

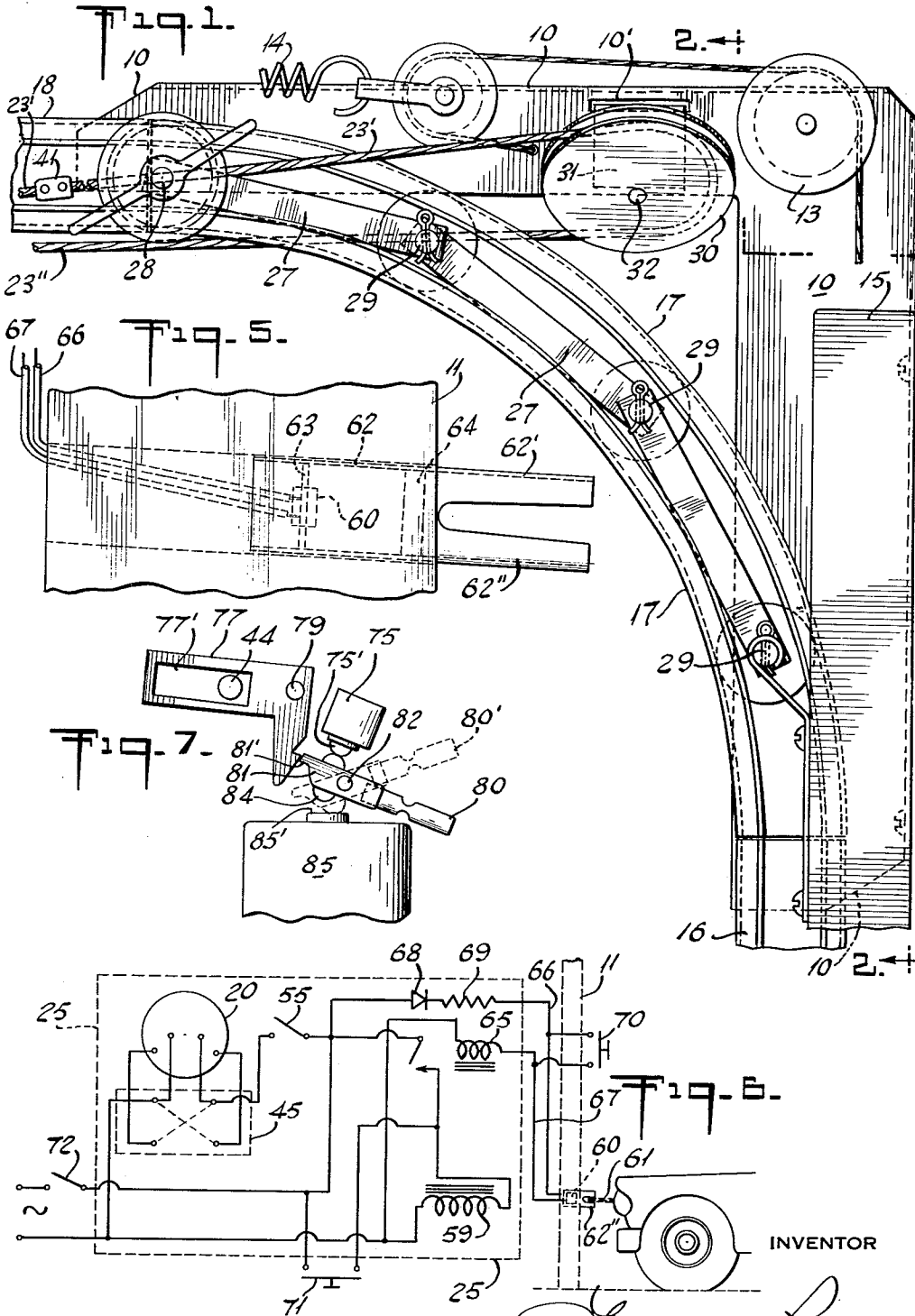
Aug. 7, 1962

F. A. PURDY
DOOR-OPERATORS

3,048,761

Filed Oct. 1, 1957

4 Sheets-Sheet 1



