Oct. 3, 1933. H. R. CRAGO 1,929,273

DOOR OPERATING APPARATUS

Filed March 18, 1931

Fig. 1.

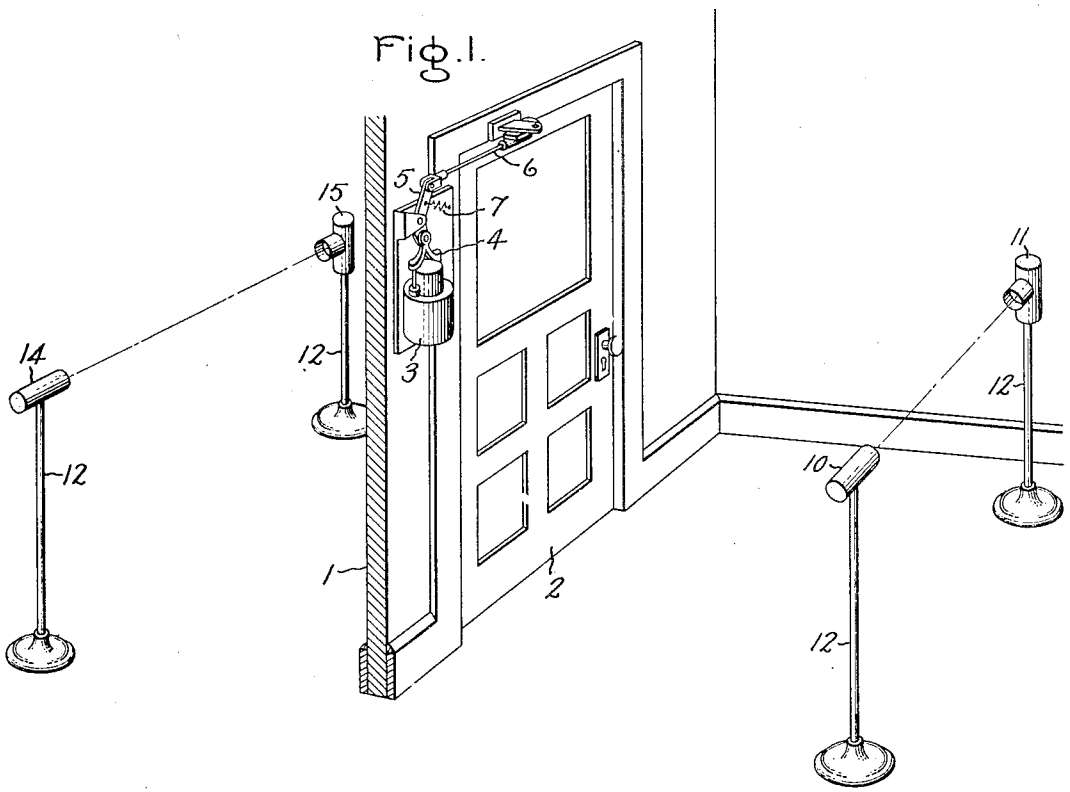
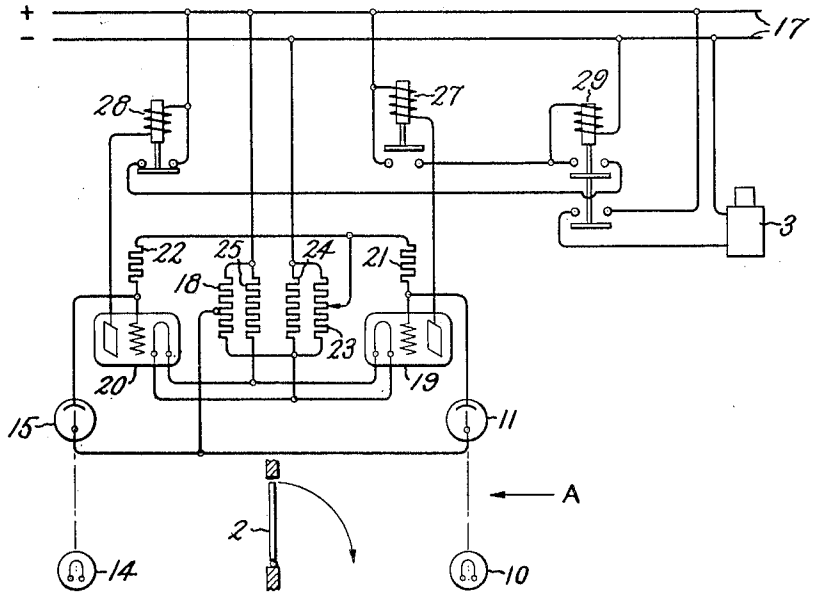


