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3,364,322

VOLTAGE AND LOAD COMPENSATED FLASHER

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2 Sheets-Sheet 1

Fig. 1.

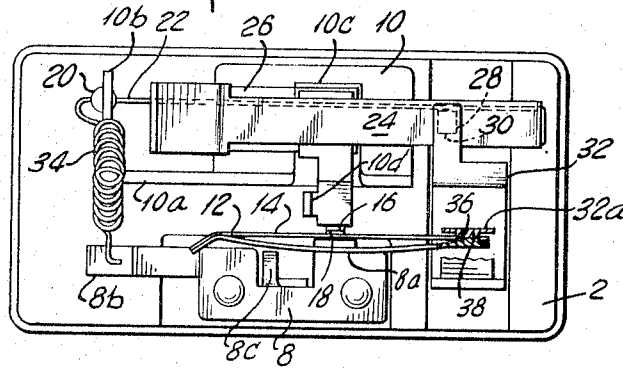


Fig. 2.

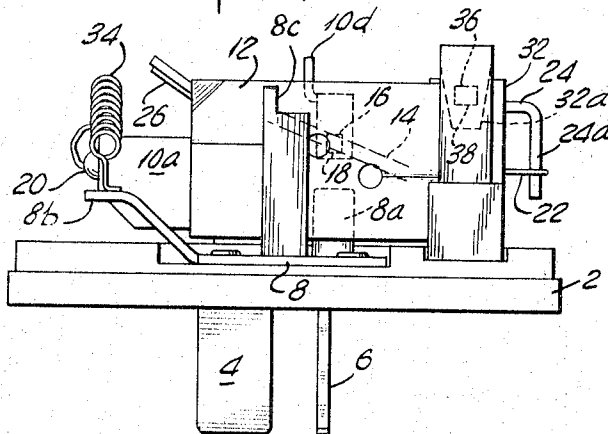
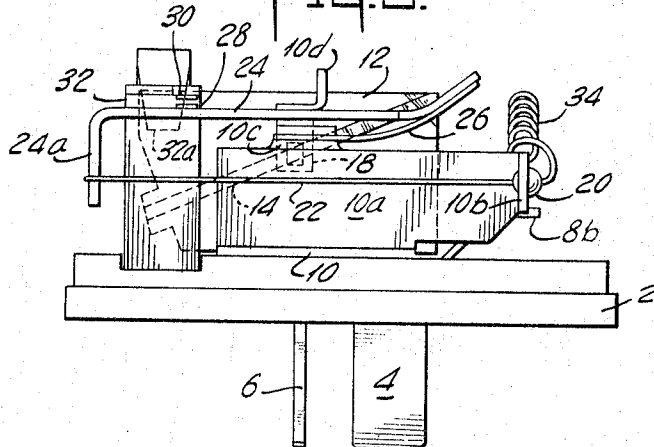


Fig. 3.



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VOLTAGE AND LOAD COMPENSATED FLASHER

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ABSTRACT OF THE DISCLOSURE

A flasher unit which is relatively insensitive to variations in supply voltage and independent of load comprising a first flasher unit of the structure having a constant "off" time corresponding to the period of cooling of a first expansible pull means and an "on" time corresponding to the heating period of the expansible pull means. A second flasher unit of the structure having an "on" time which corresponds to the period of cooling of a second expansible pull means and an "off" time which corresponds to the heating of the expansible pull means; said first and second flasher units arranged in a circuit whereby the second flasher unit will act as a shunt for the first flasher unit during heating of the first expansible pull means.

The present invention relates to flashers for control of directional signals and comprises a novel device of this type which is relatively insensitive to variations in supply voltage and independent of load.

