

Aug. 22, 1933.

H. S. CHASE

1,923,968

CONTROL DEVICE

Filed Feb. 25, 1930

3 Sheets-Sheet 1

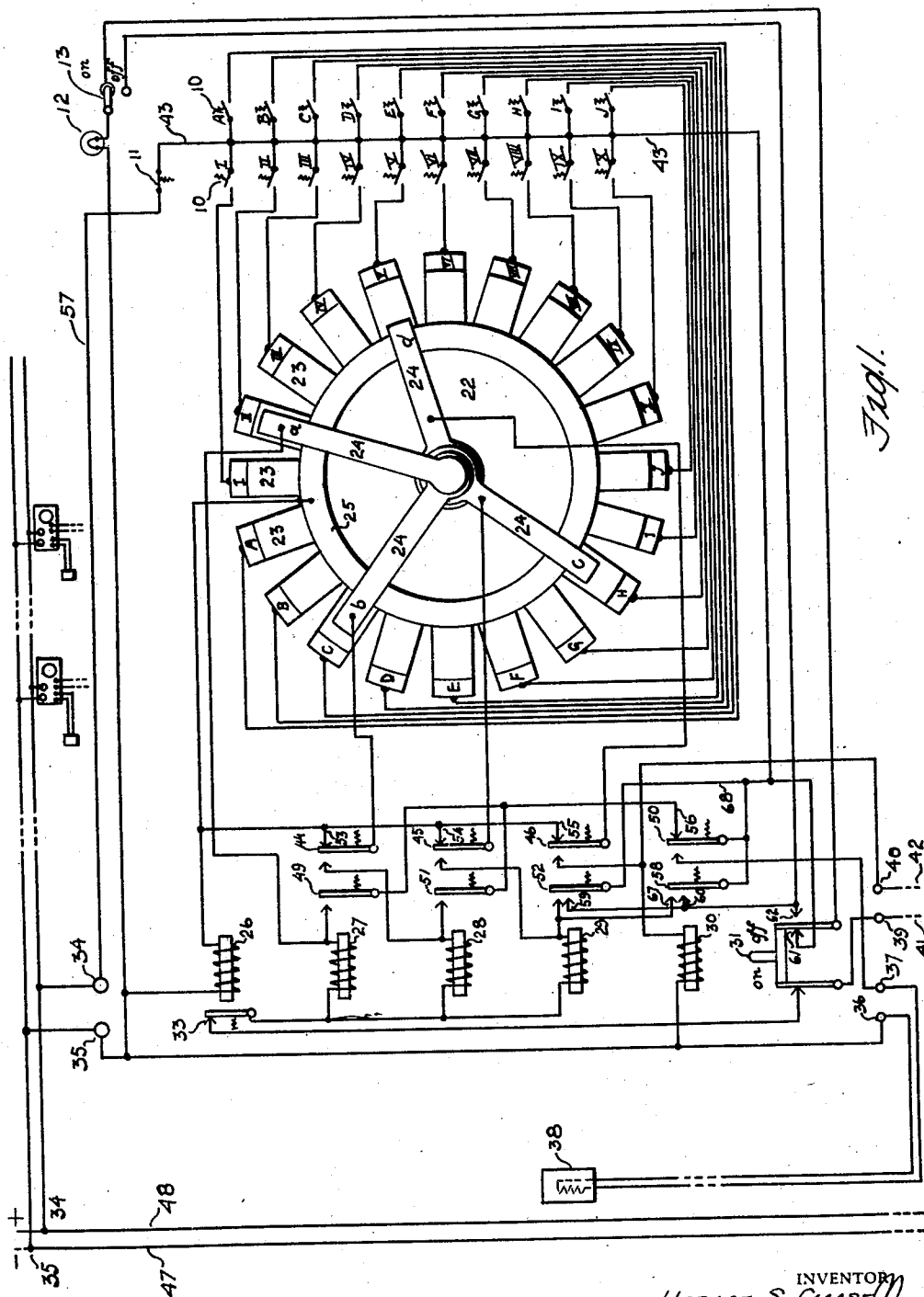


Fig. 1.

