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[54] **ELECTRIC SAFETY SWITCH APPARATUS**
 11 Claims, 18 Drawing Figs.

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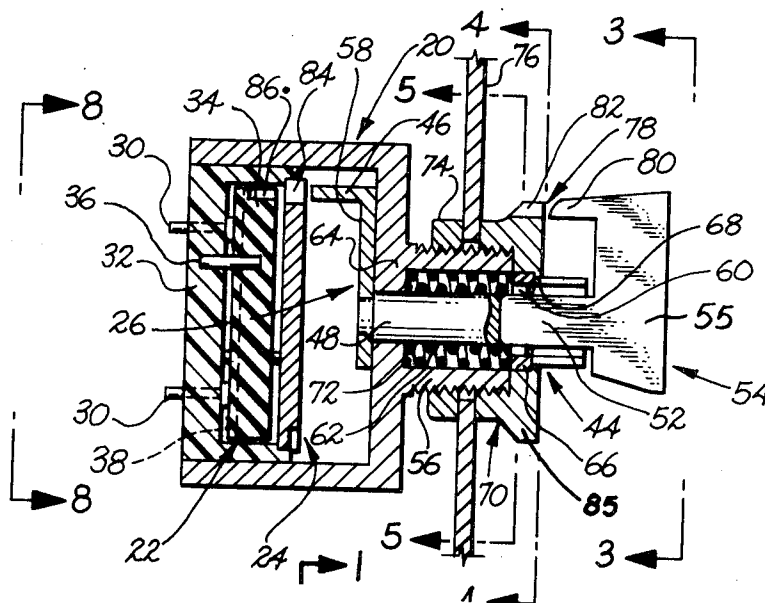
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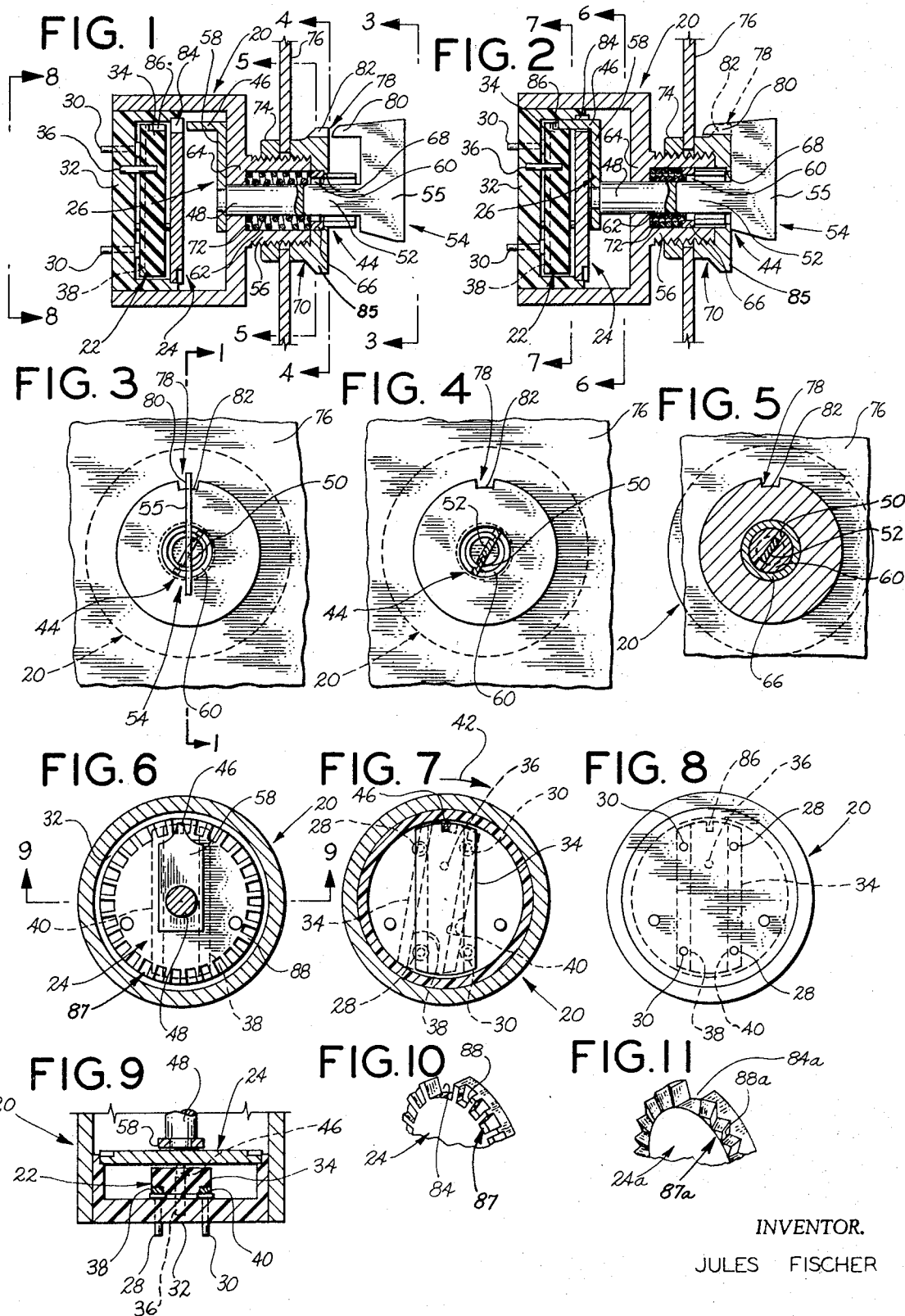
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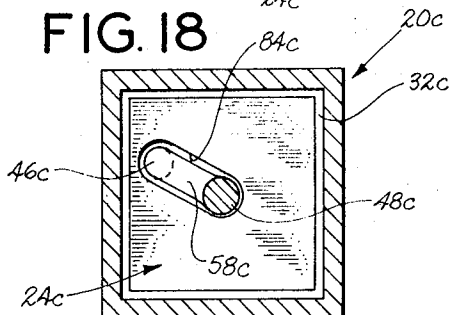
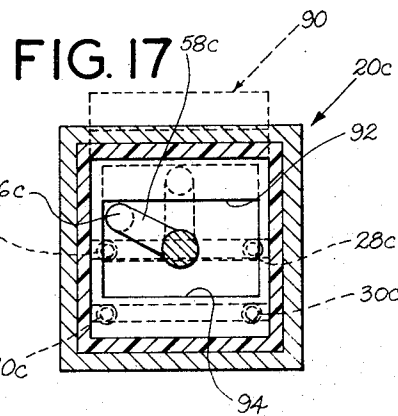
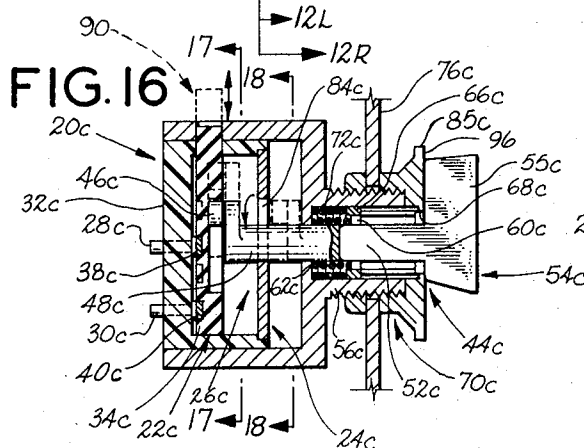
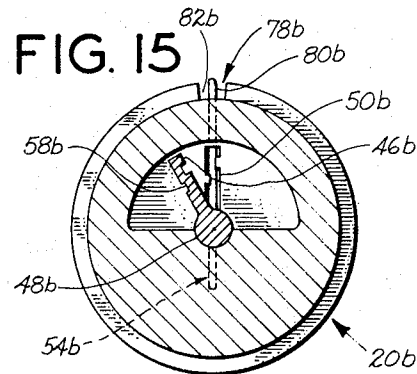
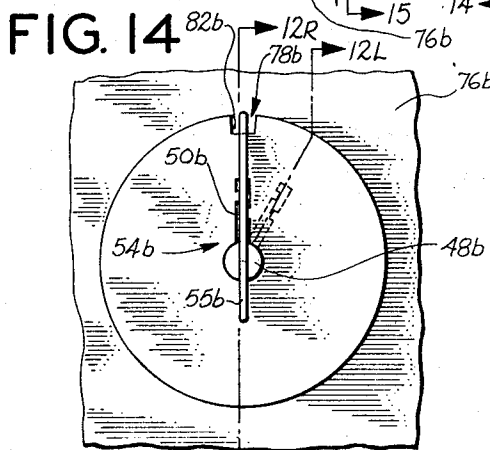
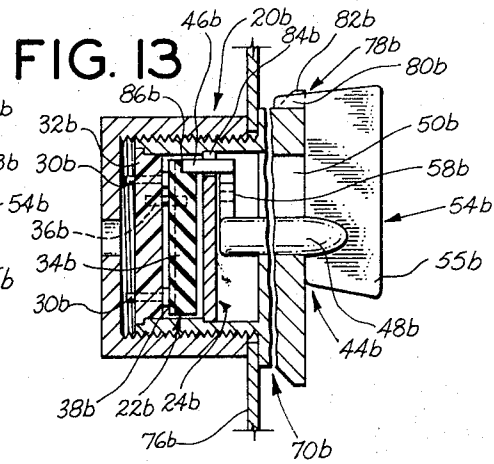
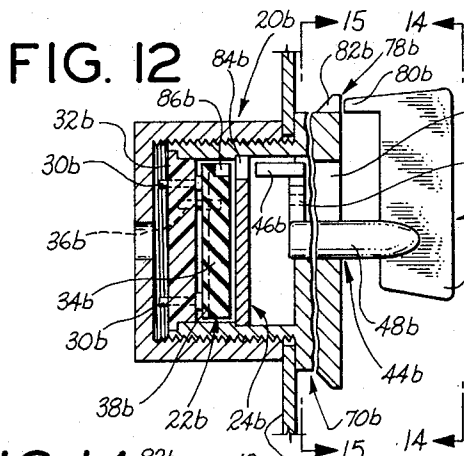
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cluding an electric switch means and controllably movable switch-operating means for actuating the electric switch means between open and closed relationship with respect to an electric circuit adapted to be connected to the electric switch means and further including inactivating means effectively cooperable with respect to the switch-operating means with respect to the electric switch means for effectively preventing the actuation thereof by said switch-operating means when in any position other than a predetermined, switch-engaging, inactivating-means bypassing relationship thereof. The switch-operating means has an input portion, an output portion, and an intervening coupling portion, with said input portion including means adapted to be effectively manually moved to an extent such as to actuate said electric switch means when said switch-operating means is in said predetermined switch-engaging, inactivating-means-bypassing relationship. The apparatus includes means for properly positioning said switch-operating means for manually caused movement into said bypassing relationship when operated by authorized personnel in accordance with a preselected, position-determining manner by said means.

