FIG. 1

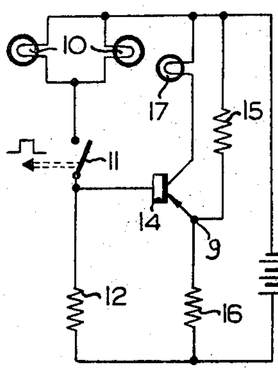

FIG. 2

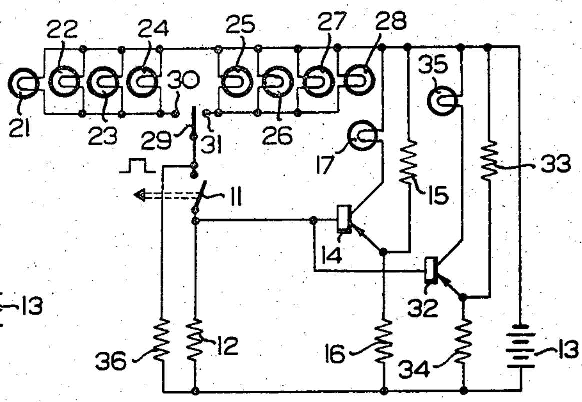

FIG. 3

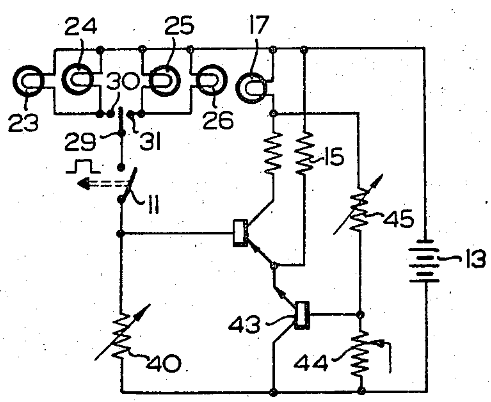

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FIG. 4

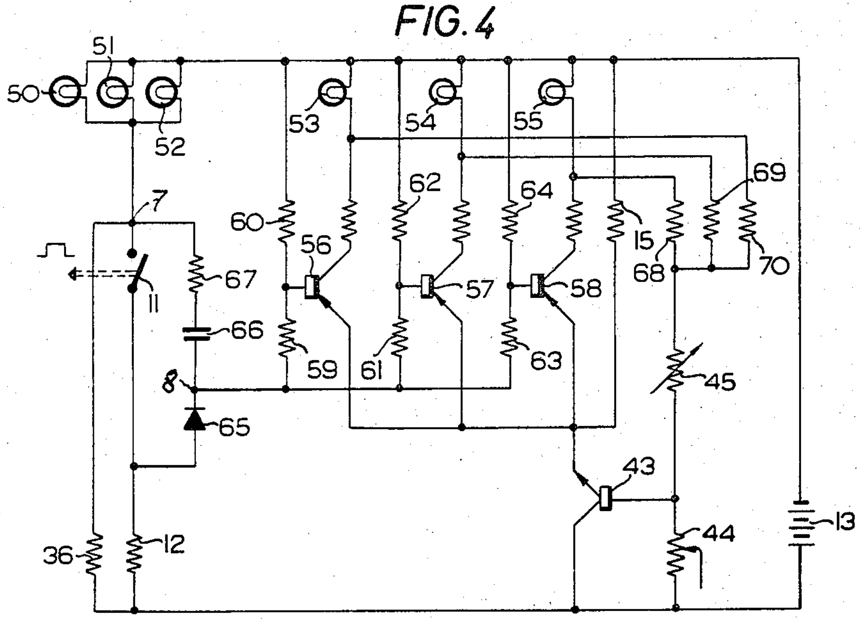

FIG. 5

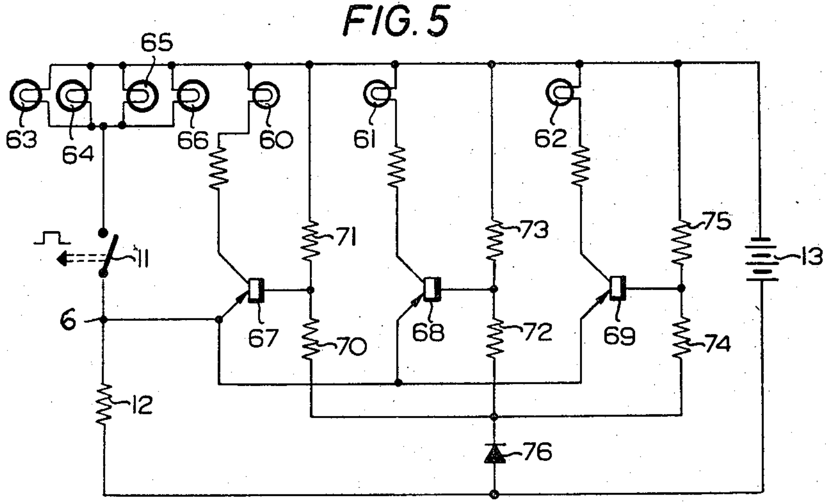

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FIG. 6

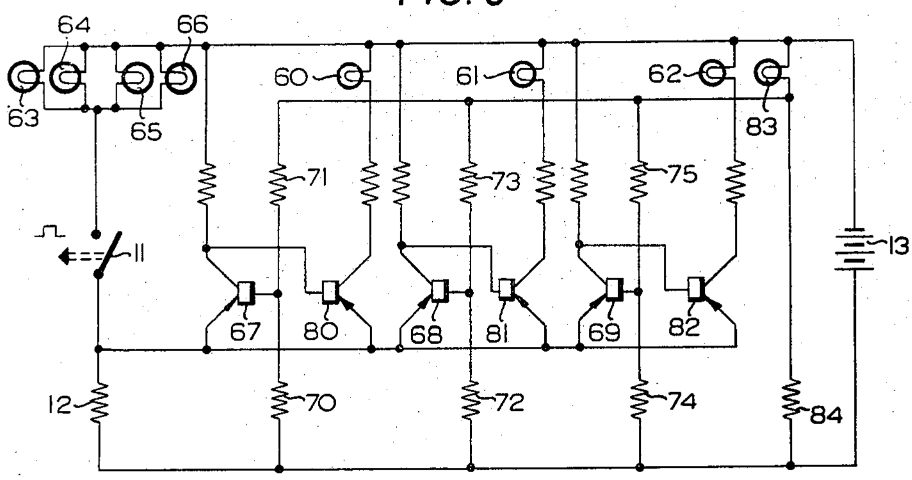

FIG. 7

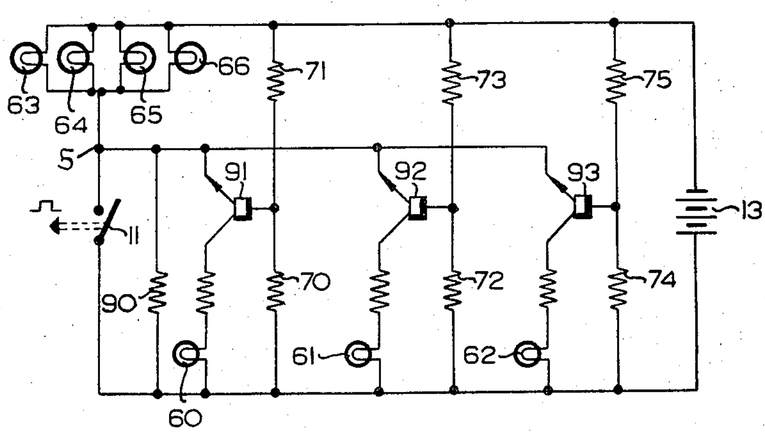

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FIG. 8

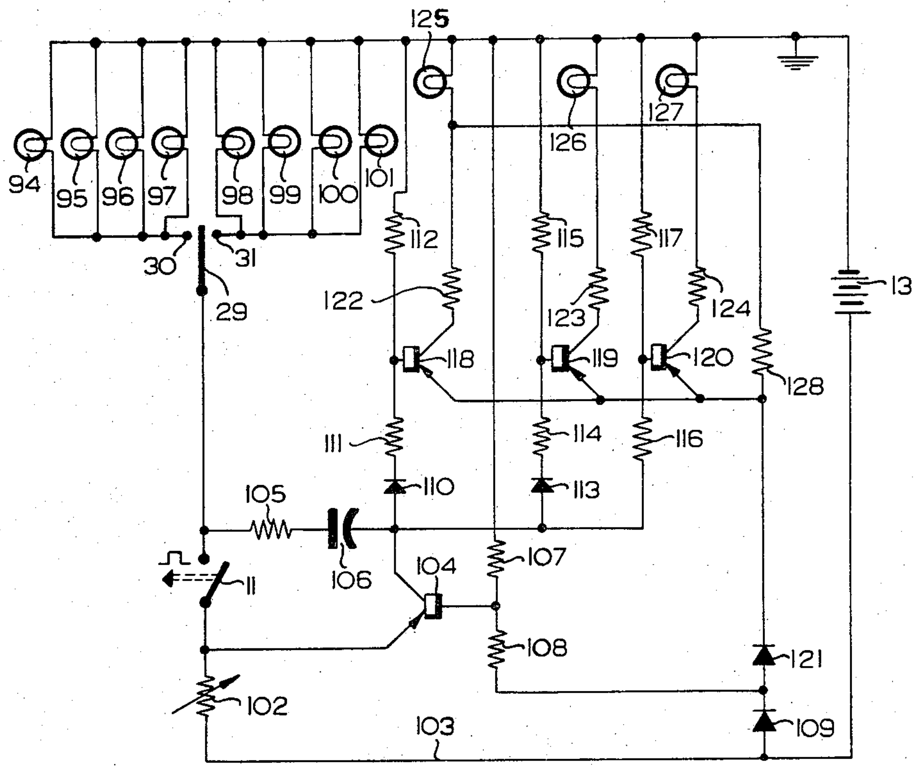

FIG. 9

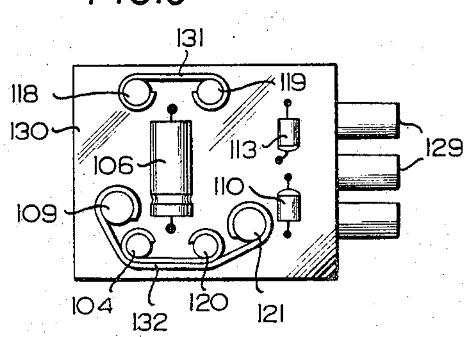

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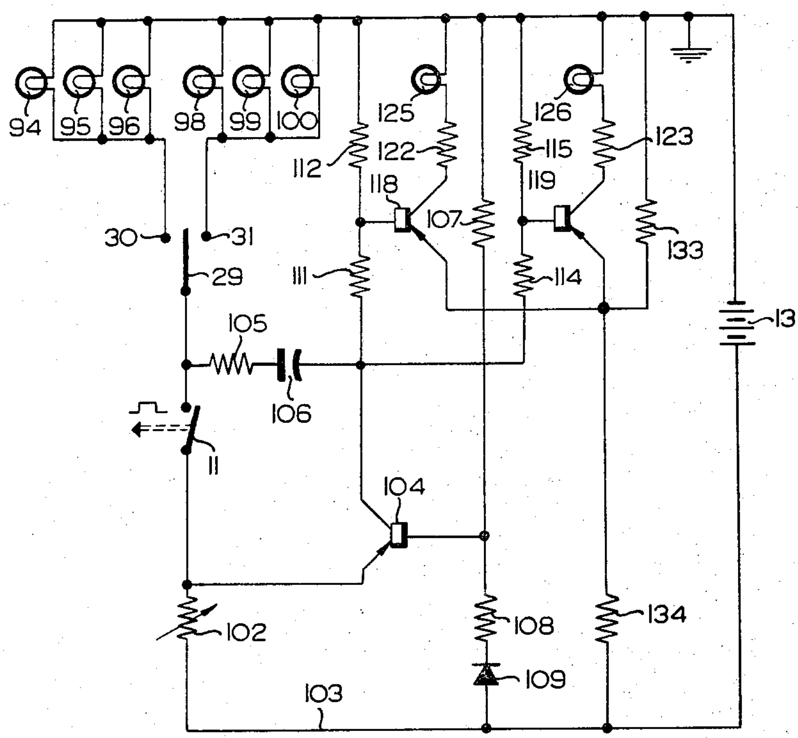
FIG.10



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3,422,421

BLINKER TYPE SIGNAL SYSTEM WITH INDICATION OF DEFECTIVE BLINKER LAMP

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U.S. Cl. 340—331 30 Claims
Int. Cl. G08b *5/38;* H05b *41/00*

ABSTRACT OF THE DISCLOSURE

An arrangement for determining the operability of the blinking type of lights in a motor vehicle. The blinking lights subjected to continuous test are connected in parallel and the parallel combination is, in turn, connected in series with a resistor. If one of the blinking lights becomes defective, the circuit through the defective lamp is opened and as a result the voltage drop across the resistor is modified. This change in voltage drop across the resistor is used to turn a control transistor on and off. The switching function of the transistor acts on an indicating lamp which will either light or not light depending upon the operational state of the blinking lights. By viewing the indicating lamp, the operator of the vehicle can immediately determine from the dashboard whether all blinking lights are operating satisfactorily.

The present invention relates to a blinker type signal system circuit arrangement. More particularly, the invention relates to a blinker type signal system circuit arrangement for indicating the energized or operative condition of the signal lights of said system. The blinker type signal lights are mounted on a vehicle such as, for example, an automotive vehicle, such as a bus, truck, trailer truck, or car for indicating to other vehicles that the signalling vehicle plans to turn right or left. The signal lights may be mounted at the front and rear of the vehicle in a row of one to four or possibly more lights at the right side and one to four or possibly more lights at the left side.

The circuit arrangement of the present invention operates an indicator lamp or a plurality of indicator lamps, mounted for example on the dashboard inside the vehicle in view of the operator of the vehicle, which indicates the operative condition of the signal lights mounted outside the vehicle. The circuit arrangement provides electrical energy for the signal lights and for the indicator lamps.