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3 Sheets-Sheet 2

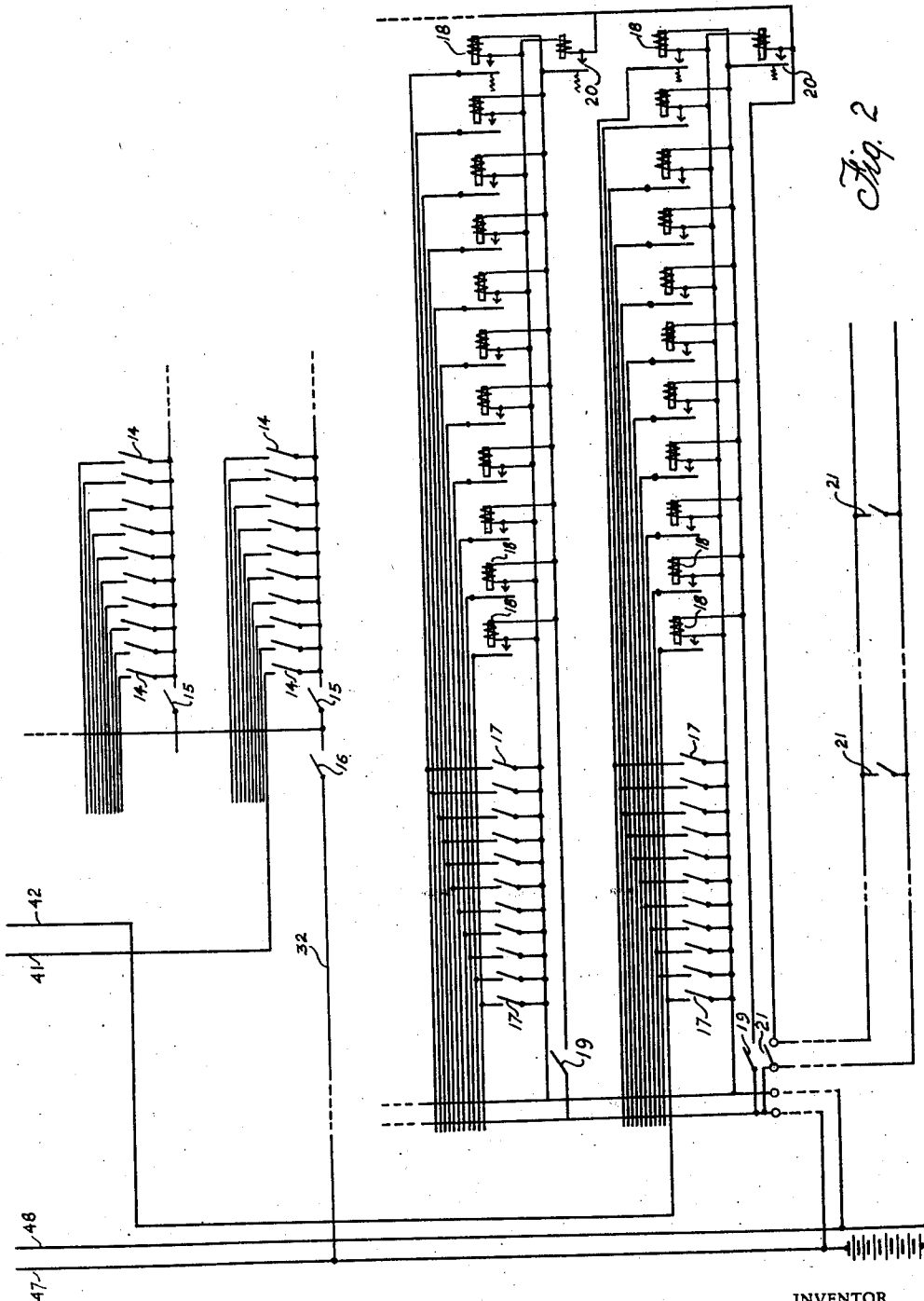


Fig. 2

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3 Sheets-Sheet 3

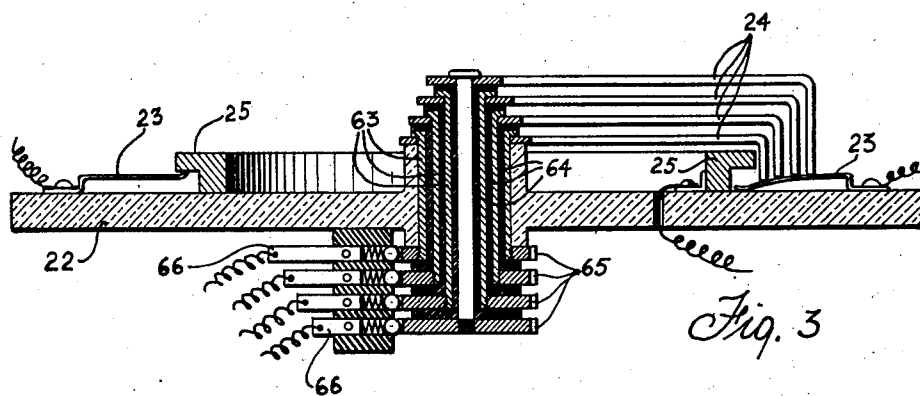


Fig. 3

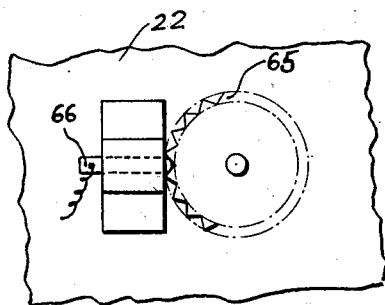


Fig. 4

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UNITED STATES PATENT OFFICE

1,923,968

CONTROL DEVICE

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Application February 25, 1930. Serial No. 431,239

10 Claims. (Cl. 70—63)

This invention relates to a control device and particularly a device for controlling locks or other mechanism, e. g., of the electro-magnetic type. More particularly the invention relates to complementary control devices adapted for operation adjacent or remote from the controlled mechanism. The invention also relates to a combination-operated device adapted to serve as one of said complementary devices.

It is an object of my invention to provide a control which is substantially proof against unauthorized operation and yet can be instantly operated or locked against operation even by authorized persons. It is also an object of my invention to provide a simple remote control by which a large number of separately controlled mechanisms may be controlled from a single switchboard placed at any convenient location or locations so as to operate or lock against operation any one or more of said mechanisms or all of them together.

With this object in view my invention includes a combination-operated locking and/or release device, a remote locking or release operating device, and a device for rendering the combination-operated device temporarily inoperative. My invention also includes various combinations of elements as more fully described and claimed below. In its broader aspect my invention has many applications in widely diverse fields, some of which will be suggested and some more fully described below by way of example and many others of which will suggest themselves to those skilled in the art. However, in order to simplify the description of my invention I have shown in the drawings and shall describe in detail below the particular embodiment of my invention which is especially adapted to use in hotels and similar apartment buildings.

In the management of hotels considerable difficulty has been experienced with the usual key-operated locks. Guests are continually forgetting to turn in their keys upon leaving the hotel and thus a considerable expense for new keys is required. With the same locks used for the various rooms over long periods of time and for many different guests all of whom at one time or another have keys in their possession, the lock can hardly be considered secure; and theft from rooms of guests is very difficult to prevent. Furthermore, the chambermaids and other servants whose duties require them to enter the rooms of guests must have keys to the rooms. When my invention is applied to the locking of hotel rooms a degree of security and

flexibility of control in the locking of rooms is attained which has never before been possible.