Fig. 2.



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DOOR OPERATING APPARATUS

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Application March 18, 1931. Serial No. 523,623

5 Claims. (Cl. 250—41.5)

My invention relates to apparatus for causing a door to open and close, and it is the object of my invention to provide improved apparatus of this character which shall operate automatically in response to the approach of a person to the door and which shall cause the door to close only in response to the person leaving the door at the other side thereof.

My invention will be better understood from the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

Referring to the drawing, Fig. 1 is a perspective view of a door and a portion of the apparatus by which it is operated; and Fig. 2 is a circuit diagram of the apparatus.

By way of illustration of my invention I have shown in Fig. 1 the partition 1 separating two rooms and containing the door 2 by which one may pass from one room into the other. The door 2 may be of any form desired being illustrated as a conventional door hinged at one side. The mechanism by which the door is swung to open and to closed position may assume various forms well known in the art, the particular mechanical means by which the door is moved forming no part of my present invention. I have chosen to illustrate this mechanical means as comprising a motor operated hydraulic mechanism, such for example, as that disclosed in patent application Serial No. 415,341, filed Dec. 19, 1921 in the name of Walter O. Lum, and assigned to the same assignee as my present invention. This mechanism comprises the casing 3 containing an electric motor which drives an impeller by which a piston is moved in a cylinder, the piston being connected through the cross head 4 to one end of lever 5. The opposite end of this lever connects through the pull rod 6 with the door 2, the construction being such that when the motor is operated the door is moved to open position and held in that position as long as the motor is energized. For returning the door to a closed position when the motor is de-energized a suitable spring is provided which for convenience of illustration is shown at 7 attached at one end to lever 5.

Arranged in front of the door is a light source 10 and a photo-electric tube 11 suitably shielded to exclude therefrom light coming from other directions than that of the light source 10. The members 10 and 11 are arranged in the normal path of travel of a person approaching the door and preferably are mounted on suitable standards 12 to elevate them to such a level that the light beam will be interrupted by a person passing between but will not be affected by household domestic animals. Members 10 and 11 preferably are arranged at a relatively greater distance from the door than that shown by the drawing in order that the door may be fully opened before the approaching person reaches it. Behind the door and in the normal path of travel of a person leaving the door are arranged another light source 14 and photo-electric tube 15 mounted on standards 12, and similar in all respects to the members 10 and 11.

In Fig. 2 I have illustrated diagrammatically the operating mechanism and circuit connections therefor. Although either direct or alternating current may be used, I have chosen to illustrate my invention as adapted to be operated by direct current. The source of direct current is shown at 17. Photo tubes 11 and 15 have one electrode of each connected together and connected through resistance 18 with the positive side of the supply 17. The other electrodes of these photo tubes connect directly with the grids of the respective three element electron discharge devices 19 and 20. These grids also connect through the respective resistances 21 and 22 with the adjustable resistance 23 which in turn connects directly with the negative side of the source 17. The filaments of devices 19 and 20 are supplied with energy from the source 17 through resistances 24 and 25. The plate circuit of device 19 connects with the positive side of the source through the winding of the relay 27 which is provided with a pair of back contacts. In a similar manner the plate circuit of device 20 connects with the positive side of the source through the winding of relay 28 which is provided with a pair of front contacts. When de-energized relay 27 closes a local circuit including the winding of the relay 29. This relay has two pairs of front contacts by one of which it closes a local circuit including the motor mechanism arranged within the casing 3 and by the other of which it closes its own holding circuit which is also controlled by relay 28.

