

Feb. 28, 1939.

H. C. MILLER

2,149,177

DOOR CONTROL SYSTEM

Filed Dec. 16, 1935

2 Sheets-Sheet 1

Fig. 1.

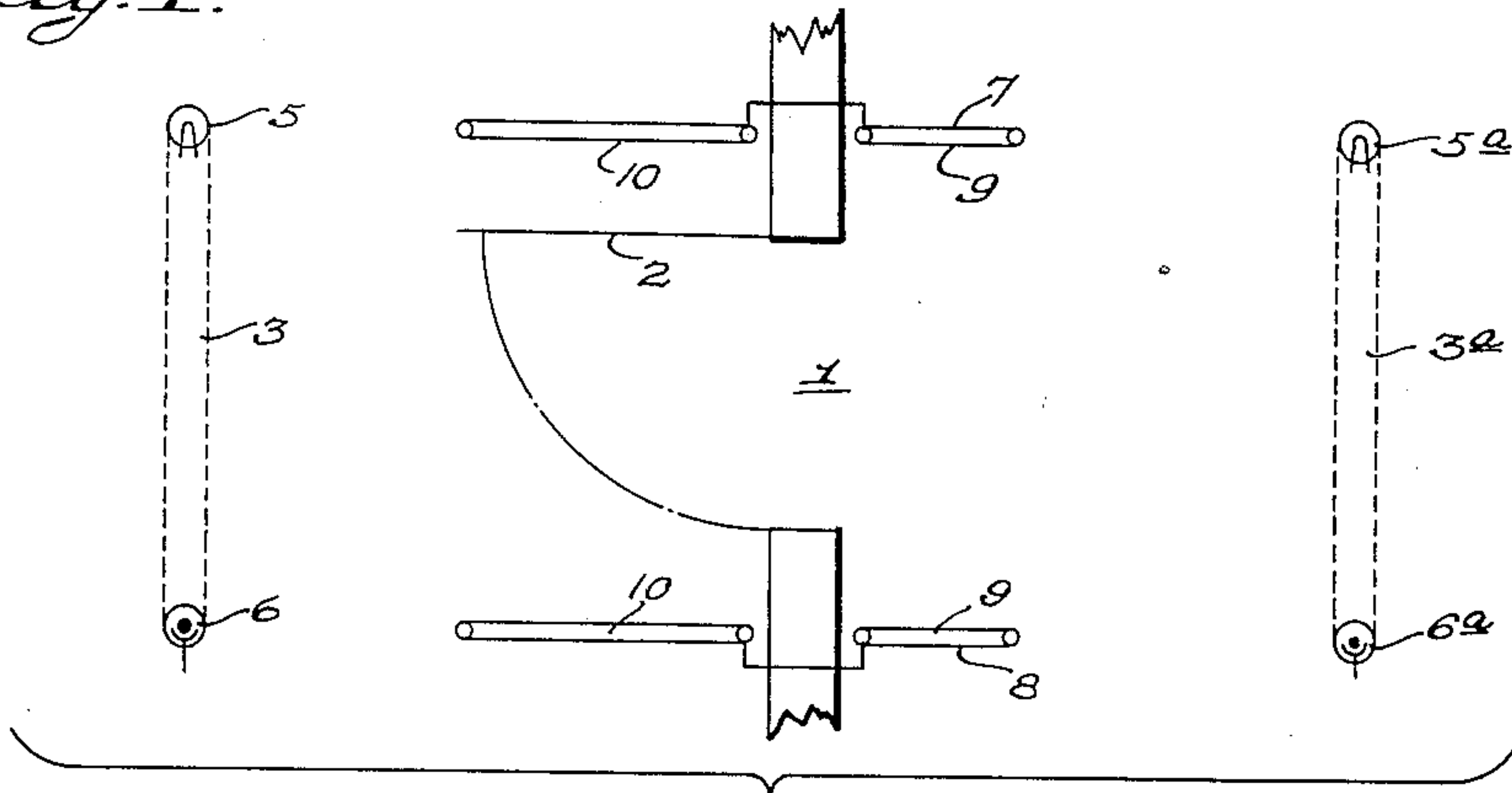
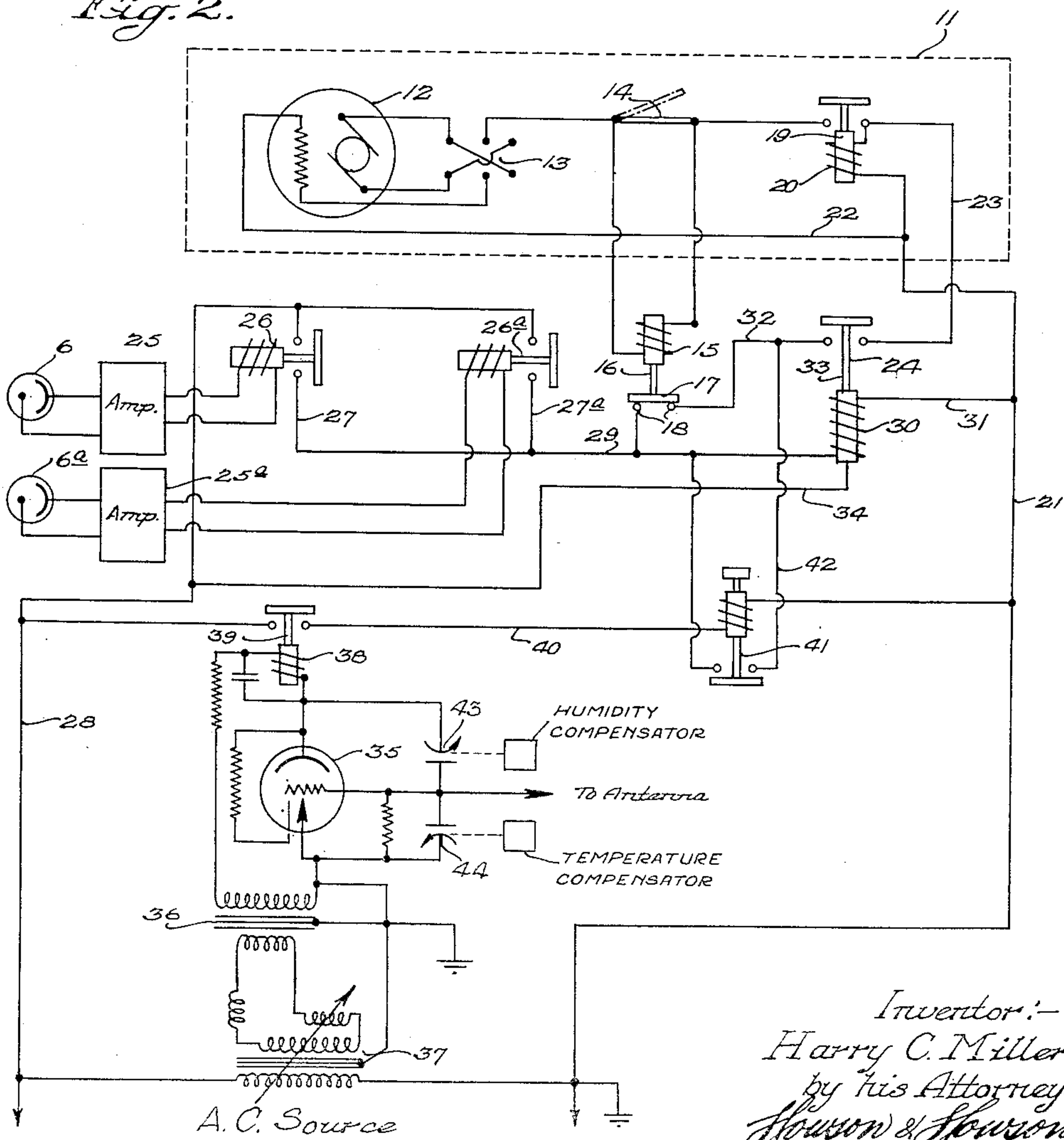


