Jan. 18, 1949. W. VON GLAHN 2,459,255

SWITCHING APPARATUS FOR FIRE CONTROL SYSTEMS

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Fig. 1

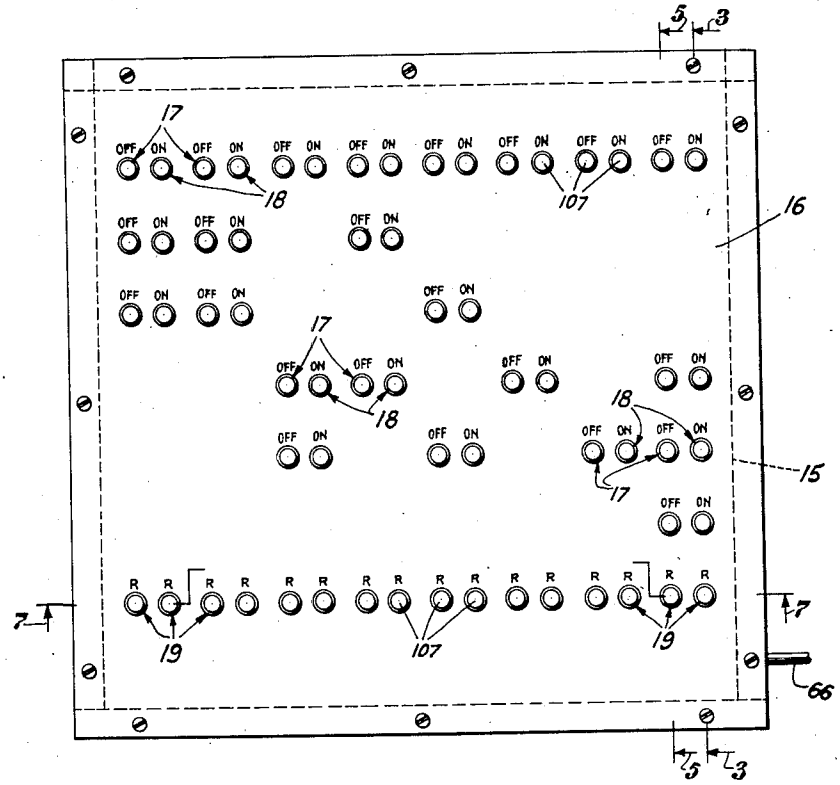
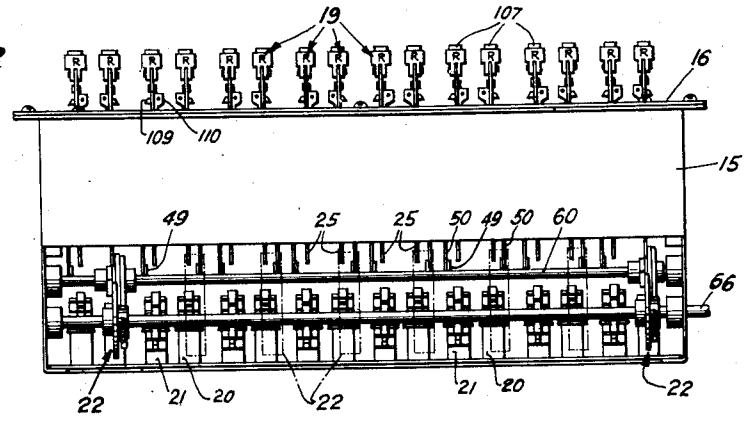