In its normal position the door 2 is closed and the light sources 10 and 14 each direct a light beam into the photo tube associated therewith. The resistances of these tubes therefore are reduced to a minimum and as a result the grids of the electron discharge devices 19 and 20 are biased positive through resistance 18. The devices 19 and 20 being thereby rendered conducting, relays 27 and 28 are both energized as shown on the drawing. Because of the fact that the

circuit controlled by relay 27 is connected to the back contacts thereof, the winding of relay 29 is held open-circuited.

When a person in approaching the door in the direction indicated by the arrow A interrupts the light beam directed from the source 10 into the photo tube 11, the resistance of the tube immediately rises to a high value thereby cutting off the positive bias on the grid of device 19 and allowing this grid to swing negative by reason of its connection with the negative side of the source 17 through resistances 21 and 23. Accordingly, this device becomes non-conducting and the relay 27 is deenergized. This closes the circuit of the winding of relay 29 which relay in turn closes the circuit of the (operating motor. The door thereby swings to open position and is maintained in that position against the force of the return spring 7. The person may then pass through the doorway at his leisure, the door remaining open until he has passed completely therethrough and interrupts the light beam between the source 14 and the photo tube 15. It will be noted that by reason of the holding circuit with which relay 29 is provided, this relay is held in energized position after the person passed beyond the light beam directed into photo tube 11 so that although this light beam is reestablished causing the device 19 to again become conducting and the relay 27 to be reenergized, the door is nevertheless held in open position. When in leaving the door the person interrupts the beam directed into photo tube 15, the incident high resistance of this tube removes the positive bias from the grid of device 20 allowing this grid to swing negative due to the connection with the negative side of the source through resistances 22 and 23. The device 20 therefore becomes non-conducting whence relay 28 is deenergized and the holding circuit controlled thereby is open circuited. This causes a deenergization of relay 29 with a consequent deenergization of the operating motor whence the door is swung closed by the spring 7.

It will be noted that as long as the light beam directed into photo tube 11 is interrupted, as for example by a second person approaching the door, the door will be held open since the relay 27 is deenergized and the circuit of the winding of relay 29 is thereby held closed.

I have chosen the particular embodiment described above as illustrative of my invention and it will be apparent that various other modifications may be made without departing from the spirit and scope of my invention which modifications I aim to cover by the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. Door operating apparatus comprising means normally holding the door in closed position, means controlled by the interception of a light beam at one side of the door for opening the door against said means and for retaining the door open and means controlled by the interception of a light beam at the other side of the door for rendering inoperative said opening and retaining means.

2. Door operating apparatus comprising light beam projecting and receiving means arranged at opposite sides of the door, means responsive to the interruption of the light beam at one side of the door for opening the door and for holding the door in open position, and means responsive to the interruption of the light beam at the other side of the door for deenergizing said opening and holding means.

3. Door operating apparatus comprising a plurality of light projectors and photo-electric devices for receiving the light thereof arranged at opposite sides of the door, a spring for holding the door closed, door opening mechanism including a relay connected with one of said devices, said relay having a holding circuit, and means controlled by another of said devices for opening said holding circuit whereby the door is allowed to close.

4. Door operating apparatus comprising a motor for moving the door to open position, means controlled by the interception of a light beam at one side of the door for energizing the motor, means for retaining it energized independently of said light beam and means controlled by the interception of a light beam at the other side of the door for releasing said retaining means.

5. Door operating apparatus comprising a motor arranged to move the door to open position, a spring tending to close the door, a photo-electric device at one side of the door, a relay responsive thereto for closing the circuit of said motor, a holding circuit for said relay, a photo-electric device at the other side of said door and a relay responsive thereto for opening said holding circuit.

HARRY R. CRAGO.