June 4, 1957 M. J. NOREGAARD 2,794,869

COMBINATION ELECTRIC SWITCH AND SHEARING APPARATUS

Filed Sept. 17, 1954 2 Sheets-Sheet 1

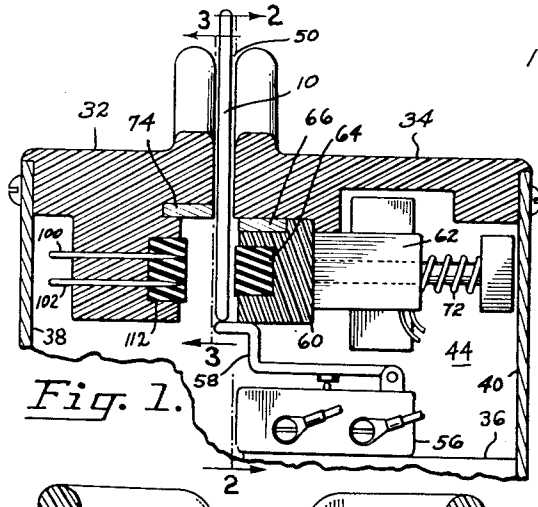


Fig. 1.

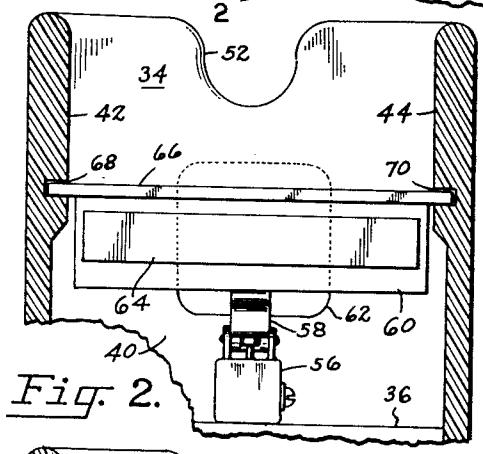


Fig. 2.

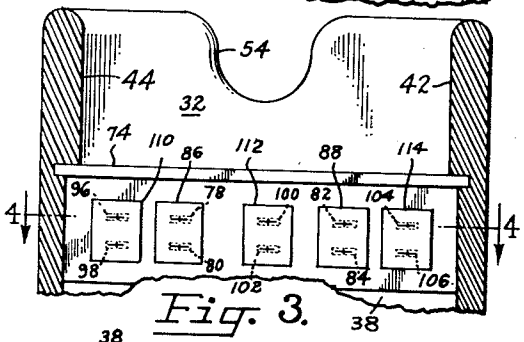


Fig. 3.

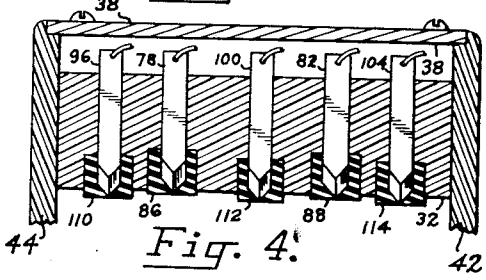


Fig. 4.

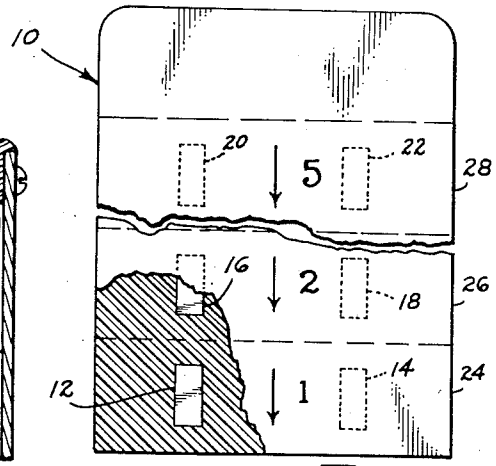


Fig. 10

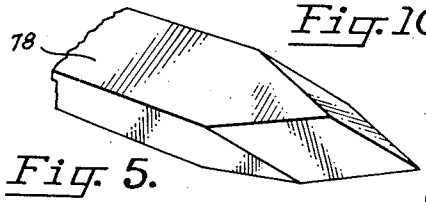


Fig. 5.

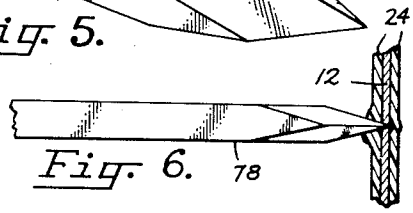


Fig. 6.

