

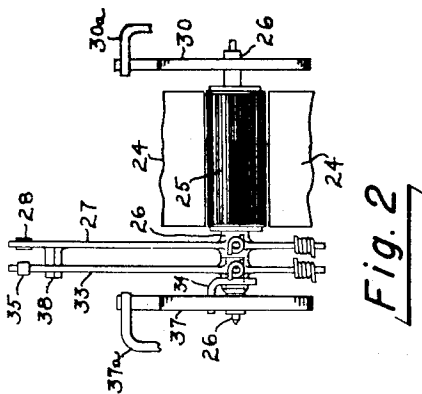
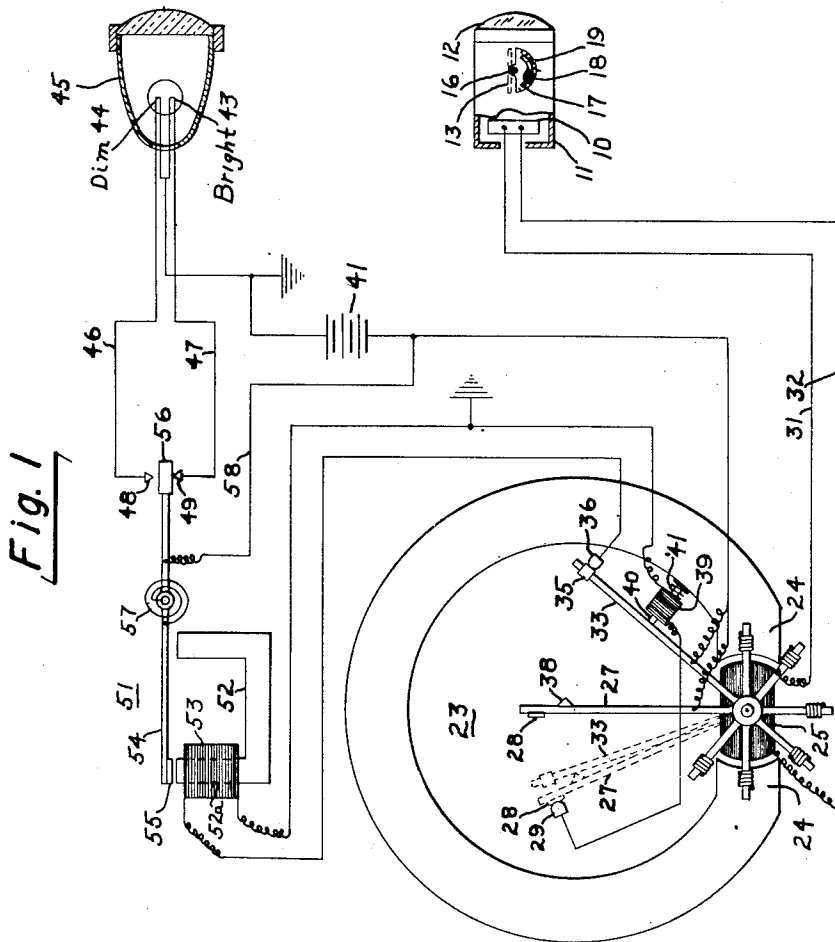
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2,464,886

ELECTRICAL CONTROL DEVICE

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ELECTRICAL CONTROL DEVICE

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This invention relates to sensitive electrical relay circuits and in particular to circuits which include an instrument type relay for controlling a load circuit or circuits in accordance with variations in a control factor measured by the instrument having a relatively small electrical output such as photo-electric cells, thermocouples, Wheatstone bridge circuits and the like.

An object of this invention is to provide an improved relay circuit of the instrument controlled type in which a load circuit is stripped to one condition when the control factor reaches one predetermined value and remains in such condition until the control factor shall have changed by a predetermined amount.

Another object is to provide an improved magnetic contact instrument type relay having different "on" and "off" operating characteristics.

A more specific object is to provide a novel instrument type relay of the magnetic contact type that includes a contact arm mounted coaxially with the pointer. The pointer is fastened to and rotates with the current responsive coil of the instrument while the contact arm, biased into engagement with the pointer, is pushed ahead by the latter as the current increases in the instrument coil into ultimate engagement with a stationary magnetized contact to close a control or load circuit therebetween. The contact arm remains in this position until the pointer has moved through a predetermined angular distance in the opposite direction by a decrease in the coil current whereupon the pointer closes contacts to effect energization of a reset solenoid which functions to release or "reset" the contact arm to thereby open the control circuit and permit the latter arm under the restoring action of its biasing means to be returned into engagement with the pointer.

