May 27, 1952 G. W. ONKSEN, JR 2,598,420

LIGHT RESPONSIVE SYSTEM

Original Filed July 10, 1948 2 SHEETS--SHEET 1

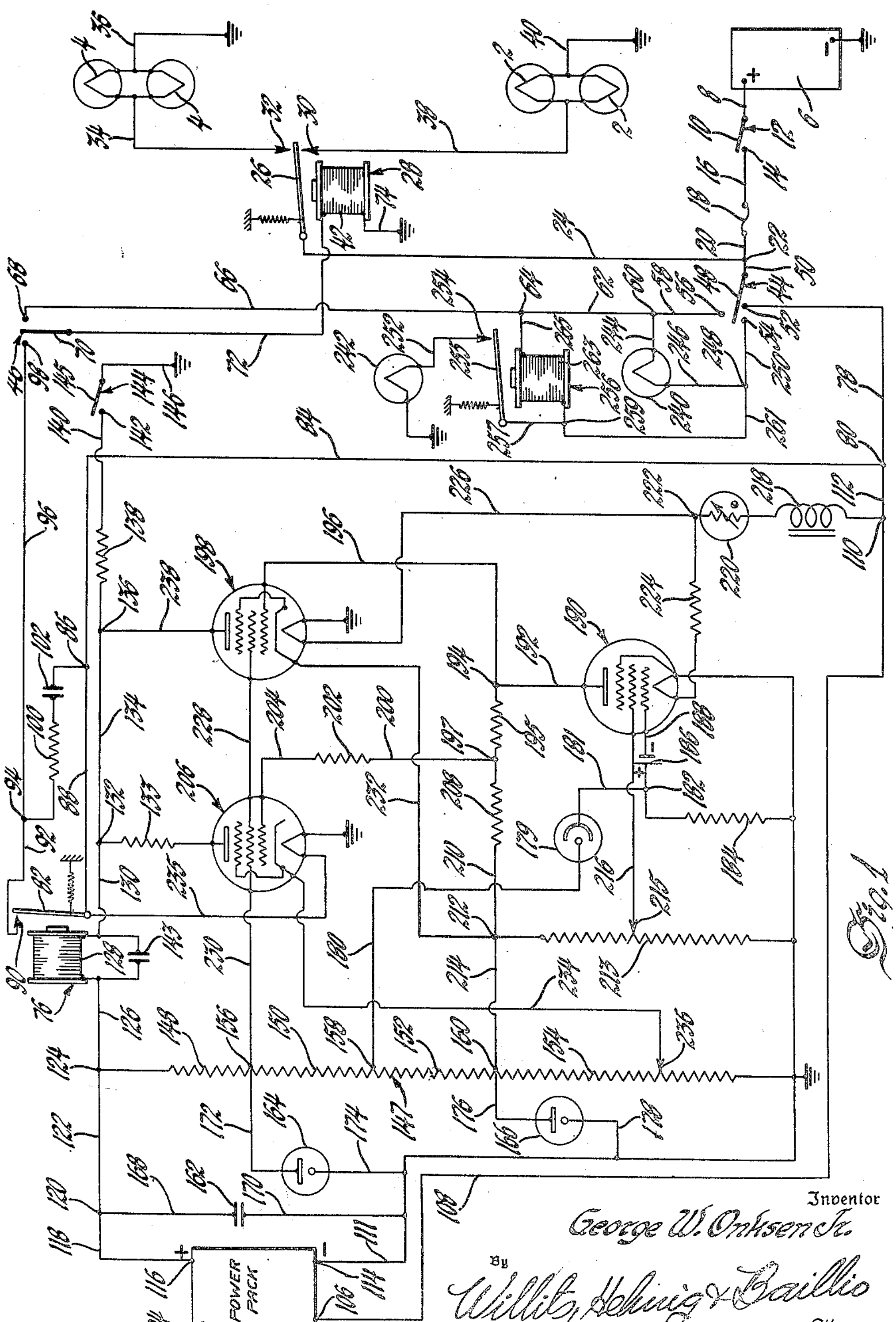


Fig. 1

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2 SHEETS--SHEET 2

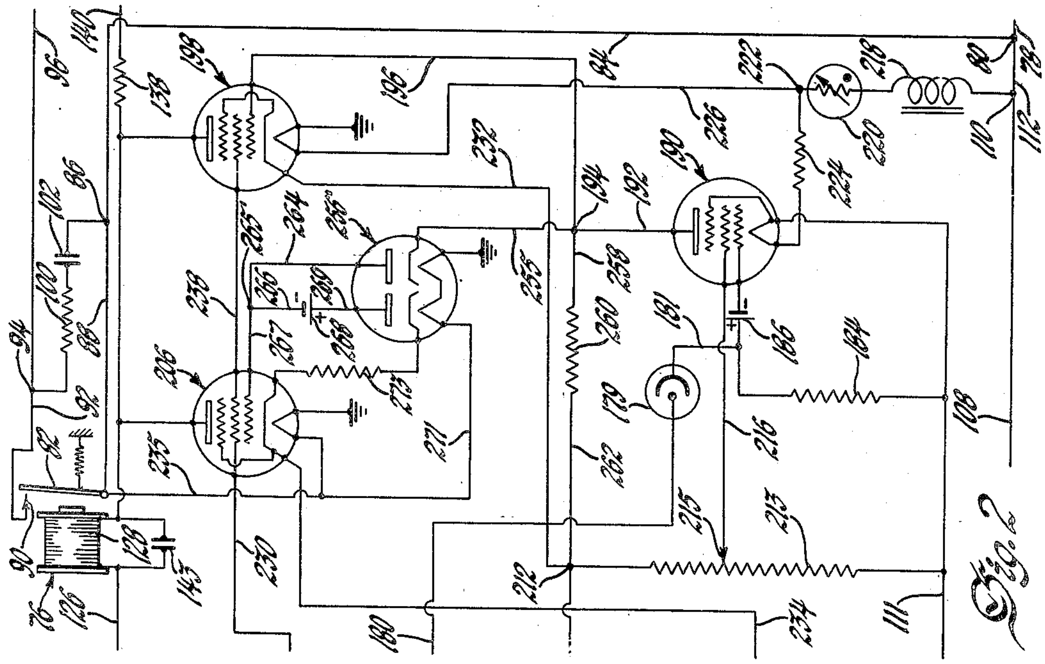

Fig. 2

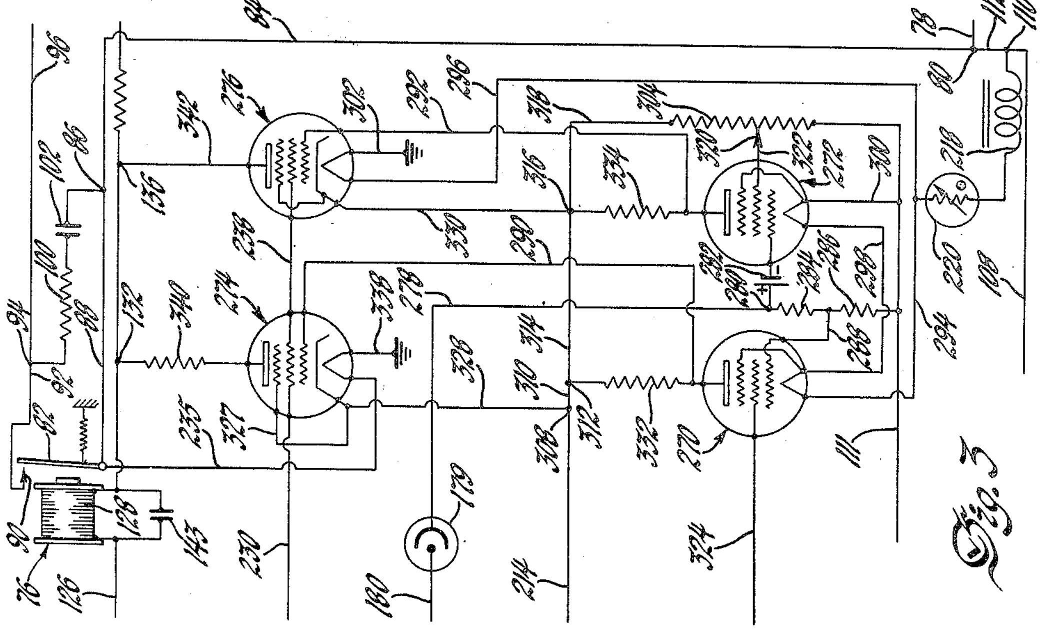

Fig. 3

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# UNITED STATES PATENT OFFICE

2,598,420

## LIGHT RESPONSIVE SYSTEM

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Original application July 10, 1948, Serial No. 37,984. Divided and this application June 30, 1950, Serial No. 171,363

3 Claims. (Cl. 315—83)

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The present invention relates to illumination systems and more particularly to light-sensitive electrical circuits adapted to control vehicle illumination systems in response to the intensity of illumination of a similar approaching system and is a division of a co-pending application Serial No. 37,984, filed July 10, 1948, in the names of George W. Onksen, Jr., and Charles W. Miller, entitled "A Light Responsive System."

