

May 30, 1961

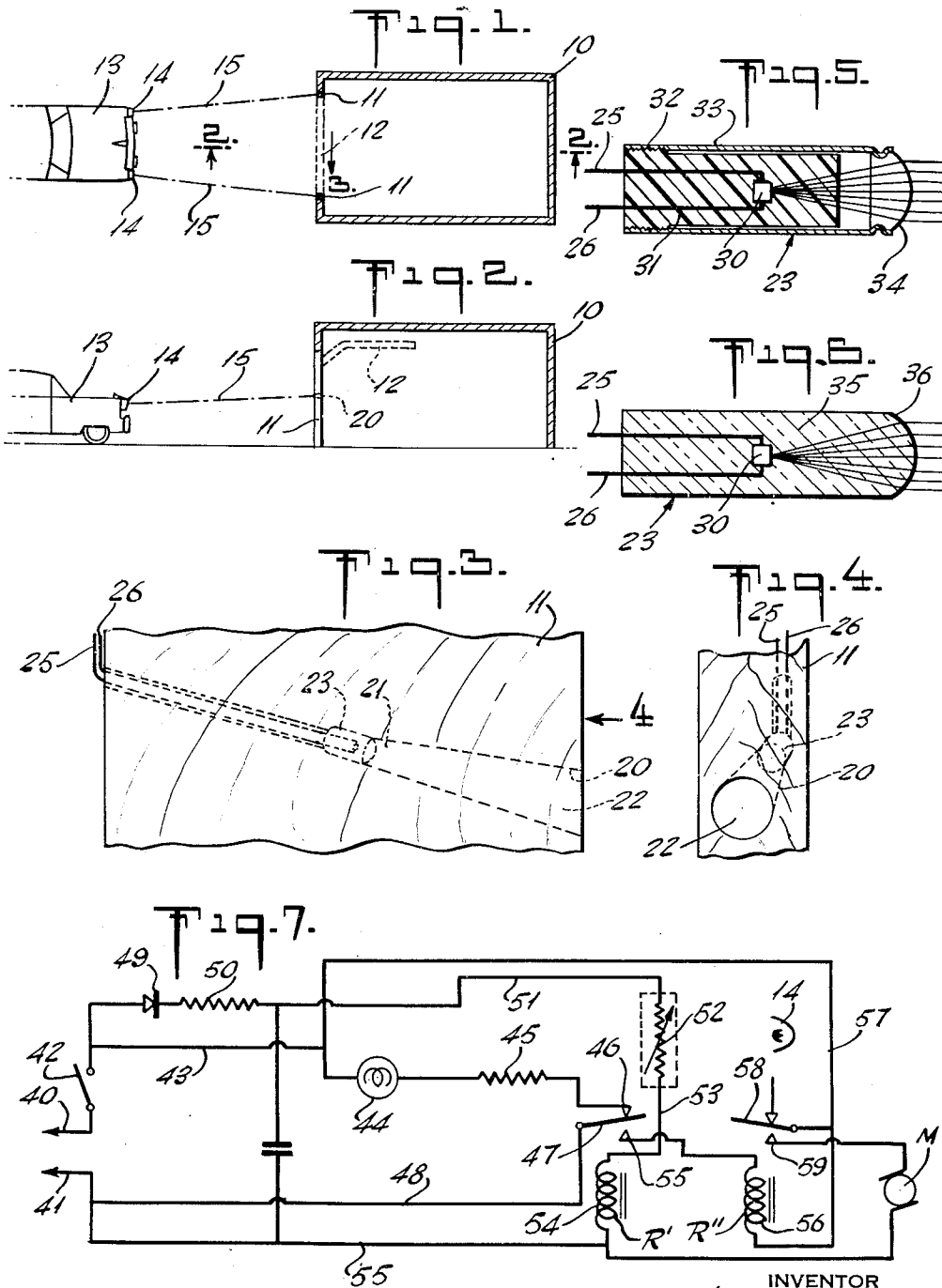
J. HOFER

2,986,689

LIGHT-SENSITIVE CONTROL MEANS FOR DOOR OPERATORS

Filed July 21, 1958

2 Sheets-Sheet 1



INVENTOR
JOHN HOFER
BY *J. W. Cole*
ATTORNEY

May 30, 1961

J. HOFER

2,986,689

LIGHT-SENSITIVE CONTROL MEANS FOR DOOR OPERATORS

Filed July 21, 1958

2 Sheets-Sheet 2

FIG.8

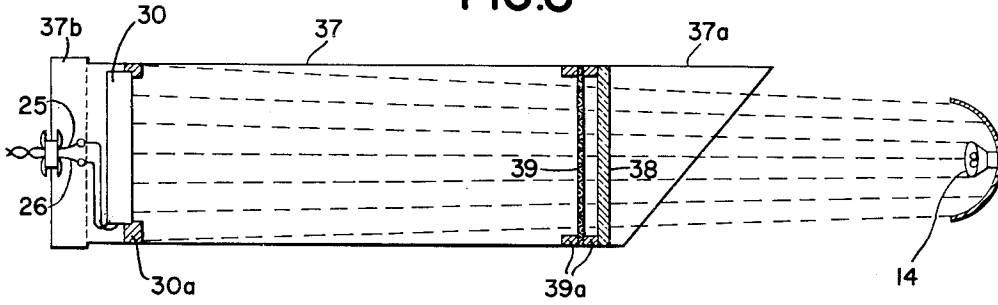
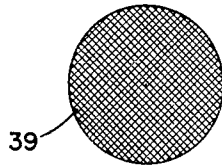


FIG.9



1

2,986,689

LIGHT-SENSITIVE CONTROL MEANS FOR DOOR OPERATORS

John Hofer, Ardsley, N.Y., assignor to Frederick A. Purdy, Scarsdale, N.Y.

Filed July 21, 1958, Ser. No. 750,284

1 Claim. (Cl. 318—480)

The present invention relates to light-sensitive control means and is more particularly directed to light-sensitive control means suitable for use in controlling the opening and closing of garage doors when subjected to or affected by light from the headlight of a motor vehicle in a driveway in front of the garage. This is a continuation-in-part of my application Serial No. 473,572 filed December 7, 1954, now abandoned.

The control circuit and device of the present invention are suitable for use with garage door operators of the character disclosed in Patent No. 2,758,836 issued to Frederick A. Purdy on August 14, 1956, and are adapted to cause opening of the garage door in response to the closing of a circuit through the action of a light-sensitive device of a particular type and to close the door by the reclosing of the control circuit. It may, however, be used with other forms of work circuit.

In accordance with the preferred form of the present invention there is provided a light-sensitive controller having a light-sensitive crystal which normally has a high resistance in the dark and a much lower resistance when subjected to light, this controller being connected to a relay circuit through which power can be supplied to a second relay circuit in the power line which in turn controls the work circuit, such as that passing through the motor of the garage door operating mechanism.