Fig. 2



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Fig. 3

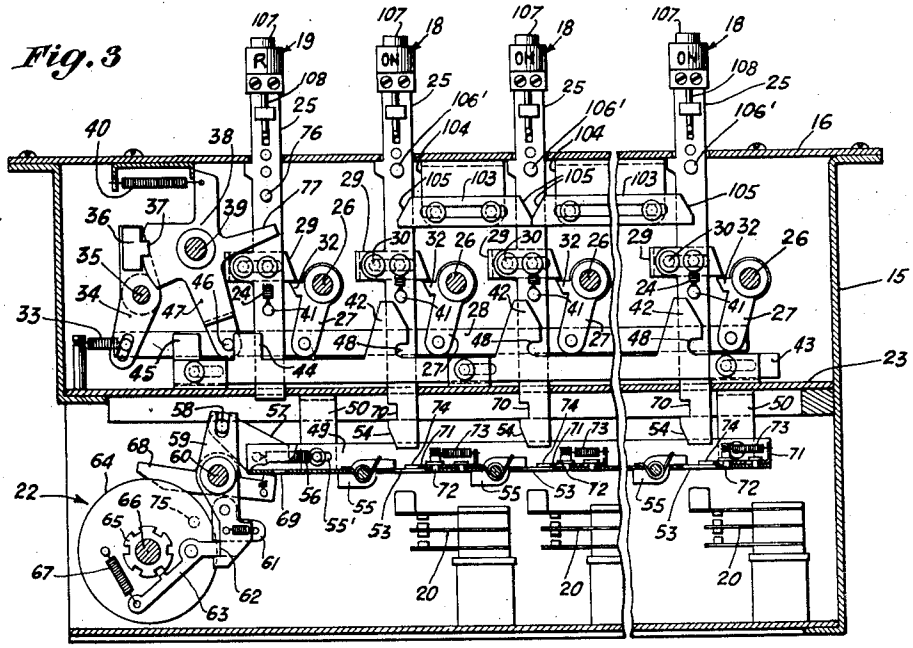


Fig. 4

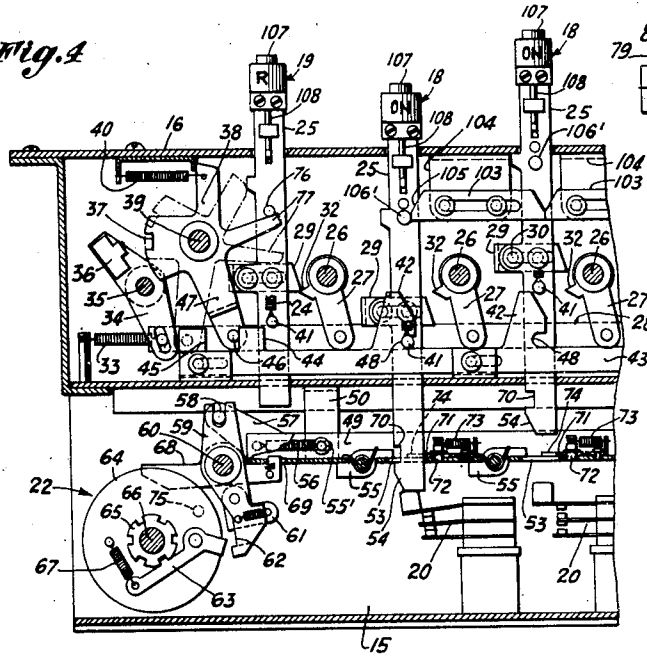


Fig. 13

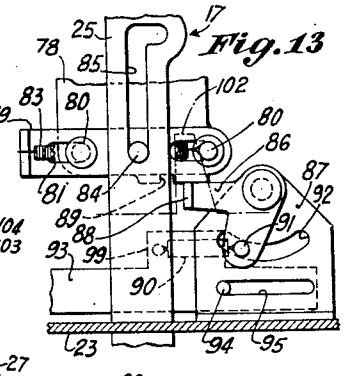
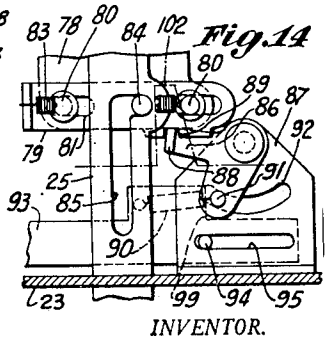


