

Aug. 28, 1951

H. COOLEY

2,566,017

KEY OPERATED SWITCH

Filed Aug. 6, 1946

2 Sheets-Sheet 1

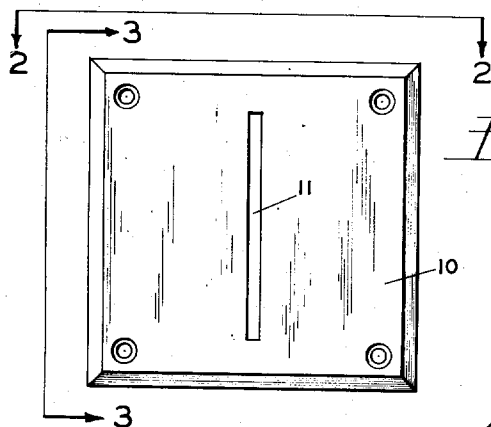


Fig. 1

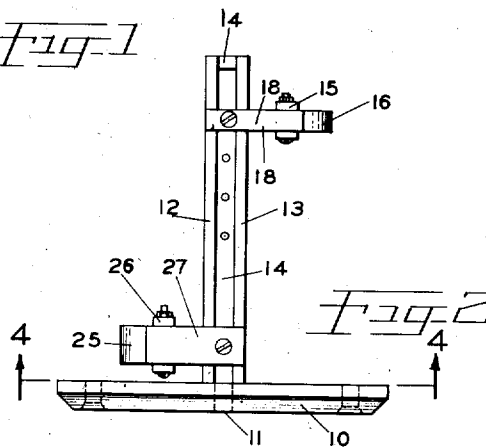


Fig. 2

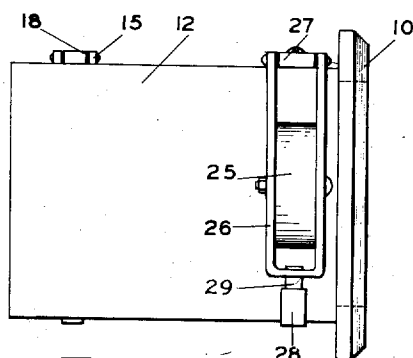


Fig 3

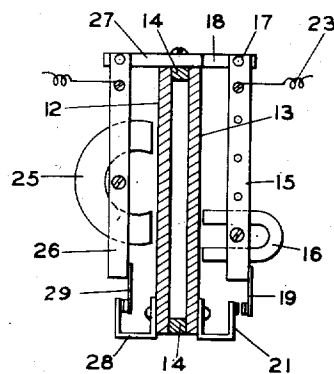


Fig 4

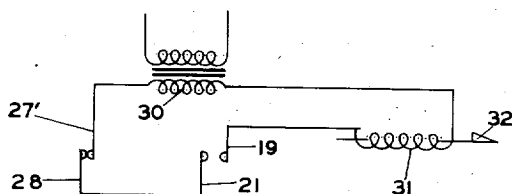


Fig 5

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2 Sheets-Sheet 2

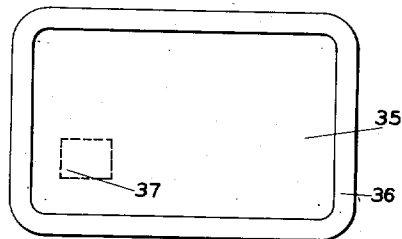


Fig. 6

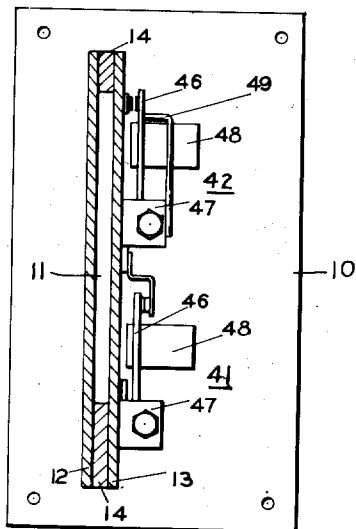


Fig. 8

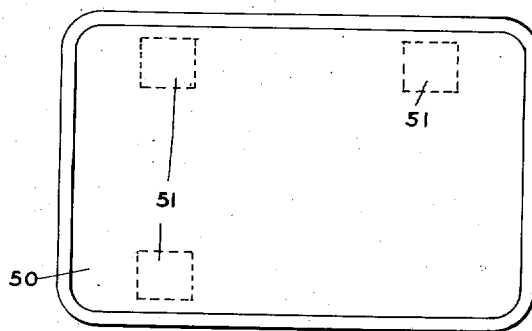
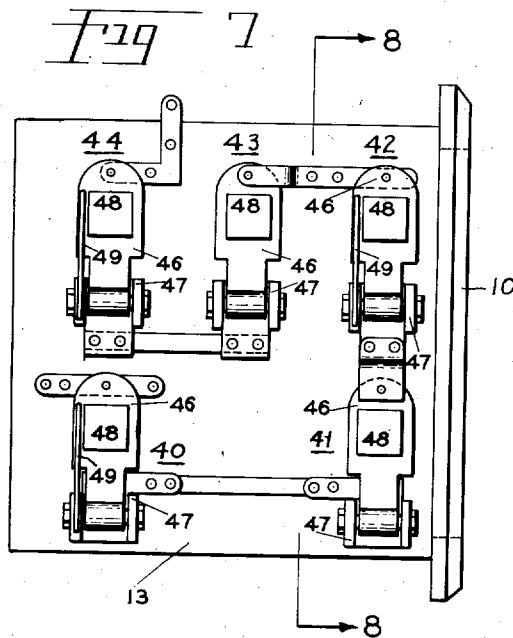


Fig. 10

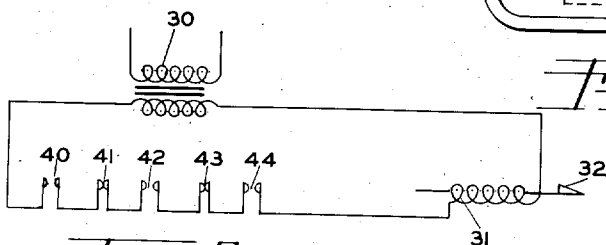


Fig. 9

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2,566,017

KEY OPERATED SWITCH

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22 Claims. (Cl. 200—87)

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The present invention relates to circuit control apparatus and, while it is not necessarily limited thereto, the apparatus of the invention is particularly suitable for use in connection with electrically controlled lock apparatus.

It is a primary object of the present invention to provide a novel form of removable key controlled switch, the key being so designed with regard to its functional features as to avoid detection. Another object of the invention is to provide a novel form of key controlled switch apparatus which is substantially foolproof, indestructible, yet quick and easy to operate with a properly designed key.

And another object of the invention is to provide a magnetic switch operating mechanism including a control element or key the greater portion of which is non-magnetic and having concealed magnetic elements embodied therein so that when the key is applied in a predetermined relation to the switch apparatus operation of the switch may be effected.

It is also an object of the present invention to provide a novel form of key controlled switch apparatus in which the key consists of a flat card having concealed functional elements incorporated therein.

Another object is to provide a new and improved key for controlling magnetically operated switch mechanisms having concealed magnetic elements embodied therein.