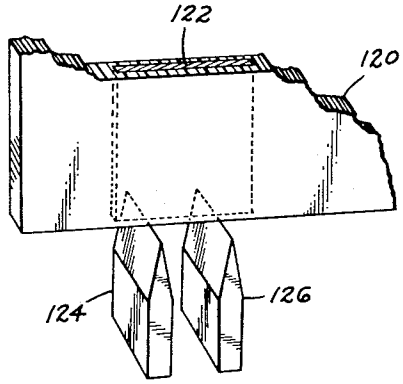


Fig. 7.

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June 4, 1957 M. J. NOREGAARD 2,794,869

COMBINATION ELECTRIC SWITCH AND SHEARING APPARATUS

Filed Sept. 17, 1954 2 Sheets-Sheet 2

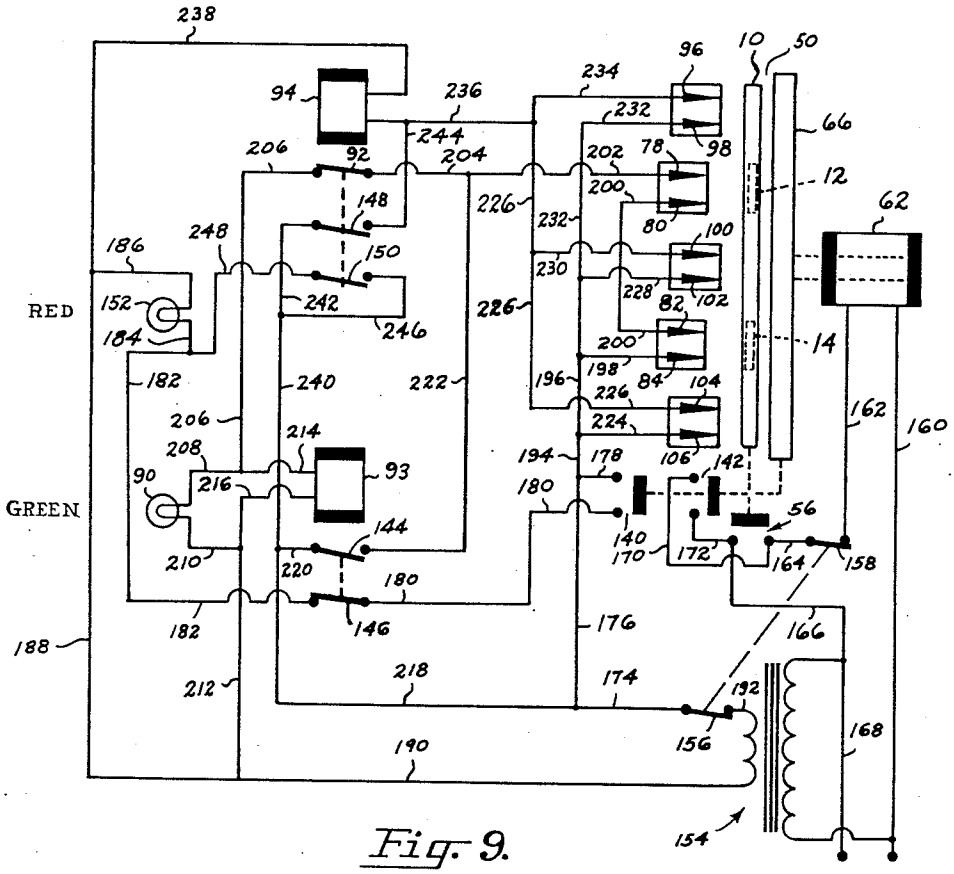


Fig. 9.

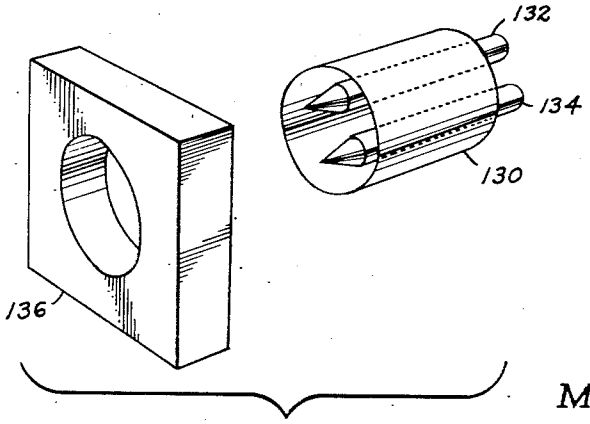


Fig. 8.

