively, and each plunger maintains a movable connection with the corresponding armature indicated by the numerals 52 and 53, respectively, which is controlled by a suitable spring disposed between the head of the solenoid and the corresponding armature.

A slot 55 is provided in the cover plate 29, and within this slot is disposed a key guide 56. This key guide extends from the front of the device to the back, ending near the contact 46 as indicated by the numeral 57. This key guide, it will be seen, is in connection with the movably mounted armatures 52 and 53 of the solenoids 41 and 42, respectively. When the solenoids 41 and 42 are energized they will attract their plungers 50 and 51 and the armatures 52 and 53 will lift the key guide 56 against the insulating member 30 carrying the reproduction of the finger print previously described. A member 58 is disposed below the key guide so as to provide a stop and proper mounting therefor. The key used in connection with this device may be the one shown in Fig. 2. Its bit is formed to mesh with the finger print reproduc-

tion on the surface of the insulating block 30. The key, as will be remembered, comprises a metallic housing 20 having the insulating block 22 carrying the reproduction of the finger print which corresponds to the serrations in the insulating block 30 within the switch lock. Embedded in the insulating member 22 of the key 21 are the operating circuit wires 60, 61, 62, 63, and 64 forming contacts on a serrated surface of the insulating member 22 which may be brought into engagement with the corresponding contacts of the operating circuit embedded in the insulating block 30. When these contacts on the serrated surface of the key engage the contacts on the serrated surface of the insulating block 30 the circuit will be closed over the conductors 31 and 36 which may be easily traced on the drawings. This circuit will extend from the battery 43 over the conductor 31 by way of the meshing contacts and conductors within the insulating block 30 and the insulating member 22 of the key and of the switch lock, respectively, and will leave the device by way of the conductor 36, contact 33', electro-magnetic device 66, over the conductors 67 and 68 and back to the battery 43. Providing the main operating circuit, including the device 66 is thus closed, the device 66 will be energized and will be able to perform the necessary switching, locking or unlocking functions.

The actuation of the main operating circuit is brought about in the following manner: The key is inserted through the slot in the guide 56 until the contact 25 of the key engages the contacts 46 provided within the housing 26. A circuit will be closed at this moment for the solenoids 41 and 42 from the battery 43 over the conductors 68 and 49, contacts 46, conductor 47, windings of the solenoids 41 and 42, and back to the battery by way of the conductors 45 and 44. The solenoids will be energized and by means of the armatures 52 and 53 will lift the key guide and with it the key against the insulating block 30. Now, since it is assumed that the key inserted fits into the lock and is provided for it, the serrations in the key will exactly tally with the grooves in the insulating member 30 and the main operating circuit for the switching device 66 will be closed over the conductors 31 and 36 as previously indicated. The switching device will now perform the necessary switching function.

The circuit for the solenoids 41 and 42 will be broken at the contacts 46 when the key is lifted into its operating position, that is, when the serrated bit of the key is lifted into engagement with the correspondingly serrated ward of the switch lock. Accordingly, the solenoids 41 and 42 will be deenergized and will release the key guide 56. The electro-magnetic device 66 and also the solenoids may be provided with well known means for operating and deenergizing so as to prevent interference, and the reenergization of the solenoids when the key assumes its position as shown in the drawings. It may be advisable, for this purpose, to insert in the circuit of the solenoids, for example in the conductor 47, a contact actuated by the device 66 maintaining the circuit of the solenoids closed for a period sufficient to warrant proper actuation. The key is then withdrawn from the switch lock.

Now, again referring to the action of the solenoids particularly to that phase of operation when the key guide and with it the key are lifted into operating position, attention is called to the

operation of the armatures 52 and 53 due to the springs inserted between the head of the solenoid and the armatures. This resilient action permits equalization in the plane of attraction of the key guide so as to accomplish a meshing of the key bit with the ward in case of small differences due to the manufacture or assembly of the different parts.

In case the switch lock is tampered with, for example, by inserting a relatively soft metallic member or a different key, one or the other of the hazard wires connected to the conductor 37 and terminating in the electro-magnetic device 38 will be energized or connected to ground through the housing and the foreign member inserted, and will cause energization of the relay 38. This relay will attract its armature and thereby will open its contact 38', disposed in the conductor 36 leading to the switching device 66. The circuit of the switching device will be opened. At the same time an alarm 70 may be sounded if desired. If necessary, and desirable, the bit of the key may be provided with a number of additional hazard wires connected to ground so as to increase the hazard in case a wrong key is inserted into the switch lock. The relay 38 may also operate additional signalling or switching means.