INVENTOR

Frederick Purdy

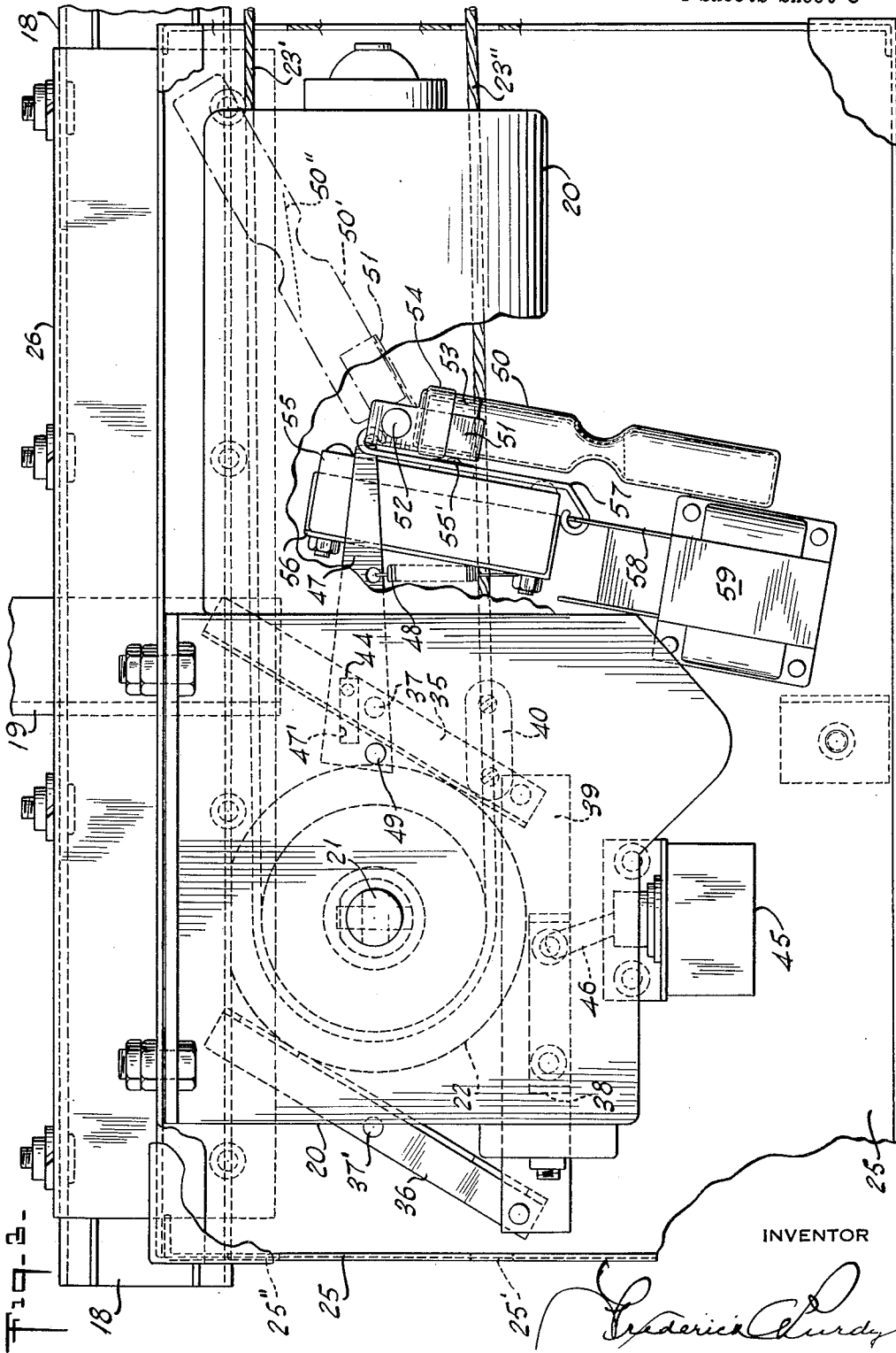
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INVENTOR

