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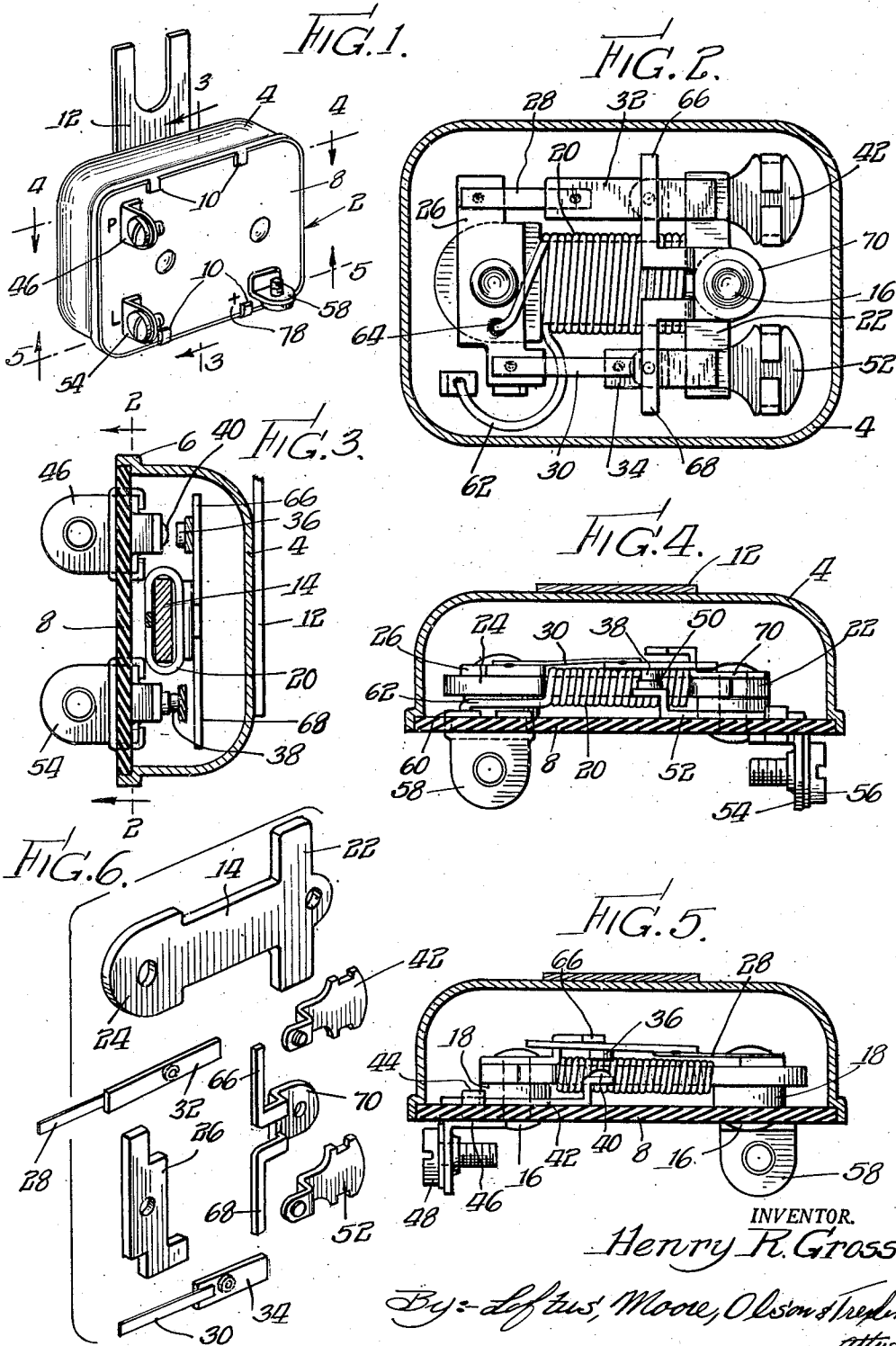
H. R. GROSS

2,451,618

COMBINED THERMAL AND MAGNETIC FLASHER SWITCH

Filed Oct. 14, 1943

4 Sheets-Sheet 1



INVENTOR.

Henry R. Gross

By: Loftus, Moore, Olson & Trepp
attys.

Oct. 19, 1948.

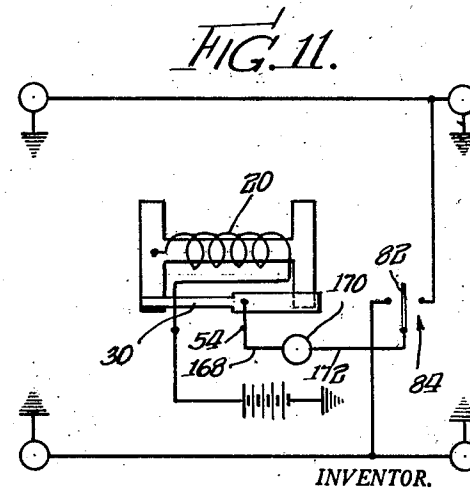
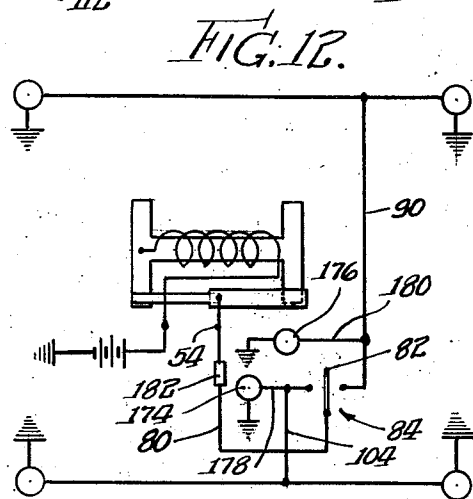
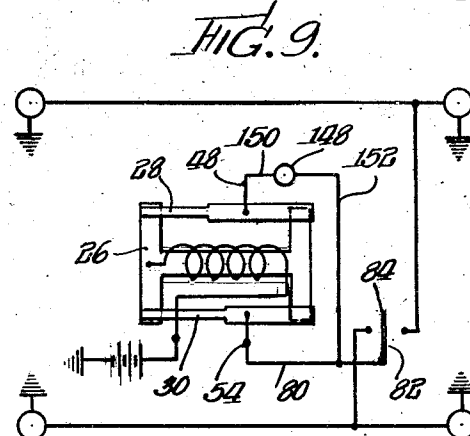
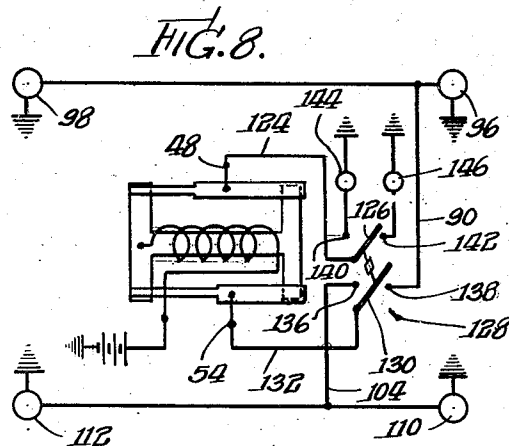
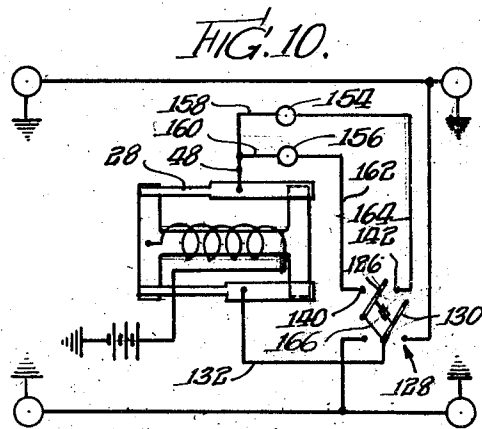
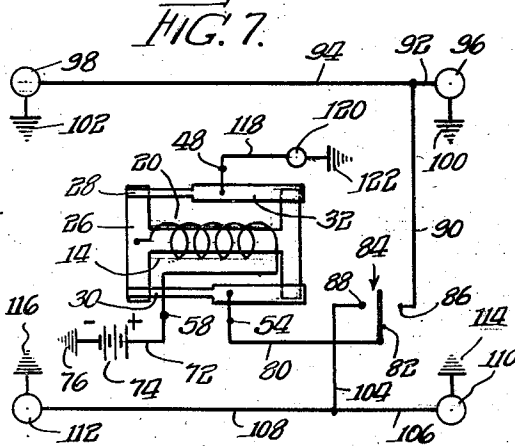
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COMBINED THERMAL AND MAGNETIC FLASHER SWITCH