The illumination systems of automotive vehicles are generally provided with dual filament headlamps with each filament in separately energizable electrical circuits controlled for alternate energization by the operator. The filament are positioned with respect to the headlamp reflector to project a high and low beam of light declining to the longitudinal axis of the vehicle at different angles so that illumination patterns are cast at different distances in its path ahead. The high beam is generally preferred for night driving on rural highways which are not illuminated from other sources, whereas the low beam is generally used for city driving conditions where additional illumination is provided.

To eliminate the hazards of passing due to the glare and dazzling effect of the high beam, the operator is required to manually operate a switch which selectively energizes the low beam circuit. This operation may distract the operator's attention from the path ahead and when the operator fails to depress the beam, extremely hazardous conditions prevail for the passing of oncoming operators.

It is therefore an object of the present invention to minimize the driving hazards prevalent under conditions of night driving by providing a light-sensitive electrical circuit for automatically controlling the illumination system of vehicles in response to the intensity of illumination of a similar approaching system.

This and other objects are obtained in accordance with the present invention by providing a selective light-sensitive electrical circuit for controlling vehicle headlighting systems which is responsive to a predetermined light intensity to dim the system yet may be subjected to a wide variation of light intensity without affecting a de-energization of the dim circuit once it has been energized. A headlight system embodying the present invention comprises the conventional dual filament headlamps with independent electrical circuits for energizing one or the other, a light-sensitive electrical circuit including a photoelectric cell, a first and second stage of amplification, a relay for selectively energizing the independent filament circuits and a common source of electrical energy. The responsiveness to a predetermined light-intensity while remaining unaffected by wide variations of light intensities once the system has been dimmed is obtained by including in the second stage of amplification, tow amplifier tubes of differing characteristics electrically connected in parallel.

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Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

For better understanding of my invention reference may be had to the accompanying drawings in which Figure 1 is a schematic diagram of the circuit utilizing the present invention for controlling a vehicle headlighting system; Figure 2 is a schematic diagram illustrating one form of modification and Figure 3 is a schematic diagram illustrating still another modification.

Referring now to Figure 1 of the drawings, there is illustrated a vehicle headlighting system embodying the present invention in which a pair of conventional headlamps, not shown, including high and low beam filaments **2** and **4** respectively, form part of electrical circuits energizable to provide either a manual or automatic control of the system.

In the system, a conventional automotive vehicle storage battery **6** of the 6-volt type is provided as a source of electrical power. In this connection it will be understood that the battery **6** is a source of power for the ignition system of the vehicle as well as the lighting system. The negative terminal of battery **6** is connected to ground and the positive terminal is connected through conductor **8** to the movable arm **10** of a single pole, single throw master switch **12**. The stationary contact **14** of switch **12** is connected through conductor **16**, current limiting fuse **18** and conductor **20** to a terminal junction **22**. A branch conductor **24** connects terminal **22** with the movable arm **26** of a single pole, double throw electromagnetic relay switch **28** provided with oppositely disposed stationary contact terminals **30** and **32**. The movable arm **26** of switch **28** is normally held in yielding engagement with stationary contact terminal **32** which in turn is connected through conductor **34** to the low beam filaments **4** of the headlamps. The other sides of the headlamp filaments **4** are grounded through a conductor 36. The circuit comprising contact 32, conductor 34, filaments 4 and conductor 36 form one branch of the headlamp circuit. The other branch comprises a conductor 38 which connects the high beam filaments 2 of the headlamps to contact 30 of the switch 28 and conductor 40 which connects the other sides of the filaments 2 to ground.

To provide for the independent manual energization and deenergization of the headlamp circuits, the solenoid coil 42 of switch 28 forms part of a circuit which includes in series relationship a single pole, double throw, selector switch 44 and a single pole, double throw foot selector switch 46. Terminal 22 is connected to the movable arm 48 of switch 44 through conductor 50. The movable arm 48 is shown in a position to bridge two stationary contacts 52 and 54, both of which are connected in circuits to the automatic control and indicating means and will be described in detail hereinafter. An oppositely disposed contact 56 of switch 44 is connected through conductor 58, terminal 60, conductor 62, terminal 64 and conductor 66 to a stationary contact 68 of the foot selector switch 46. The movable arm 70 of switch 46 is adapted to engage contact 68 and complete a circuit through conductor 72, solenoid coil 42 of switch 28 and conductor 74 to ground.