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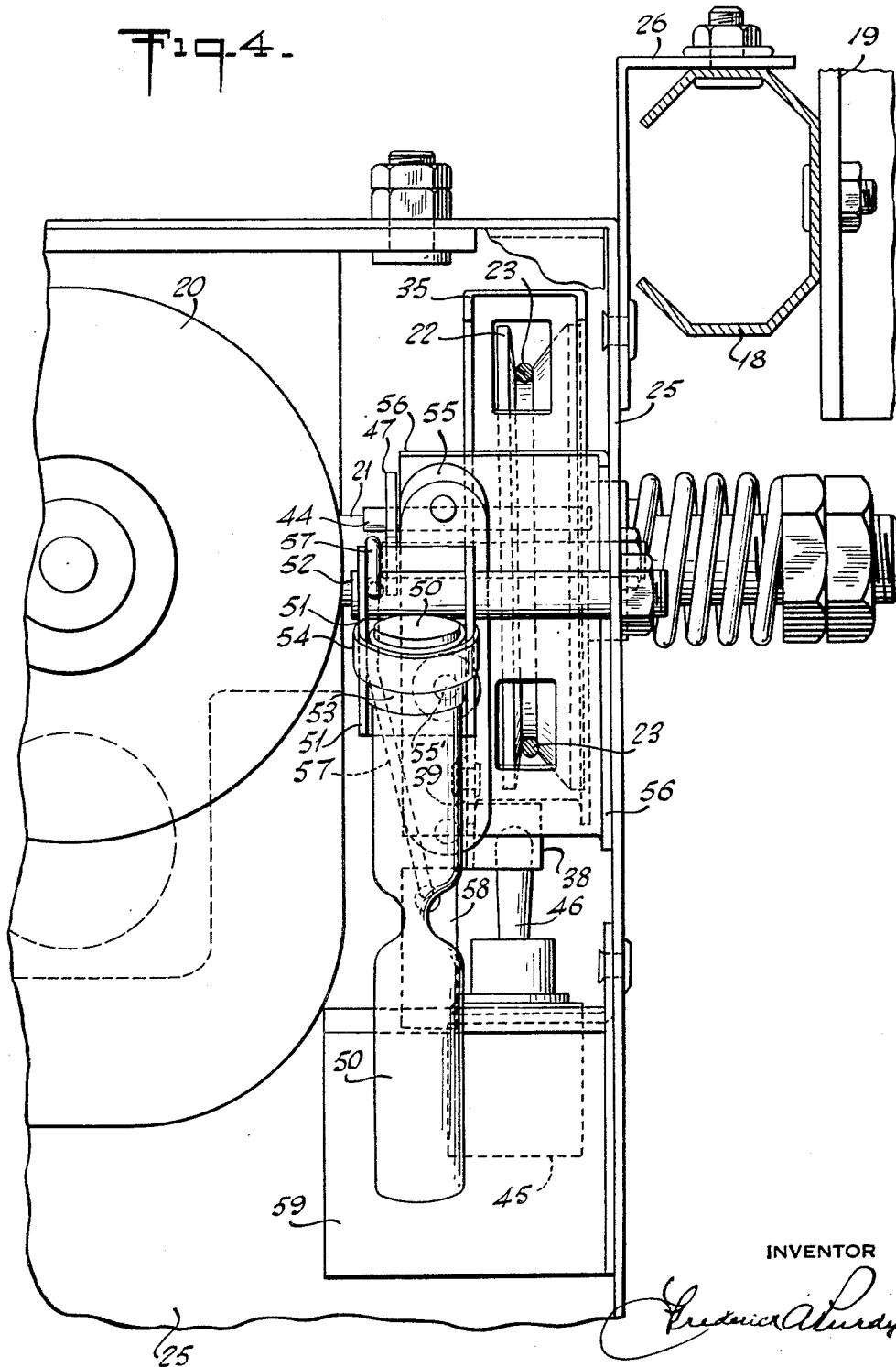
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Fig. 4.



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3,048,761
DOOR-OPERATORS
 Frederick A. Purdy, Scarsdale, N.Y.
 (300 E. 51st St., New York 22, N.Y.)
 Filed Oct. 1, 1957, Ser. No. 687,509
 9 Claims. (Cl. 318—480)

This invention relates to door-operators and controls therefor, and has particular reference to devices for opening, closing and controlling the operation of, doors at garages, residential and commercial.