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4 Sheets-Sheet 2



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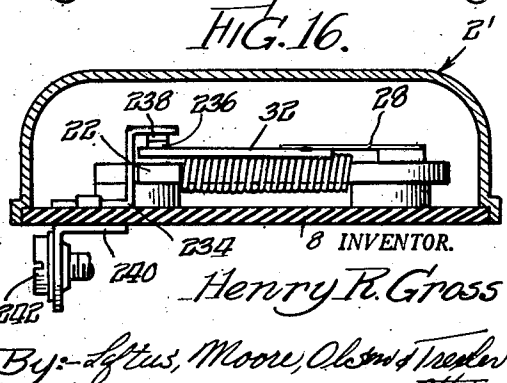
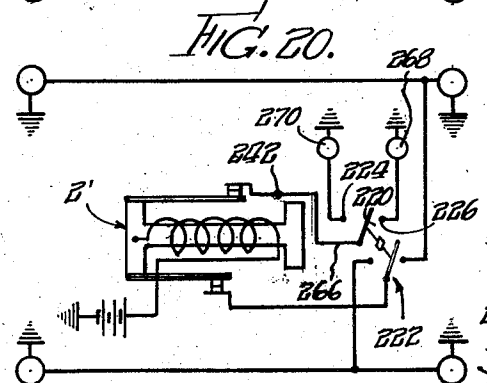
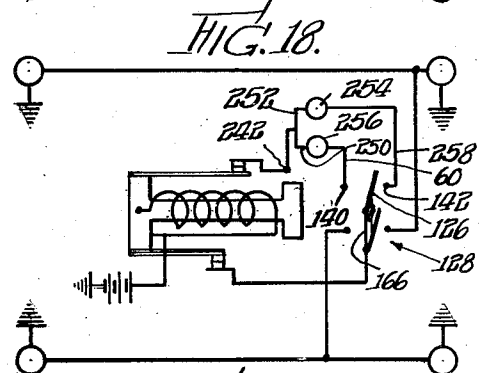
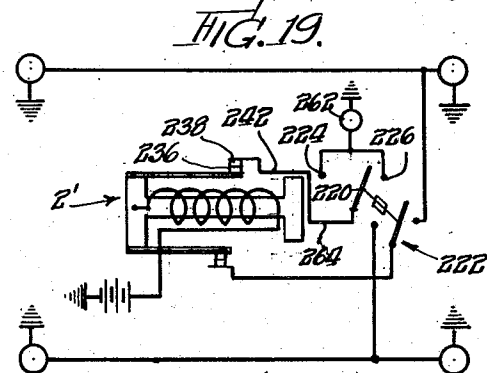
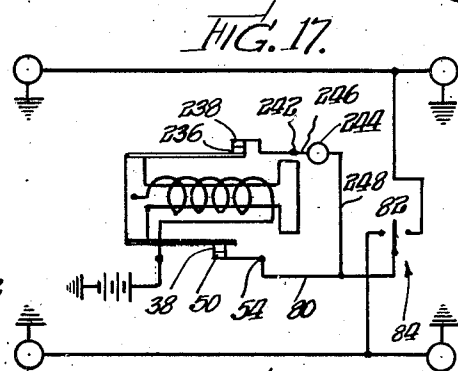
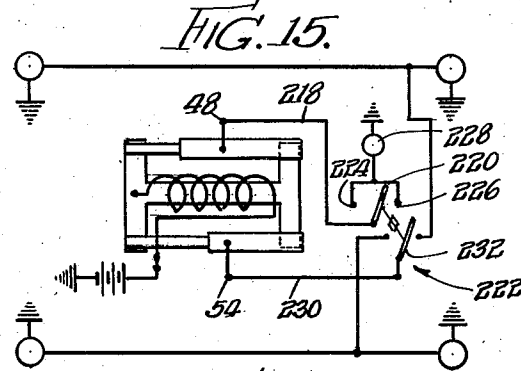
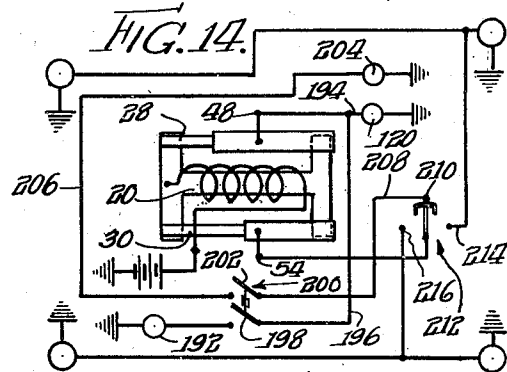
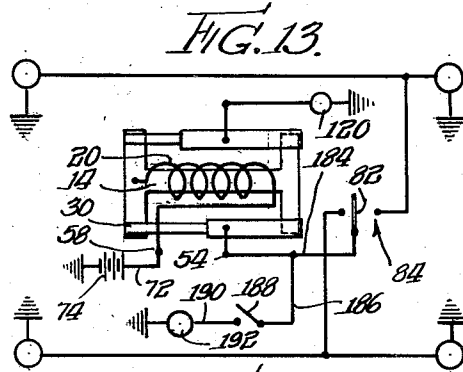
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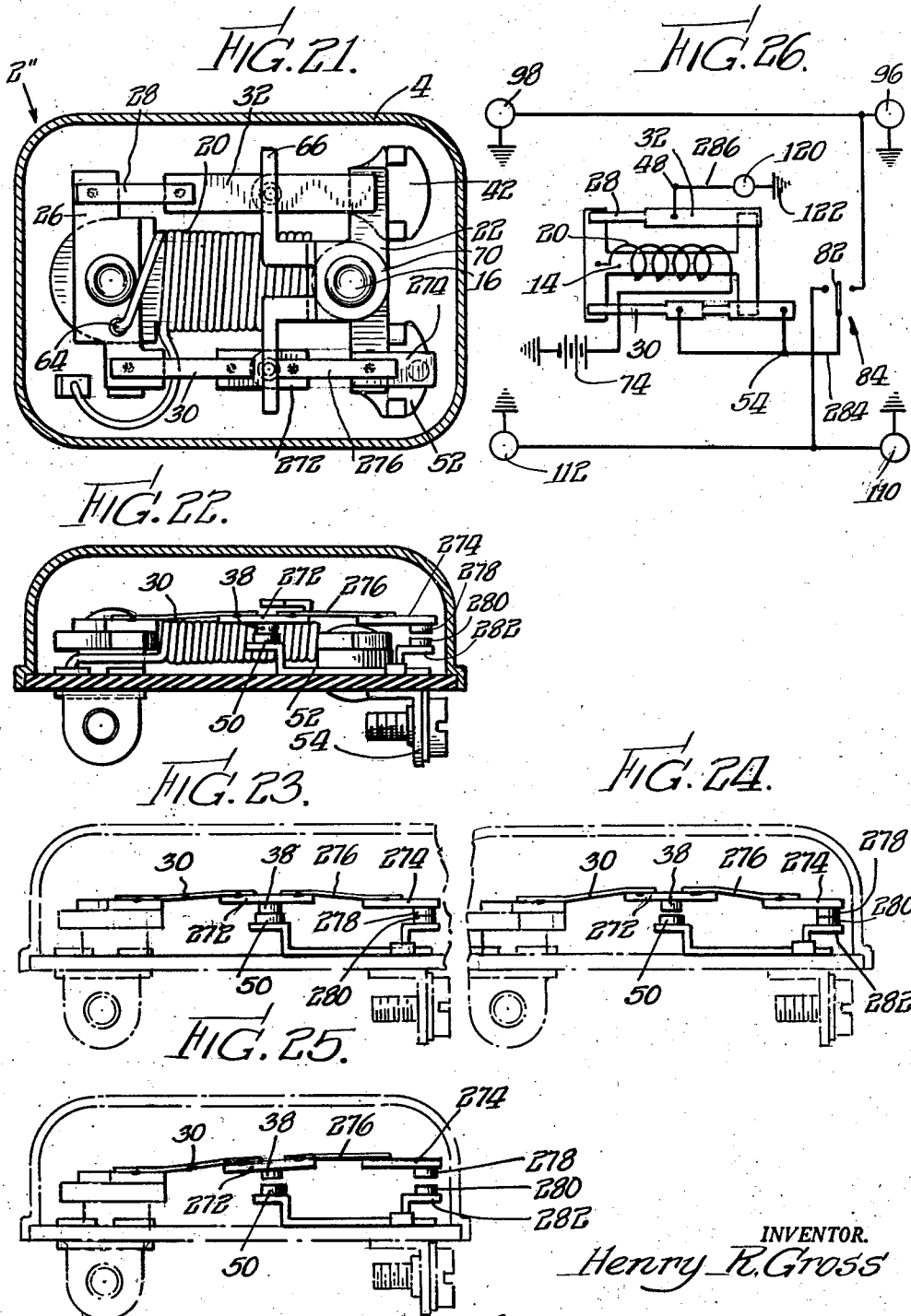
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COMBINED THERMAL AND MAGNETIC FLASHER SWITCH