In known types of blinker type signal systems circuit arrangements, the indicator lamps which indicate the operative condition of the signal lights are connected in series with said signal lights and are thus energized simultaneously with the said signal lights. However, if several blinker type signal lights which are intermittently energized are to be so controlled from a central position that at least one indicator lamp is associated with each individual signal light or with a group of signal lights, this may be achieved in the known arrangements only if a separate electrical conductor is connected to the central position from each blinker type signal light. This is a considerable disadvantage, particularly in the signal systems of motor vehicles with trailers, because experience has shown that cable damage is the principal cause of short circuits in the electrical system of a motor vehicle so that the more cables, the greater the possibility of short circuits and the greater the possibility of failure of the signalling system.

The principal object of the present invention is to provide a new and improved blinker type signal system circuit arrangement.

An object of the present invention is to provide a blinker type signal system circuit arrangement including a plurality of signal lights connected in parallel with each other which provides an indication of the operative condition of each signal light with a single circuit having a minimum number of components and a minimum length of electrical conductors or cables and which is inexpensive to produce.

This is achieved by utilizing the principal feature of the invention which is utilization of a voltage which is proportional to the current of the blinker type signal lights for actuating a current-dependent switch which switches the indicator lamps into the circuit. In accordance with the present invention, this is achieved by connecting a control resistor in series with the blinker type signal lights and connecting to the control resistor the control electrode of the current-dependent switch. The current-dependent switch may comprise a transistor with the base or emitter electrode connected to the control resistor.

The connection of the control resistor in the common supply circuit for all of the blinker type signal lights permits the circuit arrangement of the present invention to be very simple, to control all the blinker type signal lights in common, to utilize one indicator lamp with a single signal light or with a group of signal lights, and utilizes a control transistor connected to the indicator lamp so that the circuit arrangement utilizes but a single conductor connected to a common point in the connection between the control resistor and the interrupter for the blinker type signal lights.

