

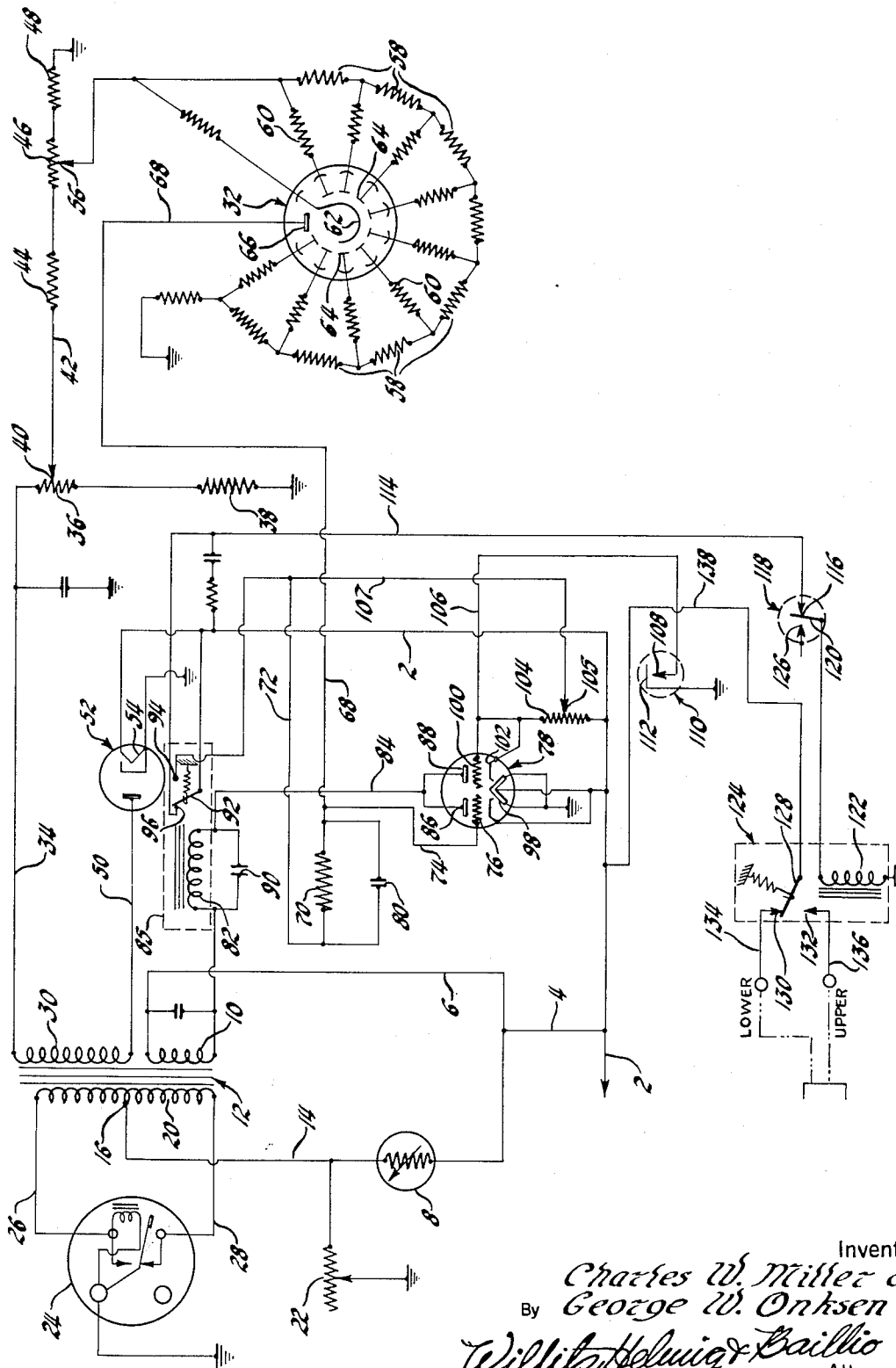
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AUTOMATIC HEADLIGHT DIMMER SYSTEM-CATHODE RESISTOR BIAS

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AUTOMATIC HEADLIGHT DIMMER SYSTEM— CATHODE RESISTOR BIAS

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This invention relates to automatic switching means and more particularly to light controlled switching means for the headlamp filaments of automotive vehicles.