Another object is to provide a novel relay system of the photo-electric type in which a load circuit is switched to one condition when the light entering the photocell reaches a predetermined maximum intensity and remains in this condition until the light intensity falls considerably below such value whereupon the circuit is switched to another condition.

A more specific object is to provide a vehicle headlight control utilizing a light sensitive device such as a photocell for the control element in which the headlights after being dimmed by a predetermined increase in light falling on the photocell from the headlights of an oncoming vehicle will be maintained in this condition until the light entering the photocell has decreased to

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a value considerably below the point which caused the headlights to be dimmed. This is obviously an advantage over known headlight control systems in which the photocell has only one operating point since it assures the driver that his lights will not be changed back to their "bright" beam until the road ahead is comparatively dark and thereby prevents erratic headlight switching operations when a number of vehicles are approaching from the opposite direction at relatively close intervals.

These and other objects and advantages will become more apparent from the following detailed description of the invention as applied to an automatic control for vehicle headlight systems together with the accompanying drawings in which Fig. 1 is a diagrammatic view of a preferred circuit arrangement while Fig. 2 is a fragmentary side elevation of a portion of the instrument relay component showing the dual arm construction by which the delayed action in the operation of the relay circuit is obtained.

Referring now to the drawing, a photocell 10 preferably of the self-generating type, is supported at the rear end of a casing 11 which is arranged to be mounted on the vehicle whose lights are to be controlled. The casing 11 is so supported that light from the headlights of an approaching vehicle will enter at the front and impinge upon the light sensitive element of the cell. In order to make the cell 10 sensitive to substantially only the light from on-coming vehicles which comes in substantially parallel to the axis of casing 11, rather than miscellaneous light rays coming in from other directions, a convex lens 12 is affixed to the front end of the casing. The lens 12 has a focal length such that the entering light rays will be concentrated over the entire active surface of the photocell 10.

If desired, a sensitivity control for the cell 10 as related to incoming light may be obtained by inserting a butterfly type light gate in casing 11 between the photocell 10 and lens 12. The gate is comprised of a vane 13 which is mounted on a shaft 16 extending transversely of casing 11 and which projects through the casing wall. A calibrated semi-circular disc 17 is secured to shaft 16 on the outside of the casing and is used for adjusting the angle of the vane 13. Disc 17 may be maintained in any position of adjustment by means of a set screw 18 which threads into the casing wall through an arcuate slot 19 cut into the disc 17, the screw head being larger than the width of slot 19 to seat against the disc surface as it is screwed in. The interior surface of cas-

ing 11 and all surfaces of the vane 13 are preferably finished in dull black to reduce the possibility of light reflections.

Control of the sensitivity of cell 10 could be accomplished by electrical means such as adjustable rheostats connected at the output of the cell 10 but the light gate is preferred for the reason that it is often quite difficult to maintain a selected setting on the rheostat with a stable electrical resistance value.

Included in the control circuit is a novel instrument relay 23 having a pair of magnet field poles 24 and an associated moving coil 25 supported on shaft 26 which is preferably mounted in known manner in jeweled bearings (not shown). Fixed to shaft 26 is a pointer 27 preferably of conductive material. A rider 28 of material suitable for electrical contacts is carried at the outer end of pointer 27 for engagement with a stationary contact member 29 and is urged counterclockwise to this position by means of a very light spiral spring 30 which is located at the opposite end of coil 25. The outer end of spring 30 is fixed to a stationary member 30a of the instrument and the inner end to shaft 26. Coil 25 is connected to the output of cell 10 via conductors 31, 32 and hence the coil and pointer 27 will rotate in accordance with the change in current through the coil as the output of cell 10 changes.

Instrument relay 23 further includes contact arm 33 of conductive material that is mounted for rotation freely on shaft 26. Arm 33 is also electrically conductive and carries a rider 35 of soft iron or other magnetic material which cooperates with a stationary contact member 36, the latter being a comparatively small permanent magnet with a rounded pole face. Preferably, the rider 35 and pole tip of the magnet contact 36 are plated or coated with a metal having a good current conductive characteristic, such as gold or silver. Contact arm 33 is also biased in a counterclockwise direction by means of a light spiral spring 37 the inner end of which is fastened to an L-shaped member 34 secured to arm 33, the outer end of which is secured to a stationary member 37a of the instrument.