ABSTRACT: An electric safety switch apparatus of a type in-







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AN ELECTRIC SAFETY SWITCH APPARATUS

Generally speaking, the novel electric safety switch apparatus of the present invention includes a movable switch-operating means, an electric switch means, and an intervening, inactivating means arranged under substantially all conditions but one predetermined, effective bypassing and switch-engaging relationship of said elements, to positively prevent said switch-operating means from actually engaging said electric switch means in a manner such as to be capable of actuating same.

In one preferred form, the inactivating means comprises blocking means physically positioned in the path of movement of the switch-operating means for physically blocking and preventing movement of same into engagement with the electric switch means for subsequent actuation of said electric switch means except when said switch-operating means is in said predetermined bypassing and switch-engaging relationship. The switch-operating means comprises an input portion, an output portion, and an intervening coupling portion. The input portion may comprise an externally manually accessible handle part capable of being forcibly manually grasped and operated so as to cause the output portion to be moved forwardly through a bypass notch in said inactivating means and into operating relationship with respect to the electric switch means, or said input portion may comprise a key-receiving means adapted to receive a key therein which can then be used to move the output portion of the switch-operating means in the manner just referred to for forcibly inwardly passing through the notch in the inactivating means and into switch-operating relationship with respect to the electric switch means. Either arrangement, or even a corresponding combination lock arrangement, is intended to be included and comprehended within the broad scope of the present invention. In either case, the input portion and the output portion of the switch-operating means are effectively connected by an intervening coupling portion.

The previously mentioned inactivating means may also include external positioning means, or position-determining means, adapted to externally indicate or determine the proper position of the input portion of the switch-operating means so that it will be in said bypassing relationship whereby forcible inward movement thereof will cause it to extend through the notch in said blocking means, comprising a part of said inactivating means, positioned between said switch-operating means and said electric switch means. Said positioning, or position-determining means in one form of the invention may comprise a radially offset receiving means positioned in the forward path of travel of a corresponding rotary-position-determining portion of a key whereby to allow a central portion of such a key to be inserted in a central key-receiving means and to then rotate the switch-operating means until said position-determining portion of said key is rotatively engaged with said positioning means, or position-determining means, at which time said key may be forcibly moved forwardly whereby to correspondingly forcibly move said switch-operating means (which is in said predetermined bypassing position) forwardly and through a bypass notch in the blocking plate means of said inactivating means into engaged relationship with said electric switch means.

In one exemplary form of the invention, said switch-operating means and said intervening blocking plate means may comprise parts of an electric circuit means adapted to be electrically connected to a remaining portion of an electric circuit means, a suitable electric power supply means, and a perceptible signal-producing means whereby to cause a perceptible alarm signal to be produced when said switch-operating means is forcibly moved forwardly by an unauthorized person into a nonaligned, nonbypassing, and electrically contacting relationship with said blocking plate means of said inactivating means.

In one exemplary embodiment of the invention, the operation of the electric switch means by an authorized person using a proper key, or using a connected externally accessible

input portion of the switch-operating means without such a key, may be arranged to also either lock or unlock a bolt, or other mechanical fastening device, in a predetermined relationship relative to the actuation of the electric switch means into either a switch-closed or a switch-open relationship, or vice versa, as the bolt, latch, or other mechanical locking device is correspondingly either locked or unlocked, or vice versa.

With the above points in mind, it is an object of the present invention to provide a novel electric safety switch apparatus wherein only an authorized person having a proper key, or a proper complete operating means which is functionally the equivalent of a key and which is insertable from the outside of the complete unit, can effectively override switch-inactivating means comprising a part of the apparatus so that an electric switch can be actuated into either open or closed position, or vice versa, either with or without the accompaniment of a corresponding actuation of a mechanical locking means.

It is a further object of the present invention to provide a novel safety electric switch apparatus of the character referred to herein, generically and/or specifically, and which may include any or all of the features referred to herein, either individually or in combination, and which is of extremely simple, inexpensive, easy-to-manufacture, and easy-to-use construction suitable for mass manufacture at extremely low, initial capital cost and per-production-item cost and suitable for the purposes outlined herein or for any substantially equivalent or similar purposes—all such as to be conducive to the widespread and large-scale manufacture and sale thereof.

Further objects are implicit in the detailed description which follows hereinafter (which is to be considered as exemplary of, but not specifically limiting, the present invention), and said objects will be apparent to persons skilled in the art after a careful study of the detailed description which follows.

For the purpose of clarifying the nature of the present invention, four exemplary embodiments are illustrated in the hereinbelow-described figures of the accompanying two sheets of drawings and are described in detail hereinafter.

FIG. 1 is a vertical, central plane, sectional view of one exemplary embodiment of the present invention taken substantially along the plane and in the direction indicated by the arrows 1—1 of FIG. 3 and shows the device during an initial stage of insertion of a key into the key-receiving slot for subsequent full insertion thereinto in the manner shown in FIG. 2 and subsequent rotation for operating the electric switch in the manner best shown in FIG. 7. Certain portions of the device are shown in full elevation, certain portions in section, and certain portions fragmentarily broken away from full elevation into section—all for the purpose of providing the maximum disclosure of various details of the invention in this single view.

FIG. 2 is a view similar to FIG. 1, but shows the device in the next-subsequent stage of the key-insertion operation such as to cause the operating arm of the switch-operating means to be moved through the bypass notch in the blocking plate into switch-actuating relationship with respect to the electric switch means, but shows the apparatus prior to rotation for the purpose of operating the electric switch means.