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COMBINATION ELECTRIC SWITCH AND SHEARING APPARATUS

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Application September 17, 1954, Serial No. 456,649

13 Claims. (Cl. 200—44)

This invention relates to a switch for making and breaking an electric circuit. More particularly, the invention relates to an electric switch operable by a key, the switch having associated with it shear means for shearing away a portion of the key each time it is used, thereby limiting its service life to a predetermined number of uses.

The presently disclosed electric switch is an improved modification of the electric switches disclosed in Cooley, U. S. 2,566,017, Cooley, U. S. 2,595,769, Noregaard, U. S. 2,648,729, and Noregaard, U. S. 2,689,279. Although electric switches involving features disclosed in the above patents have been highly successful and widely used, their application has been somewhat limited by their sensitivity to vibration. This has made them unsuitable for use in such applications as fare boxes for buses and street cars.

Also, the keys used with the aforementioned switches have been usable for an indeterminate number of operations of the switches. This has rendered the latter unsuitable for use in such applications as turnstiles for athletic events and the like where it is desired to have the keys operable for a limited and predetermined number of uses only.

Still further, since the keys used with the aforementioned switches are not altered when they are used, it has been difficult to detect keys which may have been counterfeited and, if their counterfeiting has been suspected, evidence has not been readily obtainable for proving the fact of counterfeiting.

Accordingly, it is an important object of the present invention to provide an electric switch operable by a key which may be used a predetermined, limited number of times only.

It is another important object of this invention to provide an electric switch which is not sensitive to vibration.

Still another important object of this invention is the provision of an electric switch operable by means of a key, the counterfeiting of which may be readily ascertained and proved.

It is another object of this invention to provide an electric switch which, although useable a predetermined number of times only, permits the holder to ascertain readily how many uses are left.

It is another object of this invention to provide an electric switch having means for checking and ascertaining the identity of persons using the switch.

It is another object of this invention to provide an electric switch operable by means of a key which is difficult to counterfeit.

It is another object of this invention to provide an electric switch operable by means of a key having a very large number of potential combinations, only one of which will energize the given switch.

It is another object of this invention to provide an electric switch which is versatile and may be used in the operation of selected ones of a multiplicity of electric circuits.

It is another object of this invention to provide an electric switch which is simple in construction but positive and dependable in operation.

The manner in which the foregoing and other objects of this invention are accomplished will be apparent from the following specification and claims, considered together with the drawings wherein:

Figure 1 is a sectional view in elevation of the presently described combination switch and shear apparatus;

Figure 2 is a sectional view taken along the line 2—2 of Figure 1;

Figure 3 is a sectional view taken along the line 3—3 of Figure 1;

Figure 4 is a sectional view taken along the line 4—4 of Figure 3;

Figures 5 and 6 are perspective and side elevational views respectively of a penetrating electric contact unit employed in the apparatus of Figures 1–4;

Figures 7 and 8 are views of alternate forms of penetrating electric contact means which may be employed in the apparatus of Figures 1–4;

Figure 9 is a circuit diagram including the apparatus of Figures 1–4; and

Figure 10 is a plan view, partly broken away, of a key which may be used in the apparatus of Figures 1–4.

Generally stated, the presently described electric switch and shear apparatus comprises a housing provided with a guideway adapted to receive a key having thereon one or more electrically conducting elements. Upon insertion into the guideway, the key contacts and actuates a switch which closes a first circuit including a solenoid-operated plunger with attached knife.

The knife shears off a section of the key and forces it against a pair of penetrating, spaced apart, contact points which, together with the device to be operated, are in a second electric circuit. The points contact the electrically conducting material in the key, thereby making the electric circuit through the device to be operated.

If desired, there may be incorporated in the apparatus a third circuit including a second pair of spaced apart, penetrating, contact points and a relay for opening the second circuit. The second pair of contact points are positioned forwardly of the first pair and accordingly will contact any electrically conducting material which may be present in a counterfeit or unauthorized key, opening the second circuit and preventing energization of the device to be operated even though a moment later the first contact points come in contact with the electrically conducting material. This insures that the switch will be operated only by a person holding the proper key.