Objects of Invention

Actuation of a door to open and close by directing light from the headlamp of an automobile to a light sensitive cell, set in the garage-structure, requires that the headlamp beam, or the practice of its application, differ from sunlight which may reach the cell at some garage exposures, especially towards sunrise or sunset.

I have preferred, for simplicity, to differentiate from sunlight by having the door actuated, not when light is applied by the headlamp, but when it is extinguished or withdrawn, since applied light may be extinguished at will; the practice being to extinguish or withdraw the light within about a second or two after application, and provide that application of light through a longer period as with sunlight will disable the controls as to effectiveness for door-actuation.

This has been the principle in each of my patent applications:

Serial Number 526,035, filed August 2, 1955;
 Serial Number 628,036, filed December 13, 1956
 Serial Number 669,143, filed July 1, 1957

and in an application about to be filled by John Hofer and myself as co-inventors, which, during the prosecution of this application becomes identified by Serial Number 705,712, filed December 27, 1957; and it continues to be the principle in this application. But here the invention disclosed is of extreme simplicity, dependability, and economy.

It uses a "two chambered gravity-timer" of the "hour-glass" type, having two chambers interconnected by a neck through which any suitable material, granular or liquid, held in one of the chambers, may be transferred to the other chamber by gravity in a time-period predetermined by the size of the orifice through the neck. In the embodiment here shown, sand will be the material used and referred to for convenience, and the "two-chambered gravity-timer" may be called a "sand-timer."

The timer is positioned endwise from a pivot so that one of the chambers, the "inward" one, is close to the pivot, and the other, the "outward" one, is farther removed from the pivot. The timer, normally hanging vertically from the pivot, is swung upward, above the level of the pivot, by a solenoid, and thus poised into potential switch-throwing position, when light is applied at a light sensitive cell held in the doorway frame. If the light is promptly extinguished or withdrawn, the timer falls with its weight of sand kept in the outward chamber at high leverage, sufficient to throw a switch to operate the motor which drives the door open or closed. But if there is a delay, as normally occurs with sunlight, the sand drains by gravity from the outward chamber to the inward chamber, reducing the leverage so that, when the sunlight passes, the timer falls without the force of inertia needed to throw the switch. Thus sunlight is nullified as to door-operating effectiveness. Lightning is too rapid to rock the timer as far as to set up switch-closing momentum on the return swing.

A further object of the invention is the placement of the motor and door-drive controls and connections fully

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below the level of the track as shown in FIGURE 4. Broader utility in a device of this kind is gained if the device may be installed under any conditions, whether of low ceiling or limited sideroom between track and wall. Progress in this direction is disclosed in my patent application Serial No. 669,143 filed July 1, 1957, as observed on the last line of page 1, and the first five lines of page 2. There the installation is noted as "substantially below track-level." But, as observable in FIGURE 1 of that application, about half the body of the motor is above the level of the track. It will be observed in FIGURES 1 and 2 of that application that the idler strand of cable 45 (the strand which connects to turnbuckle 45') lies above the driver-strand (the strand which is clamped at 34 to the articulated driving linkage). This arrangement was necessitated by the condition that pins for door rollers running in the track such as pin 18, FIGURE 2 of that application, and similar pins following, would obstruct a strand of cable put below the track level, colliding with shipper and turnbuckle moving in the reverse of the direction of door-movement and preventing door-operation. And since the upper and lower strands of cable 45 lined up with shaft 33 and the gear-head of the motor, the motor had, perforce, to take its position, in part, above track-level. In the arrangement shown in the present invention, this difficulty is met, with the driver-strand of the cable at track-level, and the reverse-moving idler-strand below it.

A further object of the invention is to provide, at a housing for a light sensitive cell, a lower visor, additionally to the upper visor or sun-shade shown in preceding applications. The lower visor is to intercept light-rays reflected from snow. Bright sunlight so reflected is in some conditions almost as strong as the sun's rays from above. The lower visor has the value of reducing snow-reflections to little more than ambient daylight.