When my invention is used each guest, instead of being given a key, will be given a card with the combination written upon it. In the case of a four-unit combination the probability that anyone would be able to open the lock without knowing the combination is only 1 to 116,280, that is to say, there are 116,280 different combinations which may be used; if, however, one did not know that the mechanism was not adapted to use the same number twice in a single combination then the change against his being able to open the lock without knowing the combination would be very much greater.

When a guest leaves the hotel the combination can be instantly changed by a simple manipulation requiring almost no mechanical skill, and thus no one but the guest and the room clerk need know what the combination is that will open the lock of any room. If the guest should fail to pay his bill or for any other reason it should become necessary or desirable to lock him out from his room, a switchboard in the office or beside the room clerk's desk controls the combination; and by a simple movement of a switch on this board any room or all rooms may be locked so that they cannot be entered even by the use of the proper combination.

Another switchboard which may be located in the office or beside the room clerk or in any other location where it will be under proper supervision, controls the locks so that any or all locks may be released. Thus, in case of fire it is possible by manipulation of a single switch to unlock all of the doors in the building and thus permit firemen or hotel employees to arouse all of the guests. Or, if for any other reason it becomes necessary or desirable to enter one room without using the combination, the manipulation of the switch associated with the lock in that room will release the lock and permit entrance. The same or a similar switchboard may also be used to set the combination so that it may be operated by less than all or preferably by a single number of the combination. This makes it possible to give to servants only one number of the combination and to set the combination so that that number will unlock the doors during such time as they are working in the rooms but will not unlock the door at any other time during the day. Thus, even the servants have no means of unauthorized entrance to the rooms outside of the

hours during which their duties require them to enter.

In the preferred form of the invention means are provided whereby each guest may from inside the room, render the lock control inoperative either by the full combination or by any part of it but without disturbing the control by the emergency switchboard already referred to.

In the drawings I have illustrated a preferred example of my invention.

Figure 1 and Figure 2 illustrate connected portions of an installation such as would be used in a hotel;

Figure 2 continues from the bottom of Figure 1 so that when these figures are placed edge to edge they will form a single figure;

Figure 3 is a cross-section through the selector switch used in changing the combination which will open the lock; and

Figure 4 is a fragmentary plan view taken from the bottom of Figure 3.

The electrical combination lock control illustrated in Figure 1, may consist of a push button panel having a number of operating push button switches 10, each designated by a letter or numeral and each adapted to make a contact when pushed, a reset button 11 adapted to break contact when pushed, an electric lamp 12 and lamp switch 13; a combination selector switch; and a relay panel.

Throughout the drawings I have used small tension springs to indicate switches which are normally held open or closed.

The central locking panel, illustrated at the top of Figure 2, includes a bank of switches 14, (one switch for each lock), arranged in any desired groups and advantageously with master switches 15 and 16 as later described.

The central release panel, illustrated at the bottom of Figure 2 includes a bank of switches 17, (one switch for each lock), arranged in any desired groups, a bank of room relays 18 also in any desired groups, each group of room relays advantageously being arranged to be controlled either by a group master switch 19 or by a group master relay 20. The group master relays 20 are in turn controlled by a house master switch or switches 21. Additional house master switches may be located at different points with a view to use in case of fire, etc. Closing any group master switch operates all room relays in that group and closes the same lock operating circuits as would be closed by operating all combination lock controls at the various rooms in the corresponding group. Closing the house master switch operates all group master relays which in turn operate all room relays and hence closes the same lock operating circuits as would be closed by operating all combination lock controls of all rooms represented on the central release panel.

Combination room lock control

The combination room lock control is shown as a novel electrical device operable only by pushing the exact buttons of the combination and in the exact predetermined order without any others intervening. It is adapted to operate the lock electro-magnetically. The combination is set up by closing the predetermined push button switches 10 on the push button panel in the required order. The required combination is predetermined by the combination selector switch 22, both as to the particular buttons in the com-

bination and the order in which they must be pressed. When the preceding buttons in the combination have been pressed in their proper sequence, the lock unlocks when, and remains unlocked only so long as, the last button in the combination is pressed.

Referring to the drawings, and particularly to Figures 1 and 3, it will be seen that the combination selector switch 22 has a number of contact springs 23; one for each operating push button on the push button panel; a number of selector arms 24 and a reset ring 25. Each selector arm 24 may be set in electrical contact with any of the contact springs 23. The contact springs 23 normally make contact with the reset ring 25, but when a selector arm 24 is set on any contact spring the latter is depressed as clearly shown in Figure 3 and contact with the reset ring 25 is thereby broken. The contact springs corresponding to the push buttons in the selected combination are those on which the selector arms are set, these particular springs being depressed by the selector arms from contact with the reset ring and making contact instead with the selector arms as shown by the selector switch, detail on Figure 3 of the drawings. The number of selector arms provided is equal to the number of characters which it is desired to use in the operating combination.

In Figures 3 and 4 an advantageous form of selector switch is illustrated more in detail. In this form the arms 24 are connected to concentric conducting sleeves 63 which are independently rotatable about each other and are insulated from each other by the concentric insulating sleeves 64. To the bottom of each of the sleeves 63 is secured a conducting wheel 65 preferably in the shape of a star wheel and the brushes 66 serve both to form an electrical contact and to hold the selector arms 24 in the desired position.

The combination which operates the lock may be changed at will by changing the setting of one or more of the selector arms. The only restriction upon the characters comprising a combination is that none shall appear more than once in each combination.

With a push button panel having twenty operating buttons and a combination selector switch having four selector arms as shown in the drawings there are possible 116,280 four-button combinations.

The relay panel consists of a reset relay 26 and one combination relay 27, 28, 29 and 30 for each selector arm 24 of the combination selector switch 22.

The invention also includes a guests' room switch 31 which may be mounted on the cabinet containing the electric combination lock control if that is in the wall of the room or any other convenient place on the wall or floor of the room or apartment.