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4 Sheets-Sheet 4



INVENTOR.

Henry R. Gross

By: Loftus, Moore, Olson & Trexler
attys.

UNITED STATES PATENT OFFICE

2,451,618

COMBINED THERMAL AND MAGNETIC
FLASHER SWITCH

Henry R. Gross, Chicago, Ill.

Application October 14, 1943, Serial No. 506,161

2 Claims. (Cl. 200—88)

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This invention relates to an improvement in flashers, and more particularly to improvements in thermo-responsive flasher switches controlling turn signal systems.

An object of the invention is to provide a universal auto signal flasher switch, i. e., one which shall be capable of incorporation in all, or substantially all, automobile lamp flashing signal systems.

Prior flashers embodying thermo-responsive switches have not proven entirely satisfactory because of difficulty in manufacturing, relatively high loss or breakage in manufacturing, uncertain in operation, relatively high in cost, and because of inherent limitations in their structure preventing their use in different signal circuits, so that it was not always possible to secure the particular model required for a particular auto, and considerable confusion existed in determining which model was appropriate for any particular auto. It is, accordingly, an important object of the invention to overcome these difficulties, insufficiencies and provide a flasher switch of uniform construction for all, or substantially all auto turn and stop signal systems.

It is a further object of the invention to provide a flasher device which is rugged in construction, inexpensive to manufacture, certain in operation and of relatively low cost.

Flasher switches employing contacts operated by thermo-responsive or bimetallic members have inherently a relatively short operating life by reason of the fact that they move slowly in being heated or cooled so that the contacts are separated rather slowly and are initially engaged with a very light pressure. This causes arcing and, hence, excessive wear of the contacts. Toggles or other devices between the bimetallic members and the contacts, which cause the contacts to snap into or out of engagement, are not satisfactory by reason of their added cost and the tendency of such devices to stick under adverse weather conditions and under adverse operating conditions encountered when installed in automobiles to control the signal lights thereof. It is essential that a device employed for this purpose be entirely reliable in operation for accidents will, and do, frequently happen because the operator falsely relied on a device to signal his intentions to turn or stop the vehicle. It is, therefore, an important object of the invention to provide a flasher switch employing a thermo-responsive or bimetallic member which directly controls or actuates switch contacts controlling the operation of signal circuits, which switch is

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reliable in operation and inherently capable of operation over long periods of time and yet relatively low in cost.

It is a further object of the invention to provide a flasher switch of the character described in combination with improved signal circuits, simplifying the wiring of turn signal systems and combined turn signal and brake control systems.

It is more particularly an object of the invention to provide a flasher of the character described and signal circuits therefor, by means of which the flasher may be incorporated into automobile electrical circuits regardless of the type of the circuit.

Other and further objects and advantages of the invention will be apparent from the following description when taken in connection with the accompanying drawings, wherein—

Figure 1 is a view in perspective of a flasher device embodying the invention;

Figure 2 is a view in vertical section taken substantially along the line 2—2 of Figure 3;

Figure 3 is a view in vertical section taken substantially along the line 3—3 of Figure 1;

Figure 4 is an enlarged view in substantially horizontal section taken along the line 4—4 of Figure 1;

Figure 5 is an enlarged view in substantially horizontal section taken along the line 5—5 of Figure 1;

Figure 6 is a view in exploded perspective of certain parts of the flasher device;

Figures 7 to 15 are schematic diagrams of circuits in which the flasher, Figures 1 to 5, may form a part;

Figure 16 is a view in section similar to Figure 5 of a modification of the flasher shown in Figures 1 to 5;

Figures 17 to 20 are schematic diagrams of circuits in which the flasher, Figure 16, may form a part;

Figure 21 is a view in section similar to Figure 2 showing a further improvement of the flasher of Figure 2;

Figures 22 to 25 are views in section similar to Figure 4 for illustrating operation of the further improved flasher of Figure 22; and

Figure 26 is a schematic diagram of a circuit in which the flasher of Figures 21 to 25 may be incorporated.