Flashers now in wide commercial use can be generally characterized as of either the series type or the shunt type. A series type flasher has normally closed contacts which open when an expansible pull ribbon or wire is heated to a predetermined temperature and which close after the pull ribbon or wire has cooled and contracted. This type of flasher, which is described and claimed in Schmidinger Reissue Patent 24,023, has a constant "off" period, corresponding to the time for the pull ribbon or wire to cool from the operating temperature to the initial temperature and a variable "on" time corresponding to the time it takes the pull ribbon or wire to heat up to the operating temperature. The "on" time is variable because the higher the operating voltage or the higher the load, the more rapidly will the wire heat up to the operating temperature. A shunt type flasher, which may be represented by the magnetic flasher shown in Schmidinger Patent No. 2,103,276 or by the non-magnetic flasher shown in FIG. 9 of Schmidinger Patent No. 2,761,931, includes normally open contacts which are closed when a pull wire or ribbon is heated to a predetermined temperature. When the contacts close, the heater is shunted and therefore the ribbon starts to cool and contract. With the contacts open, the resistance in series with the lamp or lamps to be flashed is so high that the lamps are not lighted. When the contacts close and the pull wire or other heater is shunted, the lamp load is energized. Thus, the "on" time of the shunt flasher which corresponds to the cooling period of the pull means is constant whereas the "off" time, when the contacts are open, will vary with the operating voltage and load.

The new device combines series and shunt type units in such a manner as to maintain constant ratio and speed with change in voltage or change in load. The combination of the two types of units is such that the "off" period of the combination is that of the series flasher and therefore constant, whereas the "on" time of the combination is that of the series flasher plus additional time determined by the connection to the shunt type flasher whereby a constant "on" time of the combination is maintained.

The shunt type unit of the new device may employ an electromagnet as in Schmidinger Patent No. 2,103,276 or it may utilize a heater winding about the pull means or

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it may include a simple spring arm held in contact open position by a pull wire when cold.

For a better understanding of the invention and of the specific embodiments thereof, reference may be had to the accompanying drawings, of which

FIG. 1 is a top plan view of a flasher embodying the invention;

FIG. 2 is one side view of the flasher of FIG. 1;

FIG. 3 is a view of the opposite side of the flasher of FIG. 1;

FIG. 4 is a diagrammatic circuit drawing showing the electrical circuit of the flasher of FIGS. 1 to 3;

FIG. 5 is a circuit diagram similar to FIG. 4 but showing an alternative arrangement of shunt type flasher;

FIG. 6 is a graph explanatory of the heating and cooling cycles of both the series and shunt type flashers; and

FIGS. 7A, B and C are curves of the "on" and "off" periods of the flasher of the invention at operating voltages of 11, 13 and 15 volts respectively showing the shift in "on" period with increasing voltage but constant ratio and speed.

Referring first to FIGS. 1, 2 and 3, the components of the flasher are mounted on an insulating base 2 carrying prong terminals 4 and 6 on its lower surface and having brackets 8 and 10 mounted on its upper surface and electrically connected through the base to terminals 4 and 6 respectively. A blade 12 which comprises the snapping element of the series flasher is mounted on an upstanding arm 8a forming part of bracket 8. The blade has a longitudinal deformation therein tending to cause the blade to be concave as viewed in FIG. 2. A pull ribbon 14 is secured at its ends under tension to diagonally opposite corners of the blade 12 and holds the blade against the bias therein in a position where it is concave toward the support arm 8a and about a vertical axis. A contact 16 is welded to the center of the pull ribbon 14 and engages under pressure a fixed contact 18 mounted on bracket 10. Bracket 10 has an upstanding wall 10a, one end of which is bent at right angles to form a tongue 10b. An anchoring bead 20 of insulating material is mounted in an aperture in tongue 10b and through the bead extends a pull wire 22, the other end of which is anchored on the end of a tongue 24a of a movable arm 24. Arm 24 at its other end is welded to one end of a leaf spring 26, the other end of which is fixed to a tab 10c formed integral with wall 10a of bracket 10. The spring 26 tends to rock the arm 24 in a clockwise direction as viewed in FIG. 3 but movement of the arm in such direction is restricted by the tension in the pull wire 22. A contact 28 is carried by the arm 24 and this contact, when the pull wire expands to permit movement of the arm 24, engages a fixed contact 30 carried by a bracket 32 fixed to the base. The end of the pull wire 22 beyond the bead 20 is coiled to provide a ballast resistor 34 and the other end of the ballast resistor 34 is secured to a finger 8b forming an extension of bracket 8. The snap blade 12 carries a contact 36 adjacent an upper corner of the blade which contact, when the pull ribbon 14 is cold, engages a fixed contact 38 mounted on upstanding spring leg 32a welded to bracket 32. Also mounted on bracket 8 is a leg 8c, the upper end of which is positioned adjacent the blade 12 for engagement therewith during snapping action of the blade. The leg 8c thus provides an adjustable back stop for the blade and simultaneously acts as a noise maker. The support arm for the fixed contact 18 is preferably provided with an upstanding portion 10d to permit of adjustment of the position of the fixed contact.