In automatic light controlled systems for the dimming of vehicular headlamps, on normal highway driving with no approaching vehicles, the headlamps are on "upper" or high beam, so that the driver may see as far ahead of the vehicle as possible. Upon the approach of an oncoming vehicle, the latter will reach a point of approach such that the light falling on the photosensitive pickup unit will be sufficient to cause relay actuation and switching of the headlamps to low beam. As soon as that occurs the oncoming driver, in courtesy, switches his lights to low beam and the amount of illumination falling on the pickup unit is materially reduced. Provision must, therefore, be made at this time to hold the lights on low beam with a lower intensity of illumination falling on the photocell. One manner of accomplishing this result is to change the sensitivity of the system so that when the switching means moves to lower beam position, the sensitivity of the system is increased so that a much smaller amount of light falling on the pickup unit is needed to hold the switch in lower beam position than was initially required to move it to that position.

One manner of accomplishing this result is shown and described in a copending application Serial No. 248,498, filed September 27, 1951, in the names of Charles W. Miller, Harold E. Todd and George W. Onksen, in which the sensitivity of the amplifier is varied.

It is therefore an object in making this invention to provide means for varying the sensitivity of an automatic headlamp dimming system between high beam and low beam positions.

It is a further object in making the invention to provide in a light actuated automatic headlamp dimming system means for varying the amplifier bias between high beam and low beam positions.

It is a still further object in making this invention to provide a positive bias for the amplifier grid in a light sensitive control system which is switched into and out of the control system by the operation thereof.

It is a still further object in making this invention to provide a grid bias for the amplifier in a light sensitive control system, which bias is obtained from a cathode resistor in another portion of the circuit.

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

The figure of the drawing is a circuit diagram of an electrical system of an automatic headlamp dimming system embodying our invention.

Referring now more specifically to the drawing, there is shown at 2 the main low voltage power line from a conventional source, such as a storage battery of an automotive vehicle. Tie line 4 connects line 2 to line 6,

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which extends between one terminal of a ballast tube 8 and one terminal of a secondary winding 10 on transformer 12. A conductive line 14 connects the other terminal of the ballast tube 8 with a center tap 16 on the primary winding 20 of the transformer 12. A resistor 22 having a variable tap thereon to adjust the same, is connected between line 14 and ground.

A conventional vibrator 24 is connected across the primary winding 20 by lines 26 and 28 to provide current for the primary halves alternately. A secondary winding 30 of transformer 12 provides the voltage supply for the light responsive member, which in this instance is shown as a photomultiplier tube 32, though it may be any other form of photosensitive device without departing from the invention. One terminal of the secondary winding 30 is connected through line 34 to one side of a potentiometer formed by two resistances 36 and 38 in series, the opposite side of resistor 38 being grounded. The adjustable tap 40 on resistance 36 is connected through line 42 to three resistances 44, 46 and 48, connected in series. The opposite terminal of the remote resistor 48 is grounded.

The remaining terminal of the secondary winding 30 is connected through line 50 to a half-wave rectifier tube 52, the heater filament 54 of which is connected to main power line 2. An adjustable tap 56 on resistor 46 is connected to a plurality of dropping resistors 58. Protective resistors 60 connect the cathode 62 and various dynodes 64 of the photomultiplier tube 32 to points adjacent and intermediate said dropping resistors 58 to supply power thereto. The anode 66 of the photomultiplier tube 32 is connected to a line 68, which extends to one terminal of a resistor 70, the opposite side being connected to a tie line 72 running to line 107. Tie line 74 extends between grid 76 of the first section of duo-triode tube 78 and line 68. A ripple filtering condenser 80 is connected in shunt with resistor 70.

The remaining terminal of the secondary winding 10 is connected to coil 82 of relay 85, the opposite terminal of the coil being connected through a line 84 with both anodes 86 and 88 of the tube 78. Thus power is supplied to the relay and it is energized when either triode section of the tube 78 conducts. A condenser 90 is connected in shunt with the relay coil 82. The relay armature 92 is spring biased to the right, as shown in the figure, and engages a stationary contact 94 when the coil 82 is deenergized. When the coil is energized, the armature is attracted and engages a stationary contact 96. The filament 98 of the first triode section of tube 78 is connected to line 2. When sufficient current flows through this first triode section, the coil 82 will be energized to attract its armature 92, but when the bias on the grid 76 varies to reduce the conductance through the tube, the current through the coil will be reduced and it will release its armature. The grid bias is controlled by the photomultiplier tube 32.