In an embodiment of the blinker type signal system circuit arrangement of the present invention, the control resistor is connected in series with the interrupter and the signal lights and the base electrode of the control transistor is connected to the control resistor and the emitter electrode of the control transistor is connected to a constant voltage.

In another embodiment of the present invention, the emitter electrode of the control transistor is connected to the emitter electrode of a transistor which functions as an emitter follower. The collector electrode of the emitter follower transistor is connected to the control resistor and the base electrode thereof is connected to the tap of a voltage divider which is connected in series with the indicator lamp via the source of operating voltage.

In another embodiment of the circuit arrangement of the present invention, the emitter electrode of the control transistor is connected to the control resistor. The control resistor is connected in series with the signal lights and the interrupter, and the base electrode of the control transistor is connected to the tap of a voltage divider which is connected to the source of operating voltage.

In a blinker type signal system circuit arrangement of the present invention which utilizes a plurality of indicator lamps each operative condition of a single signal light of a group of signal lights, all the signal lights of which group are simultaneously operated. In accordance with the present invention, each indicator lamp is switched through a control transistor associated with it and the potential of the control electrode of each control transistor is so selected that the first control transistor changes its operating condition if the first blinker type signal light becomes inoperative or one of the signal lights of the first group of signal lights becomes inoperative, the second control transistor changes its operating condition of the second blinker type signal light or one of the signal lights of the second group of signal lights becomes inoperative, and the *n*th control transistor changes its operating condition if the nth signal light or one of the signal lights of the nth group of signal lights becomes inoperative.

In another embodiment of the circuit arrangement of the present invention, the control transistor is connected as an amplifier and at least two transistors operating as switches for the corresponding indicator lamps are connected to the output electrode of the control transistor. Each of the switching transistors changes its operating condition upon a predetermined change in the output voltage of the control transistor, output voltage which depends upon the operativeness of a predetermined number of blinker type signal lights. It is only necessary to provide one switching transistor for each indicator lamp and one control transistor operating as amplifier for all the switching transistors. The resistance value of the control resistor may then be much smaller than in other embodiments of the circuit arrangement, since only very small control voltages in the order of 10 to 100 millivolts are required for each signal light. The control resistor may thus be protected against short-circuiting very easily and that it may readily be combined in a compact arrangement with the other components. Furthermore, practically the entire voltage source or battery voltage is available for the blinker type signal lights.

In another embodiment of the circuit arrangement of the invention, the control resistor is connected in series with the interrupter and between the emitter and base electrodes of the control transistor. The collector electrode of the control transistor is connected via the series connection of a resistor and a condenser to the other end of the interrupter from that which is connected to the control resistor. This circuit arrangement prevents current peaks which occur when the blinker type signal lights are cold from interfering with the operation of the blinker type signal system when the blinker type signal lights are switched on. Only after the signal lights are switched on or energized, does the circuit arrangement indicate how many of such signal lights are in operative condition. This prevents erroneous operation of the indicator lamps.

The circuit arrangement of the invention may be made particularly temperature and voltage sensitive if the voltage at the base electrode of the control transistor is stabilized in a known manner via a first diode which is connected in series with a resistor and if the housing of the control transistor is connected in heat-conductive relationship with the housing of the diode and the housing of at least one of the switching transistors. The first diode is preferably a germanium diode. In a circuit arrangement with one or two indicator lamps, the reference voltages of the switching transistors need not be stabilized via the first diode. The circuit arrangement is particularly sensitive and can operate with control voltages in the order of approximately 30 millivolts per blinker type signal light. The control resistor accordingly has a very low resistance value of, for example, 18 ohms in a 12 volt blinker type signal system.

If the circuit arrangement includes more than two indicator lamps, a second diode, preferably a silicon diode, is preferably connected in series with the first diode for stabilizing the reference voltages of the switching transistors. Thus, when the indicator lamps are in operative condition, the current of said indicator lamps flows through the first and second diodes. The housing of the control transistor and of the first and second diodes and at least of one of the switching transistors are preferably connected with one another in heat-conductive relationship. This circuit arrangement assures reliable operation of the indicator lamps even under extreme conditions.

In the last two circuit arrangements of the diodes, the control resistor may be a cold conductor. The temperature response of the control transistors may be compensated by suitable selection of the temperature coefficient.

In order that the present invention may be readily carried into effect, it will now be described with reference to the accompanying drawings, wherein:

FIG. 1 is a circuit diagram of an embodiment of the circuit arrangement of the present invention, including two blinker type signal lights and an indicator lamp;

FIG. 2 is a circuit diagram of another embodiment of the circuit arrangement of the present invention, including a plurality of blinker type signal lights and two indicator lamps;

FIG. 3 is a circuit diagram of another embodiment of the circuit arrangement of the present invention, including a plurality of blinker type signal lights and one indicator lamp;

FIGS. 4, 5, 6 and 7 are each a circuit diagram of another embodiment of the circuit arrangement of the present invention, including a plurality of blinker type signal lights and a plurality of indicator lamps;

FIG. 8 is a circuit diagram of another embodiment of the circuit arrangement of the present invention, in which two, three or four of a plurality of blinker type signal lights are selectively operated and their operative condition is indicated;

FIG. 9 is a schematic diagram of an embodiment of a layout arrangement of the components of the circuit arrangement of FIG. 8; and

FIG. 10 is a circuit diagram of an embodiment of the circuit arrangement of the present invention, including a plurality of blinker type signal lights and two indicator lamps.

In the figures, the same components are identified by the same reference numerals.

The embodiment of the blinker type signal system circuit arrangement of FIG. 1 comprises two blinker type signal lights **10** connected in parallel. The signal lights **10** are connected in series with an interrupter **11**, a control resistor **12**, and a source of operating voltage or battery **13**. The base electrode of a control transistor **14** is connected to a common point in the connection between the interrupter **11** and the control resistor **12**. The control transistor **14** is of PNP type and the emitter electrode thereof is connected to the tap **9** of a voltage divider **15**, **16** which is connected across the source **13** of operating voltage. An indicator lamp **17** is connected to the collector electrode of the control transistor **14**.

In operation, the blinker type signal lights **10** are intermittently energized and deenergized or blinked on and off in accordance with the intermittent closing and opening of the interrupter **11**. The interrupter **11** is intermittently closed and opened by any suitable means such as, for example, a relay operated by a pulse generator to alternately attract and repel the switching armature of said interrupter. The current which flows during energization of the signal lights produces a voltage drop at the control resistor **12** which is higher than the emitter control electrode potential provided by the voltage divider **15**, **16** by a factor corresponding to the emitter-base voltage of the control transistor **14**. This switches the control transistor **14** to its conductive condition, in which it conducts current, during the energized or blinking periods of the signal lights **10**, so that the indicator lamp **17** is energized and blinks simultaneously with said signal lights.

If one of the blinker type signal lights **10** becomes inoperative for any reason, such as, for example, due to filament breakage or defective wiring, only half the usual voltage is produced at the control resistor **12** during the blinking period. The voltage at the control resistor **12**, however, is smaller than the emitter control electrode potential, so that the control transistor **14** is switched to its nonconductive or blocking condition, and the indicator lamp **17** is deenergized and off.

The embodiment of the blinker type signal system circuit arrangement of FIG. 2 is utilized to indicate intended right and left turns of a motor vehicle with a trailer, such as, for example, a truck, and to indicate the operative condition of the blinker type signal lights which indicate the proposed turns. In FIG. 2, there are eight blinker type signal lights **21**, **22**, **23**, **24**, **25**, **26**, **27** and **28**. The signal lights **21**, **22**, **23** and **24** may be mounted outside the vehicle on the left side, for example, and the signal lights **25**, **26**, **27** and **28** may be mounted outside the vehicle on the right side, for example. The signal lights **23**, **24**, **25** and **26** may be mounted on the tractor vehicle of the trailer truck and the signal lights **21**, **22**, **27** and **28** may be mounted on the trailer.