The diagram of FIG. 4 is a simplified drawing of the device of FIGS. 1 to 3 and will help in understanding the operation of the device. In FIG. 4 the lamp load, which may be any number of lamps to be flashed, is indicated symbolically at 40 as a single lamp connected at one side to ground and at the other side to a manually op-

erated switch 42. Switch 42 may be considered as the directional signal or Bell switch of an automobile direction signal circuit. The other side of switch 42 is connected to terminal 6 of the flasher. The car carried battery having its negative terminal grounded is indicated at 45 with its positive terminal connected to terminal 4 of the flasher. Contacts 16 and 18 are normally closed and contacts 36 and 38 are also normally closed. Contacts 28 and 30 are normally open. Accordingly, when switch 42 is closed, current will flow from the battery through the blade 12 to the ends of the pull ribbon 14, through the halves of the pull ribbon in parallel to contacts 16 and 18 and from thence to the lamp load. This current will cause the lamps to light. It will also heat the pull ribbon 14 and cause it to expand. Substantially no current will flow through the ballast resistor 34 and pull wire 22. When the pull ribbon 14 has expanded sufficiently to permit snapping of the blade 12 into the contact open position, the current from the battery flows through ballast resistor 34, pull wire 22, to arm 24 and terminal 6 to the lamp load 40. Because of the inclusion of the ballast resistor and pull wire 22 in this circuit, the current will be insufficient to energize the lamp load. However, the current will be sufficient to cause expansion of the pull wire 22 with ultimate closing of contacts 28 and 30. Closure of the contacts 28 and 30 will have no effect until the "off" time of the series flasher including the blade 12 terminates. During the period of heating of the pull wire 22, the pull ribbon 14 is cooling and eventually the contraction thereof causes the blade 12 to snap back to contact closing position. At this time, contacts 28 and 30 being closed, the current from the battery flows from terminal 4 through contacts 36 and 38 and through contacts 28 and 30 to arm 24 and terminal 6. The lamp load will thus be energized and substantially no current will flow through the pull ribbon 14. The closure of contacts 36 and 38, while contacts 28 and 30 of the shunt flasher are closed, effectively shunts out of the circuit the ballast resistor 34 and the pull wire 22. Accordingly, the pull wire 22 will cool and contract and eventually cause opening of the contacts 28 and 30. Pull ribbon 14 of the series flasher will thereupon heat up and the cycle repeats.

From the foregoing description, it will be apparent that the "off" time of the lamp load is determined entirely by the series flasher because when the contacts of the series flasher are open, the current can only reach the lamp load through the high resistance of the ballast resistor and pull wire 22. Thus, as previously described, the "off" time will remain constant in the combined flasher irrespective of load because it is dependent solely on the series flasher. The "on" time of the combined flasher is made up of a combination of the "on" time of the series and shunt flashers because the normal "on" time of the series flasher is extended for the period in which contacts 28 and 30 are closed while contacts 36 and 38 are closed. This is because the heating up of the pull ribbon 14, which normally occurs in the "on" position of the series flasher, is delayed during the period that the contacts of the shunt flasher are closed.