The operating push button switches 10 make contact when pressed: in operating the combination these buttons are merely pressed momentarily and released. These buttons return to their normal positions and break contact, when pressure is released. The reset button switch 11 on the push button panel breaks contact when depressed and returns and remakes contact when pressure is released.

Central locking panel

The central locking panel illustrated in Figure 2, includes switches or switch keys 14 of the

single pole, single-throw type, one switch for each lock in the system. These switches may be arranged in groups, e.g., one group for each floor. These switches are normally closed, but may remain either in the open or closed position. In series with each switch group is a group reset push button switch or switch key 15; and a master reset push button switch or switch key 16 is provided in the main lead in series with all switches. These master push buttons, switches or switch keys 15 and 16 are normally closed; they break contact when operated and return to their normally closed position when released.

Central release panel

The central release panel is shown as provided with a switch or switch key 17 for each lock in the system. These switches are of the single-pole, single-throw type, normally open but adapted to remain either in the open or closed position. These switches may be arranged in groups, e. g. one group for each floor. Across each switch is bridged the contacts of a relay 18, normally open. All of the relays 18 corresponding to one group of switches 17 are arranged to be operated by the closing of a group master switch or switch key 19. Across each of these master switches is bridged the contacts of a master relay 20, normally open. All of these master relays are in turn arranged to be operated when a house master switch 21 is closed. These group and house master switches are also shown as of single-pole, single-throw type and are normally open but adapted to remain either in the open or closed position. The house master switches 21 and the group master switches 19 may be multiplied, i.e. other switches may be connected in parallel at other locations.

Returning to the relay panel each of the relays 27, 28 and 29 is provided with a pair of switches 44 and 49, 45 and 51, and 46 and 52 respectively. In each case the switch shown closest to the solenoid is connected to the panel bus 43 and thence to the power line, the switch 52 being connected directly through the conductor 68 and the switches 49 and 51 being connected through the contact 56 of the switch 50 associated with the relay 30. Each of these switches 49, 51, 52 therefore serves when the relay is once operated to shunt the solenoid circuit across the push button and selector switches and thus to hold its relay closed after the push button switch 10 is released. The switches 44, 45 and 46 which are shown farther from the solenoids are double-throw switches normally spring-pressed against the contacts 53, 54 and 55. In this position these switches serve to connect the arms *b c* and *d* of the selector switch to the winding of the reset relay 26. When, however, the solenoids 27, 28 and 29 respectively, are energized the corresponding switches 44, 45 and 46 will be separated from the contacts 53, 54 and 55 respectively, and moved to the opposite contacts, in which position they serve to connect the arms *b c* and *d* of the selector switch with the windings of the solenoids 28, 29 and 30 respectively.

The solenoid 30 also has associated with it two switches 50 and 58. The switch 58 serves through the contact 67 to energize the winding of the solenoid 29 by shunting its circuit around the push button switches 10, and the selector switch 22 to the panel bus 43. A second contact 60 of the switch 58 serves to close a circuit through the light 12 so that the corridor near the panel board will always have at least the illumina-

tion of the lamp 12 whenever the lock is opened. A parallel contact 59 in the switch 52 serves also to illuminate the light 12 so long as the relay 29 is closed. The switch 50 serves through its contact 56 to normally close a circuit to the switches 49 and 51 and to break this circuit so as to reset the relays 27 and 28 when the relay 30 is operated. Through the opposite contact the switch 50 serves when operated by the solenoid 30 to close the circuit to the lock 38 through the terminals 36 and 37.

The term "reset" as used above refers to the condition of a relay shown in the drawings, in which the one switch of the relay is in position to divert a current from its selector arm into the winding of the relay 26, and the other switch is in a position to leave open the circuit to the winding of its relay which would shunt around the selector and push button.

The reset relay 26 has only a single switch 33. This switch is in series with the windings of the relays 27, 28 and 29, so that when the relay 26 is energized the winding circuits of the relays 27, 28 and 29 are all open and the relays 27, 28 and 29 are consequently reset. From the switch 33 of the relay 26 the circuit from the windings of the relays 27, 28 and 29 passes first through the switch 31 and the terminal 39 and then through the conductor 41 and the switches 14, 15 and 16 and finally back through the conductor 32 to the power line 47.

A parallel circuit for operating the relay 30 is provided through the switches 17 or the contacts of the relays 18 and the conductor 42 and terminal 40 and thence to the winding of the solenoid 30. This portion of the circuit, as will be clear from the drawings, shunts across the push button switches 10 and 11 and the selector switch 22 and serves to operate the relay 30 regardless of the setting of any other part of the system. The locks may therefore be operated singly by the switches 17, in groups by switches 19 each of which controls one group of relays 18, or all locks may be operated by any one of the switches 21 controlling group relays 20 each of which in turn controls one group of relays 18.

Although the relays above referred to are advantageously of a type common, for example, in telephone work, I have, for the sake of clarity, referred to their contacts separately as "switches". I have also used the term "solenoid" in a broad sense to include any magnetic means for moving the contacts, whether it is as shown an electro-magnet with a fixed core, or a magnet coil with or without a movable winding.

Operation

The operation of this device can best be described by referring to the drawings. In the particular arrangement shown, the push button panel is arranged with twenty operating push buttons 10 arranged in two vertical rows of ten push buttons each. On the drawings each button in one row is designated by a roman numeral and each button in the other row is designated by a letter. These have been chosen to avoid confusion with other reference characters on the drawings. In practice, arabic numerals or any other characters may be used. The reset button 11 is shown above the operating buttons. An electric lamp 12 is mounted above the push buttons and is provided with a reflector to throw the light down upon the push

buttons 10. The lamp switch 13 which is of the single-pole, double-throw type, and remains either in the "on" or "off" position is preferably contained in the base of the lamp mounting.