Further objects and advantages of the present invention will appear from the following description taken in connection with the accompanying drawings while the features of novelty will be pointed out with greater particularity in the appended claims.

In the drawings Fig. 1 is a front elevation of the switch apparatus constructed in accordance with one form of the present invention; Fig. 2 is a top view of the apparatus; Fig. 3 is a side elevation of the apparatus; Fig. 4 is a cross sectional view taken along the line 4—4 of Fig. 2; Fig. 5 is a diagrammatic view illustrating the electrical connections for the apparatus illustrated in Figs. 1 to 4 inclusive; Fig. 6 is a side elevation of a key for use with the switch apparatus illustrated in Figs. 1 to 4; Fig. 7 is a side elevation illustrating a switch apparatus constructed in accordance with a further modification of the invention; Fig. 8 is a cross sectional view taken along the line 8—8 of Fig. 7; Fig. 9 is a schematic wiring diagram illustrating the electrical connections for the switch apparatus shown in Figs. 7 and 8; and Fig. 10 is a side elevation illustrating a key for use

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with the switch apparatus illustrated in Figs. 7 and 8.

Referring now to the drawings the invention will be described with particular reference to an electromagnetically controlled door latch arrangement. In such an arrangement the door latch includes a catch mechanism mounted within the door casing which mechanism is provided with a solenoid for tripping the catch upon energization thereof in response to completion of the energizing circuit therefor. The switch mechanism of the present invention is designed in this instance to be connected to the energizing circuit for the solenoid whereby the door latch may be released upon insertion of a key into the switch housing. It will readily be understood by those skilled in the art, however, that the switch apparatus of the present invention may be readily adapted for a wide variety of applications and it is to be kept in mind that the described embodiment is merely by way of illustration and not by way of limitation.

