June 16, 1959 J. H. GUYTON 2,891,197

PHOTOELECTRIC TRANSISTOR SWITCH CONTROL

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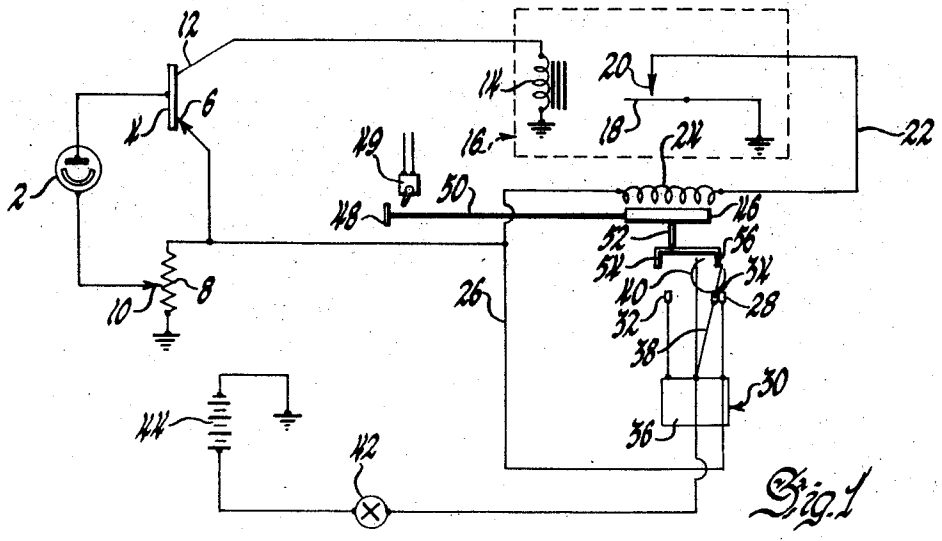

Fig. 1

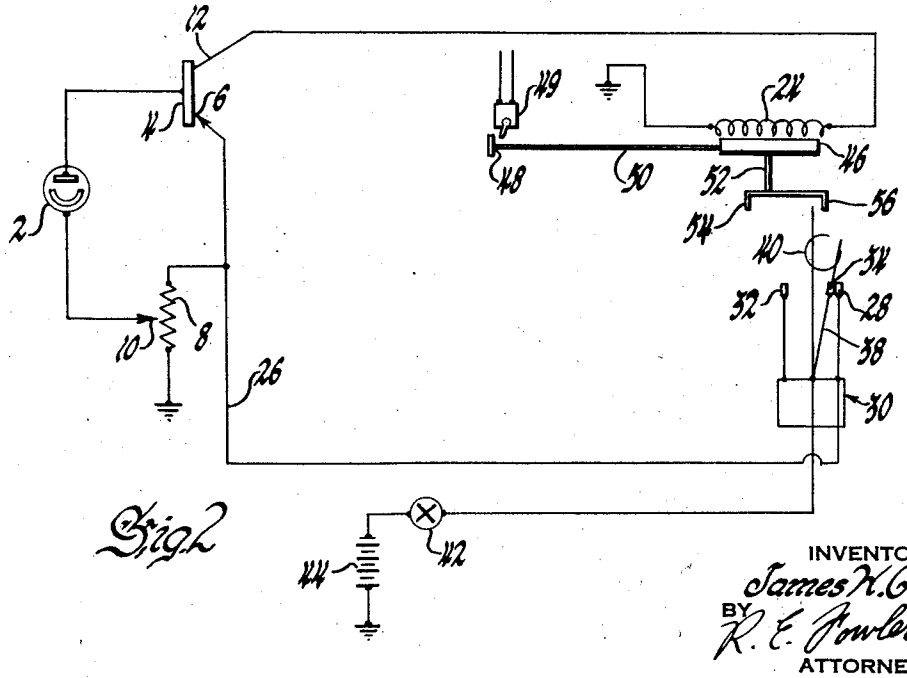

Fig. 2

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PHOTOELECTRIC TRANSISTOR SWITCH CONTROL

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4 Claims. (Cl. 317—123)

This invention relates to light sensitive switching means and more particularly to means for actuating switching means to turn on lights on an automobile as the natural light of the day diminishes at dusk.