Although the pointer 27 and contact arm 33 move in planes spaced slightly apart, one of them, and preferably pointer 27 also carries a bar-like knife edge 38 which projects into the path of movement of contact arm 33 so that the latter is pushed in a clockwise direction against the action of spring 37 by pointer 27 as the latter moves clockwise against its restoring spring 30 in response to an increase in current through coil 25. When the magnitude of the current output from photocell 10 as measured by instrument 23 is such that contact arm 33 brings the magnetic rider 35 within the field of attraction of magnet 36, the rider will be drawn quickly into firm engagement with the magnet to establish a reliable electrical contact.

The pole strength of magnet contact 36 is so chosen that the rider contact 35 on arm 33 will be held firmly to it and hence a reset mechanism is employed to separate the two contacts. In the illustrated embodiment, the reset device is comprised of a solenoid winding 39 having an armature 40 movable through the center of the winding and which is biased to a downwardly retracted position by a spring 41 when the winding is in a deenergized state. In the retracted position, armature 40 lies lightly against the contact arm 33 when the rider 35 on the latter is engaged with magnet contact 36 as shown by the solid line

position of arm 33 in the drawing. However, when winding 39 is energized, its armature 40 moves outwardly, pressing against arm 33 and pushing it far enough counterclockwise to move rider 35 out of the field of attraction of magnet 36, whereupon arm 33 continues its counterclockwise motion under the restoring action of spring 37 until it comes to rest against the projection on pointer 27.

Energization of solenoid 39 is controlled by a circuit which includes a battery 41, the pointer 27 and contact members 28, 29. When the rider 35 on contact arm 33 has been pulled against magnet 36, any subsequent decrease in current through coil 25 will of course permit pointer 27 to move back in a counterclockwise direction under the restoring action of spring 30. When the pointer has moved through an arc sufficient to close contacts 28, 29, the circuit to the solenoid 39 from the battery 41 is completed and armature 40 separates the rider 35 from magnet 36.

It will now be evident that the instrument relay 23 can be used to close a load circuit through contact members 35 and 36 when the factor measured by the instrument coil 25 (in this application, the current output from photocell 10) reaches a predetermined maximum value and will maintain the load circuit in this condition until the measured factor has subsequently decreased to a predetermined minimum value at which time the circuit will be opened. In other words, the instrument relay 23 "locks" in when the measured current has increased to a preselected magnitude and does not "unlock" until the current has decreased to a selected minimum.

This factor makes the instrument particularly useful in any relay circuit in which a gap between "cut-on" and "cut-off" operations is essential and hence is well applicable to automatic control of vehicle headlights. Thus in the illustrated embodiment, the "bright" and "dim" filaments 43, 44, respectively of a lamp in the vehicle headlight 45 are shown connected at one side to ground and on the other side via conductors 46, 47 to opposed stationary contacts 48, 49 of a power relay 51. This relay may be of any suitable design and in the illustrated form is comprised of a U-shaped core 52 having a winding 53 on core leg 52a and an armature 54 which is pivotally supported intermediate its ends. Winding 53 is connected to battery 41 in a circuit that includes contact arm 33 and contact members 35, 36. Armature 54 is provided at one end with a rider 55 of magnetic material that is drawn into engagement with core leg 52a when winding 53 is energized, and at the other end with a contact member 56 that is adapted to engage one or the other of the stationary contacts 48, 49. A spiral spring 57 associated with the armature 54 is provided to urge the latter in a clockwise direction when coil 53 is deenergized so that the relay contacts 49 and 56 are closed. In this position, the circuit for lighting the "bright" filament 43 from battery 41 is completed through these contacts, armature 54 and conductor 58. When relay winding 53 is energized upon closure of contacts 35, 36, contact 56 moves into engagement with the other contact 48 thereby connecting the "dim" filament 44 to the battery and simultaneously disconnecting the "bright" filament 43.

Thus in the headlight control, and assuming the vehicle is on a darkened road, the amount of light entering photocell 10 will be negligible and hence pointer 27 and contact arm 33 of the instrument relay will occupy their "low" current

positions, which are the positions shown by the broken lines in the drawing.