In FIG. 6 the temperature curves of a series type flasher are illustrated at three different voltages—11, 13 and 15 volts. If T_c represents a temperature level at which the contacts of the series flasher are closed and T_o the temperature at which the contacts open, then curve A represents the heating of the pull ribbon at 11 volts to the temperature T_o and its subsequent cooling back to T_c . Curve B similarly represents the heating curve at 13 volts up to the temperature T_o and then back to temperature T_c , and curve C represents the heating cycle of the pull ribbon from the temperature T_c to T_o at 15 volts and the cooling cycle from T_o to T_c .

It will be apparent from the curves of FIG. 6 that the time of heating decreases with increase in voltage whereas the cooling time is constant irrespective of voltage. For the usual shunt flasher, the same curves could represent the operation of such flasher except that during the heat-

ing period in the series flasher the contacts are closed and the flasher is "on," whereas in the usual shunt flasher the heating period is when the contacts are open and the flasher is "off." Thus, in the usual shunt flasher, there is constant "on" time and variable "off" time with variation in voltage, whereas in the series flasher, as above described, the "off" time is constant and the "on" time varies with the voltage. The shunt type part of the new flasher does not operate identically with the usual shunt type flasher because when the contacts close in the shunt type portion of the new flasher, they do not shunt the heating means when the series flasher is "off." This will be apparent as the description proceeds.

Although the curves of FIG. 6 refer to change in voltage, they are equally applicable to change in load because, when a load is increased, the current increases and this corresponds to operation at a higher voltage. Therefore, the new device will maintain constant the speed and ratio irrespective of the load. This makes the new flasher particularly adapted for use in dual intensity systems or for emergency signalling when the lamp load is doubled.

Turning now to the graphs of FIG. 7, the solid line curves *a*, *b*, and *c* represent the "on" and "off" periods for two cycles of the flasher of the invention when the operating voltage is 11, 13 and 15 volts respectively. The dashed curves *a-1*, *b-1* and *b-3* represent the heating and cooling of the pull means of the shunt unit at 11, 13 and 15 volts respectively. When the operating voltage is 11 volts, the first "on" period is that of the series flasher and by reference to FIG. 6 it will be apparent that the length of this "on" period is co-extensive with the heating period shown for the 11 volt curve. When the series type flasher snaps to open contact position, the "off" period is initiated and the shunt flasher begins to heat up as shown by the dashed curve *a-1*. When the pull ribbon of the series type flasher has cooled sufficiently to re-close the contacts, the shunt type flasher, having been heated, maintains the circuit to the lamp load and prevents heating of the pull ribbon of the series type flasher. It is for this reason that the second series of heating curves in FIG. 6 do not start immediately when the series pull ribbon has cooled to T_c . Accordingly, the second "on" period is initiated and the lamp load is kept on by the shunt flasher until the pull means of that flasher has cooled sufficiently to open its contacts. This completes one cycle. At this moment, the series flasher, still being in contact closing position, maintains the load circuit "on" during the heating period of the series type flasher. Thus, in the upper solid lines curves *a*, *b*, *c* of FIG. 7 the first "on" period is due solely to the series flasher and the second "on" period for the remainder of the cycle is due to the shunt flasher.

Similarly, in the 13 volt curve of FIG. 7, the first "on" period is that due to heating of the series type flasher and is co-extensive in length with the heating period of the 13 volt curve of FIG. 6. When the contacts of the series type flasher open, the "off" period is initiated and the heating cycle of the shunt type flasher is initiated as shown by the dashed curve *b-2*. At the higher voltage, namely 13 volts as compared to 11 volts, the temperature of the pull means of the shunt type flasher will rise higher than in the case of 11 volts and accordingly the pull means will take longer to cool. Thus, when the pull ribbon of the series type flasher is cooled sufficiently to re-close the contacts of that flasher, the shunt flasher, being heated, will have closed its contacts and initiated the second "on" period. No heating of the series type flasher occurs until the pull means of the shunt flasher have cooled sufficiently to open the shunt type flasher contacts. At this time, the series type pull ribbon will start to heat and the portion of the "on" time contributed by the series flasher will start the next cycle.