Fig. 14



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SWITCHING APPARATUS FOR FIRE CONTROL SYSTEMS

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Fig. 5

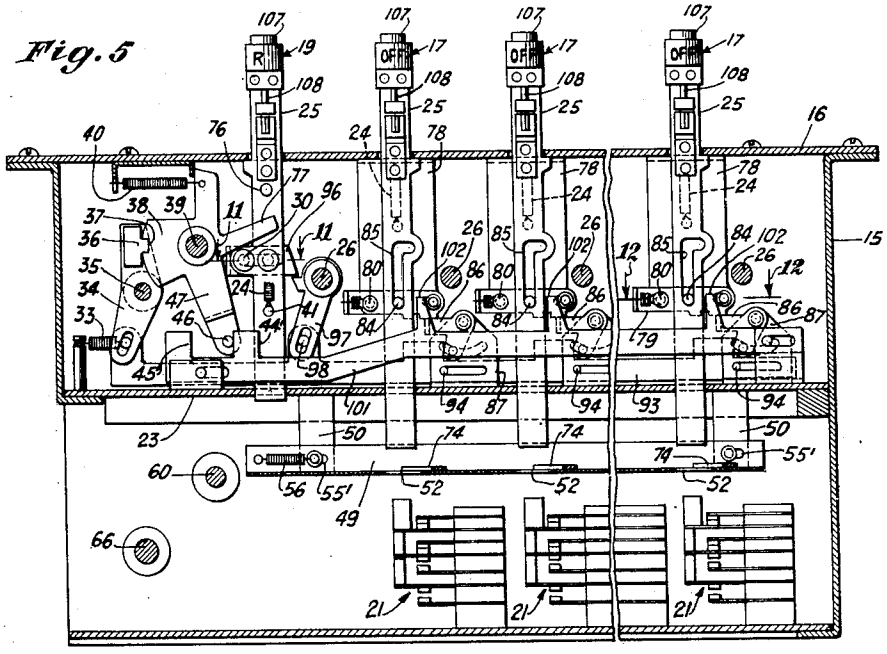


Fig. 6

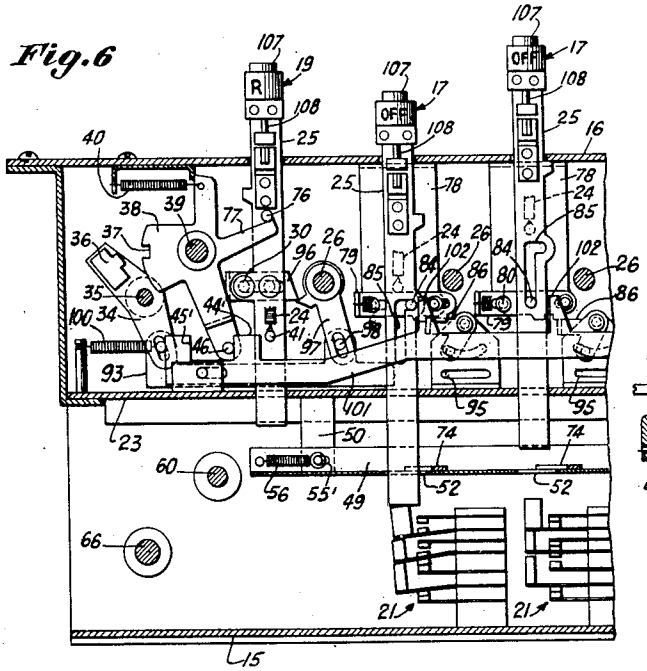


Fig. 11

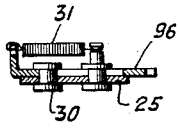
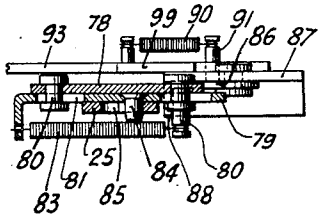


Fig. 12



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SWITCHING APPARATUS FOR FIRE CONTROL SYSTEMS

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Fig.7

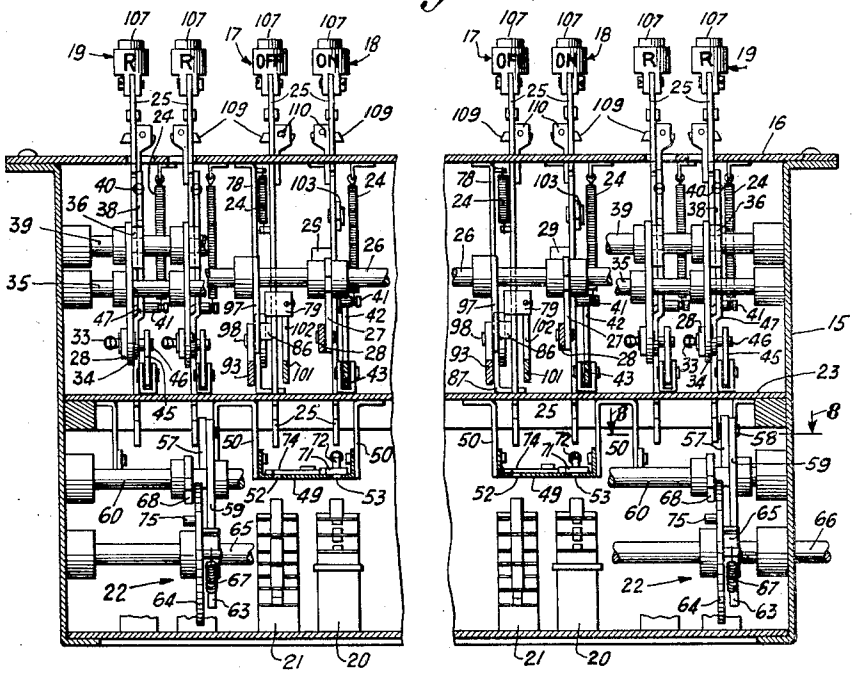


Fig.8

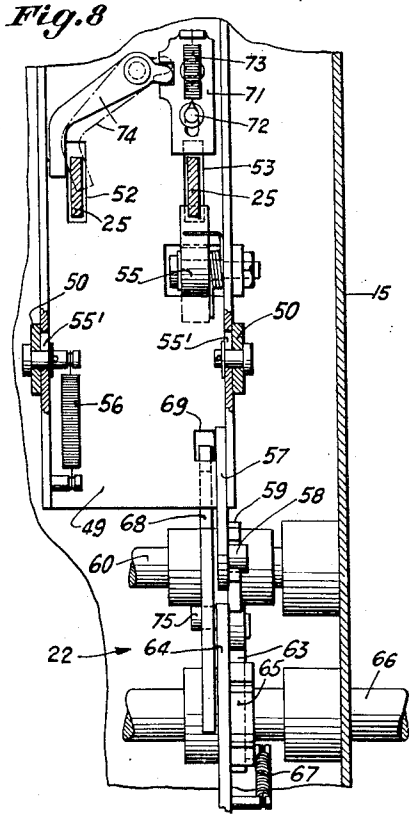


Fig.9

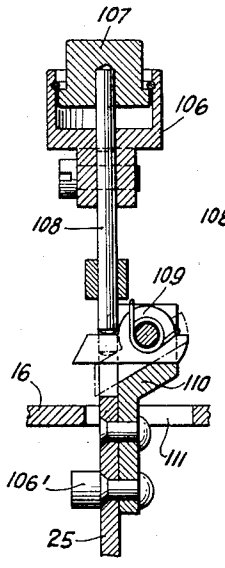
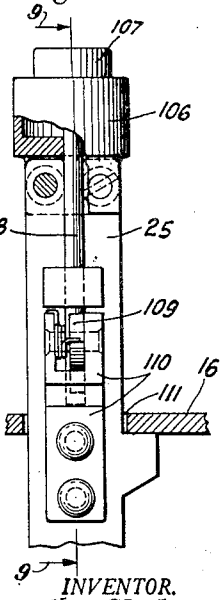


Fig.10



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UNITED STATES PATENT OFFICE

2,459,255

SWITCHING APPARATUS FOR FIRE CONTROL SYSTEMS

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Application October 22, 1947, Serial No. 781,306

11 Claims. (Cl. 74—483)

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This invention relates to improvements in switching systems and has particular reference to a key operated switching apparatus adapted for use in gunnery fire control and like systems.