Should a vehicle now approach from the opposite direction, the light from its headlamps will impinge upon photocell 10 causing an increasing output to the coil 25 on the moving system of the instrument relay 23 as the two vehicles approach each other. When the distance between them has been reduced to the point where the headlights should be dimmed to avoid a blinding effect on the driver of the oncoming vehicle, the current through coil 25 will have increased to the point where rider 35 on contact arm 33 is drawn into engagement with the magnet contact 36, thereby closing the energizing circuit for winding 53 on power relay 51 and the latter then operates to switch the headlights from "bright" to "dim."

If there is only one vehicle approaching from the opposite direction, the light falling on photocell 10 will decrease quite rapidly as soon as the vehicles pass thereby causing the pointer 27 to move in the reverse direction until rider 28 and contact 29 once more engage. When this occurs, reset solenoid 39 is energized and its armature 40 pushes against contact arm 33 to separate rider 35 and contact 36. Relay winding 53 is thereby deenergized, the lights are switched back to "bright," and arm 33 then moves back until it abuts against pointer 27.

However, should a number of vehicles be approaching from the opposite direction at comparatively close intervals, the lamps 45 will remain in their "dimmed" condition until the last vehicle in the line has been passed. This is obviously a very desirable operating characteristic and is attributable to the fact that the light entering photocell 10 must first fall appreciably below the value at which the lamps were switched to "dim" before they can be switched back to "bright." Any change in light intensity intermediate the "cut on" and "cut-off" values merely causes the pointer 27 to fluctuate in one direction or the other without effecting the switching since rider 35 and contact 36 of instrument relay 23 remain locked in until pointer 27 moves all the way back to the point where rider 28 again engages contact 29.

In conclusion, it will of course be understood that while I have illustrated and described a preferred embodiment of the novel control circuit and instrument relay, various changes in the construction and arrangement of parts may be made without departing from the spirit and scope of the invention as defined in the appended claims. It is also evident that the principles of the invention may be applied to other types of load circuits in which it is desired to control the circuit in accordance with the variation in a factor measured by the instrument relay and in which the factor is subject to minor fluctuations which would produce undesirable intermittent changes in the load circuit connections if the load circuit switches were actuated each time that the factor momentarily reached one of its predetermined limiting values.

I claim:

1. A control device comprising a measuring instrument having a current responsive moving system including a pointer, a contact arm mounted coaxially with and rotated by said pointer, said

contact arm carrying a contact for engagement with a relatively stationary contact upon a predetermined increase in instrument current, one contact being a magnetized body and the other being of magnetic material, electro-responsive means for separating said contacts, and means including switch means actuated upon a predetermined return movement of said pointer in response to a subsequent decrease in instrument current to energize said electro-responsive means.

2. A control device as defined in claim 1 wherein said switch means is comprised of a contact carried by said pointer which engages a stationary contact.

3. A control device as defined in claim 1 and further including resilient means biasing said contact arm to cause it to engage said pointer when said contacts are separated.

4. A control device comprising an instrument having a current responsive moving system including a pointer arm, a contact arm mounted coaxially with and spaced slightly axially of said pointer arm, means carried by one of said arms and projecting into the path of movement of the other to effect rotation of said contact arm by said pointer arm as the instrument current is increased, spring means biasing said contact arm into engagement with said pointer arm, a contact carried by said contact arm for engagement with a relatively stationary contact upon a predetermined increase in instrument current, one contact being a magnetized body and the other being of magnetic material, electro-responsive means for separating said contacts, and means including contacts closed by said pointer arm upon a subsequent predetermined decrease in instrument current for energizing said electro-responsive means.

5. A control device as defined in claim 4 wherein said contact arm is mounted on the same shaft as said pointer.

6. A control device comprising a measuring instrument having a current responsive moving system including a pointer, a contact arm mounted coaxially with and rotated by said pointer, said contact arm carrying a contact for engagement with a relatively stationary contact upon a predetermined change in instrument current in one direction, one contact being a magnetized body and the other being of magnetic material, electro-responsive means for separating said contacts, and means including switch means actuated upon a predetermined return movement of said pointer in response to a subsequent change in instrument current in the opposite direction to energize said electro-responsive means.

7. A control device as defined in claim 6 wherein said switch means is comprised of a contact member carried by said pointer which engages a stationary contact.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,930,497	Wright	Oct. 17, 1933
2,153,777	Swart	Apr. 11, 1939