Considering the foregoing in greater detail and with particular reference to the drawings:

The key which is employed together with the presently described combination switch and shear apparatus is illustrated particularly in Figure 10. Preferably, it comprises a flat, thin card **10** made of several plies of paper or other fibrous material. Between the plies is concealed a thin, longitudinal metal strip or, preferably, a plurality of spaced apart, thin pieces of conducting material which may be arranged in pairs as at **12—14**, **16—18**, and **20—22**. The card may be divided in sections **24**, **26**, **28**, each of which is marked off on the exterior of the card, and each of which comprises a portion of the card which may be used for a single operation of the switch.

The switch itself comprises a housing of suitable construction, for example, one comprising top sections **32**, **34**, bottom plate **36** and the side plates **38—44**. These may be made of plastic or other suitable material which is not an electrical conductor.

Top sections **32**, **34** are spaced apart to form a guide-

way 50 which is of appropriate size to receive the key 10, and which may conveniently be disposed vertically of the switch. They may be provided with finger recesses 52, 54 to facilitate introducing the key into the guideway.

An electric microswitch 56 operated by a lever arm 58 is positioned adjacent the guideway, the lever extending for example across the bottom of the same, where it may be contacted positively by the key. Accordingly, insertion of the key depresses the lever arm, closing the microswitch. This in turn closes a first basic electric circuit which includes drive means for driving the key against electrical contacts which are in a circuit with the device to be operated.

Although various types of drive means may be employed for this purpose, it is preferred to employ a reciprocating plunger 60, operated by a solenoid 62. The plunger carries a rubber block 64 which extends its full length and serves as a target for penetrating electric contact points to be described below. It also carries a knife bar 66 which is guided by grooves 68, 70 in sidewalls 42, 44 of the housing. Upon energization, solenoid 62 drives plunger 60 in the direction of the guideway, compressing spring 72. Then upon deenergization of the solenoid, the spring returns the plunger to the position of Figure 1.

Displacement of plunger 60 with attached knife bar 66 accomplishes two purposes. First, the knife bar, coacting with a cooperating knife bar 74 on the opposite side of the guideway, shears off a section, e. g. section 24, of key 10. This section, together with the electrically conducting pieces 12, 14 which it contains, is carried to the left, as viewed in Figure 1, against the opposite sidewall of the guideway.

Stationed in this sidewall is at least one pair of spaced apart contact units. These are made of electrically conducting material and may have pointed ends, as is particularly apparent from Figures 5 and 6. There may be any number of pairs of such units, but in the illustrated embodiment there are two such pairs 78—80 and 82—84. The pointed ends of the contact units are embedded in blocks 86, 88 of soft, resilient material such as rubber, while their shank portions are frictionally embedded in top member 32 of the switch, which thus serves as a support.

Contact points 78—80, 82—84 are in series with each other in a second basic electric circuit which also includes the device 90 to be operated, which may be a light (green) or motor of suitable design. Still further included in this circuit are a switch 92 and a solenoid 93, the purposes of which will appear hereinafter. It will be apparent, however, that as the severed segment of card 10 is pressed by plunger 60 against rubber blocks 86, 88, the rubber compresses under the impact, whereupon the electrically conducting needles penetrate the key section and enter the electrically conducting elements 12, 14 embedded therein (Figure 6). If switch 92 is closed, this completes the circuit through the device 90 to be operated.

Means also are provided for insuring that the switch will be operated only by an authorized person who carries a key having the pattern of electrically conducting elements illustrated in Figure 10. To this end there is incorporated in the switch a third basic electric circuit including a solenoid 94 which actuates switch 92, this combination serving as a relay to open and close the second electric circuit.

Included together with solenoid 94 in the third electric circuit is at least one pair of spaced apart electric contact units. In the illustrated embodiment there are three such pairs 96—98, 100—102 and 104—106. These, like contact pairs 78—80, 82—84 comprise electrically conducting, penetrating needles. Their forward ends are mounted in soft rubber blocks 110, 112, 114. Their rearward ends are rigidly mounted in a housing which comprises an extension of top plate 32 of the switch assembly.

The needle contact pairs 96—106 are offset from needle contact pairs 78—84 in the direction of guideway 50. Also, as is apparent from Figure 9, they are arranged in parallel in the electric circuit. Accordingly, if the key which is inserted in the guideway contains an electrically conducting element located opposite any one of these contact pairs, or if a knife blade or strip of metal were to be used in place of a key in an endeavor to pick the switch, it would be contacted by one of the contact pairs. This in turn would make the circuit through solenoid 94 which would open switch 92 so that the device 90 could not be operated.