Fig. 2.



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Fig. 3.

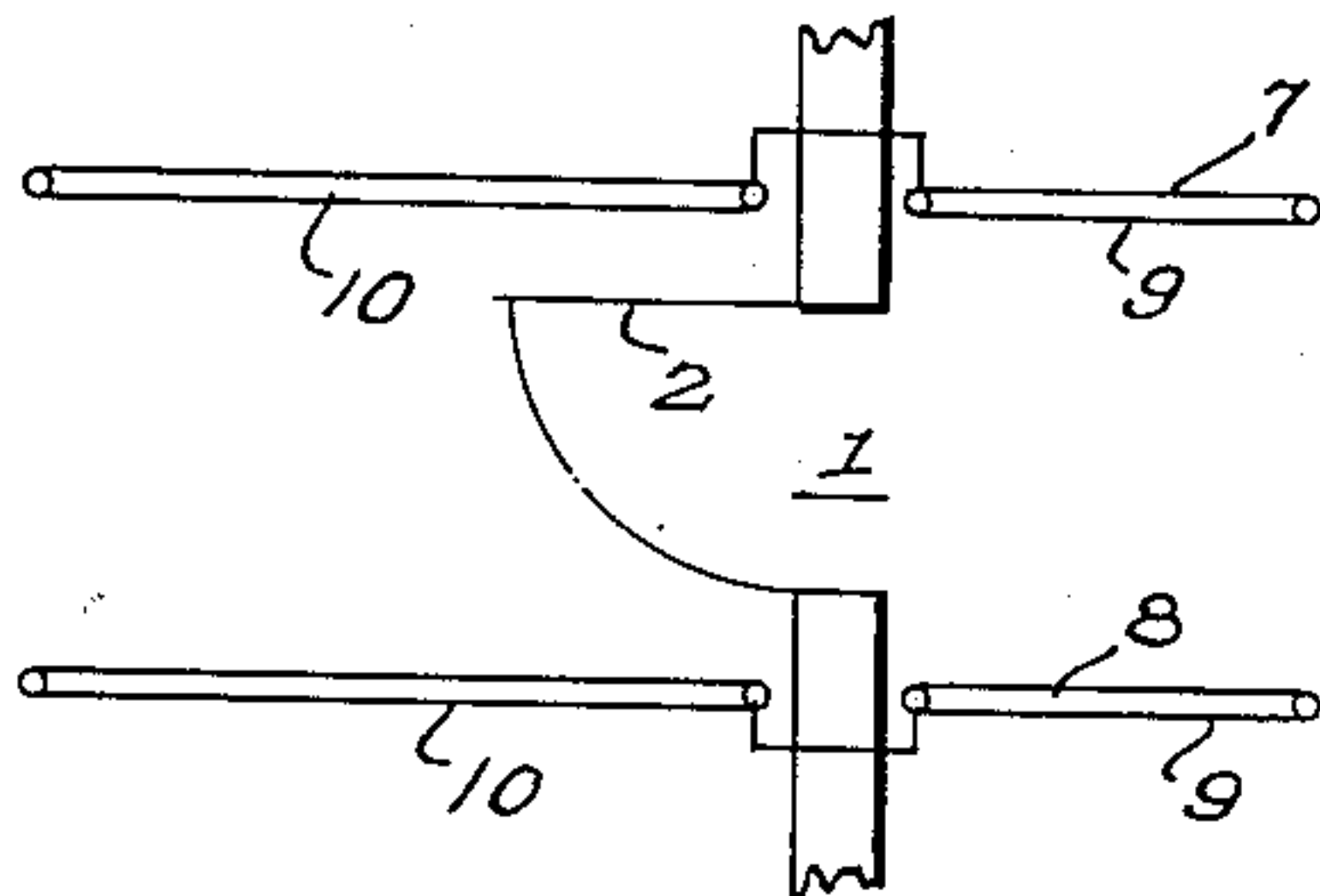
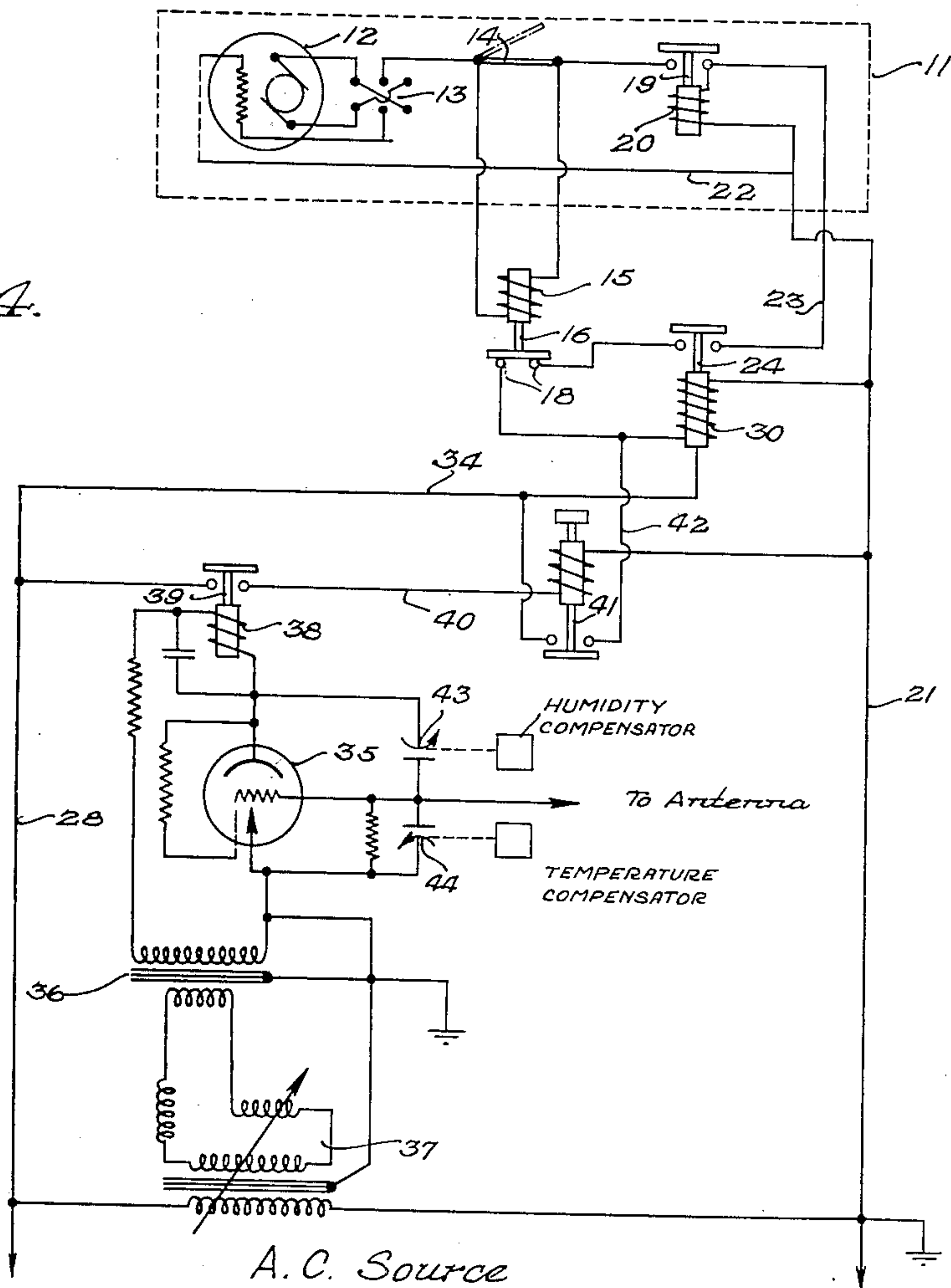