FIG. 3 is a front elevational view of the apparatus of FIG. 1 as seen along the plane and in the direction indicated by the arrows 3—3 of FIG. 1.

FIG. 4 is a view taken along the plane and in the direction indicated by the arrows 4—4 of FIG. 1.

FIG. 5 is a view taken substantially along the plane and in the direction of the arrows 5—5 of FIG. 1.

FIG. 6 is a view taken substantially along the plane and in the direction of the arrows 6—6 of FIG. 2 and clearly shows the front or operating portion of the switch-operating means in the predetermined bypassing relationship with respect to the blocking plate.

FIG. 7 is a view generally similar to FIG. 6 but taken along the plane and in the direction indicated by the arrows 7—7 of FIG. 2, which shows in broken lines the next sequential step of

the three steps illustrated in FIGS. 1, 2, and 7 for operating the electric switch means.

FIG. 8 is an opposite end elevational view from that shown in FIG. 3 and is taken substantially along the plane and in the direction indicated by the arrows 8—8 of FIG. 1.

FIG. 9 is a fragmentary, partially broken-away, sectional view taken substantially along the plane and in the direction indicated by the arrows 9—9 of Fig. 6 and most clearly illustrates the detail of the exemplary electric switch means as seen in a vertical direction at right angles to the showing thereof illustrated in FIGS. 1 and 2.

FIG. 10 is a fragmentary, partially broken-away perspective view of the exemplary first form of circular, disc-shaped, blocking-plate means and the rotary engagement means taking the form of serrated tooth means of a face ring gear type and clearly showing one exemplary form of the bypass notch means carried by said blocking plate means.

FIG. 11 is a view similar to FIG. 10, but illustrates a modified form of the blocking-plate means and the rotary engagement means carried thereby.

FIG. 12 is a view generally similar to FIG. 1, but is a composite view consisting of a right and a left portion shown in section along slightly different sectional planes, with the right portion of the device shown in FIG. 12 to the right of the section line 15—15 being taken along a plane and in a direction substantially as indicated by the arrows 12R—12R of FIG. 14 and with the remaining left portion of the apparatus shown in FIG. 12 being taken substantially along the multiplane section line indicated by the arrows 12L—12L of FIG. 14. This is for the purpose of providing the maximum disclosure of the nature of this modification of the invention in this single figure. This view shows the combination key and switch-operating means in an initial stage of insertion into the device and subsequent clockwise rotation of the necessary small extent to permit switch-operating engagement with the electric switch means.

FIG. 13 is a multiplane sectional view of the same general type as previously described in connection with FIG. 12, but shows the device after the combination key and switch-operating means has been further inserted axially toward the left into the device so as to cause the forward operating arm portion of the switch-operating means to pass through the bypass notch means of the blocking plate into engagement with the electric switch means. However, this view shows the apparatus prior to subsequent rotation of the key for causing the operation of the electric switch means in a manner generally similar to that illustrated in FIG. 7 of the first form of the invention.

FIG. 14 is a view taken substantially along the plane in the direction indicated by the arrows 14—14 of FIG. 12.

FIG. 15 is a view taken substantially along the plane and in the direction indicated by the arrows 15—15 of FIG. 12 and is partly a cross-sectional view and partly an elevational view.

FIG. 16 is a view generally similar to FIG. 2, but illustrates a modified form of the invention including a locking bolt, and shows it with the key in fully inserted position and also in switch-operating, rotated position, thus differing from the showing of FIG. 2 of the earlier form of the invention illustrating the apparatus in preswitch-operated position. It should be understood that in this view the right portion of the apparatus comprises a vertical central plane, sectional view while the left portion of the apparatus comprises a vertical sectional view just to the left of the arcuately leftwardly displaced end of the forwardly projecting operating arm. This combination of two different planes in the single view comprising FIG. 16 is employed because it maximizes the extent of the disclosure shown in FIG. 16.

FIG. 17 is a cross-sectional view taken substantially along the plane and in the direction indicated by the arrows 17—17 of FIG. 16.

FIG. 18 is another cross-sectional view taken substantially along the plane and in the direction indicated by the arrows 18—18 of FIG. 16.

Generally speaking, the present invention relates to an electric safety switch apparatus which is adapted to control one or more electric circuits, legitimately accessible only to certain authorized persons, and which may, in certain forms, also include a mechanical lock such as a bolt, latch, or the like, associated with the electric switch means. There are numerous places where such a locked switch can be employed, such as in controlling electrical circuits associated with electrically energizable means for locking and unlocking cash boxes, cash drawers, cupboards, doors, safes, and machinery which is not intended to be capable of operation by unauthorized personnel, and the like.

The novel apparatus of the present invention provides an electric switch and lock apparatus which can be actuated or operated only in a very special manner which is known only to an authorized person, but is unknown to any unauthorized person.

According to a broad aspect of the present invention, there is provided an electric switch means including switch contacts and a controllably movable switch-operating means for operating or actuating said electric switch means to open and close one or more electric circuits. The apparatus also includes inactivating means which, in one form, may include a blocking device, or means, blocking the movement of the switch-operating means and thereby preventing it from operating or actuating the electric switch means except when the switch-operating means is first preset to a predetermined switch-engaging and inactivating-means-bypassing position.

In the exemplary first form of the invention illustrated in FIGS. 1—10 inclusive, a housing such as is indicated generally at 20 carries therein an electric switch means, such as is indicated generally at 22, inactivating means taking the form of a blocking plate means, such as is generally indicated by the reference numeral 24, and switch-operating means, such as is generally indicated by the reference numeral 26.