As shown in the drawings, the flasher 2 (Figures 1 to 5) may comprise a stamped sheet metal, pan-shaped housing 4 having a peripheral offset flange 6 forming at the open mouth of the hous-

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ing a seat for a flat plate 8 of insulating material and having around its free edge lugs 10 bent over the outer face of the plate 8 and securing the same in assembled position. A mounting strap 12, preferably of sheet metal, is spot welded or otherwise fastened to the housing and is appropriately apertured or slotted to receive a mounting stud, bolt or other supporting means.

A generally T-shaped magnetic core piece or member 14 is mounted on the inner surface of the insulating plate 8, as by rivets 16 and spacing members 18. A relay coil 20 of magnet wire is wound upon the core 14 between the end cross member 22 and the enlarged opposite end portion 24. A cross piece or bar 26 of magnetic material is fixed to the end 24 of the core 14, preferably by one of the rivets which mounts the core member on the insulating plate. This cross-member 26 has welded to it at one end a resilient contact blade or strap 28 which extends therefrom toward the cross-bar 22. The cross member 26 has similarly welded to it at the opposite end a resilient bimetal switch member 30, also extending therefrom toward the cross-bar 22. The bimetallic switch member 30 is preferably of such material and so dimensioned as to operate at a temperature of approximately 800° F. Hence it is substantially insensitive to changes in atmospheric temperature. Since the difference between the highest and lowest atmospheric temperatures likely to be encountered is very small in respect to the operating temperature of this bimetallic member, its heating and cooling time period is substantially unaffected by atmospheric temperatures.

The switch blade 28 is welded at its free end to a thin strip 32 of magnetic material which extends therefrom over the cross-bar 22 so as to form an armature, attracted to the cross-bar when the coil of the relay, of which the core member forms a part, is energized. The bimetallic switch member 30 is similarly welded at its free end to a light, thin strip 34 of magnetic material which also extends therefrom over the cross-bar 22 to form an armature of the relay. The strap 32 carries on its under surface a contact 36, and the strap 34 similarly carries a contact 38. Contact 36 cooperates with a contact 40 supported therebeneath by a sheet metal bracket 42 fastened to the plate 8 by the inwardly bent lugs 44. A terminal bracket 46 is mounted on the outer surface of the plate 8. The lugs 44 are formed integral with the terminal bracket 46, extend through suitable openings in the plate 8, and are bent over the bracket 42, thus securing both the terminal bracket and the contact carrying bracket to the insulating plate. The terminal bracket 46 carries the usual terminal screw 48. The contact 38 cooperates with the contact 50 carried by a bracket 52, similar to the bracket 42, which is similarly secured to the plate 8 by the lugs of a terminal bracket 54 corresponding to the bracket 46. The terminal bracket 54 carries the usual terminal screw 56.

The terminal brackets 48 and 56 are mounted in laterally spaced relation at one end of the insulating plate 8. A terminal bracket 58, similar to the brackets 46 and 54, is mounted at the opposite end of the plate 8, as by lugs 60 which pass through suitable openings in the plate and are bent over against the inner surface of the plate. The end 62 of the relay coil 20 is secured to the lugs 60 of the terminal bracket 58, while the opposite end 64 of the coil is welded to the cross-member 26 and connected by that mem-

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ber of the core to the switch blade 28 and bimetallic member 30.

The gap between the contacts 36 and 40 and the contacts 38 and 50, when the contacts are in open positions, is determined by the readily bendable oppositely directed lateral arms 66 and 68 of a sheet metal member 70 secured in position to the cross-arm 22 of the core member 14 by the rivet 16 which fastens one end of the core member. As shown in Figure 5, the normal bow of the resilient switch blade 28 is such as normally to hold the contact 36 in open position. The normal undeflected shape of the bimetal member 30 is such as to hold the contact 38 in engagement with the contact 50, as shown in Figures 3 and 4. As the bimetal member, on being heated, reaches a temperature of about 800° F., the deflecting force built up in the member by such heating becomes greater than the magnetic holding force between the armature piece 34, carried by the bimetal member, and the cross-arm 22 of the core member. The contact 38 is thereby lifted out of engagement with the contact 50 and, when the contact 38 separates ever so slightly from the contact 50, the circuit to the relay coil 20 is broken, as will hereinafter be described, the relay coil is deenergized and the magnetic force of attraction between the armature 34 and the cross-bar 22 of the core member thereupon disappears, and the deflecting force built up in the bimetal member is enabled to move the contact 38 more swiftly away from the contact 50.

As the bimetal member cools and contracts, the contact 38 is moved, relatively slowly, thereby toward the contact 50. When the contact 38 touches the contact 50, the relay coil 20 is again energized and the magnetic force generated between the armature and the cross-bar 22 of the core member immediately pulls the contact 38 into firm engagement with the contact 50.

The gap between the contacts 36 and contact 40 is so adjusted by bending of the strip 66 that when the relay coil 20 is energized, the armature 32 is snapped down, bringing the contact 36 into engagement with the contact 40, and the resilient contact blade 28 is so dimensioned as to cause the contact 36 to snap out of engagement with the contact 40 when the relay coil is deenergized.

As shown in Figure 7, the flasher device 2 may be connected in a circuit to control auto turn signals and a single grounded pilot light which serves to indicate whether the turn signal circuits are operating. The terminal 58 of the flasher is connected by a wire 72 to the positive or ungrounded side of a battery 74, or other source of electric energy provided in the auto or vehicle. The negative side of the source 74 is grounded at 76, as is common. The outer surface of the insulating plate 8 adjacent the terminal 58 is marked with a plus sign 78 (Figure 1) to indicate that this terminal is to be connected to the positive or ungrounded side of the electric source.

The terminal 54, which is connected by the bracket 52 to the contact 50, as shown in Figure 4, is connected with wire 80 (Figure 7) to the movable switch blade 82 of the main turn signal control and selector switch 84. The switch 84 has additionally a pair of contacts 86 and 88, the contact 86 being connected by wire 90 and wires 92 and 94 in parallel to the front and rear left turn signal lights 96 and 98 respectively, grounded as at 100 and 102 respectively. The contact 88 is similarly connected by wire 104 and wires 106 and 108 in parallel to the front and rear right turn signal lights 110 and 112 respectively,

grounded as at 114 and 116 respectively. The terminal 48, which is connected by the bracket 42 to the contact 40, as shown in Figure 5, is connected by wire 118 to a pilot light 120 which is grounded as at 122.

Upon operation of the main control or selector switch 84, as, for example, to move blade 82 into engagement with contact 86, a circuit is completed from the source or battery 74 through wire 72, terminal 58, relay coil 20 and cross-piece 26 of the core member 14 to the switch blade 28 and bimetal member 30.