The light-sensitive device may, if desired, be provided directly in the circuit to the relay which causes operation of the motor. However, an advantage in the use of two relays arises when a push button is provided for manual operation to energize the second relay mentioned above. A push button circuit may be shunted around the light-sensitive means directly to the second relay. It should be understood that the flow of current through the light-sensitive crystal is on the order of 2, 3 or 4 milliamperes. Wiring from a remote push button acts as a resistance to the flow of such minute current. This could have the effect of failing to sufficiently energize the relay to close if it only a single relay were employed. By providing two relays and placing the push button in a circuit from the power source to the second relay, adequate current may be supplied to that relay for energizing the same. The resistance introduced by the length of the necessary wiring becomes negligible in this instance.

A feature of the invention is the provision of a light-sensitive controller having a light-sensitive crystal capable of instantaneous response to applied light, and capable of valving electrical current of normal house voltage and frequency in usable quantity without amplification. It contemplates an electricity valving crystal effective under atmospheric pressures, temperatures and influences. This is highly desirable in comparison with photoelectric cells requiring envelopes or containers which are evacuated or filled with some inert gas to protect the elements from the air. A crystal of the character contemplated has other advantages over a photoelectric cell in simplicity, durability and compactness of installation in a way to expose it to applied light.

2

Another feature of the invention is the placing of the light-sensitive device in such a position that it is not affected sufficiently by ordinary daylight to transmit enough current to operate the relay but at the same time is capable of having the light beam from an automobile headlight directed thereon with resultant reduction in the resistance of the crystal to an extent sufficient to permit the flow of adequate current for operating the relay.