In the exemplary first form illustrated, the electric switch means, generally indicated at 22, includes a first pair of switch contacts 28 and a second pair of switch contacts 30. This is to provide for the opening and closing of two distinct electric circuits, one of which includes the two switch contacts 28 and the other of which includes the two switch contacts 30. However, this is exemplary only and the invention is not limited specifically to two pairs of contacts, but may include one pair of contacts or any desired plurality of pairs of contacts for opening and closing a corresponding number of electric circuits.

In the example illustrated, the outer ends of the contacts are shown extending to the rear of the rear insulating plate 32 of the housing, but are not illustrated as being provided with any particular type of conventional electric terminals or fittings adapted to be engaged by corresponding wire ends or electric terminal fittings of corresponding electric circuit portions (not shown) adapted to be controlled by the electric switch means 22. This is because such electric terminals and connection fittings are well known in the art and do not touch upon the real inventive concept of the present invention.

In the example illustrated, the electric switch means 22 also includes the movable body member 34 made of electrical insulating material and pivotally mounted by the pivot pin 36 to the rear wall 32 of the housing 20 so that the entire movable body member 34 of the electric switch means 22 is capable of rotation around the pivot pin 36 in a manner such as is clearly shown in FIG. 7 wherein one position thereof is shown in solid lines and another rotated position thereof is shown in broken lines. The rear face of the movable body member 34 carries two longitudinal, electrically conductive strip members, one of which is designated by the reference numeral 38 and the other of which is designated by the reference numeral 40.

The longitudinal, electrically conductive strip member 38 is adapted to engage the two contact members 28 when the entire switch is in closed position, such as is shown in solid lines at 34 in FIG. 7, while the other longitudinal, electrically conductive strip member 40 is adapted to close and electrically

connect the other pair of electrical contacts 30, when the switch body member 34 is in the switch-closed position indicated in solid lines at 34 in FIG. 7. Thus it will be understood that when the switch body member 34 is rotated in the direction of the arrow 42 in FIG. 7, each of the two longitudinal, conductive strips 38 and 40 is effectively pivoted around the pivot pin 36 into the broken line position shown in FIG. 7 where the lower ends of said two longitudinal, electrically conductive strip member 38 and 40 are out of engagement with the lower contacts 28 and 30, respectively, thus effectively opening each of the two electric circuits including the left pair of contacts 28 and the right pair of contacts 30, respectively.

The above-described rotation of the switch body member 34 between the switch-closed position shown in solid lines at 34 in FIG. 7 and the switch-open position shown in broken lines at 34 in FIG. 7 is accomplished by the switch-operating means, indicated generally at 26, in a manner which will be described in detail hereinafter.

In the exemplary first form of the invention, the switch-operating means, indicated generally at 26, comprises an input portion, indicated generally at 44, an output portion 46, and an intervening coupling portion 48. In the exemplary form illustrated, the input portion 44 takes the form of a key-receiving slot 50 and a central insertion portion 52 of an operating key indicated generally by the reference numeral 54, and having a handle portion 55, while the intervening coupling portion comprises a rotary shaft 48 mounted within the hollow bushing or boss 56 and connected, at its inner end, by a transverse, radially directed arm 58 to the outer, longitudinally directed, forwardly projecting operating-arm portion 46, which comprises the previously referred to output portion of the switch-operating means 26.

In the example illustrated, the outer end of the rotary shaft 48 has a circumferential enlargement or annular flange 60 fixedly mounted thereon and abutting the outer end of a biasing spring 62, which has its inner end pressed against a centrally apertured wall portion 64 so that the entire switch-operating means 26 is normally biased outwardly or toward the right as viewed in FIGS. 1 and 2. An outer ring 66 is positioned immediately radially outwardly of the flange 60 and is retained in position by reason of its abutment with a radially inwardly directed lip 68 formed in an outer collar, indicated generally at 70, so that the outer ring 66 is positively retained against the outer end of a key-biasing outer spring 72 and which has its other end also pressing against the centrally apertured wall portion 64.

The previously mentioned outer collar 70 is interiorly threaded and is adapted to be threaded onto the exteriorly threaded bushing or boss 56 which has had previously threaded thereon a nut 74 so that a wall, such as is shown fragmentarily at 76, may be clamped between the threaded nut 74 and the threaded collar 70, as is clearly shown in both FIGS. 1 and 2.

The previously referred to inactivating means, generally designated by the reference numeral 24, may also be said, in a broad sense, to include a position-determining or positioning means for determining the position of the complete switch-operating means 26 so that it will be in exactly the right position (which constitutes a predetermined position because of the construction of the key indicated at 54), which may be referred to as the switch-engaging or inactivating-means-bypassing position clearly shown in both FIGS. 1 and 2. In the first exemplary form of the invention illustrated, said positioning or position-determining means is generally designated by the reference numeral 78 and comprises two portions including a rotary, angular, position-determining handle-carried offset insertion or projection element or member 80 carried by the handle of the key 54 and a corresponding, rotary, angular, position-determining offset receiving slot 82 carried by the outer rim 85 of the outer collar 70.