All the blinker type signal lights **21** to **28** are connected in parallel. A directional change or turn indicating switch **29** connects either the left side signal lights **21** to **24** or the right side signal lights **25** to **28** into the circuit via the interrupter **11**, and the control resistor **12**. The signal lights **21** to **24** are connected into the circuit when the armature of the directional change indicating switch **29** contacts the contact **30** and the signal lights **25** to **28** are connected into the circuit when the armature of said switch contacts the contact **31**. A second indicator circuit is connected in parallel with the first circuit. The first indicator circuit comprises the control transistor **14**, the voltage divider **15**, **16** and the indicator lamp **17**. The second indicator circuit comprises a control transistor **32**, a voltage divider **33**, **34** and an indicator lamp **35**. The base electrode of the control transistors **14** and **32** are directly connected to each other.

A preheating resistor **36** is connected in parallel with the series connection of the interrupter **11** and the control resistor **12**. The preheating resistor **36** preheats the signal lights when the armature of the direction-changing switch **29** is in contact with one of the contacts **30** and **31**, thereby preventing at the beginning of the periods of energization of the signal lights the flow of a current which is too high in magnitude which may result from the low cold resistance of the signal lights and which would produce an erroneous indication of operativeness.

The emitter control electrode potentials of the control transistors **14** and **32** are so adjusted that both said transistors are in their conductive conditions when all four signal lights utilized to signal a turn in one direction are energized. If one blinker type signal light becomes inoperative, the voltage drop at the control resistor **12**, which is produced by the current of all the signal lights, is reduced to a magnitude which is insufficient to maintain the control transistor **14** in its conductive condition. The indicator lamp **17** then becomes deenergized. On the other hand, the emitter control electrode potential of the control transistor **32**, provided by the voltage divider **33**, **34**, is adjusted or selected to maintain said transistor in its conductive condition in case the first and second blinker type signal lights of the group **21**, **22**, **23**, **24** or of the group **25**, **26**, **27**, **28** becomes inoperative and to switch said transistor to its nonconductive condition if the third signal light of either of said groups becomes inoperative.

The circuit arrangement of FIG. 2 has the advantage that motor vehicles may be operated with or without trailers without a change in the circuitry. If the motor vehicle is operated with a trailer, both indicator lamps **17** and **35** are energized simultaneously with the signal lights **21**, **22**, **23**, **24** or the signal lights **25**, **26**, **27**, **28** if the signal lights are operative. If the vehicle is operated without a trailer, only the blinker type signal lights **23** and **24** or **25** and **26** are simultaneously energized. The operative condition of the signal lights is indicated by the indicator lamp **35**. If one of the blinker type signal lights **23**, **24**, **25** or **26** becomes inoperative, then the indicator lamp **35** is simultaneously deenergized.

The embodiment of FIG. 3 differs from the embodiments of FIGS. 1 and 2 by the provision of a feedback circuit for the control transistor **14** in FIG. 3. The feedback circuit is of particular advantage if several indicator circuits are connected in parallel and are to be successively energized, although the principle of operation is explained for the simplest embodiment, of FIG. 3, having a single indicator circuit. The control resistor **12** of FIGS. 1 and 2 is replaced by a control resistor **40**, having cold conductor characteristics and a temperature characteristic corresponding to that of the blinker type signal lights. This prevents, at the beginning of the periods of energization of the signal lights, an increased voltage drop at the control resistor **40** despite the high magnitude of current resulting from the low cold resistance of the signal lights.

The resistor **16** of the voltage divider **16**, **15** of FIGS. 1 and 2 is replaced in FIG. 3 by the emitter-collector path of a transistor **43** which operates as an emitter follower. The base electrode of the transistor **43** is connected to a common point in the connection between the resistors of a voltage divider comprising a variable resistor **44** and a temperature-dependent resistor **45**. The voltage divider **44**, **45** is connected in series with the indicator lamp **17** across the source **13** of operating voltage. The temperature-dependent resistor **45** is a cold conductor, so that during rising operating temperatures the base potential of the transistor **43** decreases and therefore no change in the emitter potential **14** occurs due to the decrease in the internal resistance of the transistor **43** during higher temperatures.

In operation, the direction-changing switch **29** is initially switched to one of its two switching positions to indicate a proposed turn to the right or left, such as, for example, with the armature in contact with the contact **30**. If the interrupter **11** is then closed, by an suitable arrangement not shown in the drawing as hereinbefore explained, the base potential of the transistor **14** increases to a magnitude of −1.5 volts, if the potential of the positive pole of the battery **13** is considered as the zero volt reference potential. The base potential of the transistor **43** when the indicator lamp **17** is cold, is approximately −0.7 volt. This produces a potential of approximately −1.00 volt at the emitter electrode of the control transistor **14**. The control transistor **14** is switched to its current conductive condition by the decrease in voltage and the control resistor **40**.

As soon as the indicator lamp **17** is energized, its resistance rises, so that the potential at the base of the transistor **43** decreases to approximately −0.5 volt. This produces a decrease in the emitter potential of the control transistor **14** to −0.8 volt, so that said control transistor becomes more strongly current conductive. Thus, a feedback occurs through the emitter follower circuit. If one of the energized blinker type signal lights is extinguished or deenergized during the blinking or operating period, the base potential of the control transistor **14** decreases to approximately −0.75 volt and said control transistor is switched to its nonconductive condition. When the indicator lamp **17** is deenergized or extinguished, simultaneously with the signal light, the base potential of the transistor **43** and the emitter potential of the control transistor **14** are increased by 0.2 volt in a negative direction, so that the blocking effectiveness of said control transistor is increased.

In the embodiment of the blinker type signal system circuit arrangement of FIG. 4, the operative condition of each of the three blinker type signal lights **50**, **51** and **52** is indicated by a corresponding one of the indicator lamps **53**, **54** and **55**. The blinker type signal lights **50**, **51**, and **52** are connected in parallel with each other and in series with the interrupter **11** and the control resistor **12**. Control transistors **56**, **57**, and **58** are connected together, with their emitter electrodes connected to the tap of a voltage divider comprising the resistor **15** and the transistor **43**. The transistor **43** operates as an emitter follower. The base electrode of each of the control transistors **56**, **57**, and **58** is connected to the tap of the corresponding one of the voltage dividers **59**, **60** having a ratio of 1:16, **61**, **62** having a ratio of 1:9, or **63**, **64** having a ratio of 1:5. Each of the voltage dividers **59**, **60** and **61**, **62** and **63**, **64** is connected in series with a diode **65** and the control resistor **12** across the source **13** of operating voltage. A common point **8** in the connection between the voltage dividers **59**, **60** and **61**, **62** and 63, 64 and the diode 65 is connected to a common point 7 in the connection between the interrupter 11 and the blinker type signal lights 50, 51 and 52 via a capacitor 66 and a resistor 67 connected in series with said capacitor.

The base electrode of the transistor 43 is connected to a voltage divider comprising the variable resistor 44, the temperature-dependent resistor 45 and three resistors 68, 69 and 70, which are connected in parallel with each other and each of which is connected in series with a corresponding one of the indicator lamps 53, 54 and 55.

In the periods between energization of the signal lights 50, 51, 52 the capacitor 66 recharges via said signal lights, the resistor 67, the diode 65 and the control resistor 12, almost to the battery voltage of 12 volts.

If the interrupter 11 is closed, there is initially a flow of signal light energizing current of high magnitude, which voltage drop of approximately 6 volts at the control resistor 12 if all three signal lights 50, 51 and 52 are in operation. At the instant that the interrupter 11 closes, this produces an increase of approximately 6 volts in the positive direction at the capacitor 66 and this momentarily shifts the base potentials of the transistors 56, 57 and 58 to positive values. The capacitor 66 discharges via the voltage dividers 59, 60 and 61, 62 and 63, 64, the signal lights 50, 51, 52 and the resistor 67. The time constant of the discharge is principally determined by the capacitance of the capacitor 66 and the resistance of the resistor 67. The time constant is selected so that it corresponds to the time period from the energization or switching on of the blinker type signal lights 50, 51, 52 until a constant magnitude signal light energizing current.