Alternate forms of penetrating electric contact units are illustrated in Figures 7 and 8. In the form illustrated in Figure 7, the key comprises a card 120 comprising a fibrous base in which is embedded a longitudinally disposed core 122 made of an electrically conducting material. The construction of the switch is such that when the key is inserted therein its edge contacts a pair of spaced apart electrically conducting knives 124, 126. These are arranged in pairs and correspond in function to needle pairs 78—84 and 96—106 described above. After each use of the key, a knife bar analogous to knife bar 66 may be applied to shear off a section of the key so that it is usable for a limited number of uses only.

In the embodiment of Figure 8, the card shearing and penetrating means are combined in a single unit. This unit comprises a punch member 130 enclosing a pair of penetrating, electrically conducting needles 132, 134. These are mounted in the switch housing opposite the perforated die member 136. It will be apparent that if the key is placed between the punch assembly and the die, upon actuation of the punch, a section will be cut out and forced through the opening in the die. Further advancement of the punch then will cause electrically conducting needles 132, 134 to penetrate the key and contact an electrically conducting element therein, thereby closing an electric circuit in the manner described above.

For maximum utility and versatility, the electric circuit in which the presently described switch and shear apparatus is included may also include to advantage a pair of normally open micro-switches 140 and 142 which are operated by knife bar 66; a normally open switch 144 and a normally closed switch 146 which are operated by solenoid 93, a pair of normally open switches 148, 150 operated by solenoid 94; a red signal light 152 for use in conjunction with green light 90; a transformer 154 for providing a low voltage circuit in addition to one of high voltage; and a pair of normally closed manual switches 156, 158 which may comprise a double pole switch, or, in the alternative, a pair of delay relays, for breaking both high and low voltage circuits after a predetermined time. The apparatus then will include 10 separate circuits as follows:

The first circuit is a high voltage circuit, e. g. 110 volts, to the transformer. As has been noted above, it has for its function the provision of a low voltage circuit, e. g. one of about 10 volts.

The second circuit is a high voltage circuit having for its function the energization of solenoid 62 for operation of the knife bar. It includes microswitch 56, solenoid 62 and the manually operated, normally closed switch, or time delay relay 158.

The third circuit is a high voltage circuit having for its function holding closed the circuit to solenoid 62. It includes solenoid 62, solenoid operated microswitch 142, and the normally closed, manually operated switch or time delay relay 158.

The fourth circuit is a low voltage circuit and has for its function the energization of the solenoid associated with the device to be operated. It includes the retracted needles 78—84, normally closed switch 92, solenoid 93,

the normally closed, manually operated switch or time delay relay **156**, and transformer **154**.

The fifth circuit is a holding circuit for holding closed the circuit energizing solenoid **93** after the key has been withdrawn from the apparatus. It includes solenoid **93**, switch **144**, switch **92**, manual switch **156** and transformer **154**.

The sixth circuit has for its function activation of the device to be operated, e. g. green light **90**, when the proper key is used. It includes switch **92**, switch **144**, manual switch **156** and transformer **154**.

The seventh circuit has for its function energization of solenoid **94** in the event that a counterfeit key should be used. It includes the advanced penetrating needles **96—106**, solenoid **94**, manual switch **156** and transformer **154**.

The eighth circuit is a holding circuit for keeping solenoid **94** energized after a counterfeit key has been withdrawn from the apparatus. It includes solenoid **94**, switch **148**, manually operated switch or time delay relay **156**, and transformer **154**.

The ninth circuit has for its function the activation of a warning signal such as red light **152**, signifying the use of a counterfeit key. It includes switch **150**, warning signal **152**, manual switch **156** and transformer **154**.

The tenth circuit has for its function activation of the warning signal when a foreign object such as a piece of cardboard, which is not electrically conducting, is introduced into the apparatus. It includes the solenoid-actuated microswitch **140**, normally closed switch **146**, warning signal **152**, manually operated switch or time delay relay **156**, and transformer **154**.

Operation

The operation of the presently described switch and shear apparatus is particularly evident from the circuit outlined in Figure 9. When the key **10** is inserted in guideway **50** it first closes microswitch **56**. This completes the circuit including line **160**, solenoid **62**, line **162**, normally closed switch **158**, line **164**, microswitch **56**, and lines **166** and **168**.

Solenoid **62** drives plunger **64** forwardly, or to the left as viewed in Figure 9. Knife bar **66** which it carries then shears off a section of the key. This section is pressed against all of the contact pairs contained in the switch.