The switch of the invention comprises a face plate 10 which may be of any suitable shape and having an elongated, relatively narrow slot 11 therein. Mounted behind the face plate and, more particularly, behind the slot 11 thereof is a housing comprising two relatively thin, closely spaced apart, side walls 12 and 13 of non-magnetic material such as aluminum, brass or plastic sheet. The walls 12 and 13 are spaced apart along their upper, lower and rear edges by spacer strips 14. The housing defined by the walls 12, 13 and the spacer strips 14 is secured to the face plate 10 at right angles with respect thereto, the space between the walls 12 and 13 being aligned with the slot 11 which provides access to such space.

One or more magnetic units are mounted upon the housing with the end portions of the magnetic units extending relatively closely adjacent the outer surface of one or the other of the walls 12—13, each of the magnetic units being operatively connected to a corresponding circuit controlling switch. As illustrated in the drawings two such magnetic units are shown, the magnetic units in both instances being permanent magnets. One permanent magnet 16 is shown secured to an arm 15 pivotally mounted as at 17 upon a bracket member 18 secured to the upper edge of the housing. Secured to the lowermost end of the pivoted arm 15 is a movable contact bearing finger 19 which is adapted to engage co-operatively with an adjacent fixed contact bearing member 21. In the specific embodiment shown the housing including the walls 12—13 as

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well as the spacer members 14 are of insulating material, such as plastic, so that the cooperating contact bearing members may be mounted directly upon the housing without requiring any other insulation therebetween. Circuit connections may be made to the pivoted arm 15 through a flexible lead 23 and directly to the fixed contact bearing member 21. A second permanent magnet 25 is secured to an arm 26 which is in turn pivotally mounted upon a bracket support 27 secured to the upper edge of the housing. A movable contact bearing finger 29 is secured to the lower end of the pivoted arm 26 and which is adapted cooperatively to engage with a fixed contact bearing member 28 secured adjacent thereto upon the lower portion of the housing. The permanent magnets 16 and 25 are so hung with respect to their pivotal supports that they normally tend to swing away from the adjacent housing walls and the corresponding switches associated with each are so designed that the switch 19-21 is normally open and the switch 29-28 normally closed.

Referring to Fig. 5 a wiring diagram is there shown including a source of electrical energy, such as the transformer secondary 30, which is connected in series relation with the solenoid 31 of a door latch mechanism indicated generally at 32 and switches 19-21 and 29-28. It will be obvious that as the switch 19-21 is closed the solenoid 31 will be energized but if the switch 29-28 is opened simultaneously with closure of the contacts 19-21 the solenoid will remain de-energized.

The switch mechanism of the invention is intended to be controlled by a key in the form of a flat card as illustrated in Fig. 6. This card is preferably of relatively durable construction and, as shown, it comprises the central paper portion 35 which is covered on each of the opposite sides with plastic sheet, the sheets being bonded intimately together around the edges of the paper card 35 as indicated at 36. A magnetic element 37 is concealed within the card and may consist of a thin piece of magnetic material such as shim steel and which may be embedded between superimposed plies of paper forming the card 35. The magnetic element 37 may be sufficiently thin so that its presence cannot be detected by inspection other than by mutilation of the card. The magnetic element 37 is so positioned with regard to the location of the permanent magnet 16 so that when the card is inserted into the slot 11 to its full extent within the space between the side walls 12 and 13 it will be positioned immediately adjacent the end of the permanent magnet whereupon the latter will be drawn toward the housing wall 13 and effect closure of the switch contacts 19-21. The permanent magnet 16 is relatively small and so also the magnetic element 37 to increase the sensitivity of the apparatus. In different locks the permanent magnet 16 may be adjusted upwardly relative to the arm 15 and the supporting bracket 18 may also be variously adjusted upon the upper edge of the housing. Different cards would be provided for each switch with the magnetic element arranged therein in cooperative position with respect to the position of the permanent magnet 16.