The transistors 56, 57 and 58 are switched to their conductive conditions only at the instant that there is a constant voltage drop of 1.5 volts at the control resistor 12. Such delayed adjustment of the indicating current at the base electrode of the control transistors 56, 57 and 58 is necessary, since the peak current upon energization or switching on of one or two cold blinker type signal lights may be produced later than the constant energizing current through two or three hot blinker type signal lights. This would, at least momentarily, produce an incorrect indicating voltage. The base potential of the transistor 43, if the indicator lamps 53, 54 and 55 are not energized or nonoperative, and at normal temperature, is −1.3 volts, and the emitter control electrode potential of the control transistors 56, 57 and 58 is thus −1.8 volts. The base potential of the transistor 43 changes to −1.5 volts upon energization or operation of all three indicator lamps 53, 54, 55 to −1.6 volts upon energization or operation of only two of said indicator lamps, and to −1.7 volts upon energization or operation of only one of said indicator lamps, since the indicator lamps are cold conductors.

The base potentials of the control transistors 56, 57 and 58 are, when the capacitor 66 is charged to −1.5 volts, and on the basis of the afore-mentioned voltage divider ratios, to −2.1 volts of the control transistor 56, −2.6 volts of the control transistor 57 and −3.0 volts of the control transistor 58. Accordingly, all the control transistors are current conductive conditions and the indicator lamps 53, 54 and 55 blink or flash simultaneously with the blinker type signal lights 50, 51 and 52. The control transistors 56, 57 and 58 are biased even stronger in their conductive conditions when the emitter control electrode voltage of said control transistors is reduced to −1.5 volts.

If one of the blinker type signal lights 50, 51 and 52 breaks down and becomes inoperative or deenergized, the voltage at the control resistor 12 is reduced to −1 volt. This causes the base voltages of the control transistors 56, 57 and 58 to decrease to −1.6 volts, −2.1 volts or −2.6 volts. The difference between the base and emitter voltages of the control transistor 56 is then no longer sufficient to maintain said control transistor in its current conductive condition. The control transistor 56 is thus switched to its nonconductive condition. The indicator lamp 53 is then deenergized or extinguished and thus indicates that the first blinker type signal light 50 is inoperative.

If the second blinker type signal light 51 then breaks down or becomes inoperative, the indicator lamp 54 indicates such breakdown by becoming deenergized. The energizing current of the then solely operative blinker type signal light 52 produces a voltage of 0.5 volt at the control resistor 12. Accordingly, the base potentials of the control transistors 56, 57 and 58 become −1.1 volts, −1.7 volts, or −2.2 volts. Since the emitter control electrode potential is −1.8 volts, the control transistors 56 and 57 are then switched to their nonconductive condition while the control transistor 58 remains in its current conductive condition. Thus, only the indicator lamp 55 flashes or operates simultaneously with the third blinker type signal light 52. If the signal light 52 then breaks down, the three control transistors 56, 57 and 58 are switched to their blocked or nonconductive conditions with base voltages of −0.7 volt, −1.2 volts, or −1.7 volts, and all three indictor lamps 53, 54 and 55 are deenergized or extinguished.

In the embodiment of the circuit arrangement of FIG. 5, contrary to the embodiments of FIGS. 1, 2, 3 and 4, indictor lamps 60, 61 and 62 flash or operate during the deenergized periods of the blinker type signal lights 63, 64, 65 and 66 when said signal lights are operative and flash or blink in the proper manner, and the indicator lamp 60 is continuously energized when one of said blinker type signal lights is inoperative or breaks down. The emitter electrode of the control transistors 67, 68 and 69, which switch the energizing current to the indicator lamps 60, 61 and 62, are connected to a common point 6 in the connection between the interrupter 11 and the control resistor 12. The base electrodes of the control transistors 67, 68 and 69 are connected to the taps of the corresponding voltage dividers 70, 71 and 72, 73 and 74, 75, respectively. The voltage dividers 70, 71 and 72, 73 and 74, 75 are connected in series with a common diode 76 and the series connection is connected across the source 13 of operating voltage. The diode 76 functions in known manner to compensate for the influence of the operating temperature on the potentials of the control transistors 67, 68 and 69.

When the interrupter is open, the control transistors 67, 68 and 69 are switched to their current conductive conditions and the indicator lamps 60, 61 and 62 are energized. The ratios of the voltage dividers 70, 71 and 72, 73 and 74, 75 are so selected that all three control transistors 67, 68 and 69 will switch to their blocking or nonconductive conditions if all four blinker type signal lights 63, 64, 65 and 66 are energized or turned on when the interrupter 11 is closed. If one of the blinker type signal lights becomes inoperative or breaks down, the voltage across the control resistor 12 becomes insufficient to block or maintain nonconductive the control transistor 67. The control transistor 67 is then switched to its conductive condition and the indicator lamp 60 is continuously energized. The control transistors 68 and 69 remain in their blocked conditions so that the indicator lamps 61 and 62 are energized during the deenergized periods of the operative blinker type signal lights, of which there are three.

Analogously to the operation of the afore-described blinker type signal system circuit arrangements, the control transistor 68 is switched to its current conductive condition upon breakdown of a second of said blinker type signal lights and the control transistor 69 is switched to its conductive condition upon breakdown or deenergization of a third of said blinker type signal lights.

The embodiment of the circuit arrangement of FIG. 6 differs from that of FIG. 5 due to the connection of an additional transistor to each of the control transistors 67, 68 and 69. An additional transistor 80 is connected with its base electrode to the collector electrode of the control transistor **67**, an additional transistor **81** is connected with its base electrode to the collector electrode of the control transistor **68** and an additional transistor **82** is connected with its base electrode to the collector electrode of the control transistor **69**. Each of the additional transistors **80**, **81** and **82** switches energizing current to the indictor lamp connected to its collector electrode. The function of the diode **76** of FIG. 5 is performed by a lamp **83**, which is connected with the voltage dividers **70**, **71** and **72**, **73** and **74**, **75** and the resistor **84** across the source **13** of operating voltage. The lamp **83** thus functions to compensate for the effect of the operating temperature on the potentials of the control transistors.

The pairs of transistors **67**, **80** and **68**, **81** and **69**, **82** are connected with the emitter-collector circuit of each of the control transistors **67**, **68** and **69**, in parallel with the emitter-base circuit of the next following corresponding additional transistor, so that the transistors of each of said pairs of transistors operate with opposed phases. The indicator lamps **60**, **61** and **62** are connected to the collector electrodes of the transistors **80**, **81** and **82**, respectively, and are energized or operated simultaneously with the blinker type signal lights **63**, **64**, **65** and **66**. Analogously to the operation of the aforedescribed embodiments of the circuit arrangement of the present invention, all three indicator lamps **60**, **61** and **62** are energized or turned on when all four signal lights **63**, **64**, **65** and **66** are operative. If one of the blinker type signal lights **63**, **64**, **65** and **66** becomes inoperative or deenergized, the indicator lamp **60** is deenergized and is extinguished. If a second of the blinker type signal lights breaks down or becomes inoperative, the indicator lamp **61** is deenergized and is extinguished. If three of the signal lights break down or become inoperative at the same time, the indicator lamp **62**, as well as the indicator lamps **60** and **61**, is deenergized or extinguished, since the respective control transistors **67**, **68** and **69** are then in their current conductive conditions, so that their corresponding additional transistors **80**, **81** and **82** are switched to their blocked or non-conductive conditions.

In the embodiment of the circuit arrangement of FIG. 7, a control resistor **90** is connected in series with the blinker type signal lights **63**, **64**, **65** and **66** and in parallel with the interrupter **11**. Control transistors **91**, **92** and **93** of NPN type are connected with their emitter electrodes to a common point **5** in the connection between the control resistor **90** and the blinker type signal lights **63**, **64**, **65** and **66**. The collector electrodes of the control transistors **91**, **92**, and **93** are connected to corresponding ones of the indicator lamps **60**, **61** and **62**, respectively, and said indicator lamps are connected to the positive pole of the battery **13**.

The control resistor **90** has a high resistance value and also functions as a preheating resistor for the blinker type signal lights **63**, **64**, **65** and **66**. If the interrupter **11** is open, a voltage drop is produced at the control resistor **90**, as a result of the nonenergizing current which flows, and switches the control transistors **91**, **92** and **93** to their current conductive conditions. This energizes or turns on the indicator lamps **60**, **61**, **62** during the periods that the operative blinker type signal lights **63**, **64**, **65**, **66** are deenergized. When the interrupter **11** is closed, the emitter potentials of the control transistors **91**, **92** and **93** are increased to the positive voltage of the battery **13** and said control transistors are switched to their blocked or nonconductive conditions.