5 The combination selector switch 22 has twenty contact springs 23, each of which is connected to the correspondingly designated push button on the push button panel. Four selector arms determine the combination to be used. In Figure 1 selector arm *a* is shown set on contact spring II; selector arm *b* is shown set on contact spring C; selector arm *c* is set on contact spring H; and selector arm *d* is set on contact spring V. The electric combination lock control is thus set for the combination II—C—H—V. To operate the lock the correspondingly designated push buttons on the push button panel are pressed in the order shown in the above combination.

20 The contact springs II—C—H—V make contact with selector arms Nos. *a*—*b*—*c*—*d* respectively and the selector arms depress these springs so that they do not make contact with the reset ring 25.

25 Except when the reset button 11 is depressed, the push button panel bus 43, (vertical lead between the two rows of push buttons 10) connects, through the reset button 11 to the terminal 34 and thence to the power lead. It is to be noted also that while the circuit of combination relay 27 is open only at push button II, the circuit of combination relay 28 is open both at push button "C" and at the switch 44 of combination relay 27; the circuit of combination relay 29 is open both at push button "H" and at the switch 45 of combination relay 28, and the circuit of combination relay 30 is open both at push button No. V and at the switch 46 of combination relay 29. Pressing push buttons C—H— or V will therefore not operate combination relays 28, 29 or 30, unless the preceding buttons in the combination have been pressed first.

45 If, now, push button No. II is pressed, a circuit is established from the power lead 48, through the push button panel bus 43, contact spring II, selector arm *a*, the winding of combination relay 27, the contacts 33 of the reset relay 26, the guest's room switch 31 and thence through the room switch 14 on the central locking panel to the power lead 47. Hence pressing push button II operates combination relay 27. When combination relay 27 operates, its switch 49 closes a circuit through the back contact 56 of the switch 50 controlled by the combination relay 30, and thence to the push button panel bus 43; this circuit bridges push button II, and the combination relay 27 is thus locked up and remains energized even when push button II is released. The closing of its second switch 44 when combination relay 27 is operated leaves the circuit through the winding of combination relay 28 open only at push button "C".

65 If, now, push button "C" is pressed a circuit is completed from the power lead 48 through contact spring "C" selector arm *b*, the winding of combination relay 28 and thence to the power lead 47 at the central locking panel, in the same way as with combination relay 27. As in the case of combination relay 27, combination relay 28 locks up through the switch 51 which it controls and which connects its winding directly to the push button panel bus 43 over the same circuit portion as that from the switch 49 of combination relay 27; combination relay 28

therefore remains closed after the push button "C" is released. The closing of a second switch 45 by the combination relay 28 when it is energized leaves the circuit through the winding of combination relay 29 open only at push button "H".

If now push button "H" is pressed a circuit is completed from the power lead 48 through contact spring "H", selector arm *c* the winding of combination relay 29 and thence to the power lead 47 at the central locking panel over the same circuit portion as that over which combination relays 27 and 28 were energized.

85 As in the case of combination relays 27 and 28, combination relay 29 locks up through one pair 52 of its own contacts which connects its winding to the push button panel bus 43 over the same circuit portion as the locking-up circuits of combination relays 27 and 28, except that the locking-up circuit of combination relay 29 does not pass through contact 56 of combination relay 30. Combination relay 29 therefore remains closed after push button "H" is released. The closing of a second switch 46 by the combination relay 29 when it is energized leaves the circuit through the winding of combination relay 30 open only at push button V.

100 If, now, push button V is pressed, a circuit is completed from the power lead 48, through contact spring V, selector arm *d* the winding of combination relay 30 and thence to the terminal 35. This relay does not have any locking-up connection and it remains operated only so long as push button V is depressed. When combination relay 30 operates, one switch 50 controlled thereby completes a circuit directly from the push button panel bus, through the electromagnetic lock and then to the power terminal 35, thus causing the lock to operate. This same switch 50 when moved so as to close the lock operating circuit breaks the locking-up circuits of relays 27 and 28, permitting those relays to release. Combination relay 29 remains energized, however, through the lead 68 and the switch 52, so that until the device is reset, the lock will be operated each time push button V, the last button in the combination—is pressed.

120 One side of the reset relay 26 is connected directly to the power terminal 47; from the other side of this relay connections are provided directly to the reset ring 25 of the combination selector switch 22 and, through the back contacts 53, 54 and 55 of combination relays 27, 28 and 29 to selector arms *b*, *c*, and *d*. The common connection from the circuits through the windings of combination relays 27, 28 and 29 to the power lead 47 passes through the switch 33 controlled by the reset relay 26; the operation of the reset relay 26 will, therefore break the combination relay circuits and thereby release all the switches of the combination relays 27, 28 and 29.

135 When all of the combination relays are in the unoperated position—as indicated by the position of the relay contacts shown in the drawings—the electric combination lock control is said to be "reset".

140 Since all of the contact springs of the combination selector switch 22, save those corresponding to the push buttons in the combination for which the device is set, are in contact with the reset ring 25, the pressing of any button not in the combination will establish a circuit from the power terminal 34, through the contact spring 23 corresponding to the button

pressed, and thence through the reset ring 25 and the winding of the reset relay 26 to the power terminal 35. Hence the pressing, at any time, of any button not in the combination, will operate the reset relay and thus reset the device.

Suppose now, starting with the device in its normal position (i. e., all combination relays unoperated as indicated in the drawings) the first button in the combination (in this case, button II,) is pressed. Combination relay 27 then operates and locks up as already described. In so doing, it breaks the connection between selector arm *b* and the reset relay and connects selector arm *b* instead to the winding of combination relay 28. The next button in the combination is button C, and if that button were now pressed combination relay 28 would operate as already described. Consider, however, what will happen if, instead of next pressing button C, button H or button V, the third and fourth buttons respectively in the 2—C—H—5 combination, were pressed. Selector arms *c* and *d* are still connected through the back contacts 54 and 55 of combination relays 28 and 29 respectively, to the reset relay 26. Hence, if, after pressing button II, either button H or button V is pressed instead of button C, the reset relay 26 will be operated and the device entirely reset.