The arrangement is such that the central insertion portion 52 of the key 54 is initially twisted so as to be in a predeter-

mined angular relationship with respect to the angular relationship of the key-carried offset insertion element 80. This angular relationship is such that when the key-carried offset insertion element 80 is aligned with the slot 82 in the collar 70, the inner forwardly projecting operating arm 46 of the complete switch-operating means 26 is exactly aligned with a bypass notch or opening 84 positioned, in the example illustrated, at the top of the blocking plate 24 so that forcible forward movement (actually leftward movement as viewed in Figs. 1 and 2 in sequence) of the key 54 and of the complete switch-operating means 26 from the normal outwardly biased position shown in Fig. 1 into the fully inserted position shown in Fig. 2, not only moves the offset insertion element 80 into the receiving slot 82, but similarly moves the forwardly projecting operating arm 46 through the notch 84 and into engagement with a small notch 86 in the upper end of the previously mentioned main switch body 34 so that a very slight rotation of the outer handle of the key 54 in a clockwise direction as viewed from the right side of FIG. 2 (which is the direction indicated by the arrow 42 of FIG. 7) will rotate the switch body member 34 from its switch-closed, solid-line position shown in FIG. 7 into its switch-open, broken-line position shown in FIG. 7. This small degree of rotation is permitted by the arcuate extent of the slot 82 in the first example illustrated, although it may be permitted by so constructing the slot 82 and the insertion element 80 as to cause them to become disengaged when the key is moved into the fully inserted relationship shown in FIG. 2, but to be initially engaged therewith during the initial phases of the insertion movement for rotary angular position-determining purposes.

It should be noted that if an incorrect key is used, or if an unauthorized person attempts to operate the electric switch means indicated generally at 22 by the insertion of some other makeshift key or flat, spatulate element such as a screwdriver blade, or the like, into the slot 50 and then forces same inwardly with the intent of subsequently rotating same in the direction of the arrow 42 of FIG. 7 for operating the electric switch means 22, it will be found that this cannot be accomplished because such an unauthorized person will not know what angular position the key-receiving slot 50 should be in for the forwardly projecting inner operating arm 46 to be in the predetermined bypass position such that when forced inwardly, it will pass through the notch 84 and into engagement with the electric switch 22 in the manner shown in FIGS. 2 and 7. Instead, the chances are extremely great that the unauthorized person will position the slot 50 in the wrong position and when he forces it inwardly, the forwardly projecting operating arm 46 will strike some portion of the blocking plate 24 other than that portion which has the bypass slot 84. This will positively prevent any unauthorized operation of the electric switch means 22 and will also position the forwardly projecting arm 46 in engagement with the rotary engagement means 87 best shown in FIGS. 6 and 10 in one exemplary form wherein it comprises a plurality of teeth 88 which will positively prevent any rotation of the forwardly projecting operating arm 46 and, indeed, of the complete switch-operating means 26.

Furthermore, the engagement of the forwardly projecting operating arm 46 with the rotary engagement means 87 may comprise the effective closure of what might be termed two switch elements of an alarm unit adapted to be connected thereto (not shown) and also adapted to be connected to a suitable power supply and to include alarm signal producing means (both of which are also not shown, since such are well known in the art) whereby such unauthorized attempted operation of the electric switch means 22 by such an unauthorized person will cause a perceptible alarm signal to be produced.

It will be noted that immediately upon the completion of a switch actuating operation by an authorized person, such as is effectively shown in sequence in FIGS. 1, 2, and 7, the key may be manually rotated back to its original position and the previously inwardly directed manual force exerted thereon

may be removed, which will allow the biasing spring 62 to move the complete switch-operating means outwardly into disengaged relationship with respect to the electric switch means 22, as shown in FIG. 1, and the outer key-biasing spring 72 will forcibly move the outer ring 66 outwardly and thus effectively move the key 54 outwardly also into a removal position such as is shown in FIG. 1.

FIG. 11 illustrates a very slight modification of the rotary engagement means 87 of the exemplary first form of the invention as best shown in FIGS. 6 and 10. Therefore, similar parts of the FIG. 11 modification are designed by similar reference numerals, followed by the letter *a*, however. It will be noted that the blocking plate, indicated at 24a in Fig. 11, bears the slightly modified rotary engagement means 87a which comprises teeth 88a shaped slightly differently from those shown at 88 in FIG. 10. Otherwise, this modification is essentially the same as the first form of the invention and no further detailed description thereof is thought necessary or desirable.

FIGS. 12-15 illustrate a further slight modification of the invention and, therefore, parts which are structurally or functionally equivalent to or substantially similar to corresponding parts of the first form of the invention are designated by similar reference numerals, followed by the letter *b*, however.

In the FIGS. 12-15 modification, it will be noted that the major difference is the fact that what might be termed the operating handle 55b, which is equivalent to the operating handle 55 of the key 54 of the first form of the invention, is now integrally connected to the intervening coupling shaft 48b. The laterally directed member 58b and the forwardly projecting operating arm 46b are all integral and are all removable and insertable by way of a somewhat modified slot 50b. In this modification, the angular relationship between the laterally directed member 58b and the handle member 55b and, in particular, the angular position-determining insertion member 80b effectively corresponds to the angular positioning of the flat insertion tongue 52 with respect to the inner forwardly projecting operating arm 46 and the key-carried position-determining insertion member 80 of the first form of the invention illustrated in FIGS. 1-10. Thus, in the modification of FIGS. 12-15, the handle 55b would initially be turned approximately 30° counterclockwise from its position as shown in FIG. 14 until the member 58b and the forwardly projecting operating arm 46b are aligned with the slot 50b, at which time they are moved forwardly through the slot 50b until the lateral member 58b and the forwardly projecting operating arm 46b lie within the housing 20b in a position such as is indicated in FIG. 12. Then the handle 54b is rotated in a clockwise direction as viewed in FIG. 14 through approximately 30° until the angular position-determining male member 80b is aligned with the angular position-determining slot 82position-determining as shown in FIG. 14, at which time the entire key is moved further inwardly so that engagement of the male and female angular position-determining means 80b and 82b occurs while, at the same time the forwardly projecting operating arm 46b extends through the notch 84b in the blocking plate 24b and into the engagement notch 86b in the body portion 34b of the electric switch indicated generally at 22b in the manner clearly shown in FIG. 13. When this occurs, a slightly further clockwise rotation of the handle 55b will cause actuation of the electric switch 22b in the same manner as that previously described in connection with the first form of the invention and illustrated in FIG. 7. The opposite switch actuating operation is the reverse of the switch actuating operation just described.