Advancement of plunger **64** also closes the normally open microswitches **140**, **142**. Closing microswitch **142** completes a holding circuit through line **160**, solenoid **62**, line **162**, switch **158**, line **164**, line **170**, microswitch **142**, and lines **172**, **166**, and **168**. This maintains solenoid **62** energized until the circuit is broken by operation of switch or time delay relay **158**, thereby affording time for completion of the various operations of the apparatus.

Closure of microswitch **140** energizes alarm signal **152** if a counterfeit key is employed. This is accomplished by closing the circuit including transformer **154**; line **192**; switch **156**; lines **174**, **176**, **178**; microswitch **140**; line **180**; normally closed switch **146**; lines **182**, **184**; warning signal **152**; and lines **186**, **188**, **190**. The warning signal remains energized until the circuit is broken by opening of manual switch **156**.

The advancement of knife bar **66** also accomplishes the shearing off of a section of the key. This section is pressed against all of the contact pairs contained in the switch. It is pressed first against the outwardly projecting or advanced contact pairs **96—106**. These penetrate the key, but as they enter only the fibrous portion thereof an electric circuit is not established through solenoid **94**. Hence switch **92** remains closed and device **90** remains operable.

Further advancement of the key section pushes it against the retracted contact pairs **78—84**. These penetrate the electrically conducting elements **12**, **14** in the key section which thereupon bridge the gaps between the contact pairs. This energizes green light **90** or other

device to be operated, since current now flows through a circuit including transformer **154**; line **192**; switch **156**; lines **174**, **176**, **194**, **196** and **198**; contact points **82**, **84**; line **200**; contact points **78**, **80**; lines **202**, **204**; normally closed switch **92**; lines **206**, **208**; device **90**; and lines **210**, **212** and **190**.

At the same time current flows through a shunt circuit including line **214**, solenoid **93** and line **216**. Energization of solenoid **93** closes normally open switch **144** and opens normally closed switch **146**. Opening of the latter switch interrupts the circuit to the red light or warning signal **152** so that the latter is not activated when a proper key is employed in the apparatus.

Closing switch **144** establishes a holding circuit including transformer **154**; line **192**; switch **156**; lines **174**, **218**, and **220**; switch **144**; lines **222** and **204**; switch **92**; lines **206** and **208**; device **90**; solenoid **93**; and lines **210**, **212** and **190**. The green light or other device to be operated therefore remains energized after removal of the key until such time as the circuit is interrupted by opening manual switch **156**, or the time delay relay which may be used in its place.

If, in an effort to pick the lock, a strip of metal is inserted in guideway **50**, or if a key having a pattern of electrically conducting elements other than that of key **10** has been introduced, one of two eventualities will occur. First, if contact pairs **78—84** are not bridged by electrically conducting material, device **90** will not operate.

In the alternative, if at least one pair of projecting contact pairs **96—106** penetrates an electrically conducting element, an alternate electric circuit is completed. This includes transformer **154**; line **192**; switch **156**; lines **174**, **176**, **194**, **224**; contact points **106**, **104**; line **226**; and/or lines **196**, **228**, contact points **102**, **100**, and line **230**; and/or line **232**, contact points **98**, **96**, and line **234**. It also includes line **236**; solenoid **94**; and lines **238**, **188**, and **190**.

It will be apparent that when solenoid **94** is energized, normally closed switch **92** will be opened and normally open switches **148**, **150** will be closed. Opening of switch **92** will interrupt the circuit including device **90** and solenoid **93** so that the device will not be operated by the counterfeit key. Closure of normally open switch **150** completes the circuit through the warning signal. This circuit includes transformer **154**; line **192**; switch **156**; lines **174**, **218**, **240**, **246**; switch **150**; lines **248** and **184**; signal **152**; and lines **186**, **188** and **190**. Accordingly the light or other warning signal will be operated in the desired manner.

Closure of normally open switch **148** completes a holding circuit including transformer **154**; line **192**; switch **156**; lines **174**, **218**, **240**, **242**; switch **148**; line **244**; solenoid **94**; and lines **238**, **188** and **190**. This insures that the solenoid **94** and warning signal **152** will remain energized as long as desired, or until manually operated switch **156** is opened.

Warning signal **152** will be energized even though a non-metallic object, as a fibrous card, is used inadvertently or in an effort to pick the switch. Such an object will close microswitch **56**, energizing solenoid **62** and operating plunger **54**. This in turn closes microswitch **140** whereupon a circuit will be closed including microswitch **140**, normally closed switch **146** and warning signal **152**.