If buttons II and C are pressed in proper sequence, the connection from selector arm *c* to the reset relay 26 is broken and selector arm *c* is connected instead to the winding of combination relay 29; selector arm *d* however, still remains connected to the reset relay through the back contact 55 of combination relay 29. If, therefore, button V (the last button in the combination) is next pressed instead of button H (the third button in the combination), the reset relay 26 will be operated, and the device will be reset.

From the foregoing it will be seen that the lock can be unlocked from the push button panel only by (1) pressing the particular combination of buttons on the push button panel for which the combination selector switch is set, (2) in their proper sequence, and (3) pressing no other buttons than those comprising the combination.

The pressing of any button not in the combination or the pressing of any button in the combination out of its proper sequence in the combination, will reset the entire combination lock control.

It has been pointed out that after the lock has been operated by pressing the buttons comprising the combination, it can thereafter, until the device has been reset, be unlocked by pressing only the last button in the combination. It has also been pointed out that when the last combination relay has once been operated by pressing the last button in the combination, the locking circuits of all but the combination relay preceding the last are broken and the relays released. Thus, in the drawings, as buttons II, C and H are pressed, combination relays 27, 28 and 29 respectively operate and remain energized. When button V is now pressed, combination relay 30 operates and breaks the locking-up circuits of combination relays 27 and 28, thereby releasing the switches of those relays. The release of these switches breaks the connections between the windings of combination relays 28 and 29 and selector arms *b* and *c* respectively, and reestablishes the normal connections

between selector arms *b* and *c* and the reset relay 26. Hence, although until the device has been reset the lock may be operated by pressing only the last button in the combination (button V in the drawings), the pressing of any button on the push button panel other than the first or last buttons in the combination (buttons II and V in the drawings) will reset the lock. When the device is thus left to operate the lock by pressing only the last button in the combination, the chances of operating the lock without knowing the number of the last button are with the twenty-button panel shown in the drawings, 2 out of 20 for pressing one button without resetting the device, one out of 20 for pressing the correct button to operate the lock, and the a priori chance of operating the lock by two trials is about 1:18 against success:

Reset button on push-button panel

It has been pointed out that, after the buttons in the combination have been pressed in proper sequence, the lock may thereafter, until the combination control device has been reset, be operated by pressing only the last button in the combination. It has also just been explained that the device will then be reset if any buttons on the push button panel, other than the first and last buttons in the combination, is pressed. Normally, however, the device will be reset either by throwing the guest's room switch 31 to its "off" position as will later be discussed, by opening the room switch 14 or pressing the group reset button 15 or house master reset button 16 on the central locking panel as is also later discussed, or by pressing the reset button 11 on the push button panel.

It will be seen from the drawings that the power connection 57 for the operation of all relays from the push button panel passes through this reset button, and also the power for the lamp 12 on the push button panel is drawn through this same portion of the circuit. When this reset button 11 is pressed it breaks this connection. Hence, pressing the reset button will release all combination relays in the electric combination lock control thus resetting the device. Also, while this button is depressed, the lamp is extinguished. This flash of the lamp gives a visible signal that the device has been reset and that the entire combination of buttons must be pressed to operate the lock again.

Central locking panel

It has already been pointed out that the circuits through the windings of combination relays 27, 28 and 29 are connected to the power supply through the contacts 33 of the reset relay, the guest's room switch 31 and the room switch 14, the group reset button 15 and the house master reset button 16 on the central locking panel. If, therefore, the room switch 14 on the central locking panel is opened, any combination relays which may be in the operated position at that time will be released; and thereafter, so long as the room switch is left in its open position the relay circuits are open so that it is impossible to operate any of the combination relays from the push button panel. The room switches on the electric room rack therefore provide a means of barring access to any room or rooms.

Since all combination relays are released and the electric combination lock control reset im-

mediately the room switch on the central locking panel is opened, it is evident that momentarily depressing a group master reset button (the group and house master reset buttons break circuit when depressed) will reset all electric combination lock controls whose room switches are in that group. Thus, referring to the drawings, depressing the first floor master reset button 15 will immediately reset the electric combination lock control shown in the drawings and the electric combination lock controls of all other rooms on the first floor. Likewise, momentarily depressing the house master reset button 16 on the central locking panel will immediately reset all electric combination lock controls in the system.

Guest's room switch

In discussing the central locking control it has been pointed out that the connection of the windings of combination relays 27, 28 and 29 to the power supply 47 is made through the room switch 14, the group master reset button 15 and the house master reset button 16 of the central locking panel, and that this connection passes through the contacts 33 of the reset relay 26 and through the guest's room switch 31. When the guest's room switch is thrown to the "off" position, this connection is broken, all combination relays are reset, and so long as the guest's room switch is left in the "off" position, none of the combination relays can be operated from the buttons on the push button panel. Hence, so long as the guest's room switch 31 remains in its "off" position, the lock cannot be operated from the push button panel.

Push button panel lamp

The push button panel is provided with an electric lamp for illuminating the buttons. A lamp switch 13, preferably contained in the base of the lamp mounting, is provided in the lamp circuit.

When a room is unoccupied the lamp switch 13 will be in its "off" position, and the lamp will normally be out. When a guest is escorted to his room, however, the lamp switch will be thrown to its "on" position. One side of the lamp is connected directly to the power terminal 35; when the lamp switch 13 is thrown to its "on" position a connection is completed from the other side of the lamp, through the guest's room switch 31, and thence to the push button panel bus 43 and through the reset button 11 to the power terminal 34. The portion of this connection from the guest's room switch to the power terminal 34 is common to the combination relay circuits. It will thus be seen that when the reset button 11 on the push button panel is depressed to reset the electric combination lock control, the lamp circuit is also momentarily broken. A flash off of the lamp thus provides a signal that the device has been reset.