An object of the invention is to provide a control that responds, as herein described for a light-signal, to any other signal, whether radio, electronic, or otherwise.

These and other objects will appear in the development of the description.

Drawings

The accompanying drawings show, for purposes of illustration, one embodiment in which the invention may take form, but the invention is not limited to this embodiment.

FIGURE 1 is an elevation-view, toward one jamb of a garage-doorway, of a bracket on the doorway's inner facing and cable-pulleys on the bracket, also a curved track and ends of vertical and horizontal tracks held by the bracket.

FIGURE 2 is a detail view, partly in elevation and partly in section along the line 2—2 of FIGURE 1.

FIGURE 3 is an elevation or face view of a cabinet containing motor and controls set on the rearward end of the horizontal track, some of the motor being cut away.

FIGURE 4 is a side view of FIGURE 3.

FIGURE 5 is a fragmentary detail elevational view, in the plane of FIGURES 1 and 6, of a cylinder imbedded in a door-jamb, housing a light sensitive cell.

FIGURE 6 is a schematic view and wiring-diagram.

FIGURE 7 is a fragmentary diagrammatic view of an alternative timer-assembly in miniature.

Door and Motor-Drive

The door 15 is of the conventional overhead type, in several sections hinged together, of which the upper end of the top section appears in FIGURE 1, and in FIGURE 2 against trim 11. It is carried by pins from its section-hinges to rollers that travel in vertical track 16, curved track 17, and horizontal overhead track 18, the

door moving between vertical closed position at track 16, and open position at track 18. Bracket 10 supports the tracks upon the doorway's inner facing 12, and a hanger 19 (FIGS. 3 and 4) supports the remote or rearward end of track 18 from the ceiling. The door is counterbalanced by a spring 14 in the usual way, connected to a cable that runs to the door over pulley 13, FIG. 1.

The door-drive is effected by a reversible gear-head motor 20, FIG. 3, set in a cabinet 25 which is mounted by bracket 26 on the rearward end of track 18; the shaft 21 of which motor carries a double-disc cable-grip sheave 22 driving a cable 23, which cable extends in endless-belt fashion between grip sheave 22 and a pulley 30 on bracket 10, and has attached to it an articulated linkage 27 that runs within tracks 17 and 18 and connects to the door, as shown and described in detail in my application Serial No. 669,143 filed July 1, 1957.

The characteristic that distinguishes the arrangement in this application from that in Serial No. 669,143 is that pulley 30 is set at an angle to carry cable 23 down under the horizontal arm of bracket 10 and out to the side of bracket 10 and of track 18 that is away from, and clear of interference with, the several support-pins which extend from section-hinges to track-rollers, such as pin 29 in FIGS. 1 and 2. As appearing in FIGURE 2, pulley 30 is held to bracket 10, at an angle of 45° out of vertical or horizontal, by a positioner 31 of formed sheet-metal which is hung in a slot 10' punched in bracket 10, through two flanges of which positioner 31 a pivot-bolt 32 passes, this bolt being shouldered to seize positioner 31 without binding pulley 30, directioned by a 45° tapered washer 33, and tightened and locked by respective nuts 34 and 34'. Pulley 30 appears in FIGURE 2 in position relative to a cross-section of track 18, receiving in the upward level of its groove that strand of cable 23 which is the drive-strand 23', and carrying cable 23 down below the level of track 18 and out under the horizontal arm of bracket 10 to the side of track 18 that is clear of roller-pin interference, such as by pin 29 in FIG. 2; the idler strand 23'' of cable 23 running thence rearward into cabinet 25 and around grip-sheave 22, returning thence forward as the upper strand, drive strand 23', clamped at 28 to the articulated linkage 27. The upper strand of cable 23, where clamped at 28, FIGURE 1, is on a level higher than the level of the top of grip-sheave 22 in FIGURE 3 about seven feet away. Accordingly, as clamp 28 moves toward cabinet 25, cable 23 assumes a slant somewhat more steep than appears in the gradual slant of FIGURE 3. The entry into cabinet 25 of the cable, and of shipper 41 on the cable, is provided for by a vertical slot punched in the cabinet-wall.