The second section of the duo-triode tube 78 provides an overriding circuit through which the relay coil 82 may be independently energized, even though the conductivity through the first triode section is reduced by the output of the photomultiplier tube. Grid 100 and cathode 102 of this section are connected together and to one terminal of a resistor 104. The other terminal of the resistor 104 is connected to line 2. Tap 105 on resistor 104 is connected by line 107 to relay contact 94 and line 72. Conductive line 106 is also connected to the grid 100 and extends to stationary contact 108 of the overriding foot switch 110. The movable switch arm 112 of the switch 110 is grounded.

A conductive line 114 extends between stationary contact 96 of the control relay 85 and a stationary contact

116 of the conventional foot switch 118, which is of the snapover type which remains in its last adjusted position until again operated. The movable switch arm 120 of the switch 118 is connected through coil 122 of the power relay 124 to ground. The second stationary contact 126 of the foot switch 118 is unconnected and merely acts as a mechanical stop for the movable arm 116 when moved into contact therewith.

The movable armature 128 of the power relay 124 is spring biased upwardly, as shown in the figure, to engage a stationary contact 130, but may be moved downwardly into engagement with a second stationary contact 132 upon energization of the relay coil 122. Stationary contact 130 is connected to line 134 which extends to the lower beam filaments and stationary contact 132 is connected to line 136, which extends to the upper beam filaments of the headlamps (not shown). Movable armature 128 of the power relay is connected by line 138 with line 2.

In the operation of this device a suitable source of low voltage D. C. power is connected to line 2 through any conventional switching means such as headlight switches on the instrument panel. With this voltage applied to line 2, power is supplied to the vibrator-transformer system to induce in secondaries 10 and 30 suitable voltages for the operation thereof. Since in this illustrated showing a photomultiplier tube 32 is used, a relatively high voltage is induced in secondary 30 which is applied across potentiometer 36—38 to supply power for the photomultiplier tube 32. Adjustable taps 40 and 56 are moved to the proper location to apply the desired voltage to the tube. The sensitive control relay 85 is supplied with power from the secondary 10, which is of much lower voltage than that supplied by secondary 30 and the energization of the relay 85 is controlled by the amplifier tube 78. If the conventional foot switch 118 is positioned as shown in the figure of the drawing, namely with the movable arm 120 in contact with the stationary contact 116, the system is in condition for automatic operation.

With no light falling on the phototube, the control grid 76 of the first triode section of the tube 78 is at a sufficiently high potential to permit conductance therethrough, and relay coil 82 of the relay 85 is energized, holding its armature 92 to the left, as shown in the figure, in contact with stationary contact 96, and against the spring bias. With the switch 92—96 closed, a circuit is completed through the power relay coil 122 as follows: from power line 2, armature 92, contact 96, line 114, contact 116, switch arm 120, coil 122 to ground. The energization of the power relay coil 122 causes it to attract its armature 128 against the biasing spring and move it to its lower position in which it contacts stationary contact 132 to complete an obvious circuit between the power line 2 and the upper beam filaments.

As long, therefore, as no light falls upon the photomultiplier tube 32, relay coils 82 and 122 will remain energized, thereby causing the headlamps to remain on high or upper beam. Upon the approach of another vehicle and the attendant increase of illumination on the photocell caused by the headlights thereof, a point will be reached at which the grid 76 will be driven sufficiently negative, cutting down the conductance through the first triode section of tube 78 to a point at which the relay coil 82 can no longer maintain its armature to the left against the spring bias. The spring will then cause movement of the armature 92 to the right, breaking the switch 92—96 and completing switch 92—94. This breaks the supply circuit to the relay coil 122, which was previously traced, causing deenergization of the same, and permitting that coil to release its armature 128, which then moves to its upper position by spring bias, breaking the upper beam supply line and completing a supply line to the lower beam filaments.

As long as sufficient light falls on photomultiplier tube

32 to maintain grid 76 at a sufficiently low potential to cut down the conductance through the tube to a point below which relay coil 82 can attract its armature 92, the lights will remain on lower beam. If, however, the operator of the approaching vehicle does not in turn dim his headlamps, and it is desired to signal him to do so, then the operator may override the automatic control by closing overriding switch 110. This completes a direct circuit to ground through the second triode section of the tube 78, which is connected as a diode rectifier, and conductance between anode 88 and the other half of the diode formed by grid 100 and cathode 102 to ground through the switch 110 will be ample to energize coil 82 to pull its armature 92 to the left and place the headlamps back on high beam. As soon, however, as switch 110 is opened, if there is still sufficient light remaining on the photocell, the system will go at once to low beam energization.