After each operation of the switch, plunger **60** is retracted by spring **72**. Also, the section which has been sheared from the key and impaled upon the contact points is stripped therefrom by the resiliency of the soft rubber blocks **86**, **88**, **110**, **112** and **114** in which the contact points are mounted. After having been stripped from the contact points, the severed section drops into a conveniently located receiver, not illustrated, where it may be discarded, or used for evidence or statistical purposes.

Accordingly, it will be apparent that by the present invention I have provided an electric switch which is not sensitive to vibration, and which may be operated a pre-

determined limited number of times by authorized persons only. Part of the key is removed during each use and when the key has been used up, it no longer will operate the switch. Accordingly, the keys may be sold to patrons of transit companies, or to customers at sporting events and used to operate the fare boxes and turnstiles respectively of such organizations.

Furthermore, the switch is substantially pick-proof and if a counterfeit key is introduced into it, part of the key remains behind to identify the user and to be used as evidence. Thus the card may be treated with a special dye which is visible only under ultraviolet light so that a counterfeiter may be detected immediately by a guard. In the alternative, the authorized cards may have a particular secret pattern of fibrous elements, as does currency, so that examination of the sheared sections will reveal whether a counterfeit card has been employed.

Still further, because of the relatively small size of the electrically conducting elements in the key, these may be arranged in a vast number of different combinations, even in a key of relatively small area. Also, the switch is versatile in that the various electrically conducting elements in the key may be used individually to operate different electric circuits. Still further, the switch is rugged, insensitive to shock, and reliable in operation since positive electric contact is made by penetration of the electric contact means into the metal pieces contained in the key.

It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to, as by inserting a time delay mechanism 150 in the circuit with solenoid 62, without departing from the spirit of my invention, or the scope of the subjoined claims.

Having now described my invention, I claim:

1. Electric switch and shear apparatus comprising in combination: key means comprising a base of electrically insulating material having affixed thereto a piece of electrically conducting material; a housing having a guideway for receiving the key means; a first electric circuit, a first electric switch in the first electric circuit positioned adjacent the guideway and operable by the key means when inserted therein, electrically operated drive means in the first electric circuit stationed on one side of the guideway, shear means associated with the drive means; a second electric circuit including an electric device to be operated, a second electric switch in the second electric circuit, a first pair of electric contacts in the second electric circuit positioned on the side of the guideway opposite the drive means; a third electric circuit including electric motor means associated with the second electric switch, and a second pair of electric contacts in the third electric circuit positioned on the same side of the guideway as the first pair but offset therefrom in the direction of the guideway; the electric motor means acting to operate the second electric switch when the third electric circuit is closed through the second pair of contacts; the drive means acting to press the electrically conducting material on the key means against the first pair of contacts, thereby closing the second circuit; and the shear means acting upon actuation of the drive means to shear off the section of the key means carrying the electrically conducting materials.

2. The electric switch and shear apparatus of claim 1 wherein the key comprises a fibrous card having pieces of electrically conducting material embedded therein.

3. The electric switch and shear apparatus of claim 1 wherein the first and second pairs of electric contacts comprise electrically conducting needles adapted to penetrate the key and contact the electrically conducting material thereon.

4. The electric switch and shear apparatus of claim 1 wherein the drive means comprises a solenoid operated reciprocating plunger.

5. Electric switch and shear apparatus comprising in combination a housing having a guideway, a first electric circuit, a first electric switch in the first electric circuit positioned adjacent the guideway, electrically operated drive means in the first electric circuit stationed on one side of the guideway, shear means associated with the drive means, a second electric circuit including an electric device to be operated, a second electric switch in the second electric circuit, a first pair of electric contacts in the second electric circuit positioned on the side of the guideway opposite the drive means, a third electric circuit, electric motor means in the third electric circuit and associated with the second electric switch, a second pair of electric contacts in the third electric circuit and positioned on the same side of the guideway as the first pair but offset therefrom, the electric motor means acting to operate the second electric switch when the third electric circuit is closed through the second pair of contacts, the drive means acting to press an electrically conducting object inserted in the guideway against the first pair of contacts, thereby closing the second electric circuit, and the shear means acting upon actuation of the drive means to shear off the section of the object pressed against the first pair of contacts.