For automatic control of the headlamp filaments a circuit is provided from the source 6 to the solenoid coil 42 which includes a light-responsive, single pole, single throw electromagnetic relay switch 76 capable of energization and deenergization at substantially different current values. In this circuit the stationary contact 52 of selector switch 44 is connected by a conductor 78 to a terminal junction 80 which in turn is connected to the movable arm 82 of relay switch 76 through conductor 84, terminal junction 86 and conductor 88. The movable arm 82 cooperates with stationary contact 90 of relay switch 76 and is normally in yielding open circuit relationship. Contact 90 is connected through conductor 92, terminal junction 94 and conductor 96 to the remaining oppositely disposed stationary contact 98 of foot selector switch 46.

To reduce the destructive effect of arcing between the movable arm 82 and the stationary contact 90 of relay switch 76, a shunt circuit including a 100 ohm resistor 100 and a .1 mfd. capacitor 102 is connected in series between the terminals 86 and 94.

In the headlighting system of the present invention the voltages suitable to the most efficient operation of the light responsive apparatus are provided by a conversion device 104 for changing the low voltage direct current of the vehicle electrical system to a high voltage direct current suitable for the operation of the electronic elements in the circuit. Conversion devices such as the device employed in the system of the present invention are well-known and are employed extensively to provide suitable voltages for the operation of vehicle radios. In this connection the positive input terminal 106 of the converter is connected through conductor 108, terminal junction 110 and conductor 112 to the terminal 80. The negative terminal 114 is connected to ground by conductor 111. The high voltage output terminal 116 is connected by a conductor 118, terminal junction 120, conductor 122, terminal junction 124 and conductor 126 to the solenoid coil 128 of the light responsive relay switch 76. The negative output terminal of the converter is connected within the converter to ground through terminal 114. The light responsive relay 76 has the other end of its solenoid coil 128 connected through conductor 130, terminal junction 132, conductor 134, terminal junction 136, a 25,000 ohm resistor 138 and conductor 140 to the stationary contact 142 of a single pole, single throw, manual switch 144. The movable arm 145 of switch 144 is in yielding open circuit relation with contact 142 and is connected to ground by conductor 146. A shunt circuit is provided for the solenoid coil 128 of relay switch 76 which includes an 8 mfd. capacitor 143 connected between the ends of the solenoid coil.

To provide the different voltages necessary to the operation of the various electronic elements in the light responsive apparatus a voltage divider network 147 comprising 4 sections of series-connected resistances 148, 150, 152 and 154 of 5800 ohms, 800 ohms and 15,000 ohms respectively, is connected between the high voltage terminal 124 and ground. The respective resistances are connected together in the order enumerated by terminals 156, 158 and 160.

A filter 162 or 16 mfd. capacitance is connected across the output terminals 116 and 114 by means of conductor 118, terminal 120, conductor 168 and conductors 170 and 111, to minimize the A. C. ripple voltage that is present in the output circuit of the converter 104.

As the voltage at the output terminals of the converter varies between about 260 and 420 volts due to the variation of the vehicle system voltage between about 5.5 and 7 volts, voltage regulator means 164 and 166 are connected in parallel with sections of the voltage divider network 147 to obtain stable voltage levels of 150 and 75 volts respectively. The voltage regulator means 164 and 166 comprise a VR150 glow discharge tube which is connected by conductors 172 and 174 between terminal 156 and ground, and a VR75 glow discharge tube which is connected by conductors 176 and 178 between terminal 160 and ground.

