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PHOTOELECTRICALLY ACTUATED GARAGE DOOR OPENER

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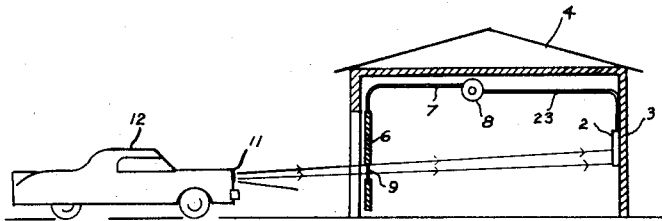


FIG. 1

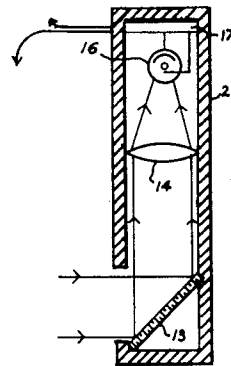


FIG. 2

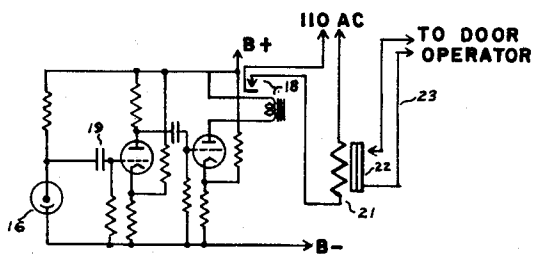


FIG. 3

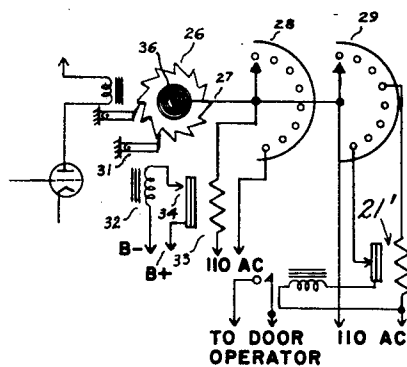


FIG. 4

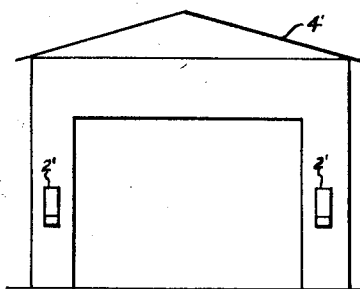


FIG. 6

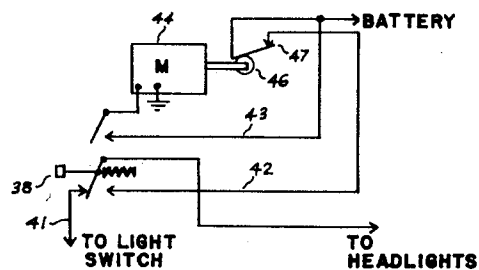


FIG. 5

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PHOTOELECTRICALLY ACTUATED GARAGE DOOR OPENER

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2 Claims. (Cl. 317—124)

This invention relates to a device for operating garage doors without requiring the driver to step out of his vehicle. It is a primary purpose of the invention to provide such a device which may be operated by manipulation of the headlight switch of an automobile, to either open or close a motor driven garage door.

Devices enabling drivers to open garage doors without emerging from the vehicle are known. The most popular types in use today employ either radio transmitters or ultrasonic devices to operate a door of a garage when the motor vehicle is in the proximity of the door. In both of these methods, fairly elaborate and very often expensive installation is required in the automobile. According to the present invention, no installation is needed in the automobile, or, at most, a very simple electrical interrupter may be used. The device operates by the action of the light from the headlights of the car impinging upon a photocell and is so arranged that steady ambient light, such as daylight or ordinary artificial illumination, does not affect the mechanism.

It is a major object of the invention to provide in a simple and inexpensive device of the above nature, means for minimizing the risk of unintentional or accidental operation of the garage door.

Another object is to provide a photoelectric garage door opener which can be operated only by a coded series of headlight flashes, so as to insure greater privacy.

The specific nature of my invention, as well as other objects and advantages thereof, will clearly appear from a description of a preferred embodiment as shown in the accompanying drawing, in which:

Fig. 1 is a schematic diagram showing the principle of the invention;

Fig. 2 is a schematic cross-sectional diagram of a photoelectric pickup according to the invention;

Fig. 3 is a schematic circuit diagram illustrating the principle of the invention;

Fig. 4 is a circuit diagram of a coding arrangement responsive only to a coded series of light flashes;

Fig. 5 is a circuit diagram of a frequency-coded photoelectric door opener; and

Fig. 6 shows a garage equipped with two pickups for simultaneous operation.