The permanent magnet 25, it will be noted, is preferably of relatively large size and is mounted adjacent the forward end of the housing so that in the event one should attempt to effect operation of the switch, such as for opening the

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door, by inserting a foreign object of magnetic material such as a knife blade, nail file or the like into the slot 11 the magnet 25 would be attracted thereby to open the switch contacts 29-28 and which would be held open so long as the foreign object is extended into the slot 11. Thus regardless as to whether or not the permanent magnet 16 is attracted by the foreign object the solenoid 31 controlling the door latch is maintained de-energized.

It will be obvious that many different combinations and permutations may be effected by variously arranging magnetic control units at different points over the side walls of the housing for controlling switches of both open circuit and closed circuit types and having matching key cards. In Figs. 7 and 8 is illustrated a still further modification of the invention which includes a combination of five interconnected magnetic switch units. In this case the switch units 40, 42 and 44 are of the normally open circuit type while switch units 41 and 43 are of the normally closed circuit type. The face plate and housing portions are the same as previously described and bear the same reference characters. The switch units are for convenience illustrated as being all mounted upon the same housing wall 13 and referring particularly to Fig. 8 the switch units each comprise a lever 46 pivotally supported within a bracket member 47 attached to the wall 13. A small permanent magnet 48 projects through a cooperating opening within the lever 46 and is fixedly secured therein such as by soldering. The permanent magnet 48 is of a bar type and extends at right angles with respect to the housing wall 13. Due to the outwardly extending portion of the magnet 48 the lever 46 is biased in a direction away from the housing wall. The normally open switches are further provided with a backstop 49, the outward motion of the normally closed switches being arrested by engagement of their switch contacts. The various switches are all connected in series circuit relation with the source of electrical energy and the solenoid of the door latch mechanism as illustrated diagrammatically in Fig. 9.

The control card for use with the switch arrangement as illustrated in Figs. 7 and 8 is shown in Fig. 10 and which card is provided with concealed magnetic elements 51 arranged therein in proper spaced relation so as to coincide with the position and arrangement of the normally open circuit switch units 40, 42 and 44. Upon insertion of the card 50 into the switch housing the magnetic elements 51 will result in the attraction of the corresponding switch units toward the housing wall or to a closed circuit position thereupon establishing an energizing circuit for the solenoid. The interlock switches 41 and 43 are provided as a safety measure to preclude picking of the switch by insertion of a solid sheet of magnetic material through the slot or of a card having an arrangement of magnetic elements therein other than that specifically provided for operating the switch mechanism.

It will be obvious that the key cards may be inserted into the switch housings in a plurality of different relative positions but they must be inserted into the slot in the face plate of the housing in a predetermined position to effect closure of the proper switches. It is contemplated that the key cards be provided with suitable printed matter providing an indication for the right edge to be held up. In the event that the switch mechanism is provided for controlling the door

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lock of a club quarters, for example, each of the club members may be provided with the customary membership card each bearing the member's name and other pertinent data and to all outward appearances resembling any other membership card. The magnetic elements are concealed therein and embedded between the layers thereof so as not to attract attention nor reveal the combination to the lock switch. The key cards being of relatively inexpensive construction may be reissued periodically such as upon the beginning of a new fiscal year and the old cards may be automatically rendered ineffective for permitting access to the club quarters upon expiration of the membership by readjustment of the magnetic switches of the controller to correspond with the newly issued membership cards.

Having described the invention in what are considered to be preferred embodiments thereof it is desired that it be understood that the specific details are merely illustrative and that the invention may be carried out by other means.

What I claim is:

1. A switch device for use with an electromagnetic lock apparatus including a source of electrical energy, a lock mechanism including a solenoid, a circuit connecting said source to said solenoid, said device comprising a housing having a pair of relatively closely spaced apart parallel nonmagnetic walls, an elongated narrow slot in an end wall of said housing providing access for a card into the space between said walls, a plurality of permanent magnets hingedly mounted on said housing and having their end portions arranged in staggered relation adjacent the outer surface of one or the other of said walls, a switch operatively connected to each of said magnets and adapted to be connected in said circuit, certain of said switches being of the normally open type and others being of the normally closed type, said switches being connected together in series relation, a card including a plurality of staggered magnetic elements embedded in a hidden manner within said card, said magnetic elements being so arranged within said card whereby upon insertion of said card into said slot one of said magnetic elements will be located adjacent the end portions of each of said permanent magnets connected to said normally open switches whereby said normally open switches will be closed.