The electronic elements that comprise the light responsive apparatus and provide for the energization and deenergization of relay switch 76 include a photocell 179 which controls a power amplifying tube 190 hereinafter referred to as a first stage or primary amplifier and a pair of power amplifying tubes 198 and 206 which are controlled by the output of the primary amplifier and have their plates connected in parallel to the solenoid coil 128 of the relay switch 76. The pair of amplifying tubes 198 and 206 will be referred to hereinafter as the second stage or secondary amplifier. The photocell 179 is connected to the voltage divider 147 by a conductor 180 which connects its anode terminal to terminal 158 at the junction of the voltage divider resistance sections 150 and 152. By connecting the photocell anode to the voltage divider at this point, a voltage of about 85 to 90 volts is provided for the operation of the cell at the most efficient portion of its response curve. The cathode of the photocell is connected by conductor 181 to a terminal junction 182 which in turn is connected through a 500 megohm resistor 184 to ground and to the positive terminal of a one and one-fourth volt biasing battery 186 which has its negative terminal connected by a conductor 188 to the control grid of the multiple grid power amplifying tube 190 comprising the first stage or primary amplifier. The output or plate of tube 190 is connected by conductor 192, terminal junction 194 and conductor 196 to the control grid of the multiple grid power amplifying tube 198 comprising part of the second stage or secondary amplifier and through terminal 194, resistor 195, terminal junction 197, conductor 200, resistor 202 and conductor 204 to the control grid of the multiple grid power amplifying tube 206 comprising the other part of the second stage or secondary amplifier. The resistors 195 and 202 have respective resistance values of 2 and 100 megohms. The plate of tube 190 is also connected by terminal 197 to terminal 160 of the voltage divider through an 8 megohm resistor 208, conductor 210, terminal junction 212 and conductor 214. A 70,000 ohm potentiometer 213 is connected between terminal 212 and ground and carries a sliding contact 215 which is connected by a conductor 216 to the screen grid of first stage amplifying tube 190. Current for heating the filament of tube 190 is supplied by connecting the filament of this tube to the 6-volt battery circuit at terminal 110. In the circuit between the terminal 110 and the filament there is connected in series a choke coil 218, an automatic regulating ballast resistance 220, a junction terminal 222 and a 25 ohm resistor 224. Current is also supplied from the battery to the filament of tube 198 through the choke coil 218 and ballast resistor 220 by connecting terminal 222 to the filament through conductor 226. The other sides of the filaments of tubes 190 and 198 are connected to ground. To obtain a stable voltage input of 150 volts to the screen grids of tubes 198 and 206 of the secondary amplifier, they are connected in series by conductors 228 and 230 to the 150 volt terminal 156 of the voltage divider 147. Voltages for the cathodes of tubes 198 and 206 are supplied from the voltage divider 147, the cathode and suppressor grid of tube 198 being connected by conductor 232 to terminal 212 and the cathode and suppressor grid of tube 206 being connected by conductor 234 to the sliding contact 236 on the potentiometer section 154. The cathode of tube 206 is heated by an independent filament which has one side connected by conductor 235 to the 6-volt battery source at the junction of conductor 88 and movable arm 82 of switch 76 and the other side connected to ground. The plates of the tubes 198 and 206 are connected in parallel to the solenoid coil 128 of relay switch 76, the plate of tube 206 being connected to terminal 132 through a 30,000 ohm resistor 133 and the plate of tube 198 being connected to terminal 136 by conductor 238.

Indicating means for the light responsive and manual control circuits are included in the switching circuit. These means comprise indicator lamps 240 and 242. Lamp 240 has one side of its filament connected to terminal 60 by conductor 244 and the other side of the filament connected to the contact 54 of switch 44 by conductor 246, junction terminal 248 and conductor 250. The filament of lamp 242 has one side connected to ground and the other side connected through a conductor 252 to the stationary contact 254 of an electromagnetic relay switch 256. The movable arm 255 of the relay switch 256 is in yielding closed circuit relationship with contact 254 and is connected by conductor 257, terminal junction 259 and conductor 261 to the terminal 248. The coil 263 of the relay 256 is energized through a circuit which connects one end of the coil through a conductor 265 to terminal 64 and the other end of coil to terminal 259.

In the circuit modification of the light responsive apparatus illustrated in Figure 2, the arrangement of the circuit and electronic elements is substantially the same as that of Figure 1 except that a duo diode tube 256′ is connected between the multiple grid tube 190 of the primary amplifier and the multiple grid tube 206 of the secondary amplifier.



In this circuit the plate of the primary amplifier tube 190 is connected to terminal 194 by conductor 192 with branch circuits connecting terminal 194 with the control grid of tube 198, one of the cathodes of tube 256′ and the 75 volt terminal of the voltage divider 147. The circuit connecting the grid of tube 198 and the plate of tube 190 is the same as hereinabove described in connection with the circuit of Figure 1. The circuit to the 75 volt terminal of the voltage divider includes a 10 megohm resistor 260 connected between terminals 194 and 212 by conductors 258 and 262. A conductor 255 connects terminal 194 with the cathode of tube 256′. The voltage of the control grid of tube 206 is controlled by the output plates of tube 256′. These plates are connected in parallel circuits to a terminal junction 265′ which is connected to the control grid of tube 206 by conductor 267. One plate of the diode is connected to terminal 265′ through a 1¼ volt biasing battery 268 which has its positive terminal connected to the plate of tube 256′ by conductor 269 and its negative terminal connected to terminal 265′ by conductor 266. The other plate of tube 256′ is connected to terminal 265′ by conductor 264. The heater filaments of tube 256′ are connected in series between ground and the conductor 235 by conductor 271. The remaining cathode of tube 256′ is connected through a 2 megohm resistor 273 to the cathode of tube 206.