From the bimetal member 30 the circuit is completed through the contact 36, contact 50, with which it is at this time in engagement, the terminal 54, the wire 80, the switch blade 82, the contact 86, the wire 90 and the wires 92 and 94 to the left turn signal lights 96 and 98. The circuit for the relay coil being thus completed through the bimetal member to the signal lights, the coil is energized and the armature 32 is thereby pulled down to cause the contact 36 to engage the contact 40 and complete the circuit from the switch blade 28 through the contacts 36 and 40, the terminal 48 and the wire 118 to the pilot light 120.

Since the contacts 38 and 50 controlled by the bimetal member are in closed position when the bimetal member is cooled and, therefore, closed when the switch 84 is open, the relay is energized instantaneously upon the closure of this latter switch and causes the switch comprising the contacts 36 and 40 to be closed instantaneously with the closing of the switch 84. Hence the pilot light, although normally disconnected from the source, is connected thereto simultaneously with the energization of the turn signal lights.

The current to the signal lights passes through the bimetal member 30, which is of such resistance as to cause self-heating at a predetermined rate, determined, of course, by the magnitude of the current supplied to the signal lights. As previously stated, the bimetal member is one rated to operate at a temperature of 800° F. As it becomes heated above this temperature, it tends to curl up on its outer end. Such deflection of the bimetal member is resisted by the magnetic force of the relay exerted on the armature 34. When the deflecting force built up in the bimetal member exceeds the magnetic holding force of the relay, the contact 38 is moved by the bimetal member away from the contact 50. As soon as the contact 38 disengages ever so slightly from the contact 50, the circuit to the signal lights is broken and the lights are, therefore, deenergized.

It should be noted that the pilot light 120 is preferably of such resistance that the current which may be supplied to it is insufficient to hold the relay operative, i. e., the magnetic force which is created by that current flowing through the relay is insufficient to hold the switch blade 28 in contact closing position. Hence the contact 36 is snapped by the resilient contact blade 28 out of engagement with the contact 40 at the same instant that the contact 38 disengages the contact 50. The pilot light 120 is, therefore, deenergized simultaneously with the deenergization of the turn signal lights.

As the bimetal member 30 cools below the operating temperature, it contracts and moves the contact 38, relatively slowly, toward the contact 50 and into engagement therewith. As soon as the contact 38 engages the contact 50, the circuit through the relay coil and the signal lights is

completed and the magnetic force of the relay exerted on the armature 34 presses the contact 38 into firm engagement with the contact 50. Hence the signal lights and the pilot light are again energized in the manner as previously described.

The gap between the contacts 36 and 40 and between the contacts 38 and 50 is so adjusted by bending of the strips 66 and 68, and the relay coil 20 is so proportioned in respect to its number of turns, as to cause flashing of the turn signals and the pilot signal at a predetermined desired rate, for example, at the rate of 60 to 70 times per minute. It will be evident that the turn signal lights 96 and 98 being in parallel, the resistance in the turn signal circuit is relatively small compared to the resistance offered by the lower candle-power, single bulb pilot light. Hence, while the total current flowing through the relay, when the turn signals are energized, is sufficient to insure operation of the relay, the current which would flow through the relay, if only the pilot light was energized, would not be sufficient to hold the relay operative.

It will be evident, of course, that if the selector switch 84 is operated to move the contact blade 82 into engagement with the contact 88, the right turn signal lights 110 and 112 will be energized rather than the left turn signal lights 96 and 98. As pointed out previously, the contact 38 is initially moved rather slowly out of engagement with the contact 50. There is, therefore, a tendency toward drawing an arc between the contacts and this results in constant wear of these contacts and the consequent pitting thereof.

Applicant has discovered that if one of the contacts is made, or provided with, a surface coating of silver, and the other made, or provided with, a surface coating of tungsten, the drawing, arcing or pitting of the contacts may be materially reduced and the life of the contacts increased many fold. Therefore, it is an important feature of applicant's invention that the directly, and relatively slowly, operating contacts controlled by the bimetal member be provided with surface coatings of silver and tungsten.

It is important to note that the signal lights and the pilot light are energized immediately on the closing of the selector switch 84 and thus insures immediate signalling of the driver's intention to make a turn. No period intervenes between the closing of the main switch and the energization of the turn signal lights, and thus the possibility is eliminated of accidents caused by failure to operate the control switch sufficiently in advance of the initiation of the turn.

If the pilot light fails to operate when the switch 84 is closed, its darkness indicates that the turn lights controlled by the switch have become burned out. If the pilot light flashes at a slower rate than normal, it indicates that one light is burned out, for, if one light is burned out, the resistance in the turn signal circuit increases to approximately twice the value—if the two signal lights were of equal power—and hence the current flowing through the bimetal member is reduced to one-half of its normal value and, consequently, a much greater time is required to heat the bimetal member by that reduced current. If the pilot light flashes at a much greater rate than normal, this indicates the existence of a partial short circuit in the turn signal circuit, because the increased current which would flow, by reason of such partial short circuit, would cause more rapid heating of the bimetallic member. By partial short circuit, of

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course, is meant a short circuit which is established through some element or medium which possesses some resistance, although much less than that of a signal light. Such partial short circuit might be effected, for example, through a broken filament in the signal light, or water short circuiting of a wire or light, or by other means commonly experienced in the operation of automobiles or other vehicles.

As shown in Figure 8, the flasher 2 may be connected to control a pair of grounded pilot lights, of which there is one for each set of turn signal lights, thus the terminal 48 may be connected by a wire 124 to one blade 126 of a double-blade double-throw selector switch 128, having its other blade 130 connected by a wire 132 to the terminal 54. The blade 130 may be provided with contacts 136 and 138, connected by the wires 90 and 104, in the manner previously described, to the left and right sets of turn signal lights. The blade 126 cooperates with poles 140 and 142 connected respectively to right pilot light 144 and left pilot light 146 respectively. It will be evident that upon operation of the master control or selector switch 128 to select a particular set of turn signal lights, the corresponding pilot light will be simultaneously selected for connection to the flasher switch. Hence when the right turn signal lights 110 and 112 are operative, the pilot light 144 will also be operative and when the left set of turn signal lights 96 and 98 is operative, the pilot light 146 will be operative.

As previously described, the flasher 2 causes the selected set of signal lights and the corresponding pilot light to flash in unison and each pilot light will indicate the operative condition of its associated set of turn signal lights. In some installations, the pilot light is ungrounded, for one reason or another, which may involve simply the desire of the auto manufacturers or the necessities of the electrical system of the particular make or model of the automobile. The flasher 2 may be connected in a single ungrounded pilot light system, as shown in Figure 9, or in a double ungrounded pilot light system as shown in Figure 10.