The 15 volt curve of FIG. 7 will be clear from the foregoing description of the 11 volt and 13 volt curves of FIG. 7. The temperature of the shunt type heater reaches

a higher value under 15 volt conditions as shown by dashed curve c-1 and a longer time is required for cooling the shunt type pull ribbon from the higher temperature.

The curves of FIG. 7 show the shift in position of the "on" period with change in voltage. However, the ratio of "on" to full cycle remains constant and the total cycle remains the same length. After initial energization of the flasher, the shift in position of the "off" section is indistinguishable to the viewer.

Referring again to FIGS. 1 to 4, it will be noted that no provision is made for snap action of the arm 24 in opening and closing the contacts 28 and 30. As the contacts ordinarily close when the series flasher is "off," there will be no tendency toward sparking at the moment of closure. When the contacts open, the parallel circuit through the pull ribbon of the series flasher is not opened and this may be the reason why substantially no sparking occurs in devices constructed in accordance with FIGS. 1 to 3. If desired, snap action can be incorporated in the device so far described merely by positioning the core of an electromagnet adjacent the arm 24 and connecting the winding in the circuit between contact 18 and terminal 6. With such an arrangement, the force of the spring supporting the arm 24 is augmented by the action of the electromagnet and snap action is provided both in closing and opening of the contacts 28 and 30.

In FIG. 5, an alternate type of shunt flasher suitable for use in the invention is shown diagrammatically in connection with the same type of series flasher as is shown in FIGS. 1 to 4.

In this embodiment of the invention, a blade 44 of the general type of blade 12 is provided and an insulated heating coil 46 is wrapped around the pull ribbon 48 which holds the blade 44 against the bias therein. Blade 44 carries a contact 50 positioned for engagement with fixed contact 52 when the pull ribbon 48 is heated and the blade snaps to contact closing position. The heater 46 is connected between the terminal 6 and terminal 4. Fixed contact 52 is connected to contact 38 of the series flasher. The operation of the circuit of FIG. 5 is substantially identical with that described in FIG. 4. When the switch 42 is closed, current flows from terminal 4 through the blade 12 of the series flasher, the ribbon 14 of the series flasher, to terminal 6, energizing the lamp load 40. The current flow through the heater 46, because shunted by the series flasher, is insufficient to cause expansion of the pull ribbon 48. When the series flasher opens, the full current is drawn by heater 46 which thereupon causes expansion of the pull ribbon 48 and ultimate closure of contacts 50 and 52. Closure of these contacts, when the series flasher re-closes its circuits, provides a shunt about the heater and the pull ribbon 14 of the series flasher, thereby prolonging the "on" period of the series flasher and starting the cooling cycle of the pull ribbon 48.

The curves of FIG. 7 are equally applicable to the circuit of FIG. 5.

The invention has now been described in connection with two embodiments thereof in each of which a combination of series type and shunt type units are employed. Both series type flashers and shunt type flashers are well known and the particular construction of these flasher portions are representative only of the general type of components to be employed in the new combination. Actually, the part of the flasher hereinabove described as of the shunt type may be any device having a pair of normally open contacts which close only after the contacts of the series type open and which remain closed for a controlled period of time to supplement the variable "on" time of the series unit. Although in the specific embodiments of the invention illustrated in the drawings, the period of closure of the normally open contacts is controlled by heat responsive means, other means of

control will be apparent to those skilled in the art. Thus, the specific elements of the physical embodiment illustrated in FIGS. 1 to 3 are representative only of suitable components and are not to be taken as limiting the scope of the invention which is limited only by the accompanying claims.