FIGS. 16-18 illustrate a further slight modification of the invention and, therefore, parts which are similar to or equivalent to corresponding parts of previously described forms of the invention are designated by similar reference numerals, followed by the letter *c*, however. In this modification, the major difference is the fact that the electric switch means, generally designated by the reference numeral 22c, is of a different type of construction, being vertically slidable rather than rotatable,

also effectively comprising what might be termed a mechanical locking means which, in the example illustrated, takes the form of a bolt or latch indicated at 90. Also in this form of the invention, the blocking plate means indicated generally at 24c is somewhat different in that the bypass notch 84c is not at a top radial extremity of said blocking plate or disc 24c in the manner of the first form of the invention as best shown at 84, but instead is angularly positioned as is most clearly shown in FIG. 18 and comprises an angular cutout shaped like the coupling member 58c and the forwardly projecting operating arm 46c of the complete switch-operating means 26c so that when the key 54c is in the position shown at the right side of FIG. 16, said coupling member 58c and forwardly projecting operating arm 46c are in the intermediate angular position shown in solid lines in FIGS. 16-18 so that, upon forcibly inward depression of the key handle 55c, said coupling member 58c and said forwardly projecting operating arm 46c will be forced inwardly through said cutout recess 84c into a position extending forwardly (or leftwardly as shown in FIG. 16) beyond said blocking plate or disc 24c and with the forwardly projecting operating arm 46c positioned in a recess having top and bottom shoulders 92 and 94, respectively, which function effectively as cam follower surfaces, or abutment surfaces, engaging the forwardly projecting operating arm 46c (which effectively comprises a bolt-operating cam) either along said upper edge 92 or said lower edge 94 depending upon the initial positioning of the combination bolt 90 and body part 34c of the electric switch means 22c. For example, as shown in FIGS. 16 and 17, said forwardly projecting operating arm 46c abuts said upper cam follower edge 92 of the combination bolt 90 and body part 34c so that clockwise rotation of the key handle 55c, when in the position shown in FIG. 17, will move the combination bolt 90 and electric switch body portion 34c upwardly into the position indicated in broken lines in FIGS. 16 and 17. This will move the switch members 38c and 40c out of engagement with the switch contacts 28c and 30c, respectively, and will simultaneously extend the bolt 90 upwardly for locking engagement with respect to any suitable auxiliary device or structure.

Following the above-described operation, the key handle 55c will then be returned to its original position, which will return the forwardly projecting, switch-operating part 46c from its previous upper position as shown in broken lines in FIGS. 16 and 17 into its normal intermediate position as shown in solid lines in FIGS. 16-18, which will allow it to be withdrawn outwardly through the cutout aperture or notch 84c in the intervening locking plate or disc 24c and, of course, the entire key can then be removed.

The switch-closing operation and bolt-opening operation is similar to that described above in that the key is inserted and forced inwardly into a position similar to that shown in FIG. 16, but then the operation changes in that the key handle 55c is then rotated in a counterclockwise direction as viewed from the front so that the forwardly projecting operating arm 46c forcibly abuts the immediately underlying cam follower edge 94 and forces the entire combination bolt 90 and electric switch body part 34c downwardly from the upper broken line position shown in FIGS. 16 and 17 back into its previous solid line position as best shown in FIG. 16, where the electrically conductive switch members 38c and 40c close the corresponding pairs of switch contacts 28c and 30c again in the manner clearly shown in FIG. 16.

The proper initial position of the key handle 55c to properly align the transverse coupling member 58c and the forwardly projecting operating arm 46c with the angularly positioned aperture 84c in the blocking plate 24c may be provided by using a rotary scale in a manner similar to a combination lock on the face 96 of the flange collar 85c if desired, or such correlation may be provided by any other rotary angular position-determining means, such as any of those previously described herein including the flange slot type described hereinbefore, which becomes effectively disengaged with respect to the key when the key is forced inwardly, thus allowing the required

rotation of the key described above to effect upward and downward movement of the combination bolt member 90 and electric switch body part 34c.

Numerous modifications and variations of the invention lie within the broad scope of the disclosure, and all such are intended to be included and comprehended herein. For example, the blocking device, such as the blocking plate 24 shown in FIG. 1, for example, need not be fixed within the housing in all forms of the invention, but might actually be carried by the switch-operating means 26 with an additional stop being carried by or adjacent to the electric switch means 22 or in the path of movement of this modified type of member 24 so as to block the movement thereof except when the switch-operating means is first preset to a position such that the notch is aligned with the stop. Also, a plurality of such blocking devices could be arranged serially in the general manner of a combination lock, with each having to be individually cleared by positioning the switch-operating means to a corresponding preset position before the electric switch means could be operated.

It is also apparent that the present invention may be employed for actuating a variety of different types of electric switch means other than the specific types illustrated, and these may comprise snap-action, pushbutton, one-way, three-way, and multiple other variant switch forms.