An object of the invention is to provide an improved apparatus wherein the operation of certain keys result in the same being securely locked against accidental release and wherein means are provided in connection with certain of said keys for preventing the operation of any one of them before the expiration of a predetermined interval of time following the previous operation of another key.

In fire control systems, provision must be made to prevent unintentional operation of the control keys due to blast shocks, or the like. For this purpose, the invention has for another object the provision of an improved construction wherein, by the initial movement of a part of the key relative to another part thereof, a stop member is rendered ineffective to prevent full operation of said key, but which will stop said key from being fully operated should said parts thereof be moved together by the effects of a blast or other pressure thereon.

The inventive idea involved is capable of receiving a variety of mechanical expressions, one of which, for purposes of illustration, is shown in the accompanying drawings; but it is to be expressly understood that said drawings are employed merely to facilitate the description of the invention as a whole and not to define the limits thereof, reference being had to the appended claims for this purpose.

In the drawings:

Fig. 1 is a top plan view of a switching apparatus constructed in accordance with the invention;

Fig. 2 is an end elevation thereof;

Fig. 3 is a fragmentary section on the line 3—3 of Fig. 1, with the keys shown in normal or inoperative positions;

Fig. 4 is a view similar to Fig. 3 showing one of the keys in a column fully depressed and locked and the release key associated with said column in a partially depressed position;

Fig. 5 is a sectional view similar to Fig. 3 taken on the line 5—5 of Fig. 1;

Fig. 6 is a view similar to Fig. 4 showing two keys in fully and partially operated positions;

Fig. 7 is a fragmentary transverse section on the line 7—7 of Fig. 1;

Fig. 8 is an enlarged fragmentary section substantially on the line 8—8 of Fig. 7;

Fig. 9 is an enlarged fragmentary section of

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one of the keys, taken on the line 9—9 of Fig. 10;

Fig. 10 is an elevation, partly in section, taken at right angles to Fig. 9;

Fig. 11 is a section on the line 11—11 of Fig. 5;

Fig. 12 is a section on the line 12—12 of Fig. 5;

Fig. 13 is an enlarged fragmentary elevational view, showing the locking means for certain of the keys illustrated in Fig. 5, with the parts in normal or unlocking position; and

Fig. 14 is a similar view with the parts in their locked position.

The switching apparatus, as illustrated, is designed for use in connection with gunnery fire control systems and is adapted for the selective manual control of director-gun mount interconnections whereby various instruments of the system may be interchangeably connected at will; however, it is not to be considered that the invention is limited to this specific use as it is conceivable that the structure involved may be adapted to other purposes without departing from the spirit or scope of the invention.

As shown in Fig. 1, the rectangular casing 15 has mounted in the top plate 16 thereof a plurality of columns of "off" and "on" keys 17 and 18, alternatively arranged across the casing, with each column having associated therewith a "release" key 19 designed to restore to normal any key in its column which has been depressed to an operative position wherein it has been locked to actuate an individual switch pile 20 (Fig. 3) mounted on the bottom of the casing 15 and controlled by a key 18, or a similarly mounted switch pile 21 (Fig. 5) assigned to each of the keys 17, said switch piles controlling circuits (not shown) for the various director-gun mount interconnections. The arrangement is such that, with respect to each column of keys 18, only one of them may be operated and maintained in a depressed position at a time and the depression of another key in said column will release a previously operated key. Also, in order to avoid the establishment of conflicting interconnections in the system served by the apparatus, each column of keys 18 has associated therewith a time delay mechanism, generally indicated at 22 and to be described later in detail, which insures the lapse of a short, predetermined interval after the operation of one of said keys before another can be fully depressed.

The casing 15 has mounted therein an intermediate horizontal supporting and guide plate 23 which cooperates with the cover plate 16 to form a guide for the vertically disposed keys 17, 18 and 19 which are normally urged upwardly to

their inoperative positions by coil springs 24 having a fixed connection with the cover plate 16, with the lower ends of the springs joined at suitable points to the shanks 25 of said keys.