Within the cabinet are two switchers 35 and 36, one each side of grip sheave as seen in FIGURE 3, pivoted on threads of respective studs 37 and 37' locked on back wall of cabinet. A button or shipper 40 on the lower strand 23'' of cable 23 is in position as when door is fully closed, and in this position has thrown the lower end of switcher 35 against grip-sheave 22 and, in the throw, has thrown a reversing switch and opened a power-switch. Another shipper button 41 on strand 23', FIG. 1, throws top end of switcher 35 against grip-sheave when door reaches fully opened position.

Switchers 35 and 36 are interconnected by link 39 upon which a two-fingered shifter 38 is riveted for throwing handle 46 of reversing switch 45 leftward as the door reaches closed position and rightward as the door reaches open position, thus conditioning the circuit to motor for a direction of drive when motor is next energized that will be the opposite of the door's direction at the end of which the switch-throw is effected.

The interconnection of switchers 35 and 36 makes unnecessary any relocating of parts to install on track at the opposite side of the garage. Cables and shippers

may enter the cabinet through hole 25' and slot 25'' indicated in the cabinet-wall leftward of FIG. 3.

Light Sensitive Cell

The light sensitive cell 60, of FIGURES 5 and 6, is held in the door-jamb 11 on one side or other of doorway, as shown in all of my patent applications referred to in column 1 of this application, in position conveniently for reception of a light beam 61, FIGURE 6, as from the headlamp of an automobile.

The cell may be any suitable device which, when lighted, provides for flow of electric current to relay 65 or to solenoid 59, and when dark, reduces or terminates such flow. It may be a crystal, such as shown by John Hofer in application Serial No. 473,572 filed Dec. 7, 1954; or it may be a self-generating or voltaic cell, having a light sensitive material bonded to a metal disc, which generates electric current when lighted; or it may be a junction-type semi-conductor, such as shown by J. N. Shive in Patent 2,641,713 issued June 9, 1953, or it may be any other device adaptable for the purpose.

Re FIGURES 5 and 6: the cell 60 is held by a disc 63, FIG. 5, which is press fitted into cylinder 62 behind a daylight filter 64 also held by press fit. Cylinder 62, imbedded in a bore in door-jamb 11, has, at its end which faces toward the automobile headlamp, upper and lower visors integral, 62' and 62'' respectively, the upper visor for intercepting light rays from above, and the lower visor for intercepting light rays from snow-reflections of bright sunlight.

Gravity Timer

A sand-timer 50 of glass, in two opposite chambers connected by a neck, containing suitable sand in quantity to fill one of the chambers, is supported by a channel-formed cradle 51 pivoted on threads of stud 52 locked to rear wall of cabinet. The glass has around it a first, or inner, wrap of elastic adhesive tape 53, FIG. 3, by which it makes a resilient fit between the flanges of cradle 51; timer and cradle together have a second, or outer, wrap of tape 54.

A power-switch 55 closed by a button 55', is held by bracket 56 riveted to back wall of cabinet, and positioned so that cradle 51 when swung leftward in FIG. 3 may depress the button to close the switch.

A latch 47, biased downward by spring 48, to engage the upper end of cradle 51 and hold the switch closed, is pivoted on the threads of stud 49 locked to rear wall of cabinet. This latch is punched with a rectangular hole 47' into which a prong 44 communicates, which prong is held by a press fit through both flanges of switcher 35. The prong swings with the switcher through an arc, to lift latch 47, and thus release cradle 51, and timer 50, to move rightward by gravity to free button 55' and to open the circuit of power to the motor, whenever switcher 35 is thrown in either direction by respective shipper 40 or 41 whenever the door reaches a short distance short of open position or short of closed position respectively.

A pull-rod 57 engaged in the top extremity of cradle 51 connects to plunger 58 of solenoid 59, so that a pull inward by the plunger swings cradle and timer to the upward position 50' indicated in broken lines of FIGURE 3.