When the guest's room switch is thrown to its "off" position the above connection from the "on" point of the lamp switch to power terminal 34 is broken and the lamp is extinguished and remains normally out until the guest's room switch is returned to its "on" position.

Referring to the connections leading from the "on" and "off" points of the lamp switch, it will be seen that the lead from the "off" point is connected to contacts 59 and 60 of combination

relays 29 and 30. Hence, if the electric combination lock control is operated either from the push button panel or from the control release panel board (as later discussed) when the lamp switch 13 is in its "off" position, a circuit from the lamp to power terminal 34 will be established through contacts 59 or 60 of combination relays 29 or 30 so that the lamp will light and remain lighted so long as combination relay 29 or 30 remains energized, or in other words, so long as the electric combination lock control is set to release the lock or to permit the lock to be operated by pressing only the last button in the combination. It is thus seen that, when the lamp switch is in its "off" position and the lamp normally out, the lamp will light if the lock is operated either from the push button panel or from the central release panel, and will remain lighted until the electric combination lock control has been reset. The foregoing performance with the lamp switch in its "off" position is independent of the position of the guest's room switch.

Thus the lamp is lighted whether the switch 13 is in the "on" or "off" position and whether the switch 31 is in "on" or "off" position whenever the lock is released.

If, however, the lamp switch is in its "on" position, the lamp will be lighted, when the guest's room switch is in its "on" position, by virtue of the contact 61, in the switch 31. When the switch 31 is in the "off" position this contact is broken, and the lamp will normally be out. If, however, the lock is then operated from the central release panel, a circuit is established through the contact 60 of the relay 30 and the lamp is again lighted.

Central release panel

The central release panel is provided with a room switch 17 for each lock in the system. These room switches may be arranged in groups—in the drawings, the room switches are grouped by floors. These room switches are normally open. When a room switch 17 is closed a connection is established from the power line 48, over the lead 42 to the corresponding electric combination lock control, through the winding of the last combination relay 30 and thence to the power terminal 35. The last combination relay therefore operates, closes the circuit through the electromagnetic lock and so causes the lock to release. The lock remains released so long as the room switch on the central release panel is closed; when the switch is opened the last combination relay is reset and the lock relocks. The foregoing operation of the lock is independent of whether the guest's room switch 31 is in its "on" or "off" position and of whether the room switch at the central locking panel is closed or open.

If, when the lock is operated from the central release panel as above described, the guest's room switch 31 is in its "on" position and the room switch 14 on the central locking panel is closed, the operation of the last combination relay 30 not only causes the lock to unlock, but it also completes a circuit through the switch 53 from the push button panel bus 43, through the winding of next to the last combination relay 29 and thence, through the contacts 33 of the reset relay 26, the guest's room switch 31 and the room switch 14 on the central locking panel, to power line 47. The completion of this circuit causes the combination relay 29 to operate and

lock up, as already described, until the device is reset, regardless of whether the room switch on the central release panel is subsequently opened or remains closed. And, so long as this relay remains locked up, the lock can be operated from the push button panel by pressing only the last button in the combination (button V in the drawings).

From the foregoing it will be seen that, providing the guest's room switch is in its "on" position and the room switch on the central locking panel is closed, the electric combination lock control can, by momentarily closing the room switch on the central release panel be set so that the lock can be operated by pressing only the last button in the combination. The electric combination lock control will not be set to permit the operation of the lock by pressing the last button in the combination either if the guest's room switch is in its "off" position or if the room switch on the central locking panel is open when the room switch on the central release panel is momentarily closed. This feature and its practical use will be discussed further under room service.

Referring to the drawings, it will be seen that each room switch on the central release panel is bridged by the contacts of a relay 18. These relays will be called room relays. In the drawings each room relay has but one pair of contacts, so that a room relay is shown for each room switch. Relays having two or more pairs of contacts, however, might be employed in actual installations, and the number of room relays correspondingly reduced. The room relays are grouped electrically in the same manner as the room switches. In the drawings this grouping is by floors.

The windings of all room relays in any one group are all connected in parallel across a pair of leads which can be energized by closing the corresponding group master switch 19. Thus, when the third floor master switch on the drawings is closed all room relays of the third floor group operate and close the same circuits as would be closed by the closing of all room switches in the third group.

At the extreme right and just below each group of room relays is shown a group master relay 20. The contacts of this relay are so connected that, when the relay operates, its contacts bridge the group master switch 19, and so cause all of the room relays in the corresponding group to operate. In the drawings the group master relays have but one pair of contacts each, so that one group master relay is shown for each group of room relays. In an actual installation, relays having two or more pairs of contacts might be employed, and the number of group master relays correspondingly reduced.

The windings of all group master relays are connected in parallel across a pair of leads which can be energized by closing the house master switch 21. Hence, closing the house master switch 21 causes all group master relays to operate, and the operation of the group master relays causes the room relays to operate. The closing of the house master switch therefore results in the closing of the same circuits as would be closed by the closing of all room switches on the central release panel.

The room switches, the group master switches and the house master switch may be multiplied in parallel so that switches may be located in

any number of desired positions as is indicated on the drawings for the house master switch. Thus, it might be desirable to have the house master switch multiplied to an off-premise location which would be accessible in any emergency.

Room service

It will be necessary frequently to change the combination of each lock. This can readily be done by means of the combination selector switch. If the house service people were to gain access to rooms by operating the complete combination, it would be necessary to supply maids etc., daily with lists of rooms and their combinations. From the standpoint of security, if for no other reason, this would be highly undesirable. Several means are available for meeting this situation. The simplest of these, in the sense that it requires no special equipment, is that provided by the arrangement in the drawings. This method will now be described.