As shown in Figure 9, the ungrounded pilot light 148 may be connected on one side, as by wire 150, to the terminal 48 of the flasher, and the opposite side of the pilot light is connected, as by wire 152, to the wire 80 which extends from the terminal 54 of the flasher to the movable blade 82 of the selector switch 84. When the selector switch is closed to energize one or the other set of turn signal lights, contacts 38 and 50, controlled by the bimetal member, being closed, the pilot light 148 will be short circuited through a short circuit extending from the terminal 48 through the contacts 40 and 36 and the switch blade 28 to cross-arm 26 of the core member 14, the bimetal member 30, contacts 38 and 50, the terminal 54, the wire 80 and the wire 152. The pilot light 148 is of such resistance that the current flowing through the relay when the bimetal contacts are open, is sufficient to maintain the switch blade 28 in its lower position, in which the contacts 36 and 40 are held in engagement. The resistance of this pilot light is, however, greater than the resistance of the bimetallic strip and, hence, when the contacts 38 and 50 are disengaged, the current of the signal lights is reduced. It will be evident, therefore, that if the pilot light 148 fails to light, it indicates that both of the lights of the selected set of turn signal lights are burned out. If the pilot light re-

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mains on longer than the usual periods, it indicates a partial short circuit in the circuit of the selected lights; whereas, if it remains off longer periods than normal, it indicates that one of the lights of the selected set of turn signal lights is burned out. The contacts 36 and 40, controlled by the switch blade 28, are accordingly held closed whenever the selector switch is operated to energize the turn signal lights, and are open only when the selector switch is open. The switch composed of the contacts 36 and 40 therefore serves to prevent sneak circulating currents.

As shown in Figure 10, left and right ungrounded pilot lights 154 and 156, respectively may be connected in parallel by wires 158 and 160 to the terminal 48 of the flasher and by wires 162 and 164 to the poles 140 and 142 of the double-blade, double-throw selector switch 128. The movable blades 126 and 130 of this selector switch are interconnected by the wire 166. Hence it will be evident that the selected pilot light 154 or 156 will be short circuited when the contacts 38 and 50, controlled by the bimetallic member, are closed, but will be connected in series with its associated set of turn signal lights when these contacts are open. The operation of this circuit will be evident from the disclosure of the operation of Figure 9, each pilot light serving in the same manner to indicate the operative condition of its associated set of turn signal lights. The switch composed of the contacts 36 and 40, operated by the switch blade 28, serves also in this circuit to insure against sneak currents and also the operation of the flasher by ground establishing faults in the pilot circuit.

In some installations it is, for various reasons, necessary or desirable that the pilot light be in series with the selected set of turn signal lights. As shown in Figure 11, the flasher 2 may be incorporated in such a circuit by connecting the terminal 54 by wire 168 to one side of the pilot light 170, which is connected at its other side by wire 172 to the movable blade 82 of the single-pole, double-throw selector switch 84. In such a circuit the pilot light 170 is of sufficiently low resistance as to permit the flow of enough current to energize the turn signal lights, notwithstanding the fact that the pilot light is connected in series therewith. It will be evident, of course, that pilot light 170 flashes simultaneously with the turn signal lights and that a ground establishing fault on the pilot circuit, if sufficient to cause an appreciable sneak current, will light the pilot when the switch 84 is open. If the pilot light fails to light when the switch 84 is closed, it indicates that both lights of the selected set of turn signal lights are burned out. If the pilot light flashes at a slow speed, it indicates that one light of the selected set of turn signal lights is burned out, and if it flashes at a higher speed than normal, it will indicate the existence of a partial short circuit in the selected set of turn signal lights.

In some installations, for various reasons, it is necessary or desirable that double-grounded pilot lights be operated in direct parallel with turn signal lights. In such an installation, the flasher may be connected as shown in Figure 12, in which the right and left pilot lights 174 and 176, respectively, are connected directly by wires 178 and 180 to the wires 104 and 90, respectively. The terminal 54 of the flasher is connected directly to the movable switch blade 82 of the selector switch 84, as by the wire 80, similar to the circuit of Figure 7. The resistance between the wire 90,

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or the wire 104, and the grounded side of the source, may be less than the total resistance between these wires and ground in the circuit of Figure 7. This will, of course, cause operation of the flasher at a higher rate. This will, of course, be unobjectionable if the rate of flashing does not exceed the persistence of vision, which is extremely unlikely. However, if the rate of flashing should be objectionably rapid, it may be compensated by the interposition of a small resistor 182 in the lead 80.

The flasher may also be connected to cause automatic flashing of a stop signal light whenever the brakes are applied and, independently of the turn signal lights, while causing simultaneous flashing of the stop light with the turn signal lights, should the brakes be applied in approaching or making the turn. Such may be accomplished by the circuits shown in Figure 13, in which the terminal 54 of the flasher is connected in parallel by wires 184 and 186 to the movable blade 82 of the manual selector switch 84 and the brake controlled switch 188. The brake controlled switch 188 is connected, as by the wire 190, to the ungrounded side of the stop signal light 192. Whenever the brake controlled switch 188 is closed, the circuit will be completed from the battery or source 74 through wires 72, terminal 58, relay coil 20, core member 14 and bimetal member 30, contacts 38 and 50, terminal 54, wire 186, switch 188 and wire 190 to the stop signal light 192. This circuit is, of course, independent of the selector switch 84 and, consequently, whenever the brakes are applied, the flasher is set into operation to cause the stop signal light to flash and the pilot light 120 to flash simultaneously therewith, but if the brakes be applied when approaching or making a turn, during which time the selector switch is closed, then the contacts 38 and 50 will control both the signal light and the stop light circuits and cause the lights to flash simultaneously.

Since the resistance to the passage of current through the bimetallic member is normally greater when the stop light alone is operated, than when the turn signals are operated, and the resistance to the flow of such current is less when the stop and turn signals are flashed simultaneously, it follows that the stop light, when operated alone, will be flashed at a relatively slow rate, which is desirable when the auto is slowing down in a line of traffic or to a stop on the road. The increase in flashing rate when the stop and turn signals are simultaneously operated will not ordinarily be objectionable. In those cases in which the increased flashing rate, under such circumstances, may be objectionable, the circuit shown in Figure 14 may be employed. As shown in this figure, the terminal 48 may be connected in parallel to the pilot light 120 and stop light 192 by means of wire 194 and wire 196, leading to the blade 198 of a double-pole, single-throw brake control switch 200. The blade 198 controls the circuit to the stop light, while the companion blade 202 of this switch controls the circuit of a stop pilot light 204. The fixed contact, cooperating with the blade 202, may be connected as by wire 206 to the ungrounded side of the pilot light 204, while the blade 202 is connected by wire 208 to the contact 210 of a single-pole selector switch 212, having additional contacts 214 and 216 connected, respectively, to the left and to the right sets of turn signal lights in the manner previously described. The switch 212 constitutes a turn signal selector switch simi-

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lar to the switch 84, but provided with the third contact 210 so positioned that the moveable blade engages that contact when in normal neutral position. The signal switch 212 being in normal neutral position, the pilot light 204 will be connected in series with the bimetallic member 30 and the relay coil 20 when the brake controlled switch 200 is closed. The current flow through this circuit causes operation of the flasher—the switch contacts 36 and 40 controlled by the switch blade 28 opening and closing simultaneously or substantially simultaneously with the opening and closing of the contacts 38 and 50. Hence the pilot light 204 and the stop light 192 will flash simultaneously at a rate determined by the resistance of the pilot light 204, which may, of course, be such to give the desired flashing rate for the stop light when operated alone. It may, if desired, be a pilot light of such power that its resistance is equal to one-half the resistance of each turn signal light and, hence, equal to the parallel resistance of the turn lights, so that the flashing rate of the stop light when used alone will be the same as the flashing rate determined by the turn signal lights.