As in FIGURE 6, schematic and wiring diagram, two wires 66 and 67, bonded into the cell 60, conduct current from or through the cell, the wire 67 conducting to the energizing coil of relay 65. If house current is used for the cell, the direct current output of rectifier 68, smoothed by resistor 69, protects the cell. Push button 70 may be used to shunt between conductors 66 and 67 to energize relay 65 and solenoid 59. Or a push button 71 may be mounted on the under wall of cabinet 25, or any counterpart of it may be located anywhere, to energize solenoid 59 directly. A master switch or "night-

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lock" 72 may be mounted on cabinet 25, or in any convenient location.

In FIGURE 7, a two-chambered gravity timer 80 is outlined as contemplated in a diminutive size which may be associated directly with a relay, or with a miniature solenoid, to eliminate one or other of these magnets. The one magnet 85 may be supported to cabinet wall, as also may be the motor-circuit's switch 75, pivot 79 of gravity-biased latch 77, and pivot 82 of cradle 81 which carries timer 80, carries a bar 84 to be attracted by the magnet, and has a tip 81' to be engaged by latch 77, and disengaged by horn 44 already described. Button 75' is spring biased within the switch body to be pressed outward into the position shown in FIGURE 7.

The drainable material within the two-chambered gravity-timer may be mercury, to afford an optimum weight, when elevated as stored energy, in proportion to the weight of non-drainable parts. If the magnet 85 were of the character of a solenoid, its plunger would be attached pivotally to cradle 81 at 84. The magnet is illustrated as a relay having a contact 85' opposite bar 84.

Operation

Upon a light-beam reaching cell 60, FIGURES 5 and 6, as from an automobile headlamp, current flows from the cell to energize relay 65, which closes a circuit to energize solenoid 59. Energization of the solenoid elevates the timer, to position 50' to store potential switch-closing energy in the form of sand in the outer chamber. If the light-beam or push-button is promptly withdrawn, de-energizing the solenoid, the stored energy brings the timer downward under gravity with a force of inertia sufficient to close the switch, and the circuit to the motor, and thus to actuate the door to open or close.

If a light-beam from the sun reaching the cell 60 should elevate the timer, it would hold the timer upward as long as the light should be sustained. The orifice in the neck of the timer is such that the sand flows from one chamber to the other in a period of 5 to 10 seconds, and, as the timer is held elevated, the sand drains off from the outer chamber to the inner one, to reach a level about that indicated at 50' in FIGURE 3. The stored potential energy at optimum leverage thus is drained to a lower leverage, and, upon the sunbeam having passed and the solenoid having been de-energized, the timer drops, counter-balanced by the plunger of the solenoid, and without a force of inertia or a momentum sufficient to close switch 55, or to actuate the door. Thus a light-beam from the sun is nullified as a door actuating agent, withdrawal of light being delayed beyond a predetermined time-period such as needed for withdrawal or extinguishment of light conveniently after application of it.

The diminutive design of FIGURE 7 becomes more and more practical as the art advances in light-sensitive cells so that more and more current is made to flow from or through the cell. Within three years past, the effective current through the cadmium sulphide crystal has more than doubled. Electric switches carrying amperage for motors of adequate size to drive doors, have been developed in which operating pressure is a fraction of an ounce, as in coin operated machines.

The parts in FIGURE 7 are shown in normal inert positions, cradle 81 having been released from latch 77, motor control switch 75 being open, and its button 75' having pressed the cradle 81 away to hold cradle released. Upon coil of relay 85 being energized from light-sensitive cell 60, relay 85 attracts bar 84 on cradle 81, raising timer 80 to its position 80'. Prompt de-energization of magnet permits fall of timer to depress buttons 75', close switch 75, energize motor, and hold button by latching with 77 while the motor drives the door. Towards the termination of door-movement, horn 44, communicating into hole 77', unlatches cradle 81, allowing switch 75 to open, and stop the motor, as already described in the

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case of latch 47. The same effect follows in the event of delay in withdrawal of light, as by sunlight, as already described for timer 50, the mercury draining from the outer chamber of timer 80 so that upon the withdrawal of light, the timer falls without the leverage and without the force of inertia that would close switch 75.