In the circuit modification of the light responsive apparatus illustrated in Figure 3 there is included a pair of multiple grid tubes 270 and 272 comprising a first stage or primary amplifier which have their outputs controlled by the photocell and which in turn control the outputs of another pair of multiple grid tubes 274 and 276 comprising a second stage or secondary amplifier.

In this circuit arrangement the control grid of tube 272 is connected to the cathode of the photocell 179 through conductor 278, terminal junction 280 and a 1¼ volt biasing battery 282 which is arranged with its negative terminal connected to the control grid and the positive terminal connected to the terminal 280. A 100 megohm resistor 284 in series with a 500 megohm resistor 286 are connected between terminal 280 and ground. A conductor 288 connects the junction of resistors 284 and 286 to the control grid of tube 270. The plates of tubes 270 and 272 are connected respectively by conductors 290 and 292 to the control grids of tubes 274 and 276. Current is supplied to the filaments of tubes 270, 272 and 276 from the 6-volt battery circuit through terminal 110, choke coil 218 and ballast resistor 220 and the branch circuits comprising the conductors 294 and 296. The filaments of tubes 270 and 272 are connected in series circuit relationship between conductor 294 and ground by conductors 298 and 300 while the filament of tube 276 has one side connected to ground by conductor 302 and the other side connected to the conductor 296. Voltage is supplied to the screen grid of tube 272 by a circuit which connects one end of a 70,000 ohm potentiometer 304 to the 75 volt terminal 160 of the voltage divider 147 and the other end of the resistor to ground. Resistor 304 is connected to terminal 160 by a circuit which includes conductor 214, junction terminal 308, conductor 310, junction terminal 312, conductor

314, junction terminal 316 and conductor 318. A slidable contact 320 associated with the potentiometer 304 is connected by a conductor 322 to the screen grid of tube 272. Voltage is supplied to the screen grid of tube 270 by connecting the grid through conductor 324 to a slidable contact 236 which is associated with the potentiometer section 154 of the voltage divider 147. The cathodes and suppressor grids of tubes 274 and 276 are connected respectively to terminals 308 and 316 by conductors 328 and 330; the suppressor grid of tube 274 being connected to the cathode externally by conductor 327. A 250,000 ohm resistor 332 and a 500,000 ohm resistor 334 are connected respectively between the plate of tube 270 and terminal 312 and the plate of tube 272 and terminal 316. Current is supplied to the filament of tube 274 by conductor 235 which is connected between the movable arm 82 of relay switch 76 and one side of the filament.

The other side of the filament of tube 274 is connected to ground by conductor 338. The plates of tubes 274 and 276 are connected respectively to terminals 132 and 136 in the coil circuit of relay switch 76 through a 100,000 ohm resistor 340 and conductor 342.

For the hereinabove described light responsive circuits to operate in response to predetermined light intensities to control the energization and deenergization of the headlamp filaments 2 and 4 through relay switch 76 it is first desirable to adjust the circuit to respond with predetermined current flow at the plate output of the tubes of the secondary amplifier. In this connection, switches 12 and 44 are closed to energize the current converter 104. The electronic elements which are connected to the high potential side of the converter are allowed to heat for a period of time so that they will operate efficiently. The sliding contacts of the three circuits are then adjusted to provide current flow through coil 128 which will vary in accordance with the intensity of light of an approaching vehicle headlight system to cause deenergization of the coil when the approaching vehicle is at a predetermined distance ahead and energization of the coil when the approaching vehicle passes by.

To provide for the automatic control of the headlighting system, switch 10 is closed to energize the low beam filaments 4 through current flow from the battery 6 through conductors 8, 16, 18, 20 and 24, movable arm 26 and conductor 34. The movable arm 48 of switch 44 is then closed on contact 52 to energize the converter 104 through the circuit including conductors 78, 112 and 108.

Referring now to the circuit diagram of Figure 1 with the electronic elements sufficiently heated and no light on the photocell 179, sufficient current flows in the circuit from terminal 116 of the converter through conductors 118, 122, 126, coil 128, conductors 130 and 134 to the plates of tubes 198 and 206 to cause energization of the relay coil 128 and movement of arm 82 of relay switch 76 into engagement with contact 90. With the movable arm 70 of the foot switch 46 engaging contact 98 a circuit is completed to coil 42 from the battery through conductors 8, 16, 20, 78, 84, 88, 92, 96 and 72. With coil 42 energized the movable arm 26 of relay switch 28 moves into engagement with contact 30 causing energization of the high beam filaments 2.