When the selector switch 212 is moved to operate a selected set of turn signal lights, the connection is broken between the contact 210 and the blade of the selector switch and, hence, the circuit to the pilot light 204 will not be completed by operation of the brake controlled switch 200. However, if the brake is operated while the turn signal light is energized, the stop light 192 will be energized and flashed by the opening and closing of the contacts 36 and 40 simultaneously with the turn signal lights and the pilot light 120. Thus increase in the flashing rate, due to application of the brakes while the turn signal is energized, is prevented.

The pilot light 204 thus serves both the double functions of indicating the operative condition of the stop light circuit when operated independently of the turn signal lights, and determines the rate of flashing of the stop signal when operated alone. Since the resistance to the flow of current through the relay and the pilot circuit is less in the circuit of Figure 14 than in other figures, as, for example, Figure 7, lamps of greater resistance must be used to prevent holding of the relay, or the gap between the contacts 36 and 40 must be widened, as by upward bending of the strips 66 and 28, so as to require a greater force of attraction to hold the contacts closed.

For various reasons, in some installations, it may be desirable or required that a single grounded pilot light serve to indicate whether the turn signal light circuit is operative or inoperative, but that it be non-flashing because to some the flashing of a pilot light is annoying or distracting. In the case of double grounded pilot lights, the flashing of the pilot lights may be eliminated by substituting in the circuit of Figure 8, pilot lights of sufficiently low resistance to allow the passage of enough current to hold the relay operative once the switch blade 28 has been operated following the closure of the selector switch 128. In such case, the switch contacts 36 and 40 controlled by the blade 28 will remain closed during the successive opening and closing of the switch controlled by the bimetal member. Hence the turn signal lights will be flashed but the selected pilot light will remain on continuously so long as the turn signal lights are being flashed and will become deenergized only when the selector switch is returned to an open position. In the case of double

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ungrounded pilot lights, this may be accomplished by connecting the wire 166 in the circuit of Figure 10 directly to ground rather than to the blade 130.

In the case of a single grounded pilot light, the circuit of Figure 15 may be employed. As shown in this circuit, the terminal 48 is connected by a wire 218 to the blade 220 of a double-pole, double-throw selector switch 222. Contacts 224 and 226, which cooperate with the blade 220, are connected in parallel to one side of the grounded pilot light 228. The terminal 54 is connected, as by wire 230, to the other blade 232 of the selector switch, which has contacts connected, as previously described, to the left and right sets of turn signal lights—the pilot light 228 being of sufficiently low resistance to allow the flow of enough current to hold the relay operative. Once the selector switch has been closed, the pilot light will remain on continuously during the operation of the turn signal lights, but will be extinguished upon the opening of the selector switch. If the selected set of turn signal lights is inoperative enough current will not flow through the relay and the bimetal member to attract the blade 28 to switch-closing position and, hence, the pilot light will remain off. It will be evident, from Figure 15, that in the case of a single ungrounded pilot light, the pilot light may be interposed in the wire 218 and the contacts 224 and 226 directly grounded.

In some cases it is desirable, or the installation may be such as to require, that the pilot light flash alternately with respect to the turn signal lights. For such purpose, the contact carrying bracket 42 may be replaced by a bracket 234, Fig. 16, which extends outside the cross-bar 22 of the core member and over the armature 32. The armature 32 now carries on its upper surface the contact 236 which cooperates with the contact 238 depending from the overhanging portion of the bracket 234. The bracket 234 is secured to the insulating base plate 8 by a bracket 240 of the same structure as the bracket 46 and carrying the terminal screw 242. For controlling single or double ungrounded pilot lights, this modified flasher, indicated by the reference numeral 2', may be connected as shown in Figures 17 and 18 and, for controlling single and double grounded pilot lights, it may be connected as shown in Figures 19 and 20.

As shown in Figure 17, the terminal 242 is connected to one side of the ungrounded pilot light 244 by a wire 246, the other side of the pilot light being connected by a wire 248 to the wire 80 which extends to the movable blade of the selector switch 84, the selector switch being closed to energize the selected set of turn signal lights. The relay, in attracting the armature 32, causes disengagement of the contacts 236 and 238. Hence, the pilot light 244 is deenergized during the time that the contacts 38 and 50 are in engagement. The contacts 236 and 238 will automatically close when the relay is deenergized and, hence, when the bimetallic strip, on heating, opens its contacts, the pilot light is energized and when the bimetallic member, on cooling, closes its contacts, the pilot light is deenergized.

If both lights of the selected set of signal lights are burned out, the contacts 236 and 238 will remain in engagement on closing of the selector switch, but the pilot light will not light because no circuit will be completed to ground.

As shown in Figure 18, the terminal 242 is connected by wires 250 and 252 in parallel to one side of the left and right ungrounded pilot lights 254

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and 256, respectively, connected on their other side by wires 258 and 260 to contacts 142 and 140, respectively, of the double-pole, double-throw selector switch 128, having electrically interconnected blades. The operation of this circuit will be evident from the description of the operation of the circuit of Figure 17.

As shown in Figure 19, a single grounded pilot light may be controlled by the flasher 2' by connecting the ungrounded side of the pilot light 262 in parallel to the contacts 224 and 226 of the selector switch 222. The blade 220 of this switch is connected by wire 264 to the terminal 242 of the flasher 2'. It will be evident that upon closure of the selector switch, contacts 236 and 238 will be opened by the consequent energization of the relay, but will be closed when the bimetallic contacts are opened and, hence, the pilot light will flash alternately with respect to the turn signal lights. It should be noted that, with this circuit, the pilot light will light immediately on the closing of the selector switch if the lights of the selected set of turn signal lights are burned out; whereas, in the circuit of Figure 17, the pilot light will remain out if the turn signal lights are burned out. Since, in the normal operation of the circuit of Figure 17, the pilot light does not light immediately on the closing of the selector switch, its continued failure to light, by reason of the burning out of the turn signal lights, may not be noted. Therefore, it may be preferable to so connect the ungrounded pilot light that on burning out of the turn signal lights, the pilot light lights up immediately on the closing of the selector switch. This may be accomplished, as will be evident, by interposing the ungrounded pilot light in the wire 264 of the circuit of Figure 19 if the contacts 224 and 226 of the selector switch are directly grounded.