In Fig. 3, wherein there is shown a column of "on" keys 18 with is associated release key 19, there is provided a series of transversely extending rods 26, one for each transverse row of the keys extending across the casing 15 and each of said rods has mounted for turning movement thereon a crank 27 for each of the keys 18, 19, in said column, with the lower ends of said cranks connected to a common link 28. Intermediate the ends of the shanks 25 of said keys, each of them carries a transversely movable strip member 29 (see also Fig. 11) slotted to receive the guide studs 30 carried by the key shank and having its beveled end urged toward the adjacent rod 26 by coil spring 31. When the keys 18 and 19 are in their normal or released position, the trip member 29 is almost in contact with a projection 32 formed on the associated crank 27 so that the initial downward movement of any one of said keys will cause its trip member 29 to rock the associated crank 27 so as to shift the link 28 to the right, as viewed in Fig. 3, against the tension of the return spring 33 connected to the left hand end of said link. This movement of the link turns a lever 34, which has a slotted connection therewith, about the supporting rod 35 upon which all the levers 34 associated with the columns of keys 18 are mounted. In the normal position of the lever 34 a detent 36 thereon engages in a notch 37 formed in the edge of a trip member 38 which is mounted for oscillation about the rod 39 and which is urged toward its normal position by a spring 40. Immediately after the lever 34 has been rocked to disengage the detent 36 from the notch 37, as shown in Fig. 4, the key 18 being depressed will engage its laterally projecting pin 41, to which the lower end of the key return spring 24 is connected, with the inclined surface of the associated locking portion 42 of the horizontally disposed locking bail 43 which is common to all of the keys 18 in the column in which one of them is being operated. Said lock bar 43 is supported upon the intermediate plate 23 and guided for horizontal movement relative thereto, and is provided at its left hand end with spaced upstanding abutments 44 and 45 between which is disposed a stud 46 carried by the arm 47 of the trip member 38, said stud 46 normally engaging the abutment 44. Thus, as the projecting pin 41 engages the inclined surface of the locking portion 42, the lock bar will be urged to the left and thereby cause its abutment 44 to rock the member 38 clockwise about its supporting rod 39, this movement being permitted at this time due to the fact that the detent 36 has been withdrawn from the notch 37. After the nose of the trip 29 has cleared the projection 32 on the cranks 27, in the continued downward movement of the key, and the pin 41 on said key has been depressed sufficiently to align itself with the recess 48 in the locking portion 42, the spring 33 will become effective to restore the link 28 to its normal position and the spring 40 connected to the member 38 will also return the latter counterclockwise to its normal position and, in so doing, will cause the stud 46 to shift the lock bar to the right so that said pin 41 will enter the recess 48 and the key will thereupon be locked in its depressed position, with the detent 36 returning into engagement with the notch 37 by reason of the restoration of the link 28 and the consequent rocking of the lever 34 in a clockwise direction.

The action which take place as the lower extremity of the key 18 is depressed will now be described. As will be noted from Fig. 1, the columns of "off" and "on" keys are alternately arranged and for each pair of said columns of keys there is provided a shiftable control member 49 of channeled formation supported for movement in a horizontal direction by brackets 50 depending from the intermediate plate 23. For each of the opposed keys 17, 18 in adjacent columns, the associated member 49 is provided, respectively, with openings 52 and 53 (Fig. 8) through which the lower ends of said keys project when they are fully depressed. As the lower extremity of a key 18 enters its opening 53 the beveled surface 54 of said key will engage a spring pressed contact member 55 pivotally supported in a side wall of the control member 49. As said member 55 is engaged by the surface 54 the channel member 49 is cammed to the left a slight distance, due to its slotted connection 55' with the supporting brackets 50, against the tension of its return spring 56, and it is this movement of said member 49 which is designed to control the operation of the time delay mechanism 22 associated therewith. For this purpose, the member 49 is provided at its left hand extremity with an extension 57 having a pin 58 thereon which engages in a bifurcation in the upper end of a lever 59 rockingly supported on the rod 60. In the normal position of the mechanism 22, as shown in Fig. 3, the lower extremity of the lever 59 combines with a pivoted and spring urged latch member 61 on said lever to form a notch 62 for receiving one extremity of a pawl 63 pivoted on a rotatable disc 64. In said normal position, the tooth of said pawl 63 is out of engagement with the teeth of the ratchet 65 carried upon a constantly rotating shaft 66 driven from any suitable source (not shown). However, when channel member 49 is shifted to the left, the extension 57 thereof turns the lever 59 a slight distance counterclockwise to the position shown in Fig. 4 wherein the extremity of the pawl 63 is disengaged from the notch 62. A spring 67 connected at one end to the disc 64 and at its other end to the pawl 63 then causes the tooth of the latter to engage with the ratchet 65, whereupon the shaft 66 will drive the disc in a clockwise direction. At the instant that the channel member 49 was shifted to the left, latch 68 pivoted on the rod 60 and spring urged in a counterclockwise direction engages one end thereof in an opening 69 in the bottom of the member 49 and thus temporarily locks the latter against return movement under the influence of the spring 56 for a predetermined interval of time depending upon the speed of rotation of the shaft 66. Immediately after the shifting movement of the member 49 and the latching thereof, the lower extremity of the depressed key will engage a switch arm of the associated pile 20 to close the contacts thereof, and the notch 70 in the shank of the key will then be aligned with the adjacent extremity of the contact member 55. Before the channel member 49 is shifted by the cam action of the surface 54 of the key, the lower end of the latter will have entered its opening 53 so that the edge of the key opposed to the notch 70 therein is in position to be engaged by the adjacent end of a trip plate 71 (Fig. 8) mounted on the channel member 49 through a pin and slot connection 72 and normally held in the position of Fig. 8 by a retractile spring 73, with the for-