If one of the blinker type signal lights breaks down or becomes inoperative, the voltage drop produced by the nonenergizing current at the control resistor **90** is no longer sufficient to maintain the control transistor **91** in its current conductive condition, so that the indicator lamp **60** is deenergized or extinguished. In the manner described with reference to the foregoing embodiments of the circuit arrangement of the present invention, the indicator lamp **61** is deenergized or extinguished when a second of the signal lights becomes inoperative or breaks down, and the indicator lamp **62** is deenergized or extinguished when a third of said signal lights becomes inoperative or breaks down.

The embodiments of FIGS. 4, 5, 6 and 7 may of course be utilized to signal directional changes or turns of a motor vehicle and to indicate the operative condition of the signal lights, if the signal lights are connected in two groups, one group for a left turn signal and the other group for a right turn signal, and if the direction change or turn indicating switch **29** is connected between the two groups of blinker type signal lights and the interrupter **11**, as in the embodiments of FIGS. 2 and 3.

The embodiment of the circuit arrangement of FIG. 8 comprises four blinker type signal lights **94**, **95**, **96** and **97**, connected in parallel for indicating a directional change or turn to the left and four blinker type signal lights **98**, **99**, **100** and **101** for indicating a directional change or turn to the right. The blinker type signal lights **94** to **101** each have a single pole connected to ground and to the negative pole of the voltage supply source **13**. The signal lights **94** to **101** are all identical and are each rated at for example, 12 volts and 18 watts. When the turn indicating switch **29** is switched with its aramature in contact with the contact **30**, the group of blinker type signal lights **94**, **95**, **96**, **97** is readied for energization and if said switch is switched with its armature in contact with the contact **31**, the group of blinker type signal lights **98**, **99**, **100**, **101** is readied for energization. The turn indicating switch **29** is connected in series with the interrupter **11** and the control resistor **102**. The control resistor **102** has a resistance value of approximately 50 milliohms and is connected to the positive pole of the source **13** of voltage supply. The source **13** of voltage supply provides an operating voltage of about 12 volts.

The emitter electrode of a control transistor **104** is connected to a common point in the connection between the interrupter **11** and the control resistor **102**. The control transistor **104** is of PNP type. The collector electrode of the control transistor **104** is connected to the other terminal of the interrupter **11** from that to which the control resistor **12** is connected via a capacitor **106** and a resistor **105** connected in series circuit arrangement with each other. The base electrode of the control transistor **104** is connected to the negative pole of the source **13** of operating voltage via a resistor **107** and then to the positive pole of said source of operating voltage via a resistor **108** and a diode **109**. The anode of the diode **109** is connected to the positive pole of the source **13** of operating voltage via an electrical conductor **103**. The base potential of the control transistor **104** is stabilized relative to the positive potential of the battery **13**, which is the zero reference potential, via the resistors **107** and **108** and the diode **109**, which function as voltage dividers.

The collector electrode of the control transistor **104** is connected to the negative pole of the battery **13** via a first blocking diode **110**, a resistor **111** and a resistor **112** and is also connected to said negative pole via a second blocking diode **113**, a resistor **114** and a resistor **115**. The collector electrode of the control transistor **104** is also connected to the negative pole of the battery **13** via a resistor **116** and a resistor **117**. Each of the pairs of resistors **111** and **112**, **114** and **115**, and **116** and **117** operate as a voltage divider and are adjusted for different voltage divider operation. Typical resistance values of the voltage divider resistors are—

Resistor:	Resistance value, ohms
111	36
112	910
114	11
115	820
116	0
117	117

The base electrode of a first switching transistor **118** is connected to a common point in the connection between the resistors **111** and **112**. The base electrode of a second switching transistor **119** is connected to a common point in the connection between the resistors **114** and **115**. The base electrode of a third switching transistor **120** is connected to a common point in the connection between the resistors **116** and **117**. The emitter electrodes of the switching transistors **118**, **119** and **120** are connected to each other and to the cathode of the diode **109** via a diode **121**. The diode **121** is preferably a silicon diode and the diode **109** is preferably a germanium diode. The collector electrode of the switching transistor **118** is connected to the negative pole of the battery **13** via a resistor **122** and an indicator lamp **125**. The collector electrode of the switching transistor **119** is connected to the negative pole of the battery **13** via a resistor **123** and an indicator lamp **126**. The collector electrode of the switching transistor **120** is connected to the negative pole of the battery **13** via a resistor **124** and an indicator lamp **127**.

The resistors **122**, **123** and **124** protect the switching transistors **118**, **119** and **120** from short-circuits of the indicator lamps **125**, **126** and **127**, respectively. A resistor **128** is connected in series with the diodes **109** and **121** and in a closed loop with the emitter-collector path of the switching transistor **118** and the resistor **122**. The resistor **128** assures a current flow through the diodes **109** and **121** even when the switching transistors **118**, **119** and **120** are in their nonconductive or blocking condition, and thus maintains the emitter potentials of said switching transistors at a determined level. This would also be achieved if the resistor **128** were connected from the diode **121** to ground. The circuit arrangement of FIG. 8, however, has the advantage that the current produced by the resistor **128** flows only in the periods that the signal lights are deenergized. The current thus flows when the switching transistor **118** is in its nonconductive or blocking condition, so that the effect of the operating heat is reduced. It is very important that the generation of heat in the circuit arrangement be kept as low as possible, due to the requirement for normal circuit operation at 60 degrees C.

FIG. 9 shows a layout arrangement of the components of the circuit arrangement of FIG. 8. The components are layed out on a base plate **130** which is provided with connecting pins **129**. The first switching transistor **118** and the second switching transistor **119** are mounted on the base plate **130** and are connected to each other via a heat bridge **131**. The capacitor **106** having a capacitance of about 100 microfarads is mounted on the base plate **130** at about the center thereof and the first and second blocking diodes are mounted on the base plate **130** near one edge thereof. The diode **109** is mounted on the base plate **130** on the other side of the capacitor **106** from the diodes **110** and **113**. The control transistor **104**, the third switching transistor **120** and the diode **121** are mounted near the edge of the base plate **130** opposite that near which the first and second switching transistors **118** and **119** are mounted. The components **109**, **104**, **120** and **121** are all connected to each other via a heat bridge **132** to assure that they have the same temperature. The heat bridges **131** and **132** may comprise, for example, copper or aluminum strips which surround the diodes and transistors in high heat-conductive relationship.

In operation, when the turn indicating switch **29** is switched with its armature in contact with the contact **30**, the group of left turn signalling blinker type signal lights **94**, **95**, **96**, **97** are operative and are energized by the energizing current supplied to them via the periodically opening and closing interrupter **11**. When the blinker type signal lights **94**, **95**, **96**, **97** flash, due to the opening of the interrupter **11**, the capacitor **106** charges via the flashing signal lights **94**, **95**, **96**, **97** the resistor **105**, the control transistor **104**, and the control resistor **102** to approximately the potential of the source **13** of operating voltage of 12 volts. The emitter electrode of the control transistor **104** is connected via the control resistor **102** to the zero potential of the positive pole of the battery **13** and the base electrode of said transistor is negative.

When the interrupter **11** closes, a current flows through the blinker type signal lights **94**, **95**, **96**, **97** and produces a voltage drop of approximately 75 millivolts per signal light at the control resistor **102**. The potential of the electrode of the condenser **106** which is connected to the resistor **105** increases from —12 volts to almost zero volt, so that the collector electrode of the control transistor **104** then has a potential of about zero volt as opposed to the positive voltage conductor **103**. The three switching transistors **118**, **119** and **120** thus initially remain in their blocked or nonconductive conditions because of the highly positive potentials at their base electrodes. The capacitor **106** then discharges via the blinker type signal lights **94**, **95**, **96**, **97** the resistor **105**, the diodes **110** and **113**, and the resistors **111**, **112**, **114**, **115**, **116** and **117**. The discharge time constant is so selected that it approximately conforms with the time period required for the blinker type signal lights **94**, **95**, **96**, **97** to reach a constant energization or lighting current. This is necessary, because when a cold signal light is energized the peak current may be greater than the average energization or lighting current through two or three hot signal lights. This would momentarily indicate an incorrect indication voltage at the control resistor **102** and the indicator lamps **125**, **126** and **127** would provide an incorrect indication.