If under normal circumstances upon the automatic system switching to low beam energization upon the approach of an oncoming vehicle, the driver of the approaching vehicle dims his headlamps in courtesy; then there will be an immediate reduction of illumination falling on the photocell 32, and means must be provided to make the system more sensitive once it has switched to low beam energization so that a smaller amount of light will maintain the lights on low beam energization than that amount of light necessary to initially switch it to that position. The amount of initial bias applied to grid 76 when no or substantially no output from the photomultiplier tube is present is provided by the setting of the adjustable tap 105 on the cathode resistor 104 in the circuit for cathode 102. This will apply an initial bias to grid 76 through line 107, line 72, resistance 70, line 74 to grid 76, and it would be necessary to overcome this bias by a relatively large output from the photomultiplier tube before grid 76 can be driven sufficiently negative to cut down the conductance of the tube and deenergize relay 85. However, as soon as relay 85 has been deenergized and armature 92 moved into contact with contact 94, then a shunting circuit is completed around that portion of resistance 104 which is being utilized for the bias to remove that additional bias from the system. Then the output of the photomultiplier tube does not need to be as high to maintain the grid at a sufficiently low potential to keep the relay 85 deenergized.

In this manner the sensitivity is changed or, stating it in another way, the amount of light falling on the photomultiplier tube need be much less to keep the conductance at a sufficiently low value so that relay 85 is not energized. Thus, upon the approach of a vehicle, a sufficiently large amount of light will drive the grid 76 negative to deenergize the relay 85 over the bias of the resistance 104, but immediately upon switching that additional bias is removed and a smaller amount of light will hold the relay 85 deenergized and the system on low beam. If, of course, the conventional foot switch 118 is moved so that its armature 120 rests in contact with stationary contact 126, then the power relay coil 122 cannot be energized and the system will remain on low beam.

We claim:

1. In a control system for multiple filament headlamps having upper and lower beam filaments, a source of power, switching means connected to the source of power and to the filaments to alternately energize the filaments, light sensitive means connected to said source of power, grid controlled amplifier means connected to the output of the light sensitive means, relay coil means connected to the source of power and to the amplifier means, electronic means connected to said relay coil means, resistance means connected between the electronic means and the source of power, an adjustable tap on said resistance means conductively connected to

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the grid of the amplifier means, and shunting switching means connected to the tapped resistance and actuated by the relay coil means to vary the grid bias with relay operation.

2. In a control system for multiple filament headlamps having upper and lower beam filaments, a source of power, switching means connected to the source of power and to the filaments to alternately energize the filaments, light sensitive means connected to said source of power, grid controlled amplifier means connected to the output of the light sensitive means, relay coil means connected to the source of power and to the amplifier means, rectifier means connected to the relay coil means, variable resistance means connected between the rectifier means and the source, and conductive means connecting the variable resistance means to the grid to supply a bias therefor.

3. In a control system for multiple filament headlamps having upper and lower beam filaments, a source of power, switching means connected to the source of power and to the filaments to alternately energize the filaments, light sensitive means connected to said source of power, grid controlled amplifier means connected to the output of the light sensitive means, relay coil means connected to the source of power and to the amplifier means, rectifier means connected to the relay coil means, variable resistance means connected between the rectifier means and the source of power, conductive means connecting the variable resistance means to the grid to supply a bias therefor, a shunt circuit around said variable resistance means, and switching means in the shunt circuit operated by the relay coil means to shunt the variable resistance means by relay operation.

4. In a control system for multiple filament headlamps having upper and lower beam filaments, a source of power, switching means connected to the source of power and to the filaments to alternately energize the filaments, light sensitive means connected to said source of power, grid controlled amplifier means connected to the output of the light sensitive means, relay coil means connected to the source of power and to the amplifier means, electronic means connected to said relay coil means, resistance means connected between the electronic means and the source of power, an adjustable tap on said resistance means conductively connected to the grid of the amplifier means, shunting switching means connected to the tapped resistance, second switching means connected to and controlling the first-named switching means, both the second switching means and the shunting switching means being operated by said relay coil means.

5. In a light responsive control system, a source of power, light sensitive means connected thereto, amplifying means having a plate and grid, said grid being connected to the output of the light sensitive means, a relay coil connected to the source and to the plate of the amplifier so that coil energization is controlled by flow of current through the amplifier, rectifier means connected to the relay coil, switching means connected between the rectifier means and ground to provide independent means for energizing the relay coil from that of the amplifier, resistor biasing means connected to the rectifier, an adjustable tap on said resistor, conductive means connecting said tap to the amplifier grid to provide a bias therefor, and shunting switching means for the tapped portion of the resistor actuated by the relay coil to vary the bias on the amplifier.