As shown in Figure 20, the terminal 242 of the flasher 2' is connected by wire 266 to the blade 220 of the double-pole, double-throw selector switch 222, while the left and right pilot lights 268 and 270 are connected respectively to the contacts 226 and 224 of this selector switch. The operation of this circuit will be evident from the description of the operation of the circuit of Figure 19. It should be noted that the selected pilot light will light simultaneously with the closure of the selector switch and remain lit if the turn signal lights of the corresponding set are burned out; whereas, in respect to the circuit of Figure 18, the selected pilot light will remain out if the corresponding set of turn signal lights is burned out. As pointed out heretofore, it may be desirable to provide, in the case of double ungrounded pilot lights, that the pilot lights go on if the turn signal lights of the corresponding sets are burned out. This may be accomplished by eliminating the connection 166 between the blades of the selector switch 128 of Figure 18 and connecting the blade 126 directly to ground.

It will be evident that in the circuits of Figures 17 and 18, the turn signal lights will be flashed by being periodically dimmed by the insertion of the additional resistance represented by the pilot light, whereas in the circuits of Figures 19 and 20, the pilot lights will be flashed by being periodically cut off. This flashing of the lights by dimming rather than by cutting off is also true of the circuit of Figure 9. Since certain advantages are inherent in the flashing of lights by dimming rather than cutting off, these circuits may, in some cases, be preferred.

Although the use of contacts, one of which

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has a silver surface and the other of which has a tungsten surface minimizes pitting and, therefore, prolongs the life of the contacts, it does not eliminate such pitting and, in those installations where the additional expense may be justified, the further improved flasher 2" of Figures 21 to 25 may be provided. As shown in these figures, the bimetallic member 30 is secured at its outer free end to a contact carrying strip 272 and this contact carrier is connected to a small armature piece 274 by a resilient phosphor bronze strip 276. The contact carrier 272 carries the contact 38 which, as before, cooperates with contact 50 carried by the bracket 52. The armature 274 carries an additional contact 278 at its outer free end and this contact cooperates with a contact 280 carried by an upwardly and outwardly struck portion of lug 282 of the bracket 52. This flasher 2" may be connected in the circuits of Figures 7 to 15 in the same manner as the flasher 2, and may be connected in the circuits of Figures 17 to 20 if the bracket 42, supporting the contact 40, is replaced by the bracket 234 carrying the contact 236, as indicated in Figure 16, and the contact carried by the armature 32 extended above the armature, as indicated in Figure 16. This is exemplified by the schematic circuit diagram, Figure 26, in which the terminal 54 is connected internally of the flasher by the bracket 52 to the contacts 50 and 280. The terminal 54 is connected by a wire 284, corresponding to the wire 8 (Figure 7) to the blade 82 of the same selector switch 84, while the terminal 48 is connected by a wire 286, corresponding to the wire 118, to the pilot light 120, which is grounded as at 122. With the selector switch in open position, as indicated in Figure 24, the contact 38 is held in engagement with the contact 50 by the bimetal member 30, but the contact 278 is held by the spring action of the spring 276 out of engagement with the contact 280, as indicated in Figure 22. When the selector switch is closed to energize the selected set of turn signal lights, the circuit to the signal lights is instantaneously completed through the closed contacts 38 and 50 and the consequent energization of the relay results in the downward attraction of the armature 274 so as to close the contacts 278 and 280, as indicated in Figure 23. As the bimetal member, on heating, moves the contact 38 out of engagement with the contact 50 and to the position as indicated in Figure 24, the contact 278 remains in engagement with the contact 280 by virtue of the magnetic action of the relay on the armature 274, the relay and turn signal circuit remaining completed through the contacts 278 and 280 in spite of the opening of the contacts 38 and 50. The current still flows through the bimetal member and, hence, as it heats up more and more, it finally reaches such a position that the force exerted on the armature through the resilient strip 276 exceeds the magnetic holding force of the relay and the contact 278, by virtue of the spring action of the strip 276, springs or snaps out of engagement with the contact 280. The circuit to the relay is then broken and at the same time the turn signal lights are deenergized. The pilot light is simultaneously deenergized by the opening of the contacts 38 and 40, as previously described with reference to the flasher 2. As the bimetallic member pulls down, it first reaches the position shown in Figure 22, in which contacts 38 and 50 are brought into engagement and, as soon as this is accomplished, the consequent energization of the relay snaps the contact 278

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into engagement with the contact 280. The closing of these contacts 278 and 280 establishes the relay circuit independently of the bimetal contacts and prevents fluttering of the contacts 38 and 50 and, thus, reduces the pitting possibilities. Since at the time the contacts 38 and 50 are separated—on the heating of the bimetallic member—the contacts 278 and 280 are still closed, no arc will be drawn between the contacts 38 and 50 as they are slowly moved apart by the bimetal member. Since the contacts 278 and 280 are moved apart by the sudden spring action of the strip 276 rather than by the slow movement of the bimetallic member, the pitting of these contacts is prevented.

It will be evident that the flasher 2' may be connected in external circuits, the same as flasher 2, and that, functionally, either one may replace the other so far as the maintenance of the operation of the circuits is concerned.

It will be further evident that the modification disclosed in Figure 16 may equally be considered to apply to the flasher 2", and that the flasher 2", when so modified, may be connected in the same external circuits as the flasher 2'.

It will be evident, therefore, that applicant has provided a universal vehicle or auto signal flasher switch which is capable of incorporation in all, or substantially all, automobile or vehicle lamp signal flasher systems, and that such device is rugged in construction, inexpensive to manufacture, certain in operation and relatively low in cost. It is also evident that applicant has provided certain novel and useful circuits inter-relating the turn signal lights, pilot lights and also inter-relating these with the stop signals; and has provided a flasher which replaces and largely makes unnecessary the manufacture and stocking of a number of different models for such circuit installations.

While certain specific structural details have been disclosed and described herein for the purpose of illustrating certain embodiments of my invention, it will be apparent that other modifications and changes may be made without departing from the spirit and scope of the appended claims.

What I claim is:

1. In a flasher switch, an electromagnet, a bimetallic member in series with said electromagnet, a first switch including a contact carried by said bimetallic member, said first switch being in series with said bimetallic member and said electromagnet, an armature for said electromagnet, a second switch including a contact carried by said armature and electrically connected in parallel with said first switch.

2. A flasher switch comprising an electromagnet, an armature for said electromagnet, a bimetal member fixed at one end thereof and electrically connected in series with said electromagnet, a resilient member secured at one end thereof to the other end of said bimetal member, said resilient member on its other end supporting said armature in the magnetic field of said electromagnet for attraction thereto on energization thereof, a pair of movable contacts, one of said movable contacts being carried on said other end of the bimetal member and electrically connected thereto, the other of said movable contacts being carried by said armature and electrically connected to said one movable contact, a pair of fixed contacts respectively disposed for engagement by said movable contacts, said resilient member being constructed and arranged and yieldable to

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permit separation of the contact carried by the bimetal member from its cooperating fixed contact during the heating of the bimetal member and prior to the separation of the other movable contact from its cooperating fixed contact, and a pair of terminals adapted to be connected to a source of supply and to a load, one of said terminals being connected to one end of said electromagnet, the other of said terminals being connected in parallel to said fixed contacts whereby the circuit through said terminals is broken by movement of the movable contact carried by the resilient member away from its cooperative fixed contact and is completed by engagement of the movable contact carried by the bimetal member with its cooperating fixed contact.

HENRY R. GROSS.

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