Still another feature of the invention is the provision of improved mounting means for the light-sensitive crystal. Several alternative arrangements are provided for this purpose. A particularly desirable arrangement is one in which the crystal is not subjected to a beam of light directed upon a single spot, but instead is flooded with light over its entire surface facing the source of light.

Other features and advantages of the invention will appear from the detailed description of one embodiment of the same, together with suggested modifications of certain of the parts which will now be described in conjunction with the accompanying drawings. It is to be understood that the drawings are illustrative of a desirable embodiment of the invention but are not to be regarded as limiting the scope thereof.

In the accompanying drawings:

Fig. 1 is a diagrammatic plan view showing an automobile in the driveway in front of a garage with closed door;

Fig. 2 is a vertical, sectional view on the line 2—2 of Fig. 1, showing the door open;

Fig. 3 is an enlarged section of the door jamb taken in the direction of the arrow 3 of Fig. 1;

Fig. 4 is a fragmentary edge view of the door jamb taken in the direction of the arrow 4 of Fig. 3;

Figs. 5 and 6 are enlarged sectional views through two forms of mount for a light-sensitive crystal;

Fig. 7 illustrates a wiring diagram;

Fig. 8 is a vertical sectional view through a further modified form of mounting means for the light-sensitive crystal and related parts, with the light source provided by an automobile headlight shown out of proportion and the rays therefrom indicated schematically; and

Fig. 9 is a face view of a screen embodied in the mounting means of Fig. 8.

In Figs. 1 and 2 a single-car garage is diagrammatically illustrated at 10. It has door jambs 11, 11 and an overhead door indicated at 12.

The automobile is indicated at 13 and rays from the headlights 14 are directed toward the door jambs, as indicated at 15, 15. These rays are shown as diverging slightly from the side of the car so as to fall on the door jambs and are illustrated as being slightly elevated. Such light rays are available from the usual automobile headlights and when an automobile is about one car length away from the garage, very strong beams of light are emitted in the directions indicated.

As shown in Figs. 3 and 4, one of the door jambs (the right) has an oblique, upwardly extending tapered light tunnel 20 adapted to receive the upwardly directed light from the headlight but substantially shut off daylight so that the inner end 21 of this tunnel is dark except when the headlight is flooding light directly into the opening 22. At the inner end of the light tunnel 20 is set a light-sensitive crystal mounting indicated at 23. The crystal 30 has two leads indicated at 25 and 26.

Two forms of mounting means are illustrated in Figs. 5 and 6. Each has a small, light-sensitive crystal indicated at 30. This crystal may be of quartz, or cadmium sulfide, and of the order of 1 to 2 mm. square on its light receiving face and its opposite face. Such a crystal of cadmium sulfide will have a very high resistance in the dark, for example, a resistance of the order of

10,000 megohms, and, when lighted, will conduct current, in the order of two milliamperes, adequate without amplification to close a sensitive relay. Its conduction of current is instantaneous upon application of light, involving no time-period such as required to heat an amplifier.

In the form shown in Fig. 5, this crystal is embedded in a transparent plastic body 31. This body is threaded as indicated at 32 and received in an internally threaded metal tube 33. The end of the tube 33 is closed by a lens 34 having a refracting power to focus the rays on the crystal. The position of the crystal can be adjusted by threading the plastic body 31 in the tube.

In the form shown in Fig. 6, the crystal and lead-in wires are enveloped in a glass body 45 with the lens-like end 36. The best results have been obtained by making the lens of greenish or brownish glass of the nature used in sun glasses.