6. In a light responsive control system, a source of power, light sensitive means connected thereto, amplifying means having a plate and grid, said grid being connected to the output of the light sensitive means, a relay coil connected to the source and to the plate of the amplifier, so that coil energization is controlled by flow of current through the amplifier, rectifier means connected to the relay coil, switching means connected between the rectifier means and ground to provide inde-

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pendent means for energizing the relay coil from that of the amplifier, resistor biasing means connected to the rectifier, an adjustable tap on said resistor, conductive means connecting said tap to the amplifier grid to provide a bias therefor, shunting switching means for the tapped portion of the resistor actuated by the relay coil to vary the bias on the amplifier, and additional switching means operated by the relay coil to control desired means.

7. In a control system for multiple filament headlamps having upper and lower beam filaments, a source of power, first switching means connected to the source of power and to the filaments to alternately energize the same, photosensitive means connected to the power source, grid controlled amplifier means connected to the output of the photosensitive means, relay coil means connected to the amplifying means, rectifier means connected to the relay coil means, variable resistance means connected between the source and the rectifier means and to the grid of the amplifier means, a movable armature for the relay coil, a plurality of spaced contacts engageable by said armature when the relay armature is in its two extreme positions, conductive means connecting one contact to the first-named switching means and conductive means connecting another contact to the variable resistor circuit.

8. In a control system, a source of power, a relay connected to said source, a grid controlled amplifier connected to the relay to control the flow of current therethrough, a rectifier also connected to the relay to establish an independent energizing circuit for the relay, and a variable resistor connected to the source and to the rectifier and to the grid of the amplifier to provide a bias therefor.

9. In a control system, a source of power, a relay coil connected to said source, a grid controlled amplifier connected to the relay coil to control the flow of current therethrough, a rectifier also connected to the relay coil to establish an independent energizing circuit for the relay coil, a variable resistor connected to the source and to the rectifier and to the grid of the amplifier to provide a bias therefor, a shunt circuit around the variable resistor and switching means in said shunt circuit actuated by the relay coil to vary the bias on the amplifier.

10. In a control system, a source of power, a relay coil connected to said source, amplifier means connected to the relay coil to control the flow of current therethrough, a rectifier also connected to said relay coil, a variable resistance connected to said source and to the rectifier and means to control the flow of current through the amplifier connected to the variable resistance to provide a bias for the amplifier.

11. In a light responsive control system, a source of power, light sensitive means connected thereto, amplifying means having a control element connected to the output of the light sensitive means, a relay coil connected to the source and to the amplifying means so that the current flow through the coil is controlled by flow through the amplifying means, rectifier means connected to the relay coil, resistor biasing means connected to the rectifier, an adjustable tap on the resistor, conductive means connecting the tap to the control element of the amplifying means and shunting switching means for the tapped portion of the resistor actuated by the relay coil to vary the bias on the amplifier.

12. In a control system for multiple filament headlamps having upper and lower beam filaments, a source of power, switching means connected to the source of power and to the filaments to automatically energize the filaments, light sensitive means connected to the source of power, amplifying means connected to the output of the light sensitive means, means for controlling the flow of current through the amplifier means, relay coil means connected to the amplifier means and to the source of power and energized by the flow through the amplifier means, biasing means connected to the means for con-

trolling the flow through the amplifier means and to the source of power, rectifier means connected to said relay coil means and to said biasing means and switching means actuated by the relay coil and connected to said biasing means to change the effective biasing means dependent upon switch position.

13. In a control system, a source of power, relay means connected to said source, an amplifier connected to the relay means to control the flow of current therethrough, a current control device also connected to the relay means to establish an independent control circuit for said relay means, and a variable impedance connected to the source, to the current control device, and to the amplifier for controlling the operation of the amplifier.

14. In a control system, a source of power, relay means connected to said source, amplifier means connected to the relay means to control the flow of current therethrough, a current control device also connected to said relay means, an impedance connected to said source and to the current control device, and means connected to the impedance to control the flow of current through the amplifier.

15. In a light responsive control system, a source of

power, light sensitive means connected thereto, amplifying means having a control element connected to the output of the light sensitive means, relay means connected to the source and to the amplifying means so that the current flow through the relay means is controlled by the amplifying means, a current control device connected to the relay, a variable impedance connected to the current control device for providing a bias for the amplifier, conductive means connecting the variable impedance to the amplifying means for controlling the operation thereof, and a shunting circuit for bypassing said variable impedance including switching means actuated by the relay means to vary the bias on the amplifier.

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