Referring to Fig. 1, the photoelectric light-responsive system of the invention may be mounted in a housing 2 on rear wall 3 of garage 4 having a conventional upward-opening door 6 which is run up onto overhead tracks 7 by energization of motor 8 in conventional fashion. Door 6 is provided with window 9 at about the same height above the ground as the headlight 11 of automobile 12, and the photoelectric system 2 is mounted so as to receive light from headlight 11 through window 9.

As shown in Fig. 2, unit 2 comprises a reflecting mirror 13 arranged to direct light from the headlight upward through lens 14 onto photocell 16 associated with

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amplifier circuit 17, the details of which are shown in Fig. 3.

Photocell 16 is connected to a conventional two-stage resistance-coupled amplifier, the second stage of which terminates in an electromagnetic relay 18. The amplifier is designed to pass very low frequencies, but not to operate under direct current output of the photocell, due to the interposition of condenser 19 in the grid circuit of the first stage. The time constant of the condenser circuit is such that when the lights of the oncoming car are turned on and off at a conveniently rapid rate, for example, about twice a second, the output relay 18 will close and open at this rate as the plate current of the second tube approximately follows the light modulations. A thermal relay 21 is connected to the contacts of relay 18, which are arranged to be normally opened. Each time the contacts of relay 18 are closed, energy is fed into the heating coil of the heating relay which cannot, however, close its contacts due to a single pulse, or less than, for example, three or four pulses in rapid succession. After several successive pulses, the bimetallic strip 22 of thermal relay 21 is raised to a sufficient temperature to close the contacts of the thermal relay and provide the signal on line 23 for opening or closing of the garage door. The mechanism for doing this is conventional and is not a part of the present invention.

It will be noted that for proper operation of the device, the fluctuations of the headlights must be made in a continuous series in order for the thermal relay to operate. If one or two flicks of light occur, as can be caused by a person passing in front of the photocell box and interrupting normal ambient light, the thermal relay will receive one or two pulses of energy, but will soon dissipate this energy and restore itself to the original condition. If, however, the pulses arrive in continuous succession, the energy level will build up, the temperature will rise, and the bimetallic strip will finally close the circuit.

Fig. 4 shows a more sophisticated system which requires a specific number of signals in a coded sequence. In this case the photocell and amplifier are the same as in Fig. 3, but the termination of the amplifier, instead of being a simple electromagnetic relay, is fed into a stepping type of relay 26 to rotate shaft 27 to operate two decks of switches 28 and 29 respectively in step-by-step fashion. The stepping relay is of the type which has a spring return and electromagnetic latch 31 by means of which the relay can be returned to its initial starting condition when winding 32 of the latch is energized. Such relays are commercially available. By way of example, a system is shown so set up that it takes four pulses and a pause followed by four additional pulses of light to operate the device. Assume that the headlights are operated properly, i.e., that the operator flashes the lights four times and waits for a short pause. This will step the relay contacts to position No. 4 and the thermal relay 21' will be energized by the 110 volt A.-C. circuit. If the contact is held for a sufficient period of time for the relay 21' to close, say in the order of one second, and the operator then continues to pulse the light four more times, reaching position No. 8, the electromagnetic relay 31 is energized through the still-closed thermal relay 21' and thus actuates the door operator. A second thermal relay 33 is actuated by second deck 28 of the stepping switch and is used to ensure that unless the sequence of operations above described occurs within a reasonable time, the entire system will revert to its initial condition and be ready for the next operation. This second thermal relay 33 is set for a time which is slightly greater overall than the required time to operate the door opener as above described. It is energized immediately upon the

first pulse and remains energized throughout the whole cycle. Eventually the thermal relay 33 warms up sufficiently to close the normally open contacts 34 and release the latch mechanism 31 so that the entire mechanism is returned by spring 36 to its initial position. If the normal sequence of operations is not performed in the required time, say approximately three seconds, this thermal relay 33 will actuate the contacts and reset the device to zero. After a few seconds to permit the relay to cool off so that the stepping relay will be again operable, the entire procedure can be repeated. Various other combinations of contacts can, of course, be arranged to change the coding. More than one waiting point can be introduced by using another thermal relay connected to another contact on the stepping switch of deck 29. Electromagnetic relay 31 may be eliminated in some cases, and the door opening circuit may be connected directly to a relay or switch used to trip the door opener.