When the capacitor **106** is discharged, the conductive condition of the control transistor **104** is controlled by the control voltage at the control resistor **102**. If two of the blinker type signal lights **94**, **95**, **96** and **97** are inoperative, there is an indication voltage of 150 millivolts at the control resistor **102**. The emitter electrode of the control transistor **104** has a potential which is negatively reduced by such voltage. Since the base potential is constant, the control transistor **104** becomes less conductive and its collector potential thus becomes more negative, in the present case by 200 millivolts. This change in potential is sufficient to switch the first switching transistor **118** to its conductive condition and thus to produce flashing or intermittent energization of the indicator lamp **125**. The indicator lamp **125** thus flashes simultaneously with the two operative signal lights, while the two other switching transistors **119** and **120** remain in their nonconductive conditions and the indicator lamps **126** and **127** remain deenergized. The operator of the vehicle is thus apprised of the fact that only two of the four signal lights **94**, **95**, **96** and **97** are operative for indicating left turns.

If three of the blinker type signal lights **94**, **95**, **96**, **97** are operative, there is an indication voltage of 225 millivolts at the control resistor **102**, and the collector potential of the control transistor **104** becomes more negative relative to the potential of the two operative blinker type signal lights by 250 millivolts. This switches the first and second switching transistors **118** and **119** to their conductive conditions. The indicator lamps **125** and **126** then flash simultaneously with the operative blinker type signal lights and only the indicator lamp **127** remains deenergized.

If all four blinker type signal lights **94**, **95**, **96** and **97** are operative, there is an indication voltage of 0.3 volt at the control resistor **102**, and the collector potential of the control transistor **104** becomes more negative by an additional 150 millivolts. This switches the tihrd switching transistor **120** to its conductive condition and the third indicator lamp **127** then flashes simultaneosuly with the operative signal lights thereby indicating to the vehicle operator that all the blinking type signal lights **94**, **95**, **96** and **97** are in operation.

The emitter electrodes of the switching transistors **118**, **119** and **120** are connected to the positive pole of the battery **13** via the diode **121** and the diode **109** to prevent a substantial change in the emitter potentials of the switching transistors **118**, **119** and **120** despite the individual operating voltages of about 100 millivolts of the indicator lamps **125**, **126** and **127**. This permits the circuit arrangement to remain very sensitive and yet nonresponsive to temperature changes, and requires only a small resistance control resistor **102**. The control resistor **102** may be readily protected against short-circuiting by utilizing a cold conductor comprising 70% manganese and 30% copper as the control resistor. The circuit arrangement thus compensates for temperature-dependent variations of the operating parameters which are not fully compensated by the germanium diode **109** alone.

The first and second blocking diodes **110** and **113** prevent the switching transistors **118** and **119** from influencing each other and from influencing the switching transistor **120**. A similar blocking diode is not necessary for a similar purpose for the switching transistor **120** since said transistor is switched to its conductive condition only if the other two switching transistors **118** and **119** are in their conductive condition, in which case the switching transistor **120** cannot influence the switching transistors **118** and **119**. The blocking diodes **110** and **113** also assist considerably in achieving high sensitivity and thus resistance to short-circuiting.

In order to attain temperature compensation, it is also important that the diodes **109** and **121**, as well as the control transistor **104** and the switching transistor **118** operate at the same temperature. This makes it possible to provide temperature compensation for the entire circuit arrangement with the single germanium diode **109**. The diode **121** may comprise a relatively temperature- insensitive silicon diode, since it serves only as a voltage stabilizer.

When two switching transistors, which are switched in their conductive conditions by different voltages, are utilized in the circuit arrangement with the control transistor **104**, the sensitivity of the circuit arrangement is increased even more and the circuit is even more resistant to short-circuiting and is of even simpler structure. An embodiment of the circuit arrangement of the present invention utilizing two switching transistors instead of three, is shown in FIG. 10.

In FIG. 10, the emitter electrodes of the switching transistors **118** and **119** are connected to each other and to the tap of a voltage divider **133**, **134** which is connected across the source **13** of operating voltage. The housings of the transistors **104**, **118** and **119** and the diode **109** are connected to each other in heat conductive relationship. This may be accomplished in the same manner as in FIG. 9.

The circuit arrangement of FIG. 10 is intended for a vehicle with only a single trailer such as, for example, a bus with a package trailer. The bus may have two or three blinker type signal lights for each directional change or turn while the trailer may have one blinker type signal light for each directional change or turn. The components of the circuit arrangement such as, for example, the control transistor **104** and the control resistor **102** may be adjusted for current amplification and resistance, respectively. The circuit arrangement is thus operated with a predetermined number of blinker type signal lights and the control resistor **102** is varied until the desired base-emitter potential of the switching transistor **119** is attained. The thus determined resistance value of the control resistor **102** is then utilized in the circuit. If three blinker type signal lights are utilized for each turn direction, the resistance value of the control resistor **102** may comprise, for example, 2000 ohms, whereas if two blinker type signal lights are utilized for each turn direction, the resistance value of said control resistor may comprise, for example 2500 ohms.

The resistance value of the control resistor **102** of the embodiment of FIG. 10 is only 18 milliohms, which is approximately ⅓ of its resistance value in the embodiment of FIG. 8. The blocking diodes **110** and **113** are eliminated in the present embodiment of FIG. 10. The resistance value of the control resistor **102** may be adjusted to a small value, because in the embodiment of FIG. 10 the energizing current of the indicator lamps **125** and **128** does not flow via the germanium diode **109**, so that the base potential of the control transistor **104** is much more constant than in the embodiment of FIG. 8. The changes in the emitter potentials of the switching transistors **118** and **119** are not disadvantageous in the embodiment of FIG. 10, since although the energizing current of the indicator lamps causes the emitter potentials of the transistors **118** and **119** to become more negative, a sufficient current may be supplied to the voltage divider **133**, **134** to limit the change in emitter potentials to a narrow range.

Otherwise than as hereinbefore described, the embodiment of FIG. 10 operates in the same manner as the embodiment of FIG. 8. If the direction change or turn indicator switch **29** is switched with its armature in contact with the contact **30** or the contact **31**, and two of the blinker type signal lights **94**, **95**, **96** or **98**, **99**, **100** are operative while the third is inoperative, the indicator lamp **125** is energized and flashes and the indicator lamp **126** is deenergized. If all three signal lights **94**, **95**, **96** or **98**, **99**, **100** are operative, both indicator lamps **125** and **126** are energized and flash. The time delay circuit comprising the resistor **105** and the capacitor **106** also operates in the same manner in the embodiments of FIGS. 8 and 10.

It is, of course, possible to deviate in detail from the described circuit arrangements or to combine the characteristics of the individual embodiments in advantageous manner. NPN type transistors may be utilized instead of PNP transistors, and vice versa, for example, by the usual circuit polarity changes. Furthermore, the interrupter **11** may comprise, for example, a switching transistor and may be controlled, for example, in a known manner, by a heating-wire or a multivibrator arrangement.

While the invention has been described by means of specific examples in specific embodiments, we do not wish to be limited thereto, for obvious modifications will occur to those skilled in the art without departing from the spirit and scope of the invention.

What we claim is:

1. A blinker signal circuit arrangement comprising, in combination, a plurality of blinker type signal lights connected in parallel with each other; a source of voltage; circuit interrupting means connected in series circuit arrangement with said plurality of blinker type signal lights and said source of voltage for intermittently energizing said blinker type signal lights; a control resistor connected in series circuit arrangement with said plurality of blinker type signal lights and said source of voltage; at least one control transistor having a control electrode connected to said control resistor; and at least one indicator lamp connectable to said source of voltage by said control transistor when the voltage across said control resistor reaches a predetermined magnitude as a result of at least one of said flasher type signal lights becoming defective, whereby said indicator lamp provides an indication of the operability of said blinker type signal lights.