ward edge of said plate 71 overlapping the slot 53. When the channel member 49 is shifted to the left, as described, the leading edge of said trip plate 71 will engage with the adjacent edge of the key shank and will consequently be prevented from moving. The member 49 will then carry the pin 72 to the other end of its slot and thus expand the spring 73. By reason of the plate 71 being held stationary by the key 18 and the relative movement of the member 49, a stop member 74 pivoted on said member and having one end engaged with said plate 71, will be rocked from its full line normal position to the dotted line position of Fig. 8 so that its other extremity will be located directly beneath the slot 52 through which the opposed "off" key 17 is adapted to pass when said key is depressed. However, with the stop member 74 located in its operative position, should the "off" key be depressed during the interval in which the time delay mechanism 22 is effective, the lower end of said key will engage with the stop 74 and thus be prevented from being fully depressed. When the member 49 is shifted, the plates 71 associated with the other keys 18 in the column in which the operated key is located will move with the member 49 since no keys are in the adjacent slots 53. Therefore, said other plates will be so positioned with respect to their slots 53 that they will prevent another key 18 in said column from being fully depressed while the member 49 is temporarily retained in its shifted position by the mechanism 22.

With the member 49 held in its shifted position by the latch 68 and the engagement of the pawl 63 with the ratchet 65, the disc 64 will rotate with said shaft 66 and this rotation will continue until a pin 75 on said disc, which is rotating clockwise, contacts the adjacent end of the latch 68 to rock the same about the rod 60 and thus disengage said latch from the opening 69 in the member 49. Thereupon, the spring 56 becomes effective to restore said member 49 to the right so that an extremity of the contact member 55 will enter the notch 70. Also, the restoration of the member 49 rocks the stop lever 74 to its inoperative position so that the "off" key 17 opposed to the operated key 18 may now be fully depressed if desired. With one of the "on" keys 18 fully depressed and locked, upon restoration of the channel member 49 the lever 59 will be rocked in a clockwise direction so that the inner portion of the spring urged member 61 will be positioned in the path of the short extremity of the pawl 63 as the disc 64 continues to rotate a short distance. Upon engagement of said extremity of the pawl 63 with said member 61 the latter will be swung slightly relative to the lever 59 until said pawl extremity is again aligned with and engaged in the notch 62, whereupon the member 61 will be restored to the position of Fig. 3 and the pawl 63 will be rocked against the tension of its spring 67 to disengage the tooth thereof from the ratchet 65, with the result that the rotation of the disc 64 will be stopped and the parts will again assume their normal positions.

Should it be desired another "on" key 18 in the same column with a key which has been previously depressed, such operation of the former key will cause the release of the second one and its restoration to normal position in the following manner. Upon depression of a second key, the trip member 29 thereof will first operate to turn the associated crank 27 and thus shift the link 28 to the right with the same results as

previously described. Thereafter, the pin 41 on the key now being operated will engage the associated portion 42 so as to cam the bail 43 to the left and when this movement has proceeded sufficiently to disengage the pin 41 of the previously operated key from its notch 48, the spring 24 of the latter key will become effective to restore the latter to its normal position. As said key starts its restoring movement, the contact member 55, which is engaged in the notch 70 at the lower end of the key, will be tripped upwardly against the tension of its spring and after the lower end of the key has cleared said member 55 its spring will restore it to normal.

The restoration of an "on" key 18 by the operation of the associated release key will now be described by reference to Figs. 3 and 4. Upon depression of the key 19, the trip member 29 thereof first rocks the associated crank 27 to shift the link 28 to the right to disengage the detent 36 from the member 38 so that the same will be free to rotate clockwise when a pin 76 on the shank of said key 19 engages the arm 77 of said member 38. The latter is now rotated to the dotted line position shown in Fig. 4 as the key 19 continues its forward movement and after the trip 29 has cleared the projection 32 on the crank 27 the link 28 is restored by the spring 33 thus permitting the lever 34 to move toward its normal position. However, the member 38 has now been rotated to a position wherein the notch 37 is out of registration with the detent 36 and the latter will therefore engage the curved surface of the member 38 at a point below the notch 37. As rotation of the member 38 continues, the pin 46 on the arm 47 thereof will engage the abutment 45 and thus shift the bail 43 to the left so that the pin 41 of any locked key 18 will be released from its notch 48 to permit restoration of said key by its spring 24 in the same manner as previously described. After the release key 19 has been fully depressed to restore said key 18, pressure is removed from the former key and it will then return to normal under the influence of its spring 24. Release of pressure upon the key 19 allows the spring 40 to turn the member 38 toward its normal position and in so doing the pin 46 will restore the bail 43 by contact with the abutment 44, and the detent 36 will re-enter its notch 37, whereupon all the parts will again be in their normal position.

The locking and release of an "off" key 17, as illustrated in Figs. 5, 6, 12, 13 and 14 will now be described. Depression of one of said keys, as shown in Fig. 6, is designed to operate the associated switch pile 21 located directly below the same, and such depression of the key is against the tension of its return spring 24. Depending from the cover plate 16 there is a bracket 78 for each of the keys 17 and the lower end of said bracket slidably supports a lock 79 for transverse movement relative thereto by virtue of the studs 80 on said bracket which extend through slots 81 in the lock 79, a retractile spring 83 connecting one of said studs with the lock in order to urge the same toward its operated or locking position. Said lock carries a pin 84 which engages in a bayonet slot 85 formed in the shank 25 of the key and when in the position of Fig. 13, said pin prevents movement of the lock 79 toward its operative position. When the key 17 is fully depressed the pin 84 will align itself with the lateral extension of said slot and under the influence of the spring 83, the lock 79 will be shifted to the right to cause the pin 84 to enter said slot extension.