2. A switch device for use with an electromagnetic lock apparatus including a solenoid lock mechanism, a source of electrical energy, a circuit connecting said source to said solenoid, said device comprising a housing including a pair of relatively thin spaced apart parallel nonmagnetic walls, a slot through an end wall of said housing providing access to the space between said walls, a plurality of magnetic units movably mounted adjacent the outer surface of said walls, a plurality of switches adapted to be connected in said circuit, certain of said switches being of the normally open type and others being of the normally closed type, each of said switches being operatively connected to a corresponding one of said magnetic units for actuation thereby, said switches being connected together in series, a control card having a plurality of concealed magnetic elements embedded therein, said magnetic elements being so spaced within said card so that upon insertion of said card in a predetermined manner into said slot each of said elements will be positioned immediately adjacent corresponding ones of said magnetic units

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connected to normally open switches for effecting completion of said circuit.

3. The combination of a membership identification card and a door lock controller, said card being adapted to serve also as a key for gaining admission to premises through a door normally restrained in a locked condition by an electrically controlled lock mechanism, the lock mechanism being operated to the door releasing condition upon mere insertion of said membership card while held in a predetermined position into a slot in said controller, said controller comprising an elongated housing including a pair of relatively closely spaced apart parallel walls of nonmagnetic material, said slot being provided in one end of said housing and communicating in aligned relation with the space between said walls, a plurality of series connected switches adapted to be connected in a control circuit for said lock mechanism, a plurality of actuating means, each of said actuating means operatively connected with a corresponding one of said switches, each of said actuating means including a permanent magnet, said magnets being arranged in a predetermined pattern on one of said parallel walls over an area limited to the extent of coverage by said card when inserted in proper position through said slot, the contacts of at least one of said switches connected in said control circuit as to require actuation of the actuating means connected therewith for conditioning said circuit for effecting releasing operation of said lock mechanism, said membership card including indicia means thereon for identifying the proper position thereof for the insertion of said card into said slot, said card being of a nonmagnetic material and having one or more relatively small magnetic elements attached thereto, the number of said magnetic elements and the arrangement thereof on said card corresponding to the number and pattern of arrangement of said permanent magnets required to be influenced for actuation of those switches required to be actuated for effecting lock releasing operation.

4. The combination of a membership identification card and a door lock controller, said card being adapted to serve also as a key for gaining admission to premises through a door normally restrained in a locked condition by an electrically controlled lock mechanism, the lock mechanism being operable to the door releasing condition upon mere insertion of said membership card held in a predetermined position into a slot provided in said controller, said controller comprising an elongated housing of nonmagnetic material including a pair of relatively closely spaced apart parallel walls, said housing having a slot in one end thereof providing access to the space between said walls, a switch adapted to be connected in a control circuit for said lock mechanism, a magnetic unit mounted on one of said walls and operatively connected with said switch, said membership card having indicia means thereon for identifying the proper position thereof for insertion into said slot, said membership card being principally of nonmagnetic material and having a relatively small magnetic element attached thereto at such a point so that upon insertion of said card while held in said proper position through said slot said magnetic element will be positioned closely adjacent said magnetic unit for effecting operation of said switch.

5. The combination of a membership identification card and a door lock controller, said card being adapted to serve also as a key for gaining admission to premises through a door normally restrained in a locked condition by an electrically controlled lock mechanism, the lock mechanism being operated to the door releasing condition upon mere insertion of said membership card while held in a predetermined position into a slot in said controller, said controller comprising an elongated housing including a pair of relatively closely spaced apart parallel walls of nonmagnetic material, said slot being provided in one end of said housing and communicating in aligned relation with the space between said walls, a plurality of series connected switches adapted to be connected in a control circuit for said lock mechanism, a plurality of actuating means, each of said actuating means operatively connected with a corresponding one of said switches, each of said actuating means including a permanent magnet, said magnets being arranged in a predetermined pattern on one of said parallel walls over an area limited to the extent of coverage by said card when inserted in proper position through said slot, the contacts of at least one of said switches connected in said control circuit as to require actuation of the actuating means connected therewith for conditioning said circuit for effecting releasing operation of said lock mechanism, said membership card including indicia means thereon for identifying the proper position thereof for the insertion of said card into said slot, said card being of a nonmagnetic material and having one or more relatively small magnetic elements attached thereto, the number of said magnetic elements and the arrangement thereof on said card corresponding to the number and pattern of arrangement of said permanent magnets required to be influenced for actuation of those switches required to be actuated for effecting lock releasing operation.