Fig. 4 shows a transverse cross section taken on line 4-4 and looking in the direction of the arrows indicated in Fig. 3. It will be seen that the insulating block 30 is provided with a channel 71 for disposing the various circuit and hazard wires as previously described. The solenoid 41 is shown in dotted lines with its plunger 50 and its armature. The key 20 is disposed within the key guide 56 which rests in normal position on the member 58. The contact 25 at the forward end of the key is also shown in dotted lines in this figure.

In Figs. 5 and 6 is shown an embodiment which is slightly simpler than the one above described. The switch lock shown in this figure comprises again a housing 72 having an insulating block 73, the face of which is serrated. Hazard wires 74 are embedded in the insulating block 73 and the operating circuit wires 75 are also embedded in the insulating block substantially in the same manner as was previously discussed. The operating circuit for the hazard wires and for the main circuit wires 75 may be substantially the same as already discussed. The key 76 also carries an insulating member 77 having finger print grooves adapted to mesh with the grooves on the insulating block 73. The key may be inserted into the key guide 78 which has a projection 79 extending into a suitable recess within the housing. Springs 80 and 81 are provided between the flanks of the insulating block 73 and the key guide 78, one spring being disposed at either end of the operating section of the key. The purpose of these springs is again to equalize slight differences in the dimensions of the individual parts or differences in the assembly. An operating knob 82 projects to the outside. It is provided with cam members 83. After the key is inserted the knob is turned so as to rotate the cam 83 and to force the key guide and with it the key into engagement with the ward.

It may be desirable in certain cases to provide a structure which deviates in its operating features as little as possible from the operating features now known, at the same time rendering the advantages resulting from my invention. Such a structure is illustrated in its essential parts in Fig. 7. This structure comprises a casing

85 in which is disposed an insulating member 86 carrying on its surface 87 a ward consisting of grooves simulating a certain finger print or section thereof. The insulating block 86 is resiliently mounted in the guides 88 and 89, springs such as 90 and 91 exerting a slight upward pressure upon the ward block. The key consists of a metallic housing such as 92 carrying an insulating member 93. On the face 94 of this insulating member are the grooves or serrations corresponding to the finger print reproduction carried on the face 87 of the insulating block 86. The key may be inserted through a guide 95.

The operation of the embodiment shown in Fig. 7 may correspond in all appearance to the well known operation of an ordinary key. The key is inserted and turned in the usual manner. A cam or snap may be provided to lock the key in operating position. The face 94 of the key, carrying the bit, will engage the face 87 of the insulating block 86 carrying the ward. These two members will mesh and close an operating circuit substantially as previously described, or a circuit suitably devised for functions and operations which may be desired in an individual case. Upon turning the key in contrary direction the cam or snap will be released and the key is then rotated to the position shown, and withdrawn. Attention is called to the fact that the cam means shown in connection with Figures 5 and 6 are adapted to perform such locking function.

Changes will suggest themselves, and can be derived and carried out when bearing in mind the invention as described in detail in this specification.

It will be apparent that I have made specific disclosures merely for the purpose of description, but not in order to indicate any limitations.

What I consider new is defined in the claims which follow:

1. In a switch device of the class described, a relatively stationary member, grooves on said member forming a predetermined pattern, an operating member, grooves on said operating member adapted to mesh with the grooves on

said relatively stationary member, contact means on said grooved stationary member and on said grooved operating member, and resiliently operable guide means for effecting the engagement of said members and said contact means thereon.

2. An operating member for a lock of the class described comprising, a carrier, an insulating member disposed on one side thereof and forming a unitary structure therewith, grooves on said member forming a predetermined identification pattern, contacts disposed on the surface of the grooved part of said member, and conductors in said members connected to said contacts.

3. A device of the class described comprising, a housing, a block made of insulating material enclosed in said housing, a predetermined identification formed in relief on the face of said block, guide means adjacent said block, an operating member for insertion into said guide means and carrying a block made of insulating material, the counterpart of said identification formed in relief on the face of said block of said operating member, and means for effecting the resilient engagement and meshing of said face on said block of said operating member with the face on said block enclosed in said housing, said means being effective after inserting said operating member into said guide means.

4. In a switch of the class described, the combination of a relatively stationary completely and relatively permanently enclosed member carrying a predetermined serrated identification pattern formed in relief thereon, with a removable operating member carrying the counterpart of said identification pattern formed in relief thereon, together with fixed contacts on said enclosed member and on said operating member constituting part of an actuating circuit, and means for operatively effecting the meshing of said patterns and the engagement of said contacts upon completing the insertion of said operating member into said switch whereby said actuating circuit is closed by way of said contacts.

ROBERT MACDONALD.