Another method of using the photoelectric trip is to mount two of the devices shown in Fig. 2 on opposite sides of the garage door so as to require the simultaneous operation of two relays in order to trip the door mechanism. This may be an advantage if it is desired to minimize the danger of children waving their hands in front of the tripping device or to prevent accidental actuation of the photocell pickup. The spread of ordinary automobile headlights is more than sufficient to reach both photocells when mounted in close proximity to the garage door. The output relays in Fig. 3 would then be wired in series so that both would have to be actuated in order for the door to open.

It should, of course, be understood that the same photoelectric device can be used to close the door when the car leaves the garage. Most door openers are now made so that the same signal will open or close the door depending the previous history.

While the device may be mounted on the exterior wall of the garage for actuation by the headlights, it appears preferable to mount the door opener as shown in Fig. 1, except when the driveway is so arranged that a car approaches the door at a slight angle so that its headlight beams illuminate the side of the garage intensely before the car stops directly in front of the door. An advantage of the arrangement of Fig. 1 is that after the car is inside the garage, flashing its lights will also operate the mechanism to close the door. Normally a manual push-button switch is employed for this purpose, if the photoelectric device is mounted outside the garage. The system described so far employs ordinary switches provided in modern cars for operation of the door, that is, either manual turning on or off of the lights rapidly for a second or two is sufficient, or if the lights are already on as is the case at night, operating the foot switch which is normally called the dimmer switch will change the intensity of lights sufficiently to operate the door opener. If preferred, however, a single push-button may be provided on the dash or any other suitable place in the automobile to operate the doors to the garage. An arrangement for doing this is shown in Fig. 5, whereby the headlights are automatically turned on and off by operation of push-button 38 independently of other switches or of whether the lights are off or on when the switch is pushed. This is accomplished as follows:

Push-button 38 and its associated switch are normally biased as shown in Fig. 5, to close the circuit through lead 41 to the normal headlight switch of a car. When the push-button is operated, it opens circuit 41 and closes circuits 42 and 43, the latter circuit energizing motor 44 which drives eccentric 46, through suitable gearing if necessary, to rapidly open and close contacts 47, which

now control the headlight circuit. Instead of the motor and the eccentric arrangement described, a slowly vibrating current interrupter can be used; this may be either electromagnetically or thermally operated as is well known. In using this device, one has merely to press the switch and hold it down until the door begins to open or close. In this case, the frequency of interruption may be much higher than with manual operation, and since this frequency will be constant, the photo-cell actuating system may also be tuned to the same frequency, which increases the privacy factor of the system.

While the mirror could be eliminated and the photocell and its lens combination directed horizontally, the arrangement of Fig. 2 appears preferable because it gives the effect of a sun shade of considerable depth to minimize the effect of brilliant sunlight shining directly into the device, which is undesirable for two reasons, first, that it could conceivably, at the height of the day's intensity injure the photocell by direct heating action, and second, that it may take the cell out of its linear range so that it will not operate because of the small additional difference due to the headlights of a car. If the angle of view of the photocell is restricted sufficiently, as can be done with the arrangement shown in Fig. 2, then even if the sun were on the horizon and shining directly horizontally into the cell, the approaching automobile would block the way of the sunlight and automatically provide the necessary shading to make the device operable. In actual operation, sunlight was found to present no problem.

It will be apparent that the embodiments shown are only exemplary and that various modifications can be made in construction and arrangement within the scope of my invention as defined in the appended claims.

While the invention is intended for use primarily with garage doors, it will be apparent that it is equally applicable to other types of doors through which vehicles pass, such as roadway and driveway gates, building gates, etc.

I claim:

1. A light-pulse actuated door opening system comprising photocell means, an amplifier circuit responsive to rapid variations in light intensity on said photocell means to produce an individual pulse of energy in its output for each such rapid variation, circuit actuating means responsive to at least a predetermined number of said pulses within a predetermined time but insensitive to a lesser number of pulses, and door operating means controlled by said circuit actuating means, said amplifier circuit comprising capacitive means arranged to block the passage of direct current from said photocell means and having resistive condenser discharge means in circuit therewith arranged to pass pulses of fluctuating current in a predetermined low frequency range in the order of one-half cycle per second, said circuit actuating means comprising a thermal delay relay means adjusted to respond to a predetermined small number of such pulses to operate said door operating means.

2. The invention according to claim 1, there being two such photocell circuits so arranged that both must be simultaneously pulsed to actuate said circuit actuating means, said two photocell circuits being spaced and positioned so that each is responsive to a separate headlight of a vehicle.

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