6. Electric switch and shear apparatus comprising in combination: a housing having a guideway, an electric circuit including an electrical device to be operated, a first electric switch in the electric circuit positioned adjacent the guideway, electrically operated drive means in the electric circuit stationed on one side of the guideway, shear means associated with the drive means, a second electric switch in the circuit, first electric contact means in the electric circuit positioned on the side of the guideway opposite the drive means and operable to actuate the second electric switch for disconnecting from the circuit the device to be operated, electric motor means in the electric circuit associated with the second electric switch and operable upon completing the circuit through the first electric contact means to disconnect from the circuit the device to be operated, second electric contact means in the electric circuit positioned on the same side of the guideway as the first contact means but offset therefrom relative to the guideway, the drive means acting to press an electrically conducting object inserted in the guideway against the second contact means, thereby closing the circuit to the device to be operated when the second electric switch is closed, and the shear means associated with the drive means acting upon actuation of the drive means to shear off the section of the object pressed against the second contact means.

7. Electric switch and shear apparatus comprising in combination: a housing having a guideway, a first electric circuit, a first electric switch in the first electric circuit positioned adjacent the guideway, electrically operated drive means in the first electric circuit stationed on one side of the guideway, shear means associated with the drive means, a second electric circuit including an electrical device to be operated, and a pair of electric contacts in the second electric circuit positioned on the side of the guideway opposite the drive means; the drive means acting to press an electrically conducting object inserted in the guideway against the pair of contacts thereby closing the second electric circuit and operating the device to be operated, and the shear means acting upon actuation of the drive means to shear off the section of the object pressed against the pair of contacts.

8. The electric switch and shear apparatus of claim 7 wherein the electrically operated drive means comprises a solenoid-operated, reciprocating plunger.

9. Electric switch apparatus comprising a housing having a guideway, a first electric circuit, a first electric switch positioned adjacent the guideway, electrically operated drive means in the first electric circuit stationed on

one side of the guideway, a second electric circuit including an electric device to be operated, a second electric switch in the second electric circuit, a first pair of electric contacts in the second electric circuit positioned on the side of the guideway opposite the drive means, a third electric circuit, electric motor means in the third electric circuit associated with the second electric switch, a second pair of electric contacts in the third electric circuit positioned on the same side of the guideway as the first pair but offset therefrom relative to the guideway, the electric motor means acting to operate the second switch when the third electric circuit is closed through the second pair of electric contacts, the drive means acting to press an electrically conducting object against the first pair of contacts thereby closing the second electric circuit, and the electrically conducting object acting upon insertion in the guideway to close the first electric switch and actuate the drive means.

10. The electric switch apparatus of claim 9 wherein the electrically conducting object comprises a fibrous card having electrically conducting material embedded therein and the electric contacts comprise spaced apart, electrically conducting needles adapted to penetrate the card and contact the electrically conducting material therein.

11. The electric switch apparatus comprising in combination a housing having a guideway therein, a first electric circuit, a first electric switch in the first electric circuit positioned adjacent the guideway, electrically operated drive means in the first electric circuit and stationed on one side of the guideway, a second electric circuit including an electric device to be operated, and a pair of electric contacts in the second electric circuit positioned on the side of the guideway opposite the drive means, the drive means acting to press an electrically conducting object inserted in the guideway against the pair of contacts, thereby closing the second electric circuit and energizing the electrical device to be operated, and the electrically conducting object acting upon insertion in the guideway to close the first electric switch and actuate the drive means.

12. Electric switch apparatus comprising in combination key means comprising a fibrous base having embedded therein pieces of electrically conducting material; a housing having a guideway for receiving the key means, a first electric circuit, a first electric switch in the first electric circuit stationed adjacent the driveway and operable by the key means when inserted therein, a solenoid-operated, reciprocating plunger in the first electric circuit stationed on one side of the guideway; a second electric circuit including an electrical device to be operated, a second electric switch in the second electric circuit, and a pair of electrically conducting spaced apart needles in the second electric circuit positioned on the side of the guideway opposite the plunger; the plunger acting to press the electrically conducting pieces in the key against the electrically conducting needles, thereby closing the second electric switch and operating the device to be operated.

13. The apparatus of claim 7, wherein the electrically conducting object comprises an elongated key of electrically non-conducting material having hidden therein at longitudinally spaced intervals pieces of electrically conducting material, a section of the key being sheared off each time it is used and the electrically conducting material contained in the sheared off section being adapted to be pressed against the pair of contacts, whereby the key may be used a predetermined number of times to operate the electrical device.

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