Referring now to Figs. 8 and 9, there is shown another and preferred form of mounting means for the light-sensitive crystal 30. This comprises a tube 37 having a forwardly extending hoodlike end 37a facing toward the headlight 14 of an automobile. This tube may be formed of any suitable material, such as brass, and has its inner surface painted black to avoid any reflection. The end of the tube opposite to its hooded end is provided with a cap 37b through which the electrical leads 25 and 26 connected with the crystal unit 30 extend. This crystal unit is mounted in the tube by a retainer 30a adjacent the end carrying the cap 37b. The cadmium sulfide forming the actual crystal is a very thin line winding back and forth between supporting layers of plastic or the like, the opposite ends of said line being connected with said leads. Adjacent the hooded end of the tube there is mounted a disc 38 formed of colored glass or the like, which is preferably ruby red in the case of a unit having a cadmium sulfide crystal as the light-sensitive element. Other colored glass or the like may be used, and in units having other types of light-sensitive elements may be preferred. A slight distance inwardly of the disc 38 there is provided a screen 39. This and the disc 38 are held in place by retaining rings 39a. The screen may be formed of copper or other suitable material but it is painted black to avoid reflection of light. Its mesh should not be so close as to shut out a substantial part of the beam of light from the automobile headlamp but sufficiently close to break up light rays entering the hood 37a and provide a relatively dark region at the rearward or inner end of the tube 37 in ordinary daylight. A mesh of between 10 and 16, i.e. 10 to 16 wires per inch in each direction, has been found satisfactory. The cadmium sulfide element 30 is rectangular in form as viewed from the outer end of the tube and may suitably be 1" long and about 5/8" wide. Its depth may be about 3/16". The tube 37 may suitably be 1 1/4" in diameter and from 3" to 6" in length, depending upon the requirements of the installation.

Fig. 7 illustrates a circuit for the light-sensitive controller. The ordinary alternating current house supply leads are indicated at 40 and 41. A suitable control switch 42 energizes the remainder of the circuit. One branch of the circuit includes a connection 43 to a pilot light 44, to show that current is supplied, a pilot light resistance 45, a contact 46 normally closed by the armature 47 of a relay (to be described) and the return wire indicated at 48.

The switch 42 also energizes the control circuit which includes a single wave rectifier indicated at 49, a resistance 50, wiring 51 and the light-sensitive crystal 52 of the nature above described, wiring 53, a coil 54 of a direct current relay R' (having the armature 47) and a return wire 55 to the opposite side of the power source. The crystal 52 is adapted to be energized by the headlight 14 as above described. The constants of the direct current circuit are such that the output of the rectifier as controlled by the resistance 50, the crystal 52 and the resistance of the coil of relay R' permits insufficient current to flow through the relay coil when the crystal is dark to cause the relay to attract the armature 47. When the crystal 52 is lighted, as from the headlight 14, its resistance is lowered to such an extent that current flowing through the relay R' will be of sufficient value to cause the relay to attract armature 47. This opens the pilot lamp circuit and connects the wire 48 and armature 47 to the lower contact 55 of the relay R' and completes the connection from the power source to the coil 56 of the second relay R'', this coil being connected to the other side of the circuit by wiring indicated at 57. The relay R'' has armature 58 biased away from the contact 59, but attracted against it when the relay R'' is energized. The contacts of the relay R'' thus close the circuit for a motor M. This motor may be used to operate the door opener or any other work circuit.

It will be understood that either of the relays R' and R'' may be arranged to have normally closed contacts which open when the crystal is lighted.

Since it is obvious that the invention may be embodied in other forms and constructions within the scope of the claim, I wish it to be understood that the particular forms shown are but a few of these forms, and, various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

I claim:

A garage door operator adapted to be controlled by the headlight of a vehicle in the driveway comprising, a non-amplified circuit extending directly from an A.C. source, said circuit including a crystal which is effective under atmospheric conditions and has relatively high resistance when dark and low resistance when lighted, means shielding said crystal from light beams from extraneous light sources but admitting light to said crystal from the headlight of a vehicle when properly positioned, a first relay in series with said crystal, a rectifier in series with said crystal and said first relay, a coil on said first relay connected directly in series with said crystal, said rectifier and said source, a switch in said first relay having a plurality of contacts, said switch being normally engaged with one of said contacts which is connected to said source, a second relay in a control circuit energized from said source by said first relay, said second relay having a coil in series with said switch when it is engaged with another of said contacts, and motor operated garage door opening and closing means energized from said source by said second relay.

References Cited in the file of this patent

UNITED STATES PATENTS

2,760,134	Johnson	Aug. 21, 1956
2,774,015	White	Dec. 11, 1956
2,776,357	Porath	Jan. 1, 1957