What is claimed is:

1. A door-operator comprising a motor for driving a door between closed and open positions, a circuit for the motor and a switch in the circuit arranged to energize the motor when the switch is closed, a two chambered gravity timer for applying a switch-throwing force to the switch, a restricted opening interconnecting said chambers, means in one of said chambers flowable through said restricted opening into the other of said chambers, signal responsive means providing a flow of electric current when activated by signals, electromagnetic means having its coil in series with said signal responsive means and a member operated upon energizing of said coil for positioning said timer with said one chamber containing said flowable means elevated to provide switch-throwing energy and to cause flow of said flowable means from said one chamber to the other, and for freeing said timer and its stored energy to close said switch upon withdrawal of the signal from said signal responsive means while a substantial portion of said flowable means remains in said one chamber.

2. Apparatus as defined in claim 1 including holding means for holding the switch closed for the duration of door-movement.

3. Apparatus as defined in claim 1 in which said restricted opening is such that when withdrawal of signal at said signal responsive means is delayed beyond a predetermined maximum period of time, a sufficient quantity of said flowable means will have flowed from said one chamber to said other chamber to render said timer inoperative to close said switch.

4. A door-operator comprising a motor for driving a door, a circuit for the motor and a switch in the circuit, a light-sensitive cell, and means for actuating said switch including a gravity timer arranged for throwing said switch under gravitational movement, and a magnet having its energizing coil energized from said cell upon application of light to the cell, for so positioning said timer that upon release it will actuate said switch.

5. Apparatus as defined in claim 4 including means for de-energizing said magnet when light is withdrawn from said cell for freeing said timer into gravitational switch-throwing fall.

6. A door-operator comprising a motor for driving a door, a circuit for supplying electric power to the motor, and a switch in the circuit; means for closing said switch including a light-sensitive cell for providing electric current flow when light is applied to it as from the headlamp of an automobile, a magnet energized by such current flow, and a gravity-timer arranged to be poised by the magnet into potential switch throwing position, and to be released by the magnet for closing said switch when applied light is withdrawn from said cell.

7. Apparatus for operating a member by remote control comprising power means connected with said member for operating the same, a circuit for the power means including a switch arranged to supply current to said power means when the switch is closed, a pivoted two-chambered gravity timer for applying a switch-throwing force to the switch, the two chambers of said gravity timer being interconnected by a restricted opening, means in one of said chambers flowable through said restricted opening into the other of said chambers, electromagnetic means including a coil and an element driven thereby connected with said timer for shifting the position of the same about its pivot, a circuit including signal responsive means for providing a flow of electric current through said coil when said signal responsive means is activated by signals, shifting of said timer by said electromagnetic means serving

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to position said one of said chambers with its flowable means in an elevated relationship to said other of said chambers to bring about flow of said flowable means from one chamber to the other of said chambers, said timer being released for return movement to its initial position upon withdrawal of the signal from said signal responsive means, such return movement being with sufficient momentum to apply a closing force to said switch when a substantial portion of said flowable means remains in said one chamber.

8. Apparatus according to claim 7 in which the flow of said flowable means through said restricted opening interconnecting said chambers reduces the force applied by said timer to said switch, whereby, upon the release of said timer after a predetermined time interval, the momentum of the return movement of said timer is insufficient to operate said switch.

9. Means for controlling the delivery of current to a circuit which comprises a switch in said circuit, a pivoted two-chambered gravity timer for applying a switch-throwing force to the switch, the two chambers of said gravity timer being interconnected by a restricted opening, a flowable material in one of said chambers flowable through said restricted opening into the other of said chambers, electromagnetic means including a coil and an element driven thereby connected with said timer for shifting the position of the same about its pivot, a circuit including signal responsive means for providing a flow of electric

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current through said coil when said signal responsive means is activated by signals, shifting of said timer by said electromagnetic means serving to position said one of said chambers with its flowable material in an elevated relationship to said other of said chambers to bring about flow of said flowable material from said one chamber to the other of said chambers, said timer being freed for return to its initial position upon withdrawal of the signal from said signal responsive means, such return movement being with sufficient momentum to apply a closing force to said switch when a substantial portion of said flowable material remains in said one chamber.

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