In order to retain the lock 79 in its operative position and thus lock the key, the pawl 86 is pivotally mounted upon a bracket 87 supported upon the intermediate plate 23 and has at one end a projection 88 which engages the lower edge of the lock 79 when the latter is in normal position. When said lock is shifted to its operative position, said extension 88 is urged into a notch 89 in the lower edge of the lock member 79, as shown in Fig. 14, this movement of the pawl being effected by a coil spring 90 connecting a pin 91 on the pawl, which rides in an arcuate slot 92 in the bracket 87, with a horizontally extending bar 93 similar to the link 28 of Fig. 3. Said bar is guided for longitudinal movement by engagement of pins 94 thereon in slots 95 formed in the brackets 87 and is only operated, as will presently appear, when the release key 19 is associated with an operated key 17 and is depressed to release the latter key. When the key has been fully depressed, its lower end will project through an opening 52 in the channel member 49 since the stop member 74 associated with said key is then in its inoperative position.

To release the key 17, the key 19 associated therewith is depressed and the first action which takes place will be the engagement of the trip member 96, similar to the members 29, with an extension of the slotted crank arm 97 which is connected to the bar 93 at 98. Said bar is shifted to the right and an abutment 99 thereon then engages the pin 91 on the pawl 86 to release the extension 88 from the notch 89 in the lock member 79. This movement of the bar 93 is against the tension of its coil spring 100 connected to the left hand end of said bar and to which is also joined a lever 34 similar to the one described in connection with the keys 18 and associated with a member 38 such as that previously described. As the downward movement of the release key continues, a pin 76 thereon engages the arm 77 of the member 38 and rotates the latter clockwise so that its pin 46 will engage the abutment 45 on the restoring bail 101. For each of the keys 17, said bail is provided with an upward extension 102 which is disposed alongside of the pin 84 on the lock member 79 so that when the bail 101 is shifted to the left by contact of the pin 46 with the abutment 45, said extension 102 will positively disengage the pin 84 from the locking end of the slot 85 in the key shank so that the pin will be aligned with the vertical portion of said slot and the spring 24 of the key will then return the latter to its normal position. When the key 19 is released, after restoration of the key 17, the former will be restored to its normal position by its spring 24, the spring 100 will restore the bar 93, and the spring 40 will return the member 38 to normal so that its pin 46 will engage the abutment 44 of the bail 101 and thus return it to the normal position thereof.

With the foregoing construction, any number of keys 17 in the same column may be fully operated at the same time, and all of said keys will be released simultaneously upon operation of the key 19 assigned to said column. Means are provided for preventing the simultaneous full depression of two keys 18 in the same column. Said means comprises a plurality of stop members 103 mounted for horizontal sliding movement on brackets 104 suspended from the cover plate 16. These stop members 103 are provided at each end with beveled surfaces 105 and adjacent ends of the members abut each other so that when a pin 106 on any one of the keys 18 engages the beveled surface 105 all of the stops 103 will be shifted laterally to allow said key to be fully depressed. However, should two keys be depressed simultaneously, the pins 106 will be stopped by the surface 105 and further depression of the keys will be prevented.

Each of the keys 17, 18 and 19 is provided with a recessed head 106 (see Figs. 9 and 10) in which is relatively movable a push button 107 carrying a stem 108 that extends downwardly through the head 106, with the lower end of said stem in contact with a spring pressed latch 109 pivotally mounted upon a bracket 110 secured to the portion of the key shank 25 which extends through an opening 111 in the cover plate 16. In the normal operation of a key, the push button 107 is depressed until it engages the bottom of the recess in the head 106 and this downward movement of said button will cause the stem 108 to rock the latch 109 to the dotted line position of Fig. 9 so that further downward movement of the key will permit the latch to pass through the opening 111 with the result that the key may be fully depressed. However, should the key be accidentally depressed, due to a blast shock or otherwise, without relative movement of the button 107 with respect to the head 106, the latch 109 will remain in its normal position and will consequently strike against the surface of the cover plate 16 and thus limit any further depression of the key and thereby avoid unintentional operation of the switch piles 20, 21 associated with said keys.

What is claimed is:

1. Switching apparatus comprising, in combination, keys arranged in columns and opposed to each other, a common locking bail for the keys in one column actuated by any depressed key therein to lock the same in its depressed position, a movable control member having a normal position from which it is actuated by a depressed key projecting therethrough, and means on said control member controlled by the movement thereof and by contact with said depressed key for preventing the full depression of a key in the other column opposed to the first named key.

2. Switching apparatus comprising, in combination, keys arranged in columns and opposed to each other, a common locking bail for the keys in one column actuated by any depressed key therein to lock the same in its depressed position, a movable control member having a normal position from which it is actuated by a depressed key projecting therethrough, a trip element mounted on said control member for engagement by a depressed key and with respect to which said control member is relatively movable when the key is engaged with said trip element, and a stop carried by said control member and actuated by said trip element when said control member is moved, to prevent full depression of a key in another column opposed to the first named key.