cation card and a door lock controller, said card being adapted to serve also as a key for gaining admission to premises through a door normally restrained in a locked condition by an electrically controlled lock mechanism, the lock mechanism being operable to the releasing condition upon mere insertion of said membership card while held in a predetermined position into a slot provided in said controller, said controller comprising an elongated housing including a pair of relatively closely spaced apart parallel walls, said housing having a slot in one end providing access to the space between said walls, a plurality of series connected switches adapted to be connected in a control circuit for said lock mechanism, actuating means operatively connected with each of said switches, said actuating means each including a proximity sensitive element, said elements being arranged in a predetermined pattern on one of said parallel walls over an area limited to the extent of coverage by said card when inserted in proper position through said slot, at least one of said switches being so arranged as to require actuation of the actuating means connected therewith for conditioning said circuit for effecting releasing operation of said lock mechanism, said membership card including indicia means thereon for identifying the proper position thereof for insertion of said card into said slot, said card being principally of a material having no effect upon said sensitive elements when positioned next adjacent thereto, said card having one or more relatively small portions thereof differing from the remainder of said card, the number of said portions and the arrangement thereof on said card corresponding to the number and pattern of arrangement of said sensitive elements required to be acted upon for effecting lock releasing operation, said last mentioned sensitive elements being sensitive to the positioning of said portions of said card next adjacent thereto for causing actuation of the switches connected therewith.

6. The combination of a membership identification card and a door lock controller, said card being adapted to serve also as a key for gaining admission to premises through a door normally restrained in a locked condition by an electrically controlled lock mechanism, the lock mechanism being operable to the releasing condition upon mere insertion of said membership card while held in a predetermined position into a slot provided in said controller, said controller comprising an elongated housing including a pair of relatively closely spaced apart parallel walls, said housing having a slot in one end thereof providing access for a portion of said card to the space between said walls, a switch means adapted to be connected in a control circuit for said lock mechanism actuating means operatively connected with said switch means, said actuating means including a plurality of proximity sensitive elements arranged in a predetermined pattern on one of said parallel walls over an area restricted to the area of said card portion when inserted in proper position through said slot, said membership card including indicia means thereon for identifying the proper position thereof for insertion of said card into said slot, said card being principally of a material having no effect upon said sensitive elements when positioned next adjacent thereto, said card having a plurality of relatively small portions thereof differing from the remainder of said card, said portions being arranged in a predetermined pattern

corresponding to the pattern of arrangement of said sensitive elements, said sensitive elements being sensitive to the positioning of said portions of said card next adjacent thereto within said housing for causing actuation of said switch means.

7. A membership identification card adapted to serve also as a key for gaining admission to premises through a door normally restrained in a locked condition by an electrically controlled lock upon insertion of a portion of a card through a wall slot whereby said card portion is positioned immediately adjacent electrical apparatus arranged behind a wall, the electrical apparatus including a plurality of permanent magnets arranged in a predetermined pattern over an area restricted to the area of said card portion, switch means connected with each of said permanent magnets and being effective for completing an electrical circuit for causing release of said lock, the invention comprising an improved membership identification card consisting principally of nonmetallic, nonmagnetic material, indicia means provided upon said card for enabling identification of the proper position thereof for insertion of said card into said wall slot, said card having a plurality of relatively small magnetic metal elements imbedded therein, said elements being arranged in a predetermined pattern corresponding to the pattern arrangement of said permanent magnets, whereby upon insertion of said card into said wall slot and registry of said magnetic elements in said card in close proximity with corresponding permanent magnets said permanent magnets will be actuated to condition the electrical circuit means to cause release of said lock.

8. A membership identification card adapted to serve also as a key for gaining admission to premises through a door normally restrained in a locked condition by an electrically controlled lock upon insertion of a portion of the card through a wall slot whereby said card portion is positioned immediately adjacent electrical apparatus arranged behind the wall, the electrical apparatus including a plurality of units sensitive to the proximity of metallic elements, said units being arranged in a predetermined pattern over an area restricted to the area of said card portion, said units being cooperatively arranged in an electrical circuit and connected to said lock for effecting release of said lock upon insertion of said card portion through said wall slot, the invention comprising a membership card consisting principally of nonmetallic material, indicia means provided upon said card for identifying the proper position thereof for insertion of said card into said wall slot, said card having a plurality of relatively small metallic portions incorporated therein, said portions being arranged in a predetermined pattern corresponding to the pattern arrangement of said sensitive units of said electrical apparatus whereby upon insertion of said card into said wall slot, said metallic portions will register with the sensitive units to influence the same to actuate said electrical circuit means to cause release of said lock.