Fig. 4.



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UNITED STATES PATENT OFFICE

2,149,177

DOOR CONTROL SYSTEM

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Application December 16, 1935, Serial No. 54,777

5 Claims. (Cl. 268—1)

This invention relates to door-operating systems and, more particularly, to control systems for electrically operable door-opening devices. The principal object of the invention is to provide a novel door-operating system by means of which a door may be operated automatically for traffic in both directions, and which insures that the door shall not strike a person within the doorway.

10 The preferred form of the invention utilizes a combination of light-sensitive and capacity-control devices. In its preferred form, the invention comprises a light-sensitive device arranged on each side of the doorway and adapted to control door-actuating means for traffic in both directions, and a device responsive to the body capacity of a person, arranged so as to maintain the door-actuating means in operative condition as long as a person is in the doorway.

20 In an alternative form, the invention comprises simply a device responsive to the body capacity of a person, which actuates the door for traffic in both directions and maintains the door in opened position as long as a person is in the doorway.

Other objects and features of the invention will become apparent as the description proceeds.

In the accompanying drawings:

30 Fig. 1 is a schematic plan view of a doorway with the control devices of the invention cooperatively associated therewith;

Fig. 2 is a diagrammatic illustration of the electrical system of the preferred form of the invention shown in Fig. 1;

35 Fig. 3 is a schematic plan view of a doorway with an alternative form of the invention associated therewith; and

40 Fig. 4 is a diagrammatic illustration of the electrical system embodied in the alternative form.

Referring to Fig. 1, there is illustrated a doorway 1 and a hinged or swinging door 2. On opposite sides of the doorway, there are positioned similar light-responsive control units 3 and 3a, each of which units comprises a light source 5 or 5a and a light-responsive device 6 or 6a, such as a photoelectric cell, as now well known. Each unit is arranged so that the light beam thereof extends across and is disposed within the path of travel of persons using the doorway 1. These units are adapted to control the door for traffic in both directions, as will be more fully explained hereinafter.

There is also associated with the doorway 1 an antenna for the body capacity control feature

above mentioned, which antenna may comprise sections 7 and 8 arranged as illustrated. These antenna sections may each conveniently comprise interconnected rods or rails 9 and 10, as illustrated. The two antenna sections may be connected to the control system described hereinafter.

While the invention is capable of use in connection with any suitable electrically operable door control system, it is preferred to use the invention in connection with the electrically operable door opener disclosed and claimed in my prior Patent No. 2,024,300, granted Dec. 17, 1935. For this reason, the invention will be described herein in this specific adaptation, for the purpose of disclosure.

Referring now to Fig. 2, there is shown at 11 a door opener of the type disclosed in the said patent. For the purpose of the present description, only the essential electrical elements of the door opener need be mentioned. As illustrated in Fig. 2, the device 11 comprises a reversible motor 12 which constitutes the source of mechanical energy for operating the door. There is preferably associated with this motor a reversing switch 13 of conventional type by means of which the direction of operation of the motor may be reversed to adapt the device for different doors. After it has been adapted for operating a certain door, however, the device does not require operation of the switch 13 in its normal operation.

A switch 14 is connected in series with the motor 12 and there is shunted about this switch the energizing winding 15 of relay 16, the purpose of which will be explained later. The switch 14 is normally closed, as illustrated, and the relay 16 is normally deenergized so that its armature 17 bridges the stationary contacts 18. The energizing winding 15 of the relay has a predetermined impedance to adapt the relay for the function described hereinafter. The switch 14 is operated by a part of the door-actuating mechanism (not shown) so that the switch is opened automatically when the door is in open position, as fully disclosed in the said prior patent. The purpose of this is to include the predetermined impedance of the relay winding 15 in the circuit of motor 12 when the door is in opened position. The inclusion of the impedance in circuit with the motor reduces the current supplied to the motor and permits energization of the motor in standstill condition to maintain the door in opened position without deleteriously affecting the motor. This is a feature of the invention claimed in the said prior patent and, in itself, forms no part of the

present invention. The brief description given herein therefore suffices for the present purpose.

A normally open relay 19 is adapted to control the energization of motor 12. One extremity of the energizing winding 20 of this relay is connected to one side of a suitable electrical source through conductor 21, and it will be noted that one terminal of the motor 12 is also connected to conductor 21 through conductor 22. The other extremity of the relay winding 20 is connected to one of the stationary contacts of the relay which, in turn, is connected through conductor 23 to a stationary contact of the relay 24.

The novel control system which forms the subject of the present invention will now be described. Referring still to Fig. 2, the light-responsive devices 6 and 6a of the control units 3 and 3a are connected respectively through suitable amplifiers 25 and 25a to control relays 26 and 26a. It will be seen that the light-responsive devices are thus adapted to control the energization of the relays 26 and 26a. The stationary contacts of these relays are connected respectively in parallel branch circuits 27 and 27a which are connected to conductor 28 leading to the electrical source. The branch circuits 27 are also connected to conductor 29 leading to one extremity of the energizing winding 30 of relay 24. The other extremity of this winding is connected through conductor 31 to the conductor 21 above mentioned. The contacts 18 of relay 16 are included in the branch circuit 32 which also includes the contacts of relay 24 and the conductor 23. The movable armature 23 of the relay 24 is composed of electrically conductive material and a conductor 34 is connected to the said armature and to the conductor 28. Thus, when relay 24 is closed, the conductor 34 is electrically connected to the branch circuit 32.