I claim:

1. A two terminal voltage and load compensated flasher comprising in combination, a first unit having two pairs of normally closed contacts adapted to open upon expansion of a current responsive element with passage of current therethrough, one of each said pair of contacts being connected to one terminal of the flasher, the other contact of one of said pairs being connected to the other terminal of the flasher, a second unit having a pair of normally open contacts, one of said normally open contacts being connected to the other contact of the other of said pairs of normally closed contacts of said first unit, the other of said normally open contacts being connected to the other terminal of the flasher, and means operative when the contacts of said first unit are open for initiating closure of said normally open contacts.

2. A two terminal voltage and load compensated flasher comprising in combination, a first unit having two pairs of normally closed contacts adapted to open upon expansion of a current responsive element with passage of current therethrough, one of each said pair of contacts being connected to one terminal of the flasher, the other contact of one of said pairs being connected to the other terminal of the flasher, a second unit having a pair of normally open contacts adapted to close upon heating and expansion of a heat responsive element thereof, one of said normally open contacts being connected to the other contact of the other of said pairs of normally closed contacts of said first unit, the other of said normally open contacts being connected to the other terminal of the flasher, and means operative when the contacts of said first unit are open for heating said heat responsive element of said second unit.

3. The flasher according to claim 2 wherein said second unit comprises a member of spring material carrying one of said normally open contacts and biased toward contact open position by the tension in the heat responsive element when the element is cold and wherein said means for heating said heat responsive element comprise a circuit including a ballast resistor and said heat responsive element connected across the terminals of the flasher, said circuit being shunted when the contacts of said first unit are closed.

4. The flasher according to claim 2 wherein said second unit comprises a member of spring material carrying one of said normally open contacts and biased toward contact open position by the tension in the heat responsive element when the element is cold and wherein said means for heating said heat responsive element comprise a heater coil in heat conductive relation to said heat responsive element, said heater coil being connected across the terminals of the flasher so as to be shunted when the contacts of said first unit are closed.

5. The flasher according to claim 2 wherein said first unit includes a blade of resilient conductive material having an initial deformation tending to bow it about one axis and wherein current expansible means is a pull ribbon connected at its ends under tension to said blade and, when cold, bowing the blade about an axis disposed at an angle to said one axis, one said pair of normally closed contacts comprising a contact mounted on said pull ribbon and a fixed contact positioned for engagement with said ribbon carried contact, said fixed contact being that connected to said other said terminal, the other pair of normally closed contacts comprising a contact mounted on said blade and a fixed contact positioned for engagement therewith, said last mentioned fixed contact being that connected to one of said normally open contacts of said second unit.

6. A two terminal voltage and load compensated flasher comprising in combination, a first flasher unit having a member adapted to occupy two different positions for operating a circuit opening and closing contact, and an expansible pull means responsive to heat generated by electric current to cause said member to move from one to the other of said positions, said first flasher unit having a constant "off" time corresponding to the period of cooling of an expansible pull means and an "on" time corresponding to the period of heating of the pull means, said first unit having at least one pair of contacts closed during the "on" time and said first unit being connected between the terminals of the flasher to provide a constant "off" period, a second flasher unit having a member adapted to occupy two different positions for operating a circuit opening and closing contact, and an expansible pull means responsive to heat generated by electric current to cause said member to move from one to the other of said positions, said second flasher unit having an "off" time corresponding to the period of heating of an ex-

pansible pull means and an "on" time corresponding to the period of cooling of the heat expansible pull means, and circuit means connecting said units only when said first unit is "on" and said second unit is "off" operative to shunt some of the current from the pull means of said first unit and thereby modify the "on" period of the first unit to compensate for change in load or voltage.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,364,322

January 16, 1968

Hemming G. Siiberg

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the heading to the printed specification, line 4, for "Warner" read -- Wagner --; column 6, line 70, strike out "said", second occurrence, and insert the same after "other", second occurrence, in same line 70.

Signed and sealed this 4th day of March 1969.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents