Oct. 3, 1944. J. W. LAWSON 2,359,371

LIGHTING SYSTEM

Filed March 31, 1943 3 Sheets-Sheet 1

SIX TERMINAL CONNECTOR PLUG

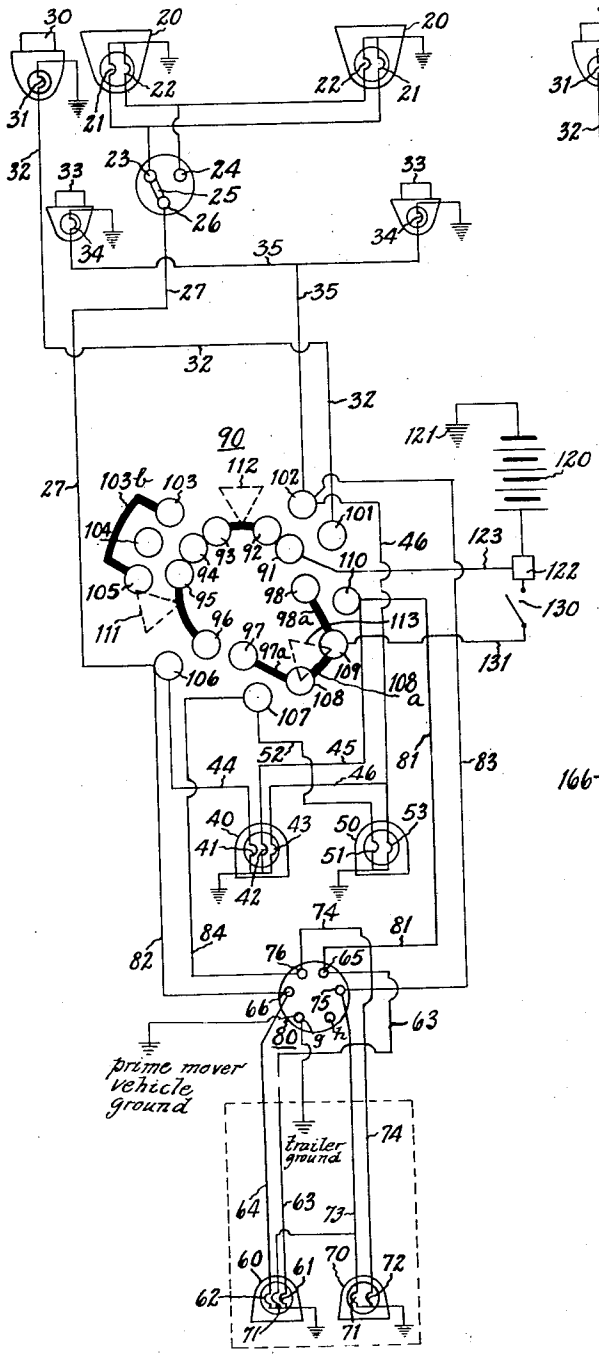


Fig. 1.

FOUR TERMINAL CONNECTOR PLUG

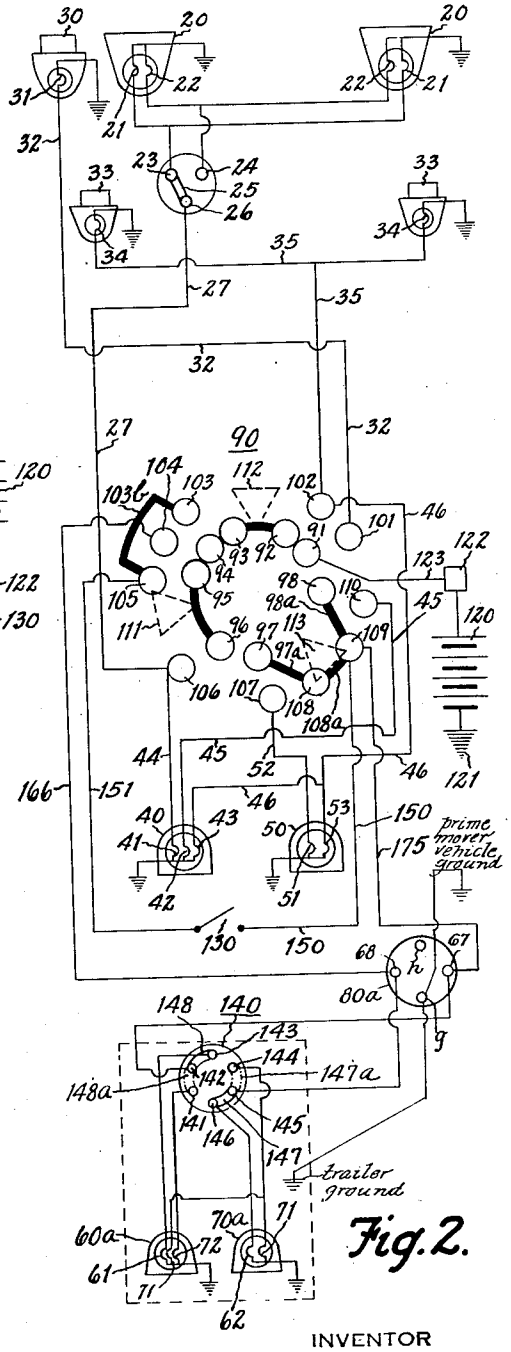


Fig. 2.

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LIGHTING SYSTEM

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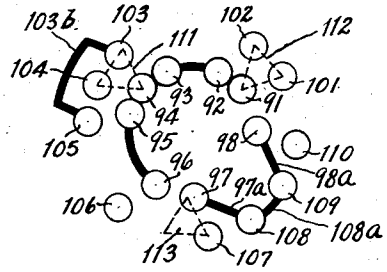


Fig. 4.

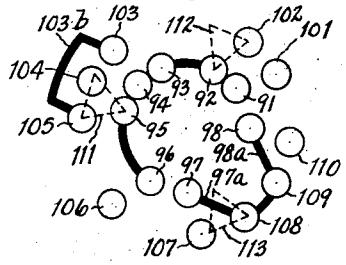


Fig. 3.

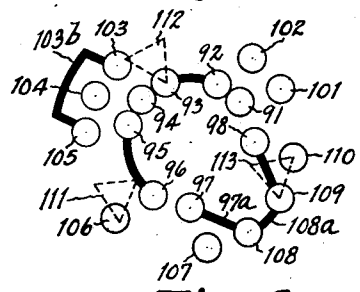


Fig. 5.

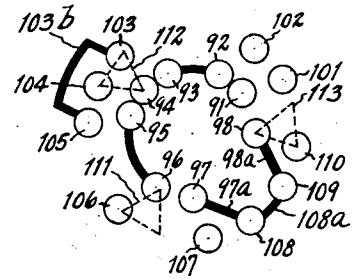


Fig. 6.

SIX TERMINAL CONNECTOR PLUG

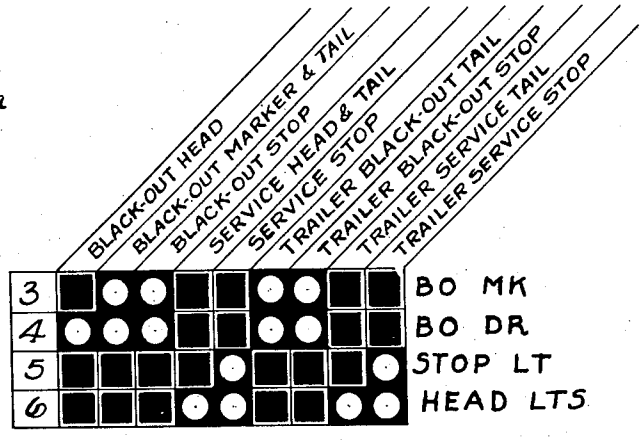


Fig. 7.

FOUR TERMINAL CONNECTOR PLUG

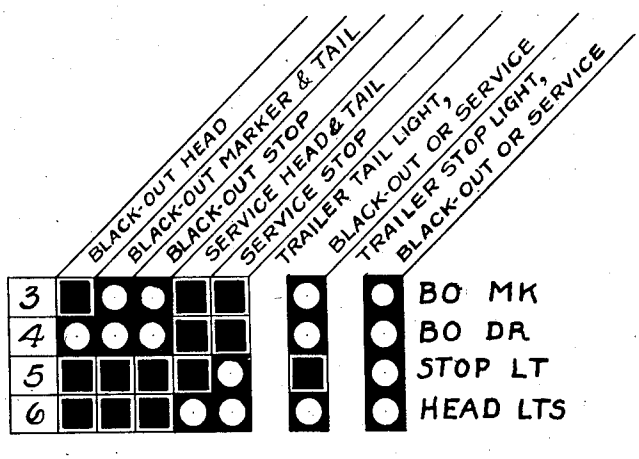


Fig. 8.

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LIGHTING SYSTEM

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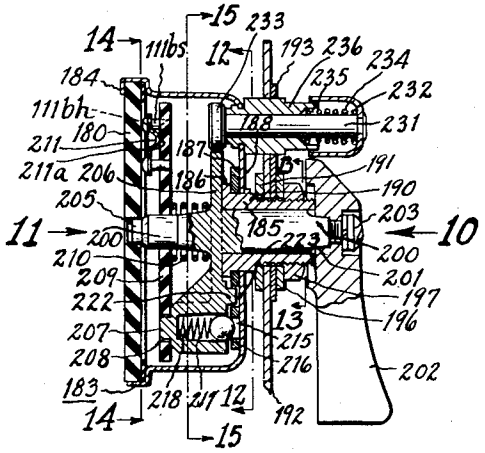


Fig. 9.

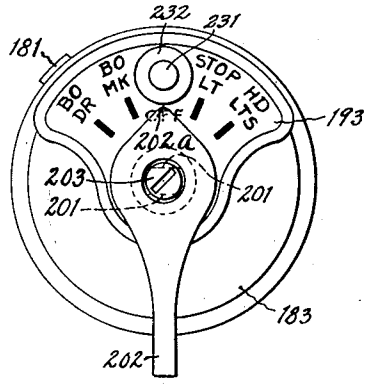


Fig. 10.

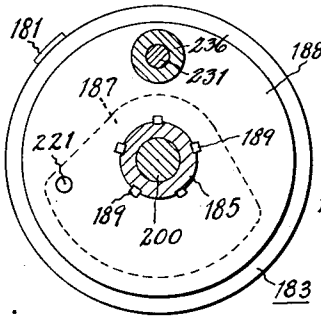


Fig. 12.

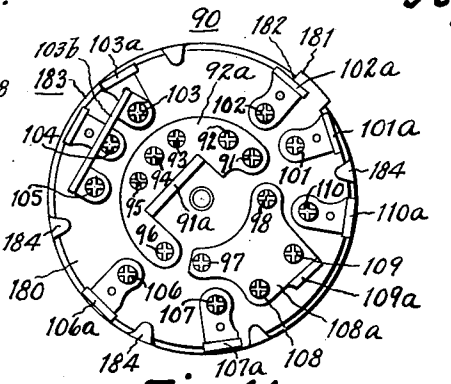


Fig. 11.

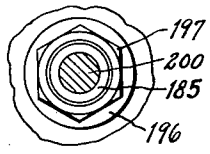


Fig. 13.

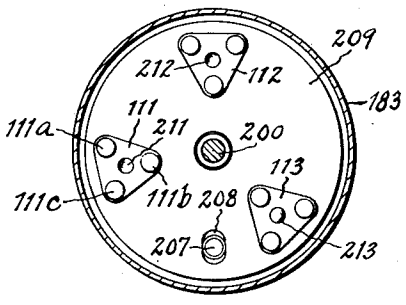


Fig. 14.

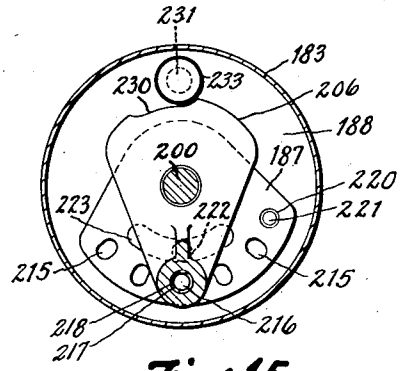


Fig. 15.

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Patented Oct. 3, 1944 2,359,371

UNITED STATES PATENT OFFICE

2,359,371

LIGHTING SYSTEM

John W. Lawson, Anderson, Ind., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application March 31, 1943, Serial No. 481,233

3 Claims. (Cl. 315—83)

This invention relates to lighting systems for use on automotive vehicles particularly the military type.

There are already in military service engine driven vehicles used with trailers equipped with multi-circuit plug-and-socket connectors for making electrical connections between circuits of the engine vehicle and circuits of the trailer. Some of these connectors provide for six electrical connections and others for four electrical connections. It is an object of the present invention to provide lighting systems for use with either a six circuit connector or four-circuit connector, said systems using main circuit controlling switches which are identical. This main circuit controlling switch is of simple and compact construction having an "off" position and four "on" positions for controlling the various lamp filaments for four conditions of driving and parking, namely, black-out parking, black-out driving, day-light driving with only the stop-light burning when the brakes are applied, and night driving with the regular or service head and tail lamps burning.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a wiring diagram of a lighting system for six terminal connector plug use including a main control lighting switch constructed in accordance with the present invention.

Fig. 2 is a wiring diagram of a lighting system for four terminal connector plug use using the same switch as for six terminal connector plug.

Figs. 3, 4, 5 and 6 show the various "on" positions of the switch shown in the "off" position in both Figs. 1 and 2.

Fig. 7 is a chart showing the circuits which are made by the switch when used in the six terminal connector plug of Fig. 1 and when the switch is in the various positions shown in Figs. 3, 4, 5 and 6.

Fig. 8 is a chart showing the various circuits which are made by the switch when used in the four terminal connector plug Fig. 2 and when the switch is in the various "on" positions shown in Figs. 3, 4, 5 and 6.

Fig. 9 is a longitudinal sectional view of the switch shown diagrammatically in preceding figures.

Figs. 10 and 11 are respectively front and back views of the switch looking respectively in the direction of arrows 10 and 11 of Fig. 9.

Figs. 12, 13, 14 and 15 are sectional views taken respectively on the line 12—12, 13—13, 14—14 and 15—15 of Fig. 9.

The electric lamp system for use in the six terminal connector plug comprises service driving lamps 20 having main filaments 21 and depressed beam filaments 22 connected respectively with dimmer switch contacts or terminals 23 and 24 adapted to be connected by a contact 25 selectively with terminal 26 connected by wire 27 with fixed contact 106 of main control switch 90. There is a blackout driving lamp 30 having a filament 31 connected by wire 32 with contact 101 of switch 90. There are two blackout marker lamps 33 having filaments 34 connected by wire 35 with contact 102 of switch 90. There is a prime mover vehicle rear lamp 40 having a service tail lamp filament 41, a service stop light filament 42 and a blackout tail lamp filament 43. Service tail filament 41 is connected by wire 44 with contact 106. Service stop filament 42 is connected by wire 45 with contact 110. Blackout tail filament 43 is connected by wire 46 with contact 102. There is a prime mover vehicle rear lamp 50 having a blackout stop lamp filament 51 connected by wire 52 with contact 107 of switch 90 and a blackout tail lamp filament 53 which, like blackout tail filament 43 of lamp 40, is connected with wire 46 and contact 102.

The trailer vehicle carries a rear lamp 60 having a service stop filament 61 and a service tail filament 62 which are connected respectively by wires 63 and 64 with connectors 65 and 66 of a plug-and-socket unit 80. The trailer vehicle carries a rear lamp 70 having a blackout tail filament 71 and a blackout stop filament 72 connected respectively by wires 73 and 74 with connectors 75 and 76 respectively of plug-and-socket unit 80. Wire 81 joins connector 65 with terminal 110. Wire 82 joins connector 66 with contact 106. Wire 83 joins connector 75 with contact 102. Wire 84 joins connector 76 with contact 107. A blackout tail filament 71 is provided also by lamp 60.

Main switch 90 has electrically connected fixed contacts 91, 92, 93, 94, 95 and 96 which are arranged in the same inner circular row with contacts 97 and 98. Switch 90 has an outer row of fixed contacts comprising contacts 101, 102, 103, 104, 105, 106, 107, 108, 109 and 110. Contacts 103, 105 are electrically connected by a strap 103*b*. Contacts 97, 108, 109 and 98 are connected together by straps 97*a*, 98*a* and 108*a*. These con-

tact connecting straps are not engaged by any of the movable contacts of the switch which include triangular shaped movable contacts 111, 112 and 113 shown in the "off" position in Fig. 1.

120 designates a storage battery grounded at 121 and connected by a fuse or other thermal protecting device 122 with wire 123 which connects with contact 91. The thermal overload protector 122 is connected with a stop light switch 130 connected by a wire 131 with contact 109 in Fig. 1.

The switch contacts 111, 112 and 113 are rotatable concurrently in either direction from the off or neutral position shown in Fig. 1. These contacts may be rotated clockwise (Figs. 3 and 4) from neutral first into the position shown in Fig. 3 which is the position required for blackout lighting. The various lamps that will burn when the contacts are in the position in Fig. 3 are indicated on line 3 of Fig. 7 by white circles. Lamps which do not burn are indicated by black squares. Similarly, when the movable contacts are moved still further clockwise (Figs. 3 and 4) into the positions shown in Fig. 4, which is the blackout drive position, the lamps which will burn are indicated by the white circles of line 4, Fig. 7. For daytime driving only the stop light is required to burn. The movable contacts are turned counterclockwise (Figs. 5 and 6) from the "off" position to that shown in Fig. 5, thereby providing connections only to the prime mover vehicle service stop light and to the trailer service stop light as indicated by the white circles in line 5 of Fig. 7. Then when the stop light switch 130 is closed the stop lights on the prime mover vehicle and the trailer will burn. When it is desired to drive at night with the regular or service lights, the switch contacts are turned to the position shown in Fig. 6 so that in addition to the connections made by the switch when in Fig. 5, the service head and tail lamps and the trailer service tail lamp will burn as indicated by the white circles on line 6 of Fig. 7.

By comparing Fig. 1 with Fig. 2, which shows the electrical system for use with the four terminal connector plug, the differences between the two systems can be readily understood. The trailer service tail lamp filament 62 is located in lamp 70*a* and the trailer service stop lamp filament 61 is located in the lamp 60*a*. Blackout tail lamp filaments 71 are located in lamps 60*a* and 70*a* and the trailer blackout stop filament 72 is located in the lamp 60*a*. The trailer carries a switch 140 having stationary contacts 141, 142, 143, 144, 145 and 146. Contact 142 is connected with plug and socket connector 67 of unit 80*a*. Contact 141 is connected with filament 72. Contact 143 is connected with filament 61. Contact 145 is connected with plug and socket connector 68 of unit 80*a*. Contact 144 is connected with filament 71. Contact 146 is connected with filament 62. Connector 68 is connected by wire 166 with main switch contact 104. Connector 67 is connected by wire 175 with contact 109. Therefore, contact 145 of switch 140, by virtue of its connections 68 and 166 with contact 104 serve as a distributing point for either the trailer service tail filament or the trailer black-out tail filament which are connected depending on whether a movable contact 147 is in the full line position or in the dot-dash-line position 147*a* shown in Fig. 2. Contact 142, on account of its connections 67 and 175 with contact 109, serves as a distributing point for the trailer service or blackout stop filament depending on whether the contact 148 is in the full line position or in the dot-dash line position 148*a*. Contacts 147 and 148 are concurrently rotated into the full line positions or to the respective dot dash line positions 147*a* and 148*a* by common operating handle not shown. The stop light switch 130 is connected by wire 150 with contact 109 and by wire 151 with contact 105. In Fig. 8, white circles show the lamps which are burning and black squares show the lamps which are out when the movable contacts are in positions shown by Figs. 3, 4, 5 and 6. As to the trailer tail and stop lights, service lights burn or black-out lights burn depending on the status of switch 140.

In either system, Fig. 1 or Fig. 2, the main switch 90 is the same. Contacts 93, 94, 95, 103, 104, 105 are not used in the system shown in Fig. 1. If the quantity of switches 90 for use in the system shown in Fig. 1 justifies omitting the contacts not used, this can be done to save material. However, contacts 92 and 96 will remain connected as will be explained later with reference to Fig. 11.

Plug-and-socket connector *g* of unit 80 and of unit 80*a* is used to make a connection between trailer chassis ground and prime mover vehicle chassis ground. Connector *h* of either of these units may be used for another accessory on the trailer to be controlled from the prime mover vehicle.

Referring to Fig. 11 which shows the back of switch 90 the ends of the rivets which carry the various stationary contacts are marked with the same numbers as the contacts. The plate which connects terminals 97, 98, 108, 109 is designated 108*a* in Fig. 11. The terminal making connection with all of these contacts is designated 109*a* in Fig. 11. To the terminal plate 108*a*, either the wire 131 of Fig. 1 is connected, or wires 175 and 150 of Fig. 2. In Fig. 11, 92*a* indicates the plate which connects terminals 91, 92, 93, 94, 95 and 96 and the terminal for that plate is designated 91*a*. To this terminal the wire 123 is connected according to Figs. 1 and 2. The strap connecting contacts 103 and 105 is designated 103*b*, as in Figs. 1 and 2. The other terminals used with other contacts are given the same numbers as the contacts with the affix "*a*." When switch 90 is used in the system of Fig. 1, plate 92*a* remains but contacts 93, 94 and 95 can be omitted. Strap 103*b*, terminal 103*a* and contacts 103, 104 and 105 can be omitted.

The various contacts and terminals shown in Fig. 11 are mounted on a non-conducting plate 180 which is provided with an ear 181 extending into a notch 182 (Fig. 11) in flange of a cup shaped switch housing 183 having tangs 184 by which the plate 180 is attached to the cup-shaped switch housing 183. The housing or case 183 has a central hole through which a bearing 185 extends, said bearing has a shoulder at 186 engaging a plate 187 engaging the inner wall 188 of case 183 and these parts are held in engagement by staking the bearing 185 at 189 as shown in Fig. 12. Thus the bearing 185 and the case 183 are united. Bearing 185 provides a shoulder 190 engaging a washer 191 engaging an instrument panel 192 having an opening through which the bearing 185 projects. Bearing 185 extends through aperture in face or index plate 193 through a washer 196 and through a nut 197 which on being screwed down forces the washer 191 against the shoulder 190 of the bearing 185 and panel 192 and the plate 193 against panel 192.

The bearing 185 supports a shaft 200, the right end of which is conically tapered and is provided with flats 201 engaging corresponding flats provided by handle 202 which is secured to the shaft 200 by a screw 203. Thus relative movement between the handle 202 and 201 is prevented.

The shaft 200 is journaled in bearing 185 and is provided with a reduced portion 205 journaled in the plate 180. Shaft 200 is integral with an arm 206 having a lug 207 received by a slot 208 in a contact carrier 209 which carries the contacts 111, 112 and 113. A spring 210 surrounds shaft 200 and is interposed between arm 206 and plate 209 for the purpose of urging plate 209 toward plate 180 and causing the contacts 111, 112 and 113 to engage therewith. Now the contacts 111, 112 and 113 are identical in shape so that only one of them need be described in detail. For example, the contact 111 has three spherical bosses or buttons 111*a*, 111*b*, 111*c*. For example, when contact 111 is in the position shown in Fig. 3 the buttons 111*a*, 111*b*, 111*c* will engage respectively contacts 104, 95 and 105. The pressure between the movable and stationary contact parts is substantially equal, because whatever force is imparted from plate 209 to contact 111 due to the action of spring 210 is delivered to the point of engagement indicated at 211*a* where the plate 209 engages a spherical boss 211. The contact 111 is axially rotated by the plate 209 due to the engagement of the plate the shanks of rivets, the heads of which provide the spherical bosses or contacts 111*a*, 111*b* and 111*c*. For example, boss 111*b*, Figs. 14 and 9 is the head of rivet having a shank 111*bs* received by a hole 111*bh* in plate 209. Each of the contacts 111, 112 and 113 has a three point contact with the plate 180 or with the stationary contacts which are flush with the inside or right side surface of plate 180. Therefore the contact pressure between the spherical rivet heads such as 111*a*, 111*b*, 111*c* are the same. Furthermore, the plate 209 has a three point support provided by the several spherical bosses 211, 212 and 213 of the respective contacts 111, 112 and 113. Therefore the pressure exerted by spring 210 upon plate 209 is equally distributed so that each contact gets one third and since each contact equally distributes its pressure to its individual three contact buttons then it may be said that each movable contact button receives substantially one ninth of the total pressure exerted by the spring 210. In this way, the movable contact buttons bear uniformly upon the stationary contacts.

The movable contacts are yieldingly maintained either in the "off" position or any one of the four "on" positions by means of a detent device which comprises a detent plate provided by plate 187 and having five equi-distant slots 215 each capable of receiving a ball 216 located in a pocket 217 of arm 206 and urged by a spring 218 toward the plate 187. Since plate 187 must be located in a definite relation to case 183 which is located in a definite relation to switch back 180, plate 187 is provided with a hole 220 which receives a projection 221 integral with wall 188 of case 183. Rotation of lever 202 in either direction is limited by stop means comprising a projection 222 of arm 206 received by an arcuate slot 223 in plate 187.

The handle 202 has a pointer 202*a* which is in the position shown when the switch handle 202 is in the "off" position. The pointer 202*a* points to certain indicia placed upon the front wall of the face plate 193. When the switch handle 202 is moved counterclockwise (Fig. 10) to bring the pointer 202*a* opposite the legend "BO-MK," the movable contacts will have been moved clockwise in Fig. 3 to the positions shown therein. When handle 202 is moved counterclockwise (Fig. 10) to bring pointer 202*a* adjacent to the legend "BO-DR," the movable contacts will have been moved clockwise in Fig. 4 to the positions shown therein. When the handle 202 is moved clockwise (Fig. 10) to bring the pointer 202*a* adjacent to the legend "STOP-LT" the movable contacts will have been moved counterclockwise in Fig. 5 to the positions shown therein. When the handle 202 is moved clockwise (Fig. 10) to bring the pointer 202*a* adjacent the legend "HD-LT" the movable contacts will have been moved counterclockwise in Fig. 6 into the positions shown therein. Referring to Fig. 10 movement of the handle from the "off" position to the "STOP-LT" position can take place without hindrance but the handle cannot be moved to position "HD-LTS" or positions "BO-MK" and "BO-DR" without requiring an additional manipulation which is required because it is dangerous to permit any inadvertent or accidental movement of the handle 202 from "off" into the positions which cause head and tail lamps to burn. To prevent this accidental or inadvertent movement of handle 202 then the arm 206 is provided with a notch 230 shown in Fig. 15 which receives a plunger 231 having a cup shaped push button 232 adjacent a reduced portion 233 provided by plunger 231 which will clear the arm 206 when pushed in against the action of a spring 234 retained in a pocket 235 within the hub 236 riveted to the back 188 of the housing 183 within which the plunger 231 slides. Normally the spring 234 holds the plunger in such position that movement of the lever 202 clockwise from "off" position further than "STOP-LT" position is prevented. The lever cannot be inadvertently moved counterclockwise from "off" position. Only while pressing in the button 232, may the lever 202 be moved into those positions which cause head lamps to burn. Once the lever 202 has been moved into "BO-MK" (blackout-marker lamps) position, lever 202 can be turned to "BO-DR" (blackout-drive) position without manipulation of the button 232. When the lever 202 is returned from from the blackout drive or the blackout marker position to "off" position the button 232 will snap out again. Ouce the lever 202 has been moved into "HD-LTS" position, it can be moved back to "STOP-LT" or to "off" positions. When the lever 202 returns to said positions, the button 232 snaps out again.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A lighting system for an automotive vehicle comprising a current source, service head lamps, a black-out head lamp, black-out marker lamps, rear lamp providing service stop and black-out stop filaments and service tail and black-out tail filaments, a stop light switch closed in response to brake application, and a five-position main lighting switch having a rotary operating member movable from (1) "off" position in one direction of rotation into the positions in sequence, namely, (2) black-out marker, (3) black-out drive, and movable from (1) "off" position in the

other direction of rotation into the positions in sequence, namely, (4) stop-light only, (5) service head lights, said switch comprising stationary contacts arranged in concentric circular rows and three triangular movable contacts operated by the rotary member and insulatingly supported thereby with an apex of each contact extending radially toward the axis of rotation of the rotary member and capable of connecting a contact of the inner row with one or more contacts of the outer row, said contacts comprising two groups, namely, (1) two movable contacts and stationary contacts comprising connected contacts located in the inner row and connected with the current source, and contacts in the outer row to which distribution is made by the two movable contacts, contacts in the outer row making connections respectively with the black-out head lamp, black-out marker and black-out tail lamps, and service head and service tail lamps, (2) one movable contact and connected stationary contacts for making connection with the current source through the stop light switch, said stationary contacts including two contacts in the inner row and two contacts in the outer row, other stationary contacts in the outer row to which distribution is made, said contacts being connected respectively with black-out stop and service stop filaments.

2. A lighting system according to claim 1 further characterized by the addition of trailer service and black-out tail lamp filaments and trailer service stop and black-out stop lamp filaments, conducting means separately connecting said filaments with the following contacts of the main switch, namely, service head and tail lamp contact, black-out marker and black-out tail-lamp filament contact, service stop lamp filament contact and black-out stop lamp filament contact, and characterized by the fact that the connected stationary contacts of the second group of contacts are connected directly with the lamp side of the stop-light switch which is directly connected with the current source.

3. A lighting system according to claim 1 further characterized by the addition of trailer service and black-out tail lamp filaments and trailer service stop and black-out stop lamp filaments, and a trailer filament selecting switch having a tail lamp main terminal and stop lamp main terminal and branch service tail and black-out tail terminals and branch service stop lamp and black-out stop lamp terminals, said branch terminals being respectively connected with said trailer lamp filaments, and contacts movable into one position for connecting the main terminals of the trailer switch with the service tail and stop lamp filaments and movable into another position for connecting said main terminals of the trailer switch with the black-out tail and stop lamp filaments, and further characterized in that the first group of contacts of the main switch includes three stationary contacts in the outer row, one of said contacts being connected with the tail lamp main terminal of the trailer switch, and the other contacts being connected with the current source side of the stop-light switch which, on closing, makes a connection with the connected stationary contacts of the second group of contacts, and further characterized in that the connected stationary contacts of the second group of contacts is connected with the stop lamp main terminal of the trailer switch.

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