With the approach of a similar lighting system, light of gradually increasing intensity falls on the photocell 179 causing an increasing current



flow from terminal 158 of the voltage divider through conductor 180, photocell 179, conductor 181 and resistor 184 to ground. With the gradually increasing current flow in this circuit the voltage at terminal 182 changes and gradually overcomes the negative grid bias on the control grid of tube 190 caused by the biasing battery 186. As the bias on the control grid gradually changes from negative toward positive the flow of current from terminal 160 of the voltage divider through conductors 214, 210, resistors 208 and 195 and conductor 192 to the plate of tube 190 increases and a voltage drop occurs at terminals 197 and 194 due to the IR drop across resistors 195 and 208. These voltage changes are carried to the control grids of tubes 206 and 198 respectively through circuits including conductor 200, resistor 202 and conductor 204 and conductor 196 respectively. This causes a change of grid bias on the control tubes 198 and 206 causing both tubes to become sequentially non-conducting; the tube 198 being the first to cut off, but relay 128 will not drop out until tube 206 is cut down in conductance to a low value after tube 198 is nonconducting. With very little or no current flowing to the plates of tubes 206 and 198 the coil 128 of relay 76 is deenergized moving arm 82 out of engagement with contact 90 and the circuit through coil 42 of relay 28 is broken causing the movable arm 26 to move into engagement with contact 32 for the energization of low beam filaments 4 and the deenergization of high beam filaments 2.

If the source of illumination to which the photocell is exposed then begins to decrease in intensity, a current of decreasing value flows from the terminal 158 of the voltage divider through the circuit including the photocell to ground as hereinabove mentioned. Accordingly, the voltage at terminal 182 decreases until the voltage of the biasing battery is imposed on the control grid of tube 190. The flow of current through tube 190 decreases and consequently the voltages at terminals 197 and 194 increase altering the grid bias in tubes 206 and 198. As these biasing voltages change the flow of current in tube 206 gradually increases to normal value, and tube 198 begins to approach the conducting point. However, while tube 198 remains non-conductive there is insufficient current flow in the coil circuit of relay 76 to cause it to move the arm 82 into engagement with contact 90. When it does become conductive sufficient current flows in the relay circuit to cause relay 76 to move the arm 82 into engagement with contact 90 and filaments 2 and 4 of the headlamp circuit respectively are energized and deenergized. There is thus a definite difference in the illumination level at relay drop-out to that at relay return. With this arrrangement it will be obvious that substantial changes in intensity of illumination are required before the relay 76 will be energized or deenergized from its existing state thereby preventing flickering or repeated alternate energization of the filaments due to extraneous lighting conditions.

If the operator of the vehicle should desire to reenergize the high beam elements 2 while the low beam elements are energized and under the control of the light-responsive apparatus, the independent resetting manual foot switch 144 is provided to close a circuit through the coil 128 of relay 76 from the terminal 116 of the converter 104 to ground. This circuit comprises conductors 118, 122, 126, relay coil 128, conductors 130, 134, resistor 138, conductor 140, switch 144 and conductor 146.

Manual control of the filaments 2 and 4 is obtained in the same manner as in the conventional headlight system. In this connection the movable arm 48 of selector switch 44 is moved into engagement with contact 56 thereby completing a circuit from battery 6 through conductors 8, 16, 20, 50, 58, 62 and 66 to the stationary contact 68 of the foot switch 46. When the movable arm 70 moves into engagement with contact 68, the circuit is completed from the battery 6 to the coil of relay 28 through the switch 46 and conductor 72. Movable arm 26 of relay switch 28 moves into engagement with contact 30 and the high beam filaments 2 are energized. Manually breaking the circuit at switch 46 causes a deenergization of relay coil 42 and an energization of the circuit to the low beam filaments 4.

Lamps 240 and 242 indicate the controlling condition of the light responsive apparatus and the respective energization of the headlamp filaments. With the movable arm 48 of switch 44 in engagement with contacts 52 and 54 for energization of the light responsive apparatus are hereinabove described, a circuit is completed from terminal 248 through conductor 246, lamp 240 and conductor 244 to terminal 60. An additional circuit is completed from terminal 248 through conductor 261, coil 263 of relay switch 256 and conductor 265 to terminal 64. This circuit also includes a branch circuit from conductor 261 to the movable arm 255 through conductor 257. With the coil of relay switch 256 deenergized, this circuit is completed through contact 254, conductor 252 and lamp 242 to ground. When the arm 70 of switch 46 is in engagement with contact 98 for control of the filaments 2 and 4 by the light responsive apparatus, lamp 242 is energized, indicating that the light responsive apparatus is controlling. When the movable arm 70 of switch 46 moves into engagement with contact 68, coil 263 of relay 256 is energized moving arm 255 out of engagement with contact 254 whereby the lamp 242 is deenergized. At the same time, lamp 240 becomes energized. With switch arm 48 moved out of engagement with contact 54 both indicating lamps become deenergized. With such an arrangement of indicating lamps there is visual means for indicating which of the headlamp filaments is energized when they are controlled manually and whether the filaments are under the control of the light responsive apparatus.