It should be understood that the figures and the specific description thereof set forth in this application are for the purpose of illustrating the present invention and are not to be construed as limiting the present invention to the precise and detailed specific structure shown in the figures and specifically described hereinbefore. Rather, the real invention is intended to include substantially equivalent constructions embodying the basic teachings and inventive concept of the present invention.

What is claimed is:

1. An electric safety switch apparatus, comprising: a hollow housing; an electric switch means in said housing; rotatably movable switch-operating means extendable into said housing from the exterior thereof for actuating said electric switch means to open and close at least one electric circuit adapted to be connected to said electric switch means; inactivating means in said housing effectively cooperable with respect to said switch-operating means and with respect to said electric switch means for effectively preventing the actuation of said electric switch means by said switch-operating means when said switch-operating means is in any position other than a predetermined bypassing and switch-engageable position relative to said inactivating means, said inactivating means comprises blocking means physically positioned in the path of movement of said switch-operating means and cooperating therewith for physically blocking and preventing movement of said switch-operating means into switch-actuating engagement with said electric switch means in all relative rotative positions of said switch-operating means except when said switch-operating means is manually rotatively adjusted into said predetermined bypassing and switch-engageable position; said switch-operating means comprising an input portion, an output portion, and an intervening coupling portion, said input portion including manually rotatable means adapted to be effectively, manually rotated to any desired extent, said manually rotatable means having a central part drivingly connected to said intervening coupling portion and also being provided with a positioning and position-determining means' first element and a positioning and position-determining means' second element cooperable in a particular rotative-angular-position-determining, longitudinally relatively movable relationship with said position and position-determining means' first element for determining the corresponding position of said central part of said manually rotatable means of the input portion of said switch-operating means whereby to cause said switch-operating means to be in said predetermined bypassing and switch-engageable position when said first and second elements of said positioning and position-determining

means are in said particular rotative-angular-position-determining relationship.

2. Apparatus as defined in claim 1, wherein said positioning and position-determining means' first element comprises an offset insertion element radially spaced outwardly from said central part of said manually rotatable means of said input portion of said switch-operating means, and wherein said positioning and position-determining means' second element comprises an offset mating receiving slot fixedly mounted with respect to said hollow housing and adapted to receive in a longitudinally relatively movable, but rotatively immovable manner, said offset insertion element of said positioning and position-determining means when said switch-operating means is positioned within said hollow housing in said predetermined bypassing and switch-engageable position.

3. Apparatus as defined in claim 1, wherein said manually rotatable means of said input portion comprises a key having an outer manually graspable operating handle, a forward central insertion part, and a positioning and position-determining means' first element at a location radially offset from said central insertion part, and further comprises key-receiving means drivingly connected to said intervening coupling portion of said switch-operating means and cooperable with, and adapted to receive, said central insertion part of said key therein for forcible forward movement of said entire switch-operating means when in said predetermined bypassing switch-engageable position only and for forcibly rotating said output portion of said switch-operating means and the electric switch means engaged thereby for actuating said electric switch means.

4. Apparatus as defined in claim 1, wherein said manually rotatable means of said input portion comprises an outer manually graspable operating handle drivingly connected to said intervening coupling portion of said switch-operating means and carrying, at a location radially offset therefrom, said positioning and position-determining means' first element and cooperable for forcible forward movement of said entire switch-operating means when in said predetermined bypassing, switch-engageable position only and for forcibly rotating said output portion of said switch-operating means and the electric switch means engaged thereby for actuating said electric switch means.

5. Apparatus as defined in claim 1, wherein said blocking means comprises a blocking plate positioned effectively between said switch-operating means and said electric switch means and normally effectively, physically isolating and longitudinally axially spacing and separating same from each other.

6. Apparatus as defined in claim 5, wherein said blocking plate is provided with a bypassing front-to-rear directed notch means positioned between said switch-operating means and said electric switch means in a path at a predetermined and specified location such as to allow the effective bypassing in a longitudinal axial direction of said blocking plate by a front part of said output portion of said switch-operating means whereby to effect the rotary coupling of said switch-operating means and said electric switch means only when said switch-operating means is initially manually rotatively adjusted into said predetermined bypassing and switch-engageable position.

7. Apparatus as defined in claim 5, wherein said blocking plate is provided with rotary engagement means engageable by said output portion of said switch-operating means when said switch-operating means is in any position other than said predetermined bypassing and switch-engageable position and is forcibly moved forwardly by an unauthorized person attempting to operate the electric switch means.

8. Apparatus as defined in claim 7, wherein said rotary engagement means is cooperable with said output portion of said switch-operating means when engaged therewith to rotatively immobilize said switch-operating means against manual rotation while in such engagement.

9. Apparatus as defined in claim 19, wherein said output portion of said switch-operating means and said rotary en-

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gement means are electrically conductive and effectively comprise a portion of an electric alarm circuit means adapted to be electrically connected to a remaining portion of such an alarm circuit means which is adapted to be provided with electric power supply means and a perceptible alarm-signal-producing means whereby to cause a perceptible alarm signal to be produced whenever said switch-operating means is forcibly forwardly moved by an unauthorized person into electrically conductive engagement with said rotary engagement means of said blocking plate.

10. Apparatus as defined in claim 1, including mechanical locking means effectively movable, in response to operating

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movement of said electric switch means, between mechanically locked and unlocked relationships.

11. Apparatus as defined in claim 10, wherein said mechanical locking means effectively comprises a portion of said electric switch means cooperable for moving first electric contact means thereof into and out of electrical engagement with second electric contact means thereof whereby to correspondingly close and open said electric switch means in correspondence with the operation of said mechanical locking means between two different conditions.

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