2. A circuit arrangement as claimed in claim **1**, wherein said control transistor has an emitter electrode, an emitter-collector path connected in series with said indicator lamp and a base electrode connected to said control resistor, and further comprising circuit means for applying a substantially constant voltage to the emitter electrode of said control transistor.

3. A circuit arrangement as claimed in claim **1**, wherein said control resistor is a cold conductor.

4. A circuit arrangement as claimed in claim **1**, wherein said control resistor comprises approximately 70% of a material having a low temperature coefficient and approximately 30% of a material having a positive temperature coefficient.

5. A circuit arrangement as claimed in claim **1** wherein said control resistor comprises approximately 70% manganese and approximately 30% copper.

6. A circuit arrangement as claimed in claim 1, further comprising a resistor connected across the series connection of said control resistor and said circuit interrupting means.

7. A circuit arrangement as claimed in claim 2, wherein said circuit means comprises a voltage divider connected across said source of voltage and having a tap, the emitter electrode of said control transistor being connected to the tap of said voltage divider.

8. A circuit arrangement as claimed in claim 2, wherein said circuit means comprises a voltage divider connected in series with said indicator lamp across said source of voltage and having a tap; a transistor having a base electrode connected to the tap of said voltage divider, an emitter-collector path connected in series with a resistor across said source of voltage, and having an emitter electrode connected to the emitter electrode of said control transistor.

9. A circuit arrangement as claimed in claim 8 wherein said voltage divider includes a temperature-dependent resistor.

10. A circuit arrangement as claimed in claim 8 further comprising an additional voltage divider connected in series with said control resistor across said source of voltage and having a tap, and wherein the base electrode of said control transistor is connected to the tap of said additional voltage divider.

11. A circuit arrangement as claimed in claim 1, further comprising a plurality of indicator lamps and a plurality of control transistors each having an emitter electrode, an emitter-collector path connected in series with a corresponding one of said indicator lamps and a base electrode connected to said control resistor and circuit means for applying a substantially constant voltage to the emitter electrodes of said control transistors whereby when one of said blinker type signal lights becomes inoperative a corresponding one of said control transistors is switched to its nonconductive condition thereby deenergizing the corresponding one of said indicator lamps.

12. A circuit arrangement as claimed in claim 11, wherein the operative condition of said blinker type signal lights determines the voltage across said control resistor and the voltage across said control resistor controls the conductive condition of said control transistors.

13. A circuit arrangement as claimed in claim 12, wherein said circuit means comprises a voltage divider connected in series with each of said indicator lamps across said source of voltage and having a tap; a transistor having a base electrode connected to the tap of said voltage divider, an emitter-collector path connected in series with a resistor across said source of voltage, and having an emitter electrode connected to the emitter electrodes of said control transistors.

14. A circuit arrangement as claimed in claim 13, further comprising a plurality of additional voltage dividers each connected in series with said control resistor across said source of voltage and having a tap, and wherein the base electrode of each of said control transistors is connected to a tap of a corresponding one of said additional voltage dividers.

15. A circuit arrangement as claimed in claim 14, further comprising a rectifier, a capacitor connected in series circuit arrangement with said rectifier, said series circuit conection having one end connected to a common point in the connection between said blinker type signal lights and said circuit interrupting means and another end connected to a common point in the connection between said circuit interrupting means and said control resistor, the base electrodes of said control transistors being connected to a common point in the connection between said rectifier and said capacitor.

16. A circuit arrangement as claimed in claim 1 wherein said control transistor has a base electrode, an emitter-collector path connected in series with said indicator lamp and an emitter electrode connected to said control resistor.

17. A circuit arrangement as claimed in claim 16, further comprising a voltage divider connected across said source of voltage and having a tap, the base electrode of said control transistor being connected to the tap of said voltage divider.

18. A circuit arrangement as claimed in claim 1 further comprising a switching transistor having an emitter-collector path connected in series with said indicator lamp and an emitter-base path, and wherein said control transistor has an emitter-collector path connected in parallel with the emitter-base path of said switching transistor.

19. A circuit arrangement as claimed in claim 1 further comprising a plurality of indicator lamps, a plurality of switching transistors each having an emitter-base path, an emitter electrode and an emitter-collector path connected in series with a corresponding one of said indicator lamps, a plurality of control transistors each having an emitter electrode and an emitter-collector path connected in parallel with the emitter-base path of a corresponding one of said switching transistors and connecting means connecting the emitter electrodes of said switching and control transistors to said control resistor whereby when one of said blinker type signal lights becomes inoperative a corresponding one of said switching transistors is switched to its conductive condition thereby energizing the corresponding one of said indicator lamps.

20. A circuit arrangement as claimed in claim 19, further comprising a plurality of voltage dividers each connected across said source of voltage and having a tap, and wherein each of said control transistors has a base electrode connected to the tap of a corresponding one of said voltage dividers.

21. A circuit arrangement as claimed in claim 1, wherein said control resistor is connected in parallel with said circuit interrupting means and the parallel connection is connected in series circuit arrangement with said plurality of blinker type signal lights and said source of voltage for intermittently energizing said blinker type signal lights.

22. A circuit arrangement as claimed in claim 1, further comprising a plurality of indicator lamps and a plurality of control transistors each having an emitter electrode connected to said control resistor, a base electrode and an emitter-collector path connected in series with a corresponding one of said indicator lamps whereby when one of said blinker type signal lights becomes inoperative a corresponding one of said control transistors is switched to its nonconductive condition thereby deenergizing the corresponding one of said indicator lamps.

23. A circuit arrangement as claimed in claim 22, further comprising a plurality of voltage dividers each connected across said source of voltage and having a tap, and wherein the base electrode of each of said control transistors is connected to the tap of a corresponding one of said voltage dividers.

24. A circuit arrangement as claimed in claim 1, further comprising a switching transistor having an emitter electrode, a base electrode and an emitter-collector path connected in series with said indicator lamp, and wherein said control transistor has a base electrode, an emitter electrode connected to said control resistor and a collector electrode connected to the base electrode of said switching transistor whereby when a number of said blinker type signal lights becomes inoperative the voltage at said control resistor varies thereby controlling the conductive condition of said control transistor which controls the conductive condition of said switching transistor.

25. A circuit arrangement as claimed in claim 1, further comprising a resistor, a capacitor connected in series circuit arrangement with said resistor, one end of said series circuit arrangement being connected to the collector electrode of said control transistor and the other end of said series circuit arrangement being connected to a common point in the connection between said blinker type

signal lights and said circuit interrupting means, said control transistor having an emitter-base path, and connecting means connecting the emitter-base path of said control transistor in parallel with said control resistor.

26. A circuit arrangement as claimed in claim **25**, further comprising voltage stabilizing means connected to the base electrode of said control transistor for stabilizing the base potential of said control transistor, said voltage stabilizing means comprising a resistor, a diode connected in series circuit arrangement with said resistor and connecting means connecting one end of said series circuit arrangement to said source of voltage.

27. A circuit arrangement as claimed in claim **26**, further comprising a housing for said switching transistor, a housing for said control transistor, a housing for said diode and heat conductive means connected to each of said housings to conduct heat therebetween.

28. A circuit arrangement as claimed in claim **26**, further comprising additional voltage stabilizing means connected to the emitter electrode of said switching transistor for stabilizing the voltage of said switching transistor, said additional voltage stabilizing means comprising an additional diode connected in series circuit arrangement with said diode, connecting means connecting one end of said series circuit arrangement to the emitter electrode of said switching transistor and connecting the other end of said series circuit arrangement to said source of voltage.

29. A circuit arrangement as claimed in claim **28**, further comprising a housing for said switching transistor, a housing for said control transistor, a housing for said diode, a housing for said additional diode and heat conductive means connected to each of said housings to conduct heat therebetween.

30. A circuit arrangement as claimed in claim **27**, further comprising a blocking diode connected between the collector electrode of said control transistor and the base electrode of said switching transistor.

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