As daylight fades in the evening, a large portion of the drivers on the highway do not turn on their small parking lights while they are driving, but delay until it becomes sufficiently dark to necessitate the regular headlamps, and then turn on those. During the twilight stage, however, it becomes increasingly difficult for drivers to see other unlighted cars on the highway, particularly where there are buildings and trees to cast shadows. This causes accidents. It would be very helpful if drivers utilized their parking lights during this twilight stage, which would assist the other drivers in seeing the vehicle.

It is therefore an object in making this invention to provide light sensitive means to automatically switch on lights when the ambient illumination falls below a predetermined level.

It is a further object in making this invention to provide light sensitive switching means to automatically turn on the lights of an automobile as the ambient light falls below a predetermined level.

It is a still further object in making this invention to provide light sensitive switching means for controlling automobile lights which operate from the car battery voltage supply and utilize transistor means for low power dissipation.

With these and other objects in view which will become apparent as the specification proceeds, my invention will be best understood by reference to the following specification and claims and the illustrations in the accompanying drawings, in which:

Figure 1 is a circuit diagram of a control system embodying my invention; and

Figure 2 is a circuit diagram of a modified form of control system embodying my invention.

In the control system shown in Figure 1, a photovoltaic cell 2 is connected between the base 4 of a transistor and the emitter electrode 6, a resistance 8 with an adjustable tap 10 being included in the circuit. The cell 2 may be any type of generating light cell such as that currently used in light meters for photographic purposes. The collector electrode 12 of the transistor is connected through the operating coil 14 of a relay 16 to ground. The movable armature 18 of the relay is grounded. It is designed to engage a stationary contact 20 when the relay coil 14 is energized, but drops away from engagement when the coil is deenergized. The stationary contact 20 is connected through line 22 to one terminal of a solenoid 24, the opposite terminal of which is connected to line 26.

Line 26 extends between the emitter electrode 6 and stationary contact 28 of a snapover switch 30. Switch 30 has a stationary stop 32 which is supported in spaced relation to contact 28. Contact 34, mounted on a spring

arm 38, may be moved between the two stationary members 28 and 32. All are mounted on an insulating base 36. The spring arm 38 has two sections, an inner one on which the contact 34 is supported, and an outer longer one. A C-shaped spring 40 is mounted between the two portions to cause a snapover center action when the outer end is moved. The center contact 34 remains in engagement with one of the stationary contacts until the outer end is moved to provide a snapover action. The center arm 38 is electrically connected through the ignition switch 42 to the battery 44 of the car.

The solenoid 24 has a core 46 which is manually adjusted to a desired position to the left, but is pulled to the right when the coil is energized. The cap 48 on the end of the arm 50, attached to the core 46, diagrammatically illustrates a part which may engage a light switch 49 to turn on the car parking lights. A bracket 52 is also connected to the core 46 and includes two spaced arms 54 and 56 which actuate the snapover switch as the solenoid core moves.

When the ignition switch is turned on, voltage from the battery 44 will be applied to the transistor and photocell, and, as controlled by the transistor, to the relay coil 14. In the presence of daylight the transistor will not provide enough current flow to cause the relay coil to attract its armature 18. At this time the cap 48 has been manually pushed to the left, the snap switch 30 is in the position shown, and the light switch 49 is in off position. If a PNP transistor is used, positive voltage is applied to the base electrode 4 with respect to the emitter 6 from the photocell action in the presence of light and very little current will flow in the emitter to collector circuit. Negative voltage from the battery opposes or bucks this voltage produced by the cell, the required amount being adjustable by moving contact 10 over resistance 8. Therefore as light fades and it becomes dark, this portion of the battery voltage tends to predominate over the reduced negative voltage and at a predetermined point the collector current will be sufficient to cause coil 14 to attract armature 18 and close the circuit to the solenoid 24.

The coil 24 attracts its core toward the right as shown in Figure 1, and cap 48 actuates switch 49 to turn on the parking lights. At the same time arm 54 strikes switch arm 38 to cause the switch to snap over and contact 34 moves away from contact 28 to open the circuit to the transistor and deenergize the control system. Thus the parking lights are automatically turned on at a given light intensity and the control circuit deenergized. The light level for switching may be adjusted by moving tap 10. The system operates from the conventional storage battery and has a very low current consumption.