The portion of the control system above described includes the light-responsive devices which are adapted to effect operation of the door for traffic in either direction. The remaining portion of the control system, now to be described, includes the body capacity control feature which serves to maintain the door open, as above mentioned, and thus insures against the door striking a person within the doorway. The body capacity control unit preferably comprises a grid-glow tube 35 which may be a type K. U.-618 tube manufactured by the Westinghouse Electric and Manufacturing Company. This tube and its associated circuits form a commercial unit which need not be described in detail. The control grid of the tube is connected to the antenna of the system as clearly indicated. The capacity control unit including tube 35 is supplied with the necessary electrical energy through transformer 36 which, in turn, is supplied with energy from the electrical source by the voltage regulator 37 which preferably comprises a Raytheon voltage regulator of the V. R.-2 type. This also is a commercial unit which needs no further discussion.

The energizing winding 38 of relay 39 is included in the output circuit of tube 35, and the relay 39 is arranged so as to control the energizing circuit 40 of the relay 41. This latter relay is of the instantaneous-closed, time-delay open type. It will be understood, therefore, that while this relay closes instantaneously, it remains closed for a predetermined period of time after deenergization. The relay 41 controls a branch circuit 42 connected between the branch circuit 32 and conductor 29 as illustrated.

Considering now the operation of the device illustrated in Figs. 1 and 2, the interception of the light beam of either of the units 3 and 3a by a person approaching the doorway 1 in either direction causes the light-responsive device 6 or 6a of the particular unit to send an electrical impulse through its associated amplifier and the amplified impulse energizes the associated relay 26 or 26a. It will be seen that this momentary energization of either of the relays 26 or 26a completes a circuit which includes the conductor 28, one of the branch circuits 27, conductor 29, relay winding 30, conductor 31, and conductor 21. The relay 24 is thus energized and completes an energizing circuit for the relay 19, which circuit includes the normal closed contacts 18 of relay 16 and the branch circuit 32. The closing of relay 24 serves to lock in the relay 19 by the closing of a branch circuit which includes the conductor 34, the armature 33 of relay 24, the right-hand stationary contact of the said relay, and the winding 20 of relay 19.

Immediately following the initiation of the operation of the system, as just described, the person approaching the doorway comes within operative range of the capacity control device so that the capacity of the antenna is varied by the capacity of the said person's body. This effects operation of the capacity control unit including the tube 35 and sufficient current flows in the output circuit of the tube and through the winding of relay 39 to cause operation of that relay. The relay 41 is thus energized and closes its contacts. This closes a locking-in circuit for relay 24, which circuit comprises conductor 28, conductor 34, the conductive armature of relay 24, the left-hand stationary contact of that relay, the branch circuit 42, the winding 30 of relay 24, conductor 31, and conductor 21. Thus it will be seen that the conductive armature of relay 24 completes an energizing circuit for that relay, as well as a circuit controlled thereby which includes the winding of relay 19. As long as a person is within range of the antenna, the capacity control device is maintained in operative condition and relay 19 is maintained closed so that the door is held in open position by the continuous energization of motor 12. At such time as there is no one within range of the antenna, the relay 39 is deenergized and the relay 41, consequently, opens its contacts after a predetermined interval of time sufficient to insure that the door will not strike anyone in closing.

In the door-opening operation, when the door has reached its open position, the switch 14 is opened in the manner above mentioned and the winding of relay 16 is effectively included in the motor circuit. The relay 16 is thus energized and opens the branch circuit at 32 through which initial energization of relay 19 was established. Thus the relay 16 serves a dual function, viz. it controls initial energization of relay 19, and the predetermined impedance of its winding reduces the current to motor 12 to permit stand-still energization of the motor as above mentioned.

In the device of Figs. 3 and 4, the control is effected entirely by the body capacity control mechanism, the light-sensitive control feature being omitted. As shown in Fig. 3, the doorway has associated therewith an antenna similar to that of the above-described device. The antenna is connected to the body capacity control device in the same manner as before. The elements of Figs. 3 and 4 which correspond to those of Figs. 1 and 2 are similarly designated. The circuit

connections shown in Fig. 4 are substantially the same as those of Fig. 2 with the omission of the light-responsive devices and the relays controlled thereby. In the system of Fig. 4, however, the branch circuit 42, which is controlled by relay 41, is connected to the conductor 34 as clearly illustrated.