9. A membership identification card adapted to serve also as a key for gaining admission to premises through a door normally restrained in a locked condition by an electrically controlled lock upon insertion of a portion of the card through a wall slot whereby said card portion is positioned immediately adjacent electrical ap-

paratus arranged behind the wall, the electrical apparatus including a plurality of proximity sensitive elements arranged in a predetermined pattern over an area restricted to the area of said card portion, said elements being effective for actuating electrical circuit means for releasing said lock, said membership card including indicia means thereon for identifying the proper position thereof for insertion of said card into said wall slot, said card being principally of a material having no influence upon said element when positioned adjacent thereto, said card having a plurality of relatively small portions thereof treated differently than the remainder of said card, said treated portions being arranged in a predetermined pattern corresponding to the pattern of arrangement of said sensitive elements, said portions being treated in a manner so as to influence said elements when positioned next adjacent thereto whereby said electrical circuit means will cause release of said lock.

10. A membership identification card adapted to serve also as a key for gaining admission to premises through a door normally restrained in a locked condition by a remote controlled lock mechanism, the lock mechanism being operated to the door releasing condition upon mere insertion of a portion of the card through a wall slot whereby said card portion is positioned immediately adjacent selectively responsive lock control apparatus arranged behind the wall slot, said apparatus including a proximity sensitive element arranged in a predetermined position immediately adjacent one side of said card portion, said element being effective for causing releasing operation of said lock mechanism, the invention comprising an improved membership card including indicia means provided thereupon for identifying the owner and the proper position thereof for insertion of said card into said slot, said card being introducible into said slot in a plurality of different positions including either end first, said card being flat, thin and flexible in all directions, said card being principally of material having no influence upon said element when positioned adjacent thereto, said card having a relatively small portion thereof treated differently than the remainder of said card, said treated portion being arranged in a predetermined position upon said card corresponding to the predetermined position of said sensitive element, said portion being treated in a manner so as to influence said element when positioned next adjacent thereto whereby upon proper insertion of said card into said slot said element will be influenced by said card portion for causing release of said lock mechanism.

11. A membership identification card adapted to serve also as a key for gaining admission to premises normally restrained in a locked condition by a remote controlled lock mechanism upon insertion of a portion of said card through a wall slot in a remote controller whereby said card portion is positioned immediately adjacent selectively responsive lock control apparatus arranged behind said slot, the control apparatus being selectively responsive to a predetermined arrangement of means on said card portion for effecting releasing operation of the lock mechanism, the invention comprising an improved membership card of thin material flexible in all directions, said card being introducible into said slot in a plurality of different positions including either end first, means provided on said card effective for causing operation of said lock con-

trol apparatus upon insertion of said card in said slot, indicia provided upon said card for identifying the proper position thereof for insertion into said slot, said means being provided in a predetermined relation upon said card with respect to the edges thereof as determined by the setting of said lock control apparatus.

12. An electric switch operable by a key having thereon a plurality of magnetic elements arranged in a characteristic pattern; said switch comprising a plurality of magnetic elements responsive to the magnetic elements on the key and arranged in a corresponding pattern, means for movably mounting the magnetic elements in the switch to enable their movement between advanced and retracted positions, and a plurality of electric contact pairs in series circuit relationship with each other, one contact pair being operatively connected with each of the magnetic elements in the switch, one contact of each pair being movable with the magnetic element with which it is connected, thereby making and breaking contact with the opposed contact of the pair as the magnetic element moves between its advanced and retracted positions.

13. The electric switch of claim 12 wherein the magnetic elements in the switch comprise pieces of material responsive to the force exerted by a magnet.

14. The electric switch of claim 12 wherein the magnetic elements in the switch comprise magnets.

15. An electric switch comprising a plurality of magnetic elements, means for movably mounting the magnetic elements to enable their movement between advanced and retracted positions, and a plurality of electric contact pairs in series circuit relationship with each other, one contact pair being operatively connected with each magnetic element and one contact of each pair being movable with the magnetic element with which it is connected, thereby making and breaking contact with the opposed contact of the pair as the magnetic element moves between its advanced and retracted positions, at least one of the contact pairs being normally closed and at least one of the contact pairs being normally open.