The advantages of the present transistorized control circuit over a tube amplifier light control circuit are that the transistorized circuit requires only battery voltage for operation and not the higher voltages demanded by tubes. The conventional power supply unit with its vibrator and transformer may, therefore, be omitted and the cost of such apparatus saved. A transistor circuit further only requires a fraction of the power required by a tube amplifier, and therefore only a low current drain is applied to the power source. In this system, which is energized during daylight conditions, the low current drain is important and makes this type of control circuit practical, whereas the higher power demand of a tube amplifier would be impractical for this use. Transistor equipment is also of small size, which is important in all automotive equipment.

If the transistor is capable of conducting a substantial amount of current, or if two or more stages of transistors

are used, one as an amplifier, the relay may be dispensed with and the transistor output directly connected to the solenoid. Figure 2 illustrates the first condition. As in Figure 1, the photo-voltaic cell **2** is connected between tap **10** of resistor **8** and the base **4** of the transistor. The emitter electrode **6** is connected to resistor **8**, the opposite terminal of which is grounded, and through line **26** to switch contact **28**. The collector electrode **12** is connected through the solenoid operating coil **24** to ground. The solenoid core **46** has the same switch operating bracket **52** and cap **48** to actuate the light switch **49**. The storage battery **44** is connected through ignition switch **42** to switch arm **38** and contact **34**.

When the ignition switch is turned on, in Figure 2, the battery voltage is applied as before to the emitter electrode **6** through switch **30** in the position shown. However, if light is falling on the photo-voltaic cell **2**, a positive voltage is applied to base electrode **4**, which opposes the battery voltage, and keeps current flow in the emitter and collector circuits at a low level. At this time the solenoid assembly is at the left-hand extremity of its movement. When light fades, the negative voltage obtained by contact **10** on resistor **8** dominates to increase the current flow through the transistor and at some predetermined point the solenoid will attract its armature to throw the light switch **49** and the snapover switch **30** to deenergize the control system as in Figure 1.

I claim:

1. In a light sensitive control circuit, a junction type transistor having base, emitter and collector electrodes, a source of electrical power connected to the emitter electrode, a photoelectric cell connected between the base and emitter to restrain collector to emitter current flow in the presence of light, a relay operating coil connected in the collector-emitter, power source circuit and energized by current flow through the transistor as controlled by the photoelectric cell, a solenoid having a movable core, switching means actuated by the relay coil and connected in series circuit with the solenoid and source of electrical power to control energization of the solenoid, and control means actuated by movement of the solenoid core when the solenoid is energized.

2. In a light sensitive control circuit, a junction type transistor having base, emitter and collector electrodes, a source of electrical power, switching means connecting said source of power to the emitter electrode, a photoelectric cell connected between the base and emitter to provide a negative bias on said emitter in the presence of light, a relay operating coil connected between the collector electrode and ground and energized by current flow through the transistor as controlled by the photoelectric cell, a solenoid having a movable core, a second switching means actuated by the relay coil and connected in series circuit with the solenoid and source of electrical power to control energization of the solenoid, control means actuated by movement of the solenoid core when the solenoid is energized, and switch actuating means mounted on the solenoid core and engageable with the first-named switching means to move the same to disconnect the source of power when the solenoid coil is energized.

3. In a light sensitive control circuit, a junction type transistor having base, emitter and collector electrodes, a source of electrical power, switching means connecting said source of power to the emitter electrode, a photoelectric cell connected between the base and emitter to provide a negative bias on said emitter in the presence of light, a solenoid connected between the collector electrode and ground and energized by current flow through the transistor as controlled by the photoelectric cell, a core mounted adjacent the solenoid and moved by the energization thereof and means carried by the core and engageable with the first-named switching means to move the same when the core is moved by energization of the solenoid.

4. In a light sensitive control system, a transistor having base, emitter and collector electrodes, a variable resistance and a photoelectric cell connected in series between the base and emitter electrode, a source of electrical power, a snapover switch connected between the source of power and the emitter electrode to supply power to the transistor, a relay coil connected between the collector electrode and ground and controlled by current flow through the transistor, relay switching means actuated by the coil, a solenoid having a movable core, a light controlling switch and means carried by said core and engageable with the snapover switch and with the light controlling switch to operate both as it moves in response to energization of the solenoid, said solenoid being connected to the source of power and the relay switching means and its energization controlled by the latter.

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