3. Switching apparatus comprising, in combination, keys arranged in columns and opposed to each other, a time delay mechanism associated with the keys in said columns, a control member for said mechanism through which said keys are adapted to project when fully depressed, cooperating means on a key in one of said columns and on said control member for actuating the latter as said key is being depressed, means operated by the actuation of said control member to initiate the operation of said time delay mechanism, and means responsive to the actuation of said control member for preventing the full depression of a key in another column opposed to the first named

key during the effective interval of operation of said time delay mechanism.

4. Switching apparatus comprising, in combination, keys arranged in columns and opposed to each other, a time delay mechanism associated with the keys in said columns, a control member for said mechanism through which said keys are adapted to project when full depressed, cooperating means on a key in one of said columns and on said control member for actuating the latter as said key is being depressed, means operated by the actuation of said control member to initiate the operation of said time delay mechanism, a trip element mounted on said control member for engagement by said key and with respect to which said control member is relatively movable when said key is engaged with said trip element, and a stop carried by said control member and actuated by said trip element, when said control member is moved, from an inoperative position to an operative position to prevent full depression of a key in another column opposed to the first named key while said time delay mechanism is operating.

5. Switching apparatus comprising, in combination, keys arranged in columns and opposed to each other, a time delay mechanism associated with the keys in said columns, a control member for said mechanism through which said keys are adapted to project when fully depressed, cooperating means on a key in one of said columns and on said control member for actuating the latter as said key is depressed, a locking bail common to the keys in said column and having a locking portion individual to each of said keys, means on each key engageable with its locking portion to render said bail effective to lock a depressed key in such position, means operated by the actuation of said control member to initiate the operation of said time delay mechanism, and means responsive to the actuation of said control member for preventing the full depression of a key in another column opposed to the first named key while said time delay mechanism is operating.

6. Switching apparatus comprising, in combination, keys arranged in columns and opposed to each other, a time delay mechanism associated with the keys in the said columns, a control member for said mechanism through which said keys are adapted to project when fully depressed, cooperating means on a key in one of said columns and on said control member for actuating the latter as said key is depressed, a locking bail common to the keys in said column and having a locking portion individual to each of said keys, means on each key engageable with its locking portion to render said bail effective to lock a depressed key in such position, individual locking means associated with each of the keys in the other column, a common release bail for said individual locking means, means operated by the actuation of said control member to initiate the operation of said time delay mechanism, and means responsive to the actuation of said control member for preventing the full depression of a key in another column opposed to the first named key while said time delay mechanism is operating.

7. Switching apparatus comprising, in combination, keys arranged in columns and opposed to each other, a time delay mechanism associated with the keys in said columns, a control member for said mechanism through which said keys are

adapted to project when fully depressed, cooperating means on a key in one of said columns and on said control member for actuating the latter as said key is being depressed, means operated by the actuation of said control member to initiate the operation of said time delay mechanism, means responsive to the actuation of said control member for preventing the full depression of a key in another column opposed to the first named key during the effective interval of operation of said time delay mechanism, means to lock the first named key in fully depressed position, a release key in the column in which said locked key appears, a trip member operable by the depression of said release key and having means to actuate said locking means to release a locked key, and means to thereupon restore the latter key.

8. Switching apparatus comprising, in combination, keys arranged in columns and opposed to each other, a time delay mechanism associated with the keys in said columns, a control member for said mechanism through which said keys are adapted to project when fully depressed, cooperating means on a key in one of said columns and on said control member for actuating the latter as said key is being depressed, means operated by the actuation of said control member to initiate the operation of said time delay mechanism, means responsive to the actuation of said control member for preventing the full depression of a key in another column opposed to the first named key during the effective interval of operation of said time delay mechanism, means to lock the first named key in fully depressed position, a release key in the column in which said locked key appears, a trip member, a locking detent for said trip member normally engaged therewith, an operating member for said detent common to all the keys in the last named column, means on each of said keys operable when it is depressed for actuating said operating member to disengage said detent from said trip member, and means on said trip member for actuating said locking means to release a locked key only when said release key is depressed.

9. Switching apparatus comprising, in combination, keys arranged in columns and opposed to each other, a time delay mechanism associated with the keys in said columns and including a continuously operating driven element and an intermittently operable driven member, means to releasably retain the latter element inactive, a control member for said mechanism connected to said retaining means and through which said keys are adapted to project when fully depressed, cooperating means on a key in one of said columns and on said control member for actuating the latter as said key is being depressed, means operated by the actuation of said control member to initiate the operation of said time delay mechanism, and means responsive to the actuation of said control member for preventing the full depression of a key in another column opposed to the first named key during the effective interval of operation of said time delay mechanism.

10. In combination, a key having a head and a shank with the latter adapted to extend through an opening in a plate, a spring urged latch carried by said shank and normally in position to engage said plate to limit movement of said shank through said opening, and means movable relative to said shank and head to render said latch inoperative.

11. In combination, a key having a head and a shank with the latter adapted to extend through an opening in a plate, a spring urged latch carried by said shank and normally in position to engage said plate to limit movement of said shank through said opening, a push button recessed in said head for limited movement relative thereto, and a stem movable with said button and engageable with said latch and operable, upon relative movement of said button, to adjust said latch to an inoperative position.

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The following references are of record in the file of this patent:

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