The operation of the light responsive circuit of Figure 2 is substantially the same as that of Figure 1. In this circuit, the intensity of light on the photocell determines the current flow in tube 190 and through resistor 260 which in turn controls the current flow in tubes 198 and 206 by changing the voltage on the control grids of these tubes. With no light on the photocell, both tubes 198 and 206 conduct sufficient current to cause the energization of coil 128 of relay 76 at a substantially high current value. As the photocell becomes exposed to increasing intensities of light, the voltage bias on the control grids of tubes 198 and 206 causes the tube 198 to become non-conductive and reduces the current flow of tube 206 to a sufficiently low current flow to cause relay coil 128 to become deenergized. Current value at which the relay coil becomes deenergized is substantially less than that at which it becomes energized. In this circuit the purpose of the diode tube 256′ is to replace resistor 202 of the circuit of Figure 1 and prevent the control grid of tube 206 from becoming positive with respect to the cathode.

In the light responsive circuit of Figure 3 the operation is substantially the same as that of light responsive circuits of Figures 1 and 2 except that the flow of current through tubes 274 and 276 is directly and separately controlled by tubes 270 and 272 respectively of the primary amplifier. These tubes of the primary amplifier are in turn controlled by the photocell. As in the light responsive circuits of Figures 1 and 2 when the photocell is not exposed to light tubes 274 and 276 both conduct current of substantially high value to energize relay coil 128. As the intensity of light on the photocell increases the photocell conducts increasingly more current in the circuit from the voltage divider to ground through the photocell, conductor 278 and resistors 284 and 286. With increasing current in this circuit voltage changes occur across resistors 284 and 286 to cause the voltage bias on the control grids of tubes 270 and 272 to change, thus changing the current output of the tubes 274 and 276 and the voltage bias on the control grids of tubes 274 and 276. With sufficient light intensity on the photocell, tube 276 no longer conducts current and tube 274 conducts current of less value than that required to retain relay coil 128 energized. While specific circuit constants have been used in connection with the description of the circuits of the present invention and their operation it will be understood by those skilled in the art that they are illustrative and that the circuits are capable of operation at other values than those recited.

With the light responsive circuits such as described above wherein the light responsive relay controlling the headlamp filament circuit is in turn controlled by an amplifier comprising two amplifier tubes in parallel, the energizing and deenergizing of the headlamp filaments is accomplished at substantially different intensities of illumination. This important feature makes the operation of an automatic dimmer device for vehicle headlighting systems feasible because of the lack of response of the device to other sources of light causing flickering due to the repeated energization and deenergization of the high and low beam headlamp filaments.

What I claim as new and desire to obtain by Letters Patent of the United States is:

1. In an automatic vehicle headlight control system, the combination of power supply, a phototube connected thereto, a dark actuated amplifier circuit connected between the phototube and the power supply, a relay in the output circuit of the amplifier, and an electronic means to pull on the relay armature in the absence of light on the phototube, wherein, said relay armature operating as a means to automatically switch lights from high beam to low beam upon the application of light and returning them to high beam when the light is removed.

2. In a control for automatically dimming multiple filament headlamps, a light sensitive pick-up device, a source of electrical power, voltage amplifier means connected to the source of power and to the pickup device, current amplifying means connected to the output of the voltage amplifying means, a relay connected to the output of the current amplifying means, said relay being normally energized in the absence of light on the pickup device and deener-

gized upon the application of light thereto, and a switch operated by the relay to change the power source from the headlight high beam to the headlight low beam filament when the relay is deenergized by light falling on the pickup device and upon removal of the light to change the power source back to high beam filament.

3. In a control system for automatically dimming multiple filament headlamps, a light sensitive pickup device, a source of electrical power, a multi-element voltage amplifier tube connected to said source of power and having a control grid and plate, said control grid being connected to the pickup device, a current amplifier tube having a control grid and plate, said control



grid being connected to the plate of the voltage amplifier tube and relay means connected in the plate circuit of the current amplifying means normally energized in the absence of light on said pickup device and deenergized upon the application of light to the pickup device, and switching means operated by the relay to change the power source from the headlight high beam filament to the low beam filament when it is deenergized by light falling on the pickup device and return it to the high beam filament when the light is removed.

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No references cited.