In operation of this simplified form of the system, the capacity control device, including tube 34, responds to the body capacity of a person approaching the doorway from either side. This effects energization of relay 39 which, in turn, energizes relay 41. Closure of relay 41 completes an energizing circuit for relay 24, which circuit includes conductor 34, the closed contacts of relay 41, the winding 30 of relay 24, and conductor 21. Energization of relay 24 closes a branch circuit which includes the closed contacts of relay 16, the closed contacts of relay 24, and the winding 20 of relay 19. Relay 19 is thereby energized and, in turn, energizes the motor 12.

When relay 24 closes, a branch circuit for relay 19 is closed through the right-hand stationary contact of relay 24 and the conductive armature thereof. In this manner, the relay 19 is maintained energized until the relay 16 opens its contacts in response to opening of switch 14.

It will be seen that the door will be maintained open until such time as no one is within range of the antenna, at which time, the relay 38 will open and relay 41 will be deenergized, and relay 41 will open after a predetermined period of time, insuring that no one will be struck by the closing door.

In order to compensate for any variations in temperature or humidity of the atmosphere which might affect the operation of the capacity control mechanism, the condensers 43 and 44 may have associated therewith, respectively, a humidity compensator and a temperature compensator. These devices may take the form of conventional devices which are adapted to respond to humidity or temperature variations and to vary the adjustment of condensers 43 and 44 to compensate for any variation in the capacity of these elements.

Although the invention is illustrated and described with particular reference to certain embodiments, it will be understood that other forms of the invention are possible and that various changes and modifications may be made. In its broad aspect, the invention contemplates the provision of a body-capacity control device adapted to control the operation of an electrical door-operating system and, in its preferred form, the invention contemplates broadly the combination of light-responsive and body-capacity control devices as embodied in the illustrated system.

I claim:

1. A door-operating system, comprising a door and door-way, a door-actuating device including a motor and a switch in series therewith, a normally closed relay having an energizing winding of predetermined impedance connected in shunt relation with said switch, control means responsive to the presence of a person, arranged cooperatively with said door-way, and means controlled by said control means for energizing said door-actuating device, said last means including a circuit through the closed contacts of said relay.

2. A door-operating system comprising a door and door-way, a door-actuating device including a motor and a switch in series therewith, a normally closed relay having an energizing winding of predetermined impedance connected in shunt relation with said switch, control means responsive to the presence of a person, arranged cooperatively with said door-way, circuit means including the closed contacts of said relay for initiating operation of said device, means operable by said control means for energizing said circuit means, and means for completing a holding circuit for said device independently of said relay contacts.

3. A door-operating system, comprising a door and door-way, a door-actuating device including a motor and a switch in series therewith, a normally closed relay having an energizing winding of predetermined impedance connected in shunt relation with said switch, control means adjacent said door-way responsive to the passing of a person approaching the door-way, a circuit including the closed contacts of said relay for initiating operation of said device, a relay energizable by said control means for controlling said circuit, a circuit controlled by said last-mentioned relay for maintaining the operative condition of said device independently of said relay contacts, control means arranged cooperatively with said door-way and responsive to the presence of a person therein, and means operable by said second control means for locking in said last-mentioned relay.

4. A door-operating system, comprising a door and door-way, a door-actuating device including a motor and a switch in series therewith, a normally closed relay having an energizing winding of predetermined impedance connected in shunt relation with said switch, control means adjacent said door-way responsive to the passing of a person approaching the door-way, a circuit including the closed contacts of said relay for initiating operation of said device, a relay energizable by said control means for controlling said circuit, said last-mentioned relay having an armature with an electrically conductive core, a circuit including said armature core for maintaining the operative condition of said device independently of said relay contacts, control means arranged cooperatively with said door-way and responsive to the presence of a person therein, a second circuit including said armature core and the winding of said last-mentioned relay, and means operable by said second control means for controlling said second circuit, whereby said last-mentioned relay is locked in as long as a person remains in said door-way.

5. A door-operating system, comprising a door and a door-way, a door-actuating device including a motor and a switch in circuit therewith, a normally closed relay having an energizing winding of predetermined impedance connectable by said switch in circuit with said motor, control means responsive to the presence of a person, arranged cooperatively with said door-way, and means controlled by said control means for energizing said door-actuating device, said last means including a circuit through the closed contacts of said relay.

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