16. An electric switch operable by a key of non-magnetic material having thereon a plurality of magnetic elements arranged in a characteristic pattern; said switch comprising a plurality of magnets, means for movably mounting the magnets to enable their movement between advanced and retracted positions, and a plurality of electric contact pairs in series circuit relationship with each other, one contact pair being operatively connected with each magnet and one contact of each pair being movable with the magnet with which it is connected, thereby making and breaking contact with the opposed contact of the pair as the magnet moves between its advanced and retracted positions, at least one of the contact pairs being normally closed and at least one of the contact pairs being normally open, and the pattern of the magnets connected with the normally open contact pairs corresponding to the pattern of the magnetic elements on the key, whereby to enable upon introduction of the key into the switch the closing of the normally open contact pairs without opening the normally closed contact pairs.

17. An electric switch operable by a key of non-magnetic material having thereon a plurality of magnetic elements arranged in a characteristic pattern; said switch comprising a plurality of

magnets arranged in a pattern corresponding to that of the magnetic elements on the key, a plurality of support members each of which is adapted to mount one of the magnets, means for pivotally attaching the support members to the body of the switch thereby enabling the movement of the magnets between first and second positions, and a plurality of electric contact pairs in series circuit relationship with each other, one contact pair being operatively connected with each magnet and one contact of each pair being movable with the magnet with which it is connected, thereby making and breaking contact with the opposed contact of the pair as the magnet moves between its first and second positions.

18. An electric switch operable by a key of non-magnetic material having thereon a plurality of magnetic elements arranged in a characteristic pattern; said switch comprising a plurality of magnets arranged in a pattern corresponding to that of the magnetic elements on the key, means for movably mounting the magnets to enable their movement between advanced and retracted positions, and a plurality of electric contact pairs in series circuit relationship with each other, one contact pair being operatively connected with each magnet and one contact of each pair being removable with the magnet with which it is connected thereby making and breaking contact with the opposed contact of the pair as the magnet moves between its advanced and retracted positions, and guide means for directing the movement of the key within the body of the switch to position the magnetic elements on the key in registry with the magnets in the switch.

19. An electric switch operable by a key of non-magnetic material having thereon a plurality of magnetic elements arranged in a characteristic pattern; said switch comprising a housing, a face plate having a slot therein, the housing and the face plate forming a guide for the introduction of the key into the switch, a plurality of magnets within the body of the switch and arranged in a pattern corresponding to that of the magnetic elements on the key, means for movably mounting the magnets to enable their movement between advanced and retracted positions, and a plurality of electric contact pairs in series circuit relationship with each other, one contact pair being operatively connected with each magnet and one contact of each pair being movable with the magnet with which it is connected, thereby making and breaking contact with the opposed contact of the pair as the magnet moves between its advanced and retracted positions.

20. An electric switch operable by a key of non-magnetic material having thereon a plurality of magnetic elements arranged in a characteristic pattern; said switch comprising a plurality of magnets arranged in a pattern corresponding to that of the magnetic elements on the key, a plurality of support members each of which is adapted to mount one of the magnets, means for

pivotally attaching the support members to the body of the switch thereby enabling movement of the magnets between advanced and retracted stations, a plurality of electric contact pairs in series circuit relationship with each other, one contact pair being operatively connected with each magnet and one contact of each pair being movable with the magnet with which it is connected, thereby making and breaking contact with the opposed contact of the pair as the magnet moves between its advanced and retracted stations, and guide means for directing the movement of the key within the switch until the magnetic elements on the key are in registry with the magnets in the switch.

21. A key for operating an electric switch comprising a thin, substantially flat and flexible base member comprising fibrous layers of substantial area, and concealed therein without being discernible visually or tactually a plurality of magnetic elements comprising thin wafers of flexible magnetic material having a flexibility that maintains substantially uniform flexibility of the said base member, the magnetic elements being arranged in a pattern corresponding to the pattern of responsive magnets within the switch and adapted to move the same when placed adjacent thereto, thereby operating the switch.

22. A key for operating an electric switch, said key comprising a thin flexible non-magnetic base member introducible into the switch in a plurality of positions but operable in only one such position, indicating means on the base member for indicating the proper introducing position, and a thin flexible magnetic element concealed within the base member in a predetermined position calculated to register with a responsive magnetic member when the key is introduced into the switch said magnetic element having a flexibility that maintains the flexibility of said base member substantially uniform.

HAL COOLEY.

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