Maids, etc., are supplied with the last digit or letter of the combination of rooms they are to enter. This may be done either by means of lists giving room numbers and corresponding last button designations, or the last buttons in the combinations may be assigned in accordance with a code. For example, the combinations of all rooms under the care of one maid could end with the same digit or letter, or a code could be devised whereby the last button of the combination could be determined from the room number by anyone knowing the code.

At the time it is desired that a maid have access to a room, the room switch for that room on the central release panel is momentarily closed. This, as has already been explained, sets the electric combination lock control so that the lock can be operated by pressing only the last button of the combination, providing the room switch on the electric room rack is not open and providing the guest's room switch is in its "on" position. If the guest is in his room and has his guest's room switch thrown to its "off" position the maid will have to knock to be admitted.

When a maid has finished work in a room she presses the reset button on the push button panel and resets the electric combination lock control.

Power supply

In the drawings a single centralized power supply is shown, and separate power leads for each floor are indicated. In an actual installation it may be preferable to have a power trunk line supply only one or two floors. It is advantageous that the power should be taken from a separate source which will not be cut off if the main house current fails or is cut off, as in case of fire. The panel lights will, in such case, serve to light the guests along the corridors and may prevent panic with its attendant often disastrous results. For this purpose I prefer to provide storage batteries, and in order that a failure in the circuit may not render the entire system inoperative I prefer to use independent circuits in each corridor or floor or for different parts of each corridor on one or more floors.

Although I have described above in considerable detail a particular embodiment of my invention as applied to hotels, etc., it is to be understood that many changes in the construction and many other applications may be made

without departing from the scope of my invention. Thus it will be apparent that various other means may be substituted for the electrical means illustrated and described above.

The above changes and suggestions are, of course, only exemplary and it will be readily appreciated by those skilled in the art that many other modifications may be made.

What is claimed as new is:

1. A combination operated device comprising a control device, means subject to manual control at one position and capable of operating said control device when manipulated so as to set up a predetermined sequence of the combination, but incapable of affecting said control device until said sequence is set up, and means manually operable from a position remote from the first named means and adapted to prevent the setting up of one element of the combination, whereby, without rendering it totally inoperative, to prevent operation of the control device by the predetermined manipulation of the first-named manually controlled means.

2. A combination control device comprising a plurality of means for blocking a normal operation of the control, each alone capable of effectively blocking operation of the control, means manually operable by an inobvious manipulation for removing the effect of said blocking means, and means adapted to disconnect at least one of said blocking means from said manually operable means without rendering the control inoperative, but thereby to prevent operation of the control by said manually operable means even with the proper manipulation.

3. A combination electrical control device comprising a series of independently operable manual switches, a series of relays the first of which is connected to one of said manual switches and the others of which are in circuit with others of said switches but electrically connected thereto only by the operation of the preceding relay of the series, and an independently operable circuit for operating one of the later relays of said series whereby the device may be set to operate with less than the entire series of switches.

4. A combination control device comprising manually operable means adapted, when operated in a predetermined sequence, to effect operation of said device, a plurality of means for blocking operation of the control device by said manual means, each requiring a predetermined inobvious manipulation to remove its blocking effect and each, until so operated, being under normal conditions capable alone of effectively blocking operation of the control device by said manual means, and means remote from the position for effecting said manual operation adapted to render some of the blocking means ineffective to prevent operation of the control device by said manual means and thereby to set the device for operation after proper manipulation to remove less than all of the blocking means.

5. A device as defined in claim 4 which further includes means for destroying the effect of any previous partial manipulation of the device so as to require the manipulation of all of the blocking means, said first named means being operable from a position remote from the position for effecting the manual operation.

6. An adjustable combination switch which comprises a number of manual switches greater than the number used in a combination, a circuit

controlled by switches in the combination, means for opening said combination circuit a separate contact connected to each of said switches, a conductor normally connecting each of said contacts to the means for opening the combination circuit selectors in said combination circuit one for each switch used in the combination and adapted to be electrically connected to any one of said contacts and when so connected to hold open the connection with the means for opening the combination circuit.

7. A combination electrical control device comprising a series of independently operable manual switches, a series of combination relays the first of which is connected to one of said manual switches and the others of which are in circuit with others of said switches but electrically connected thereto only by the operation of the preceding relay of the series, a circuit breaker relay the armature of which is connected into energizing circuits of the combination relays so as when operated to break the energizing circuits of the combination relays to cause them to drop their armatures, means normally connecting each of said manual switches to said circuit breaker relay but adapted to be readily disconnected therefrom, and conducting selectors, one connected to each of the series of relays and each selector being adapted to be moved to any of said switch-connecting means and when so positioned to disconnect said connecting means from circuit breaker relay and to connect it instead to the relay associated with that selector.

8. A combination-operated electrical device which comprises a series of relays, the first of which is operable directly and each of the others is operable only through a contact controlled by the preceding relay of the series, each relay which controls such a contact having another contact controlled by its own operation whereby when once operated it will remain energized until its circuit is otherwise broken and means for releasing preceding relays of the series while holding one of the relays energized whereby the device may thereafter be operated by less than the entire combination.

9. A combination-operated electrical device which comprises a series of relays, the first of which is operable directly and each of the others is operable only through a contact controlled by the preceding relay of the series, each relay which controls such a contact having another contact controlled by its own operation, whereby when once operated it will remain energized until its circuit is otherwise broken, and means adapted to energize the next to the last relay of said series whereby to permit subsequent operation of the device by the last switch of the combination.

10. A room door control comprising a lock associated with each of a plurality of doors, lock-operating means associated with each lock and positioned outside of a room to which the door gives access, incapacitating means remote from said lock-operating means and adapted to render the lock-operating means incapable of operating the lock by correct manipulation thereof but without rendering it wholly inoperative and without directly interfering with the operation of the lock, and an emergency control means operable from a central station remote from said door adapted to operate said lock-operating means